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Hydraulicking at Waldo, Ore.

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SYNOPSIS—The Waldo placer field is in southern Oregon, only seven miles from the California line. Hydraulic elevators are required for most of the deposits on account of lack of grade for disposal of tailings. Some interesting details of the operations and equipments are given. Besides the gold, a little platinum is recovered.

The visitor to the placer fields of the Waldo district, Oregon, is at once impressed with the importance of the part played by the hydraulic elevator in mining opera-

miles west of Grants Pass, a station on the Southern Pacific R.R. It is reached by daily automobile stage running between Grants Pass, Ore., and Crescent City, Calif. The town of Waldo, from which the district takes its name, is situated in the center of the placer field 1500 ft. above sea level.

The commonly accepted story of the first discovery of gold in the district is that in 1851 a party of sailors, deserting their ship, made their way inland and found gold in a ravine, which thereafter took the name of Sailors Gulch. This ravine heads on the east side of the ridge on which the Osgood mine is situated. The usual rush fol-



PIPING IN THE PIT OF THE LOGAN MINE, WALDO, ORE.

Hydraulic elevators are necessary at most of the mines in this district, the grade of the bedrock being insufficient to dispose of the tailings

tions. In March, 1915, three mines were active—the Logan, the Osgood and the Deep Gravel. Waldo district is situated in the southwestern part of Josephine County, seven miles north of the Oregon-California line and 40

lowed and the surrounding territory was thoroughly worked as far as the depth of gravel and crude methods would permit. Later, ditches were dug and water brought in from a distance of 3 to 11 miles for hydraulicking the deeper gravels.

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For the most part the bedrock at the Logan and the Deep Gravel mines is Cretaceous sandstone and conglomerate, but some serpentine occurs at the upper end of the Deep Gravel mine. The conglomerate is composed of rotten, rounded pebbles and boulders of greenstone, with some granitic rocks. In places it has a reddish color, but the freshly exposed portions observed have a purplish tint. The conglomerate is gold bearing and is soft enough to be piped, but with the exception of the Osgood mine none of it is rich enough for profitable hydraulicking. This conglomerate is of marine origin, having been deposited about the shores of a Cretaceous island and is considered¹ the source of the later gravels being washed at the Logan and the Deep Gravel mines.

The Logan mine, operated by J. T. Logan, is situated one-half mile north of Waldo. It consists of 1000 acres and has an average depth of 35 ft. The gravel is easily piped and is all put through a Joshua Hendy hydraulic elevator, the largest boulders being 6 in. diameter. The first work done on this mine was through a race one mile north of the present workings. Then a pit was opened on French Flat, not far from the schoolhouse and just east of the pit now being worked. The tailings were elevated and stacked with giants. Tailings from the present pit are deposited in the old pit and two giants are employed in the distribution. Mr. Logan purposes reclaiming the old workings for farming as the work progresses.

Water for the present work is obtained from the east fork of Illinois River, across the state line in Del Norte County, California. One ditch, 11 miles long, with capacity of 13 cu.ft. per sec., gives a working head of 340 ft. A second ditch, 5 miles long, supplies 33 cu.ft. per sec., at a working head of 125 ft. The first ditch is used for the elevator exclusively. The second ditch supplies the four giants, two in the pit and two on the tailings dump and the top lift of the elevator. The two giants in the pit are used to wash down the bank. The gravel is carried by a bedrock sluice to the hydraulic elevator which raises it to a height of 49 ft. and into a flume which passes it into the old pit. Accompanying illustrations plainly show the method of working at the Logan, and interesting features at the Osgood and the Deep Gravel.

DETAILS OF THE LOGAN MINE EQUIPMENT

The bedrock sluice is 200 ft. long and 30 in. wide. No riffles are used. High-carbon steel plates, $\frac{1}{2} \times 20 \times 30$ in., are placed on 2×4 -in. wooden crosspieces standing on edge. The crosspieces are usually set 2 in. in from the ends of the plates and as the plates are placed $1\frac{1}{2}$ in. apart there is a clear space of $4 \times 5\frac{1}{2}$ in. under the ends of the plates. Occasionally the crosspieces are placed at the center of the plate only. This arrangement is varied at intervals by laying the long dimension of the plate lengthwise of the sluice, giving a 5-in. space each side of the plate. The plates greatly facilitate the passage of the sand and gravel through the sluice. The wear is slight. No other gold-saving device is used here, but Mr. Logan states that 93% of the gold recovery is made in the sluice.

The elevator has the following dimensions: Entrance section, 20 in.; throat, 9 in.; inside diameter of upraise pipe to top lift, 13 in.; inside diameter of upraise pipe

from lift to flume, 15 in. The water for the top lift comes into the elevator through a needle valve about 10 ft. below the discharge. It is used only when there is a scarcity of water in the high-line ditch. The elevator handles from 15,000 to 30,000 cu.yd. per month, the grade of the bedrock sluice governing the yardage. The flume into which the elevator discharges is 40 in. wide and 340 ft. long. In this flume are 200 ft. of Hungarian riffles made up of $\frac{1}{2} \times 2 \times 2$ -in. angle iron; then 40 ft. of 8-lb. rails with $\frac{3}{8}$ -in. steel plates for the remaining 100 ft. Besides the four giants and elevator mentioned there is a water lift used to keep the pit dry when no piping is being done. Altogether, there are 1500 ft. of pipe, ranging in diameter from 15 in. to 24 in., of 14- and 16-in. gage.

Water is taken from the pipe lines to generate the electricity used in lighting the mine and buildings. It also furnishes power for various electrical appliances, such as the blower for the bullion furnaces and electric range and heaters in the residence. During the idle months the water is used for irrigating the farming land.

While the gold has a fineness of 975 it is rusty and does not amalgamate easily, that observed having a purplish coating of oxides. However, it is coarse and is not hard to save. A considerable amount of platinum is obtained. The black sand is concentrated by working it over with a square-pointed shovel in a smooth, wide sluice, with a flat grade and a small amount of water. The concentrate is shipped to a smeltery. The operating expenses are between \$600 and \$700 per month and the cleanups, including gold and platinum, run between \$8000 and \$10,000 per month. Eight months is the average length of the season.

ELEVATING NOT NECESSARY AT OSGOOD MINE

The Osgood mine is situated about one mile southeast of Waldo on a ridge running north and south which forms the divide between the east and west forks of the Illinois River. The summit of the ridge is about 300 ft. above the east fork and about one mile distant. The gravel that is being hydraulicked is Cretaceous conglomerate, which caps the summit of the ridge. The conglomerate lies on greenstone which is very uneven. It is decomposed, fissured and veined and has a decided purple color due to iron oxides. The property embraces an area of 636 acres. It is being operated under lease by J. T. Logan.

Piping has been done for 1000 ft. along the ridge and at the present site a width of over 100 ft. is exposed. The present bank is 90 ft. high. The deposit is cemented, but gives no great difficulty in piping. Water at 125-ft. head is supplied by a ditch 11 miles in length, from the east branch of the Illinois River. The mine is equipped with one No. 2 and one No. 3 giant; 1500 ft. of pipe 11 to 15 in. diameter; and 300 ft. of 40-in. flume. Steel plates are used as at the Logan mine, but are separated at intervals by sections of Hungarian riffles made of $\frac{1}{4} \times 2 \times 2$ -in. angle irons and steel rails. The gravel is piped directly into the flume, the great amount of fall giving no occasion for elevating the gravel. The gold content runs between 12c. and 15c. per cu.yd. One feature of this mine is that the gold is very black. Mr. Logan reports great difficulty in saving it, which, however, he is successfully doing. The gold fineness is 930.

¹Diller, J. S., Bulletin 546, United States Geological Survey.

In Frye Gulch, which heads on the west side of the ridge near the Osgood mine, A. H. Gunnell, of Grants Pass, and associates are doing some prospecting by sinking shafts with the view of developing dredging ground. The work was just starting at the time of my visit in March, 1915, so that no results were obtainable.

THE DEEP GRAVEL MINE SOMETIMES HAS WATER ENOUGH TO WORK ENTIRE YEAR

The Deep Gravel mine, owned by W. J. Wimer of Waldo and A. E. Reames of Medford, Ore., under the name of Deep Gravel Mining Co., is worked under lease by H. L. Herzinger. The property contains 530 acres, of which two-thirds is mining ground. Forty acres have been worked since Mr. Wimer became the owner in 1873. It extends from the west fork of the Illinois River to within half a mile of Waldo, and is situated northwest of the town and separated from the Logan mine by a low ridge. The depth of the gravel

Water is obtained from the east fork of the Illinois River by a ditch 3 miles long, which carries 2800 in. of water and gives a working head of 140 ft. to 202 ft., depending on the part of the property being worked. Another ditch gives 500 in. of water. For six months in the year the total amount of water available is 10,000 in. Mr. Wimer states that some years it is possible to operate the full 12 months.

EQUIPMENT OF THE DEEP GRAVEL MINE

The property is equipped with a No. 2 hydraulic elevator; a sand and gravel elevator; water lift; two No. 1, one No. 2, and one No. 4 giants; 80 ft. of 40-in. flume with 50 ft. of undercurrent; 120 ft. of bedrock sluice 22 in. wide; and 5000 ft. of pipe from 11 to 24 in. in diameter. A tailrace 7000 ft. long discharges into the west fork of the Illinois River.

The riffles in the bedrock sluice are made of 2x4-in. lumber, in sets of six, and connected at each end by



RAISING GRAVEL TO THE FLUME WITH HYDRAULIC ELEVATOR, LOGAN MINE, WALDO, ORE.

Note the auxiliary lift about 10 ft. below the top of the elevator. This is only used when the supply of water for the main line is low. The elevator handles from 15,000 to 30,000 cu.yd. of gravel per month, the grade of the bedrock sluice governing the yardage.

to bedrock varies from 12 ft. at the upper end of the property to 120 ft. at the lower end on the Illinois River.

The greatest depth the ground has been worked is 80 ft., and to do that it was necessary to elevate the gravel 49 ft. That there is some rich ground on bedrock has been proved by two shafts of 122 ft. and 120 ft. The output since 1878 has been more than \$350,000 at a cost of \$150,000. It is said that much of the cost was due to litigation, which has now been settled.

strap-iron-covered cleats. The riffles are 5 ft. long and are placed lengthwise of the sluice with the 2-in. side uppermost. This side is sharply beveled and covered with $\frac{1}{8}$ x2-in. strap iron. The bevels alternate to the right and left on the successive sets in order to prevent scouring currents. In the first 20 ft. of flume 12x12-in. blocks are placed, which are followed by 30 ft. of heavy pole riffles. At the end of the poles the undercurrent runs off at right angles to the flume. The screen for the undercurrent is formed by 8-lb. rails set with $\frac{1}{4}$ -in. openings. From the undercurrent to the end of the

flume, a distance of 50 ft., pole riffles are used. Hungarian riffles are used in the undercurrent, the size of the iron being $\frac{1}{4} \times 2 \times 2$ -in. angle.

The system of mining is essentially the same as that employed at the Logan mine. The gravel is much more compact, however. The bank is difficult to pipe, but readily crumbles up under weather and moisture. A small charge of powder will loosen a large area. The two large giants are set up on the bedrock at the bottom of the pit. They wash the gravel into the bedrock sluice, from the end of which the elevator raises it 27 ft. to the flume. The coarse material is carried through the flume into the race, while the fines pass through the screen into the undercurrent. At the present point of operations the bank is about 45 ft. The elevation at the Wimer mine is 65 ft. lower than at the Logan. By tunneling the ridge the two properties could be worked conjointly.

The gold is coarse and bright. With the gold some platinum is also saved. The largest amount of platinum recovered in one year was 20 oz. and Mr. Wimer estimates

ordinary panning and the pannings saved. These are worked down by a careful forward-and-back motion of the pan. It is found that the whirling motion ordinarily given the pan in washing the sand was responsible for a great part of the loss, as was also the custom of washing all the sand possible from the amalgam when picking it up in the sluices.

The platinum occurs in small, bright scales, but some nuggets are found. Mr. Wimer exhibited one the size of a large wheat grain and stated that he had found one as large as a pea. An analysis of the platinum cleanup gave the following results: Gold, 0.4%; platinum, 70.5%; osmiridium, 20.5%.

Mineral Production of Hungary in 1913

The mineral production of Hungary in 1913, as officially reported, was as follows (*Montanistische Rundschau*, July 1, 1915)—the items, except those of gold and silver, being given in metric tons, and arranged in order



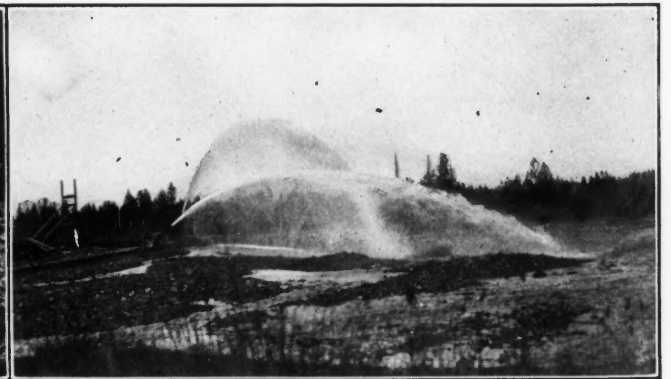
Piping in the pit of the Deep Gravel Mine at Waldo. See view of sluice and elevator below



The Osgood is the only mine at Waldo having sufficient grade to dispense with elevators for disposing of tailings



BEDROCK SLUICE AND ELEVATOR AT THE DEEP GRAVEL MINE



GIANTS DISTRIBUTING TAILINGS AT THE END OF THE LOGAN FLUME

that 120 oz. was lost in the cleanup. Mr. Wimer has made a special study of the problem of saving platinum and was awarded the highest honors at the Lewis & Clark Exposition for his exhibit. He found in his experiments that only one-seventh of the platinum was recovered by the ordinary cleanup methods. He increased the recovery of platinum sevenfold by simply using great care in handling the cleanup. When the gold and amalgam is picked up in the sluices the sand is collected with it. The amalgam is separated from the sand by

of descending values: Lignite, 8,801,166; pig iron, 608,966; salt, 301,806; coal, 1,058,878; gold, 2924 kg.; iron ore for export, 551,734; coke, 160,073; briquettes, 117,186; pyrites, 106,629; silver, 8696 kg.; antimony, crude and refined, 1048; copper, 404; ammonium sulphate, 2122; lead, 1136; copper cement and ore, 1679; quicksilver, 89; coal tar, 7193; manganese ore, 19,006; petroleum, 2105; silver ore, 204; zinc ore and residue, 407; alum stone, 1792; sulphur, 41; sulphuric acid, 555; antimony ore, 28.

Metal Loss in Copper Slags--I

BY FRANK E. LATHE*

SYNOPSIS—The first of three articles discussing copper losses in slags. The introductory article presents a résumé of the most important literature on the subject and diagrams showing the variation of copper in slags under different conditions.

In his endeavor to reduce slag losses to the lowest possible point the metallurgist often finds himself limited by local conditions. Thus in the early days of the Southwest, in smelting oxidized copper ores with high-priced coke, it was sometimes found economical to waste in the slag more copper than a few of our present-day companies find in the ore itself. Even now, in districts where cheap fluxes are not available or other conditions are adverse, valuable metals in quantities which could be saved are allowed to pass into the slag; the metallurgist—perhaps an ardent conservationist—consoling himself for the sacrifice of his ideals with the thought that more dollars are nevertheless going into the pockets of shareholders.

Until recently, little was known concerning the chemical combinations of the copper, gold and silver lost in copper smelting, and the methods adopted to keep these losses

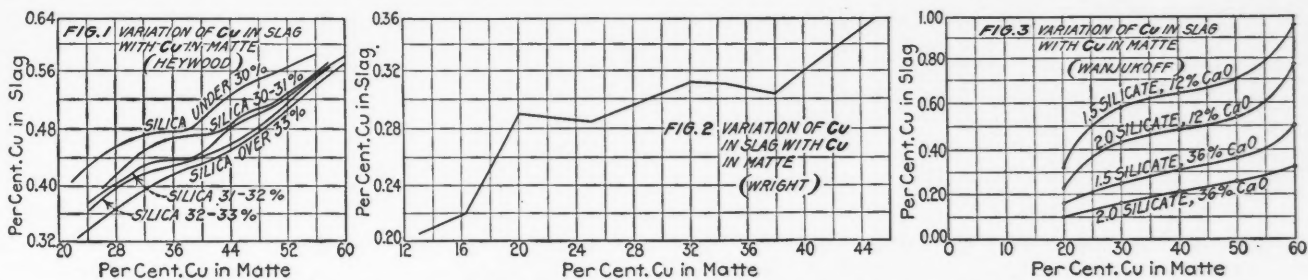
of copper lost except with mattes of more than 50%, when the totals were approximately equal. The average decrease of copper appears to be about 1% of the increase in SiO_2 .

Lewis T. Wright (*Trans. of A. I. M. E.*, 1909, Vol. 40, p. 492)—Mr. Wright expressed his disbelief in the common theory that all the copper in slags existed as prills of matte, giving several reasons:

1. That matte did not separate from slag kept in the molten state even for a long time.

2. That no concentration of the valuable metals was possible by elutriation after fine grinding.

3. That the proportions of gold, silver and copper in slag were often different from those in the accompanying matte. This was illustrated by four examples from Mr. Wright's experience. The amount of gold in his slags varied from 31-69% (average 58%) of what might be expected if all the copper in the slag were present as mechanically suspended matte, while for silver the corresponding amounts were 76-93% (average 81%). From these data Mr. Wright concluded that probably a part of the matte was chemically dissolved in the slag; hence copper sulphide, presumably more soluble than gold or



VARIATION OF COPPER IN SLAG WITH TENOR OF MATTE—AFTER HEYWOOD, WRIGHT AND WANJUKOFF

down have not been discussed as fully as their importance deserves. In this paper I shall review some of the more recent articles on slag losses, give in detail the results of my own investigations and conclude with a general consideration of the whole subject.

REVIEW OF SLAG LITERATURE

William A. Heywood (*Engineering and Mining Journal*, 1904, Vol. 77, p. 395, and "Pyrite Smelting," p. 231)—Mr. Heywood, relating his experience at the Tennessee Copper Co.'s smeltery, showed graphically the effect of variations in the composition of the slag and in the grade of matte on the percentage of copper lost. He plotted the copper content of 2590 slags, representing the average of two furnaces for a period of 2½ years, against the copper content of the matte for curves of (1) under 30% SiO_2 in the slag (2) 30-31%, (3) 31-32%, (4) 32-33%, (5) over 33%. These curves (Fig. 1) show an increase of slag loss with the grade of matte, and also indicate the decidedly lower losses with increasing acidity of the slag. Even though the higher percentage of SiO_2 was due to the addition of barren quartz to the charge, Mr. Heywood found a decrease in the total amount

silver, was found there in greater proportion than those metals.

4. He then plotted a curve (Fig. 2) of the copper in slag against that in matte, as found in his experience, showing between 15% and 45% matte, an average increase of 0.005% copper in the slag for each per cent. of copper in the matte. He remarked that the curve showed depressions at 25% and 37%. He thought that if metallic copper separated from matte in quantities increasing with the grade of the latter, the tendency of this copper to settle out might prevent the observed increase of copper in the slag with the higher mattes.

5. His experience also showed that the copper in slags decreased about 0.01% for each increase of 1% in the silica content. This he thought indicative of solution rather than mechanical suspension of matte.

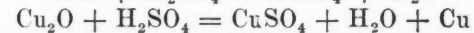
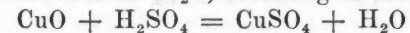
6. In conclusion, Mr. Wright stated that if a slag made with a matte of certain gold and silver content were afterwards left in contact with a different matte it would itself assume different metal ratios to correspond to the changed conditions. This fact he had made use of to great advantage in smelting, and in explanation of it he suggested that the matte and slag were both acting as solvents, dividing the metals between them.

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J. Parke Channing (*Trans. of A. I. M. E.*, 1910, Vol. 41, p. 485)—Commenting on Mr. Wright's paper, Mr. Channing stated that he had discussed this question with J. E. McAllister, and they were both of the opinion that a considerable part of the copper entered the slag as oxide or silicate and not as sulphide, either suspended or dissolved. This theory appeared to explain why the amounts of gold and silver Mr. Wright had found in the slag were smaller than the calculated contents. In support of it Mr. Channing stated that when they were using an oxidized charge (roasted ore) at the Tennessee Copper Co.'s smelter, the slags contained 0.5% Cu, as against 0.3% in pyritic smelting at the same plant. (It was not stated whether the grade of matte and composition of the slag remained the same in pyritic smelting.)

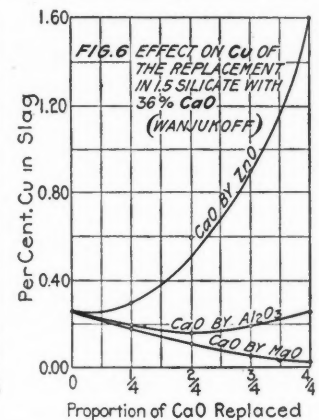
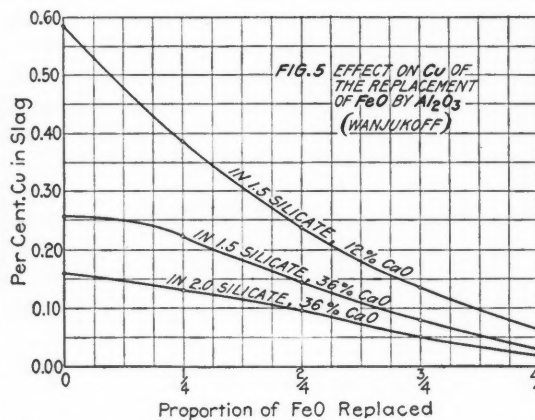
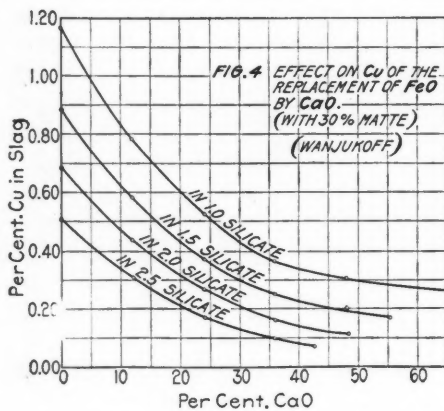
C. A. Heberlein (*Engineering and Mining Journal*, 1910, Vol. 89, p. 617)—Mr. Heberlein, recounted his experience in blowing in the furnace of the Maine & Nebraska Mining Co., using an ore with only 0.3% copper, but carrying considerable gold and silver. The slags produced averaged about 0.09% copper, or a recovery of 78%, while that of the gold was nearly 96%, the silver being somewhat lower. (This gives the ratio

copper also determined in that solution by electrolysis. The former result represented all the copper present as CuO and half of it as Cu₂O, according to the equations:



The percentage obtained by HNO₃ and H₂SO₄ (sulphide) was checked by determining the total copper in another portion by usual methods.

In this way the copper present as oxide in a normal slag of 0.22% was found to be about 55% of the total copper, while in one carrying 0.455%, due to excessive furnace oxidation, it was 66%. (It is worthy of note that there was also more sulphide in this slag.) Mr. Kiddie found that these ratios agreed with the gold-copper ratios of slag and matte, assuming that the sulphide alone carried gold into the slag. He also fused a quantity of the 0.455% slag with some ferrous sulphide in a crucible, and the resulting slag carried only 0.05% Cu. (Even if all the oxide were reduced and settled in this case, there must in addition have been two-thirds of the sulphide settled.) From these results Mr. Kiddie concluded that if the copper present as sulphide in any slag was as high as 66% of the total it would be advisable to employ



VARIATION OF COPPER IN SLAG WITH CHANGE OF SLAG COMPOSITION—AFTER WANJUKOFF

of gold to copper about 18% of that calculated from the matte, as against 58% found by Mr. Wright.)

F. A. Sundt (*Engineering and Mining Journal*, 1910, Vol. 89, p. 1097)—Mr. Sundt gave the results of his work at different smelteries in Chile, and from these he concluded that the percentage of copper in a slag depended, in part at least, on that in the charge. Rich charges in general gave slags carrying more copper, though percentage recoveries were better. He also derived a formula for finding the recovery efficiency of smelting under various conditions.

DETERMINING OXIDE COPPER IN SLAG

Thomas Kiddie (*Journal of C. M. I.*, 1911, Vol. 14, p. 487)—Mr. Kiddie stated the results of some laboratory experiments performed under his direction. By actual determination of the oxide of copper present he learned the percentages formed under normal conditions. The laboratory method (private communication) was as follows:

A sample of finely ground slag was digested at 80° C. with 5% H₂SO₄, two treatments being desirable; the insoluble was filtered and washed, and copper was determined in the filtrate by electrolysis. The residue was then treated with strong HNO₃ and H₂SO₄, and

a second settler, while if the same amount existed as oxide additional settling capacity would be of no avail. In this latter case he said some of the oxidized copper would be recovered if the slag were passed over a bath of low-grade matte in a second settler.

C. A. Grabill (*Engineering and Mining Journal*, 1910, Vol. 89, p. 776)—Mr. Grabill classified the losses as physical and chemical. The former consisted of those due to poor settling, insufficient difference of specific gravity of the matte and slag, and gas flotation; but he considered that all of these were small under normal conditions. The chemical losses might be due to the formation of copper oxide or to solution of metals and sulphides. The former he believed to be small in matte smelting, owing to the instability of copper oxide in the presence of sulphides, but of more concern in the production of black copper from oxidized ores. The loss as dissolved metal or sulphide he thought the most serious of all, and suggested that there might be a dissociation of the dissolved matte at high temperatures, like that observed for the slag itself, thus resulting in solution of the separate constituents of matte rather than for the latter as a group.

Owing to the difficulty of carrying out laboratory experiments under commercial conditions he did not place

much faith in results thus obtained in the settling of matte from slag. He thought that in a general way any conditions in the furnace tending to the production of metallic copper would probably raise the copper content of the slags.

W. Wanjukoff (*Metallurgie*, 1912, Vol. 9, pp. 1 and 48)—In an elaborate series of experiments Mr. Wanjukoff investigated the losses of copper in artificial slags of different degrees of acidity, with the oxides FeO, CaO, MgO, ZnO and Al₂O₃ replacing one another in varying proportions, as well as in contact with mattes of all ordinary grades. Some of his curves are reproduced in Figs. 3-6, replotted from the author's data.

He investigated also the relation of copper and sulphur in slags, but found little regularity. The amount of sulphur carried by the slags depended largely upon their

pyrite. His conclusion was that much of the copper had been present as oxide or silicate, owing to the contained sulphur being insufficient in amount to unite with all the copper as cuprous sulphide. As a regular treatment for molten converter slag—if iron flux were not desired for blast furnaces—he suggested pouring it into an externally fired settler through the roof of which pyrite was dropped in small quantity. This would require little fuel, and would save the copper without the usual re-smelting of slag.

H. O. Hofman (*"Metallurgy of Copper,"* opp. p. 174 and p. 257)—The analyses of blast-furnace slags in Table 1 are given in Doctor Hofman's book, and have been rearranged in the order of increasing copper content. The names of companies have been omitted, as the only comparison desired is that of the conditions under which

TABLE 1. BLAST-FURNACE SLAGS ARRANGED IN ORDER OF INCREASING COPPER CONTENTS—AFTER HOFMAN

No.	Matte			Slag						
	Cu	Sp.G.	Sp.G.	Cu	SiO ₂	FeO (+MnO)	CaO (+MgO)	Al ₂ O ₃	ZnO	BaO
1	30	5.0	<3	0.14	48.5-49.0	16.0	18	12	3.5-4.5	
2	12.38			0.15	38.2	38.5	12.5	6.0		
3	10-14			0.15-0.20	49	16	29-30	3-5		
4	35-38	4.64-4.71	2.81-2.84	0.19	49.09	5.95	21.84	16.02		
5	42-46	4.64-4.71	2.81-2.84	0.19	48.56	2.78	24.81	17.60		(K ₂ O-4.5)
6	20+			0.2	33.6-29	19.9-23.1	15.4	8.2-7.2	1.31	9.1
7	10	4.6	3.34	0.21	44.5	39.7	9.9	6.2	1.5	
8	40			0.23	42	22	26	3.5		
9	33	5.12	3.2-3.4	0.24	45-47	16-18	22-26	7-9		
10	40-50	5	3.2	0.2-0.3	40-45	20-24	23-26	6-8		
11	18-22	4.62	3.54	0.29	42.2	39.4	7.0	4.0		
12	43	5.2	3.3	0.3	39.3	24.8	25.2	6.2		
13	30			0.3	30	27	12	11		
14	20	4.6	3.55	0.31	35.9	43.1	7.6	4.6		
15	31.4	4.8	3.5	0.35	36.2	45.0	10.8	4.3	1.5	
16	13-20			0.35	39.31	38.74	12.88	0.43	2.87	
17	45-52	4.7-5.0	3.6-3.75	0.4-0.3	35-38	48-40	3-3.5	0.5-8.3	1.2-1.5	2-3
18	40.21	4.386	3.66	0.36	36.25	19.26	3-4.7	10.03	7.41	23.7
19	33.7			0.36	37.5	33.2	13.7	9.1		
20	49.37	5.0	3.2	0.37	37.7	26.2	24.4	8.0		
21	20-50			0.40	40.6-44.1	36.6	23.6	3.1		
22	40-50	4.9	3.4	0.40	42.5	26.1	25.5	4.6		
23	45-50			0.52-0.58	36.3-40.5	28.8-35.2	19.2-24.0	7.1-9.3		
24	62.16	5.25	3.60	0.69	34	46	11	5		
25	45			0.77	32.47	56.83	2.57	1.67	1.87	
26	35	4.75	4.0	1.10	23.0	29-31.5	2.8	5.6	23.0	8.0

composition, certain metals under favorable conditions passing in as sulphides to a much greater extent than the copper.

In his attempt to find a reagent which would dissolve either the oxide or the sulphide from a slag and leave untouched the other combination, most of the promising chemicals were tried, including H₂SO₄ of moderate strength (temperature not given), HCl, NH₄OH and NH₄Cl, AgNO₃ and KCN. H₂SO₄ (1:3) attacked the copper sulphide only slightly, as did HCl (1:7), but all the other reagents appeared to be quite unsatisfactory. His conclusion was that the relative quantities of copper sulphide and oxide could not be even approximately determined.

METALS WITH HIGH-SULPHUR AFFINITIES CARRY COPPER INTO SLAG

He noticed that slags containing metals with a strong affinity for sulphur were more likely to contain considerable copper than those with metals which did not so readily form sulphides. He gave the following as the order of some of the common metals with reference to their affinity for sulphur, in descending scale: Cu, Ni, Co, Fe, Mn, Zn, Ca, Mg, Al.

John W. James (*Engineering and Mining Journal*, 1914, Vol. 97, p. 1114)—Mr. James told of passing into a reverberatory furnace molten converter slag which by settling had been reduced in copper content to 1.25-1.50%. After a treatment with green poles and charcoal the copper was 0.75-0.85%. Half of this residual quantity was reduced in a few minutes by throwing in a little

certain amounts of copper enter the slag. Table 2 gives similar analyses of modern reverberatory slags.

TABLE 2. REVERBERATORY SLAGS ARRANGED IN ORDER OF INCREASING COPPER CONTENTS—AFTER HOFMAN

No.	Matte			Slag					
	Cu	Sp.G.	Sp.G.	Cu	SiO ₂	FeO (+MnO)	CaO (+MgO)	Al ₂ O ₃	ZnO
1	35			0.36	36.8	35.1	9.3	10.5	3.0
2	46			0.37	37.8	38.6	4.0-4.5	6.0	
3	45	4.85	3.35	0.40	45	29	17	6	1
4	33-48	4.85-4.56	3.40	0.41	43.4	33.5	12.8	5.8	
5	35-45	5.0-5.6	3.21	0.45	41.9	32.6	7.4	10.6	
6	45-48		3.3	0.40-0.52	44	29-30	6	6-8	
7	37.27	4.60	3.32	0.51	35.5	33.4	1.8	11.15	1.0

A. J. Bone (Private Communication)—Reference has already been made to the practice of the Tennessee Copper Co. Mr. Bone has kindly supplied the information in Table 3, showing the varying losses as changes were made in the smelting practice there. The saving in copper by adding limestone to the matte-concentration charge is seen to be a striking one, and the greater quantity of slag produced would not materially change these proportions.

TABLE 3. COPPER LOSSES IN SLAGS RESULTING FROM CHANGE IN SMELTING PRACTICE—AFTER BONE

Date	Charge	Matte Cu	Cu	Slag SiO ₂	FeO
1901-1904.	Rough-roasted ore	41.12	0.474	32.9	50.7
1905-1907.	Low-grade matte and ore (No limestone)	38.4	0.662	37.4	51.8
1907-1908.	Raw pyrite	31.0	0.420	39.8	44.0
1909-1912.	Low-grade matte, with limestone	31.9	0.347	37.4	44.5

Comparing the raw-pyrite smelting and recent matte smelting it appears that the greater quantity of copper on the charge in the latter case did not raise the copper in the slag materially, being more than balanced by other conditions—(limestone?).

(To be Continued)

Potash Deposits in Chile

BY SEVERO SALCEDO*

Potash was discovered in Chile many years ago, but for reasons too many to enumerate these salts have not attracted the attention of Americans, even though two magnificent samples with 16 and 28% of potassium chloride respectively were exhibited in 1901 at the Chilean pavilion in Buffalo.

The potash salts are found in the Province of Tarapaca, Chile, in Pintados and Bella Vista Lakes, which together have an area of about 10,000 acres. The deposits are only about three miles from the railroad that runs from Iquique to Lagunas.

The potash occurs as chloride in a crust at the surface, samples of which vary from 3 to 36% of KCl. The density of the bed is about 1.352. This superficial crust varies, having an average thickness of 20 cm., but this is only a part of the potash contained in these lake beds, as the water underlying the crust contains the same salts (8 kg. of potassium chloride per cubic meter of brine), which by evaporation and capillarity have formed the salt crust; when the salt bed is removed it is again formed—in 8 to 12 years—by the same process. The data on which this article is based are taken from the reports of Chilean engineers, and especially from the report of an investigation by Messrs. Lemetayer, Martens and Vasquez, and of Enrique Taulis.

P. Lemetayer, professor of chemistry in the University of Chile, in company with the chemists, P. Martens, chief of the Government Chemical Laboratory at Iquique, and Doctor Vasquez, made an examination of the Pintados and Bella Vista Lakes in 1905, at which time they calculated a KCl content of 2,037,948 tons in a salt bed, ranging from 3 to 12% of potassium chloride. Up to the present no soundings have been made deeper than 3 or 4 ft. Enrique Taulis, director of the Agricultural College in Santiago, who made a study of the Stassfurt deposits in Germany, also reported on the Guaica deposits of Pintados Lake. He reported in 1901 the following analysis of a sample from a representative shipment of Pintados (Guaica) salts:

Moisture (at 110°).....	5.000
Insoluble in water.....	1.324
Chlorine.....	37.961
Sulphuric anhydride.....	15.334
Calcium.....	0.272
Carbon dioxide.....	0.134
Sodium.....	29.533
Potassium.....	7.409
Magnesium.....	trace
Oxygen of the sulphates.....	3.066

This elementary composition corresponds according to the laws of chemistry to the following:

Calcium sulphate.....	0.925
Sodium carbonate.....	0.323
Sodium sulphate.....	28.392
Sodium chloride.....	51.447
Potassium chloride.....	14.151

Having crystallized a solution of these salts, he concluded from a study of their crystallographic character that none of the potash was present as sulphate. Hence, all of the potassium is calculated as chloride. It is important to note the absence of magnesium salts, as well as that of bromides or iodides, which have a toxic action on plants. Mr. Taulis determined that the calcium salts existed in the form of sulphates, and that the deposit might be considered as consisting of sulphate of sodium and

chlorides of sodium and potassium, which fact simplifies the economical extraction of concentrated salts. In normal times the Pintados salts would have to compete with the Stassfurt products, and he made the accompanying comparison of the Pintados salts with that of carnallite and kieserite, the Stassfurt salts which most nearly approximate the Guaica deposit. Magnesium chloride, hav-

COMPARISON OF STASSFURT AND PINTADOS SALTS

Composition	Carnallite	Kieserite	Pintados
Potassium chloride.....	15.5	11.8	14.15
Magnesium sulphate.....	12.1	21.5	none
Magnesium chloride.....	21.5	17.2	none
Sodium chloride.....	22.4	26.7	51.45
Calcium sulphate.....	1.9	0.8	0.93
Sodium sulphate.....	none	none	28.29
Insoluble in water.....	0.5	1.3	1.32
Moisture.....	26.1	20.7	5.00

ing a high solubility, increases the cost of purification on account of the complicated procedure required for such salts.

Taking the composition of the Pintados salts as sulphate of soda and chlorides of soda and potassium, and keeping in mind that the maximum solubility of sulphate of soda is reached¹ at a temperature of 20° C., at which the chloride dissolves only to a small extent, it will therefore suffice to submit these salts, suitably ground, to a lixiviation with water at this temperature to dissolve the whole of the sulphate and only a part of the chlorides. The residue of this first washing will consist of a mixture of chlorides. The solubility of the chloride of potash increases with rise of temperature, while that of chloride of soda remains constant.

On the other hand, since the solubility of sulphate of soda decreases with increase of temperature, if the water from the first lixiviation be heated the sulphate will be partly eliminated and all of the chlorides retained in solution. Since the potassium chloride is more soluble than the sodium chloride, the crude salt can with a single lixiviation be exhausted completely of its potassium chloride, obtaining a product with a concentration of more than 40% of chloride of potassium. By means of lixiviations successive to those already indicated, the concentrated salts can be produced with a content of 90% potassium chloride, if necessary.

One-third of all the chloride of potassium sold in Europe is used for the manufacture of potassium nitrate from the nitrate of soda imported from Chile. These two salts being only a few miles distant in the Province of Tarapaca, the benefits that can be derived are obvious. To make 100 kg. of potassium nitrate it is necessary to use 73.95 kg. of chloride of potassium and 84.15 kg. of nitrate of soda (Chile saltpeter). Hence it would be easy to undertake this manufacture in Chile. A freight of 58 kg. on inert substances would be eliminated for each 100 kg. of nitrate of potash exported.

It is worth noting that the pipe line supplying potable water to Iquique passes across the Pintados properties. This pipe line, or the wells situated in the vicinity, can supply sufficient water for an extraction plant.

It is to be hoped that in the near future the world will not have to depend exclusively on the European monopoly which has for so many years dominated the potash market. An engineer left New York on July 24 to examine the Pintados deposit for American interests, which will immediately undertake the exploitation of the Chilean potash if the representations of the local engineers can be substantiated.

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¹ Given by other authorities as 32.3° C.

Orebodies of the Mesabi Range--IV

By J. F. WOLFF*

SYNOPSIS—Previous theories as to ore formation correct in main features. Three types of bodies related. Relation between folds and orebodies. Fracturing permitted entrance of groundwater, leading to iron concentration. Function of the Intermediate slate was to control water circulation. Western Mesabi sandy ores due to lack of vigorous circulation and of transportation of silica. Discussion of probability of correctness of conclusions.

In the preceding parts of this series the structure and exploration of Mesabi range orebodies were discussed for the particular assistance of engineers in the district. This part will present additional data from which, together with what has gone before, conclusions will be drawn as to the geological conditions under which these orebodies have developed. Of course it is impossible to prove absolutely that any one set of causes governed the formation of the ore but I believe that sufficient positive information is at hand from which to draw valid conclusions.

logical Survey Monograph 52 Van Hise and Leith present the theory that the orebodies have occurred in gently folded synclines and anticlines, which were produced by the slight warping or folding of the iron-bearing rocks. In neither of these publications was there presented any direct evidence in support of these theories other than a discussion and statement of general field observations. It is proposed here to present geological plats and structural sections to show that in the main both of these theories are correct. Spurr's observations were made upon the orebodies from Mountain Iron east, because at this time little work had been done west of Mountain Iron, and his theory has application mainly to the orebodies now included in the Virginia, Eveleth, McKinley and Biwabik districts. Van Hise and Leith had practically the whole Mesabi range as a field for their investigations and their theory is applicable broadly to the entire range. It is a matter of considerable satisfaction to find that theories based upon broad field observations are so closely in accord with facts worked out from detailed explorations. Spurr probably emphasizes faulting more than the facts as now known will warrant, but his principal

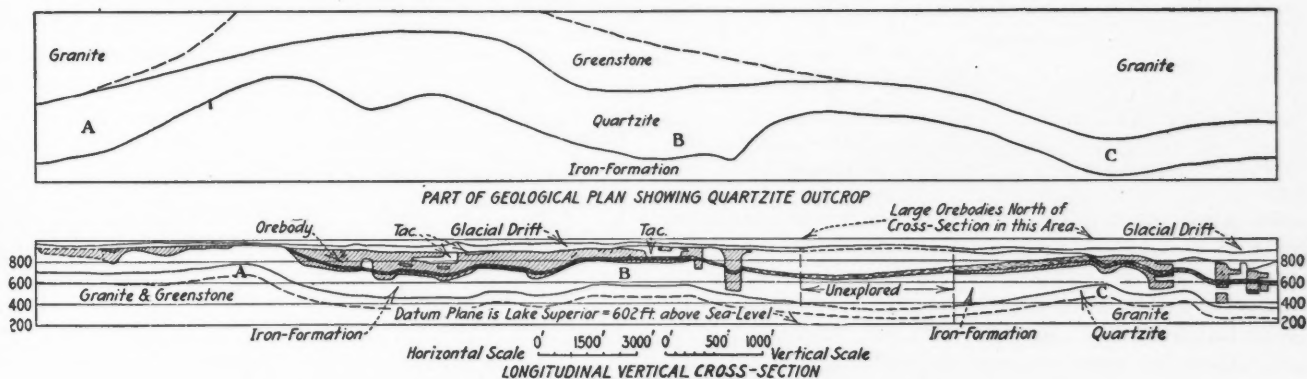


FIG. 28. LONG PLAN AND SECTION SHOWING RELATION OF ORE TO STRUCTURE

In the first article, the process of actual formation of the ore by the leaching out of the silica, the oxidation of the iron and the compacting or slumping of the iron in place was described. All mining engineers and geologists who have had anything to do with the Mesabi range in recent years are agreed upon this process of formation. It was simple, and ordinary close observation is all that is necessary to establish it; but the geologic conditions which allowed this leaching and oxidation in certain places and not in others are not directly observable and have been worked out only after the study of the great mass of information available to me which was mentioned near the end of the first article.

PREVIOUS THEORIES

In 1894 in Minnesota Geological Survey Bull. 10, "The Mesabi Range Iron-Bearing Rocks," J. E. Spurr presented the theory that the orebodies were formed in zones of weakness produced by faulting or fracturing of the rocks. He inferred that the fracturing occurred for the most part along the axes of anticlines. In U. S. Geo-

idea, that the orebodies from Mountain Iron east have formed in zones of fracturing and consequent weakening of the iron formation layers, seems to be substantiated. From a practical standpoint the theories of Spurr and Van Hise and Leith are essentially the same.

THREE TYPES OF OREBODIES

The Mesabi orebodies, as previously noted, may be divided into three types, viz., trough bodies, flat-layered bodies and fissure bodies, named in the order of their importance. The structure of the trough bodies has been described and emphasized in the preceding articles as being the typical structure, because by far the larger part are of this type. The flat-layered bodies are generally continuations of the trough bodies and some of them are extensive laterally but of moderate thickness, about 50 ft. being a maximum. The fissure bodies generally occur along the limits of larger trough bodies. They are simply narrow vertical fissures of ore which are the alteration of the taconite on vertical cracks in it. They really represent a step in the formation of trough bodies, being incompletely formed orebodies. There are a few bodies of this type

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ies, but these apparently are the remnants left by the erosion of former large bodies. This type of orebody will be understood better by reference to Fig. 36. The second stage *B* in the formation of a trough body is a good cross-section of a fissure body. It remains to explain what probable geological conditions controlled the formation of these three types.

STRUCTURAL SECTIONS

In order to determine whether or not any relation exists between the positions of the orebodies and the general structure of the iron formation, a longitudinal section 30 miles long, parallel to the strike of the iron formation and taken approximately midway between the limits of the iron-formation outcrop, was made for that part of the range between Sections 17, 58-19 and 24, 56-24. This sec-

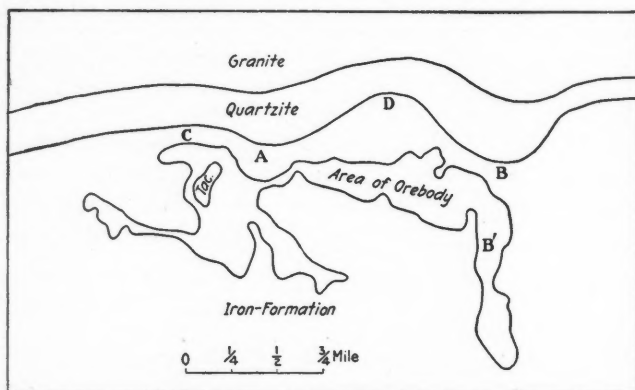


FIG. 29. OREBODY CORRESPONDING TO STRUCTURE SHOWN BY QUARTZITE OUTCROP

tion reveals some interesting facts. A part of it is shown in Fig. 28. It was prepared from all of the drill information available. Examination of Fig. 28 shows that the orebodies conform closely to the major structure of the iron formation and the quartzite, i.e., they occupy the troughs of the synclines and the crests of the anticlines (it should be noted that the vertical scale is $3\frac{1}{2}$ times the horizontal). The section shows two main troughs in the quartzite between the anticlines marked *A*, *B* and *C*. Between the points *A* and *C* are the most extensive orebodies of the range and the great size and lateral extent of these are directly connected with the major folding of the iron formation as shown on the section. The plan in Fig. 28 shows the quartzite outcrop and its relation to the underlying granite and greenstone, and to the overlying iron formation. Attention is called to the relation between this outcrop and the quartzite shown in the section. Casual observation shows that the embayments in the quartzite line on the plan correspond to the troughs or synclines in the quartzite on the section. Letters *A*, *B* and *C* on the plan correspond to letters *A*, *B* and *C* on the section and indicate the axes of gentle anticlinal folds. The distance between *A* and *B* appears greater on the plan than on the section, because the section is taken about a mile south of the quartzite outcrop and the axes of the anticlines *A* and *B* converge toward the south. This general relation between the shape of the quartzite outcrop and the structure of the formation is an important one to recognize and it will be referred to later. Of course, minor irregularities in the quartzite line may be due to irregularities of erosion. It may be thought also that

the irregularity of the quartzite outcrop simply represents the contour of the shore line upon which the quartzite was laid down, but this is hardly probable because the original shore line must have been several miles north of the present outcrop and progressive erosion has steadily moved the outcrop southward. There is so direct a relation between the outcrop and the section shown as to make the conclusion irresistible that the large bends in the outcrop correspond to the structural folds in the formation. Indeed it seems impossible that there should not be such flexures in a sedimentary series as extensive as the Mesabi. Structural study of the part of the range represented in Fig. 28 reveals many minor folds in the major folds and field observations show minute warping and bending of the taconite and ore layers. Thus there are gentle folds of all orders from extremely large ones down to those of small dimensions in the iron formation. Similar study and observation confirm this fact for all parts of the range.

A further interesting fact revealed by this 30-mile section is that on the western end of the range, where the sandy ores exist, no marked folding of the series has occurred. The deformation has been so slight that the quartzite line is practically flat.

AREAS OF OREBODIES

Figs. 29 to 35 inclusive show the areas of different orebodies and their relation to the general surface geology. By applying the fact above established regarding relations

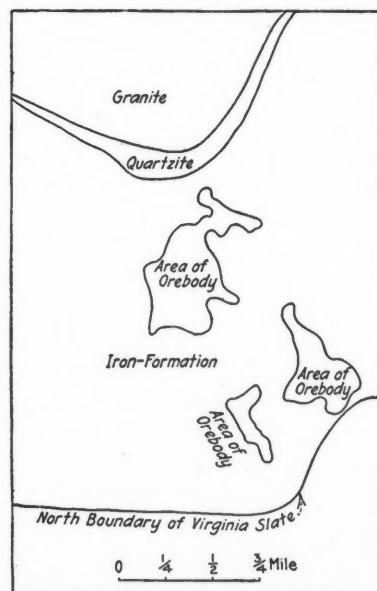


FIG. 30. OREBODIES ON AXIS OF ANTICLINE

between quartzite outcrop and structure of the formation, the relation between the locations of orebodies and the general structure of the formation can be inferred. For example, Fig. 29 shows an orebody which corresponds roughly to the general structure shown by the quartzite outcrop. It occupies the axes of two anticlines *A* and *B* and the troughs of two gentle synclines *C* and *D*. The part of the orebody *B'* is evidently on the axis of the anticline *B*. Fig. 30 shows orebodies which have been formed on the axis of a pronounced anticline. On this plat both the quartzite and the Virginia slate lines indicate the location of the anticlinal axis. Figs. 31 and 32 show other orebodies which are formed on the axes of anticlines. Fig. 33 shows an orebody which has no apparent relation to any structural feature of the formation. It has pronounced sharp walls and is comparatively deep. From the general shape and direction of the orebody one would infer that it had formed on the locus of fissures or cracks cutting across the strike of the formation at angles

of 20° to 80°. Fig. 34 shows an orebody, part of which, *A*, occupies a structural basin in the formation while the other part, *B*, apparently occupies the axis of an anticline. A careful structural study of the drilling in this area proved that these inferences are facts, because there is a marked flexure down to the east, in the layers of the iron formation just east of orebody *B*. Fig. 35 shows an extremely large orebody and one which is somewhat exceptional. Apparently it occupies a general synclinal fold. The three lobes *A*, *B* and *C* unite to form the major trough *D*. From their relations to the quartzite outcrop the branches *A* and *B* seem to be on either side of the axis of a small anticline and the branch *C* appears to be directly on the axis of another small anticline. This body is the best example on the range of two or more troughs uniting to form a larger one. It is a large body, as can be seen by reference to the scale on the plat, while the ore is deep and has sharp rock walls. Parts of this body were explored in the early days and from the information gathered in this and in orebodies represented in Figs. 30 and 34 Spurr drew his conclusions regarding the geological conditions which allowed the formation of Mesabi ore. The orebodies represented in these figures are from the most important producing parts of the range. They are the smaller of the principal bodies. Those shown in section in Fig. 28 and those on the western part of the range are so extensive in area that they are not included here nor would their representation be of more value to the present purpose. From what has

Almost everywhere the taconite is found to be broken into paralleloiped rocks by at least two sets of fractures, the directions of which are not the same in all areas. In some places, particularly on the axes of anticlines and synclines, this fracturing has been pronounced and in these localities groundwaters found their way into the formation most readily. In other places, such as the large areas represented in Fig. 28, the fracturing must have been general rather than localized. In such an area the penetration of groundwaters must have been extensive, and therefore orebodies extending over large areas have been formed. The gentle rolls in the formation made natural structural channels, controlling the flow of underground waters. The smaller bodies formed where the cracking was localized. The process of leaching out the silica and the concentration and slumping of the ore

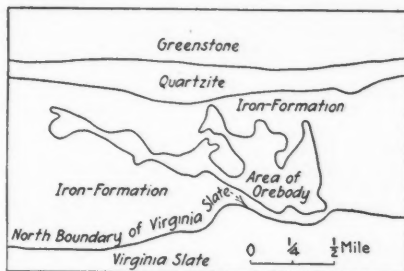


FIG. 33. ORE FORMED AT LOCUS OF FISSURES

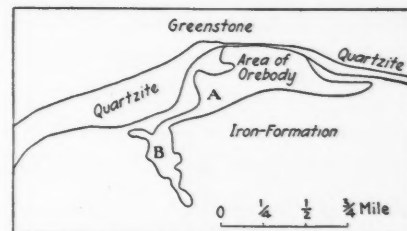


FIG. 34. A IN BASIN, B ON ANTICLINE

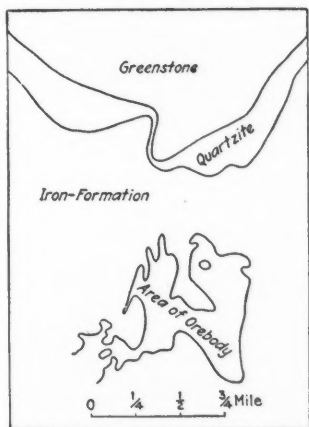


FIG. 31
OREBODIES ON AXES OF ANTICLINES

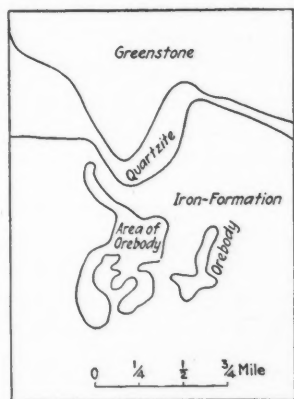


FIG. 32

need not be described again here, since it was discussed in part I. However, Fig. 36 is presented to show the probable development of one of the smaller bodies on a series of parallel fissures. The successive stages shown illustrate the progressive development of the orebody better than would a long description; this is not the mere expression of a theory but is well founded on fact. All four stages shown, and even intermediate stages, can be observed in the orebodies themselves. In Fig. 36, *A* represents tension cracks in the iron formation on the axis of a gentle anticline; *B* represents the formation of ore by the alteration of the taconite on the vertical fissures and along bedding planes; *C* represents the process of alteration well advanced; and *D* represents the present condition of the average orebody. Surface erosion of taconite and ore is shown also. This illustration refers particularly to the deep, sharp-walled trough bodies from Mountain Iron east. The same process has operated, but over large areas, in the Hibbing, Chisholm and Western Mesabi districts. The rock horses and rock pillars found in the lower blue ore in every deep-trough orebody are simply incompletely altered blocks of taconite. In many bodies, in which mining has progressed far enough, stringers of ore can be followed out into narrow fissures in the rock until they finally give way to decomposed taconite which in turn gives way to solid taconite. On the edges of a few orebodies these stringers or vertical fissures of ore are so numerous that they constitute what have been referred to previously as a fissure type of orebody. The orebodies formed by the complete alteration of the fractured areas or zones as above described are characteristic trough bodies (*D*, Fig. 36). The origin of the third type or flat-layered body will be discussed now.

From the persistence of the altered Intermediate slate layer or the paint-rock layer (Parts I, II and III) it

been presented some definite conclusion can be drawn as to the geological conditions governing the formation of the ore.

GEOLOGIC CONDITIONS UNDER WHICH OREBODIES FORMED

The evidence already presented in this and preceding parts shows conclusively that the sedimentary rocks of the Mesabi range have been gently folded and fractured and in a few places faulted by the earth movements which have occurred since their deposition. Because of its brittle nature, the iron formation yielded to this folding by fracturing and by slight bending of the layers. A great deal of gentle major and minor folding has been disclosed by close structural study of exploration and mining work.

must be evident to the reader that this layer has had a marked influence in the formation of the ore, otherwise the paint-rock layer would not be found so universally in the ore. One would expect to find alteration of the taconite immediately above the quartzite or of the taconite immediately below the Virginia slate as frequently as one finds alteration of the part of the formation both above and below the Intermediate slate layer. It remains therefore to secure an explanation of the presence of the Intermediate paint-rock layer in almost every orebody of any size and importance. When erosion started to truncate the Mesabi series, surface waters flowing over the top of the iron formation seeped into it in fissured areas. The waters flowing down the greenstone and granite flowed first on the iron formation below the Intermediate slate layer and entered this formation wherever possible. The waters which flowed across the outcrop of the Intermediate slate layer entered the fractured upper taconite wherever it was sufficiently broken up. The Intermediate

cherty taconite, 5 to 20 ft. thick. This layer is badly broken up and is always difficult to drill through. Its exceptional chertiness may be the result of deposition of silica out of the waters ponded under the slate (Fig. 37). The diagram shows the circulation of the waters beneath the Intermediate slate as finding its way through cracks in the slate up into the upper taconite. Immediately below the slate layer there may have been a return current making its way to the outcrop. Evidence of this is to be found in the incomplete alteration of the lower yellow taconite in most of the orebodies in the eastern part of the district and in the excessively sandy layer found in

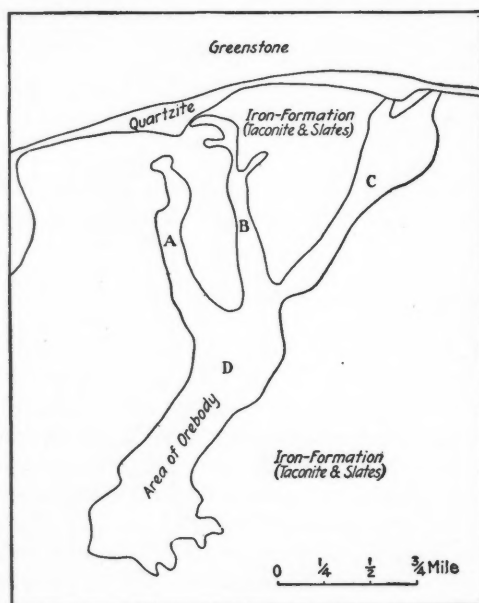
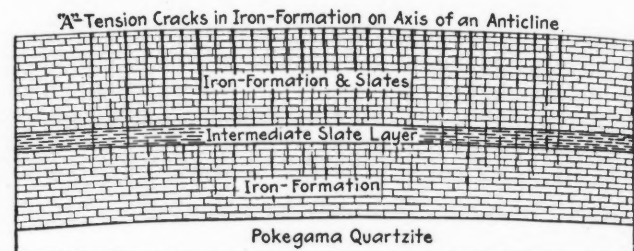


FIG. 35. LARGE OREBODY FORMED OF SEVERAL JOINED TROUGH

slate itself is relatively impervious to water except for the cracks which traverse both it and the taconite above and below it, and which allow water to penetrate into it and through it. It is not so permeable as the taconite in any sense. Therefore the waters in the taconite underneath it were considerably ponded. The waters in the taconite above the Intermediate slate flowed down under the Virginia slate until they became ponded under it. The Intermediate slate thus acted as an impervious basement for the upper waters and ponded the lower waters; together with the folds in the formation it controlled the circulation of the groundwaters. Fig. 37 is a diagram illustrating the probable circulation of water within the iron formation. Above the Intermediate slate layer an artesian circulation must have been set up by the ponding of water under the Virginia slate. Evidence of this is to be found in the flowing wells which have been developed in several places by drilling through the Virginia slate into the iron formation beneath it. Further evidence is found in the existence immediately beneath the Virginia slate of a layer of almost pure chert or extremely



"A" Tension Cracks in Iron-Formation on Axis of an Anticline

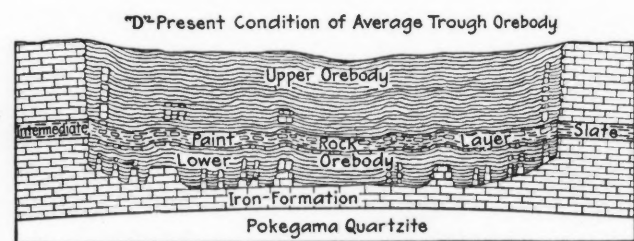
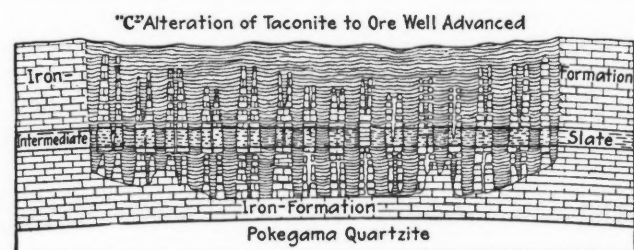
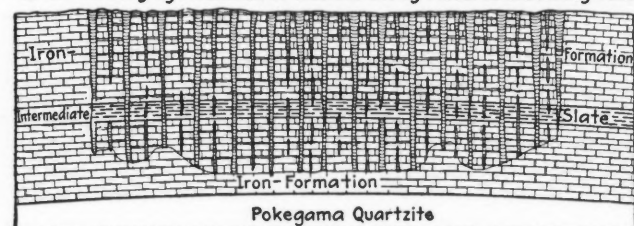


FIG. 36. DEVELOPMENT OF OREBODY THROUGH FISSURE TYPE TO TROUGH TYPE

the bodies from the Hibbing district west. This evidence means either that there was incomplete circulation and consequent solution and transportation of silica from the formation immediately below the Intermediate slate layer or else that this sandy ore and rocky layer under the slate represents precipitation of silica out of solution, due either to the ponding of water or to a reaction with the alumina in the slate layer. There is good evidence that the escape of the waters beneath the Intermediate slate was through cracks or fissures extending from the upper taconite down through the slate. In several flat-layered orebodies beneath the slate, where no extensive

body occurs above this layer, individual drill holes or a few drill holes show that fissures or chimneys of ore extend from the surface down to the slate layer. Since the ore in these drill holes is not connected with any large orebody the inference seems reasonable that the ore in them was caused by waters ascending from beneath the slate layer rather than from descending surface waters. There is no other explanation for the outlet of these waters ponded underneath the Intermediate slate and the evidence of these chimneys or fissures of ore in the upper taconite suggests directly the explanation just given.

FLAT-LAYERED BODIES

In Fig. 12, Part II, there is shown a section of a flat-layered body which is the continuation down the bedding of the iron formation from a trough body. This flat-layered body is derived from the lower yellow taconite. The occurrence of extensive flat-layered bodies as extensions of trough bodies immediately underneath the Intermediate slate is so common all over the range as to attract immediate attention. The explanation seems simple enough. The waters ponded underneath the slate layer sought escape laterally along bedding planes and their flow was directed by the gentle folds in the formation until they found outlet through fissures extending from the

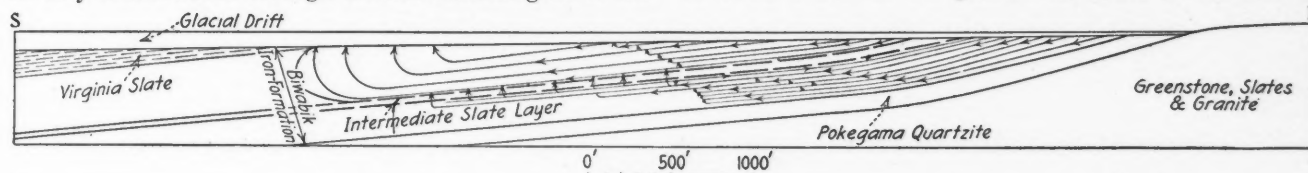


FIG. 37. DIAGRAM OF PROBABLE WATER-CIRCULATION

upper taconite down through the Intermediate slate. As previously indicated, these orebodies are not thick or of exceptional richness. Down the slope of the bedding some of them grade into lean ore or decomposed taconite. Parts of them are not of merchantable grade.

There are other flat-layered bodies in the upper taconite. For the most part these are extensions down the dip of trough bodies. Some of them may be the remains of larger bodies which have been removed chiefly by preglacial erosion.

ALTERATION OF INTERMEDIATE SLATE

Although the Intermediate slate layer has been spoken of as an impervious layer this term, of course, is a relative one. The tremendous length of time during which alteration has proceeded has caused even this layer to be partially or completely altered by the solvent and oxidizing effect of groundwaters. In many places the upper and lower parts of this layer are well altered and a slate core remains. This is further direct evidence of circulation both above and below the layer. In other orebodies or parts of orebodies this layer is completely altered and is now a soft clayey material infiltrated with iron precipitated out of solution. Its moisture content is much higher than that of the altered taconite.

This member is so dense and homogeneous that the only alteration which has occurred in it has been at its contact with the iron formation. In some places the upper 5 or 10 ft. of it has been decomposed into a sand and in one place it is known to be so saturated with iron from the orebody above as to be practically an ore. Aside from

this alteration the quartzite apparently has been impervious to groundwaters.

THE SANDY WESTERN MESABI ORES

The best explanation known to me, of the occurrence of large amounts of low-grade ores and sandy washable ores on the Western Mesabi is the one suggested by the longitudinal section referred to above, part of which is shown in Fig. 28. As already stated, this section reveals no structural basins in the quartzite in the Western Mesabi district. Therefore no natural underground water channels have controlled the circulation. The waters simply seeped into the iron formation, having no definite drainage courses as in the central and eastern part of the district. Moreover the dip of the formation is extremely gentle, being only about 4% or 5%. Therefore, while decomposition of taconite and oxidation and concentration of iron have been quite complete in this area, the solution and transportation of silica out of the orebodies have not been complete.

SUMMARY

In order to emphasize the essential facts set forth in these articles a general summary seems not out of place. In Parts I and II the general structure of the Mesabi

range and its orebodies was pointed out and exceptional structural features were described and illustrated. It was shown that all orebodies on the range from one end to the other have a uniform structure. They occupy irregular trough-shaped basins in the taconite or country rock. They consist of an upper and a lower high-grade member separated by a low-grade member which is the alteration of an interbedded slate layer. Ordinary close observation of exploration and mining work will disclose to the engineer or mining man this characteristic structure of a typical orebody.

In Part III the method of exploring Mesabi range orebodies was described and illustrated. The best known method for determining the structure from the exploration records was presented in detail and illustrated with a complete set of structural vertical sections of an orebody as I actually worked it out for commercial purposes.

In Part IV additional data have been given from which, together with those presented in the first two articles, well defined conclusions have been drawn as to the geological conditions under which the Mesabi range orebodies have developed. I have shown that exploration and mining work and particularly close structural study of all parts of the range substantiate the theories which J. E. Spurr in 1894 and the geologists of the U. S. Geological Survey since 1903 proposed regarding the geological conditions determining the formation of the orebodies, viz., that they formed in zones or areas where the iron formation was much cracked or broken up, due principally to gentle warping or folding and slight faulting of the Mesabi series of ore formations.

I have presented these articles in order to diffuse among engineering and mining men particularly on the Mesabi range a knowledge of a great many facts valuable to them in their work. All of this information represents results of several years' observation and study, but it is not presented as being the last word on the subject by any means. Rather it is presented as an outline on which others may work.

It is hoped that the present articles will instigate and stimulate work in this direction, so that there will be uniformity of effort along these lines and eventually the structure and geologic history of the Mesabi range will be known more completely than that of perhaps any other mining district in the country.

✻

Forfeiture of Placer Locations

BY A. L. H. STREET*

In affirming a decree quieting title to a placer-mining claim as against a junior location, the Supreme Court of Oregon decided the following principal points related to forfeiture of such claims:

Clearing brush and trees from the surface of ground located constitutes such assessment work as prevents forfeiture of a claim, when it is done for the purpose of enabling the claim to be worked by dredging.

When a junior locator asserts forfeiture of the claim by the senior locator through failure to do annual assessment work, the burden is on the former to establish such failure, rather than on the latter affirmatively to show performance of the work.

Resumption of work by a senior locator before relocation by another defeats a relocation.

Since it is only against intervening rights that a resumption of work by a locator does not revive the possessory rights of the claimant, it must be held that where the senior locator of a placer claim failed to do required assessment work, a relocation of the claim by another person, who also failed to perform assessment work for a succeeding year, does not forfeit the right of the senior locator to resume work thereon, so as to authorize a third person to relocate the claim after the senior locator had done the assessment work for a succeeding year. (Richen vs. Davis, 148 Pacific Reporter, 1130.)

✻

Electric Steel Production

There were, at the beginning of 1914, according to the *Elektrotechnische Zeitschrift*, 138 arc furnaces and 35 induction furnaces in operation for the production of steel. The arc system is thus far more generally in use, though judged on the basis of steel output the advantage would appear to be with the induction system. The opinion expressed in recent years that the induction furnace would prove the better of the two, has given place to the conviction that each system has its own special field of operation. So far as the sizes of the furnaces are concerned the problem of a construction for a capacity over 15 tons has yet to be solved. Larger furnaces than the 25-ton Heroult have not yet been constructed, and the practicability of this dimension has not been demonstrated as yet. The Girod system has attained the

*Attorney, St. Paul, Minn.

15-ton margin, the Nathusius and Röchling-Rodenhauser 12 tons, while the production of castings on the Stassano method is limited to small units of no more than two tons. Nevertheless, units of 30 tons are still being built on the Heroult system and 20 tons on that of Frick. During 1913 the output of the electro-thermic steel works increased in Germany, Austria-Hungary and France, though the increase was less than in previous years. The total production in North America remains nearly stationary. On the whole, it is the general belief now—as against previous opinions to the contrary—that the electro-steel industry has a long period of development still confronting it, and that the experimental stage is far from having been passed.

Herewith is given a list of the several systems and their development in 1913 and 1914. Arc furnaces working and under construction: Heroult 67, Girod 27, Nathusius 9, Stassano 10, Keller 6, Chaplet 8, others 11; total 138. Induction furnaces working and under construction: Kjellin 10, Röchling-Rodenhauser 17, Frick 6, others 2; total 35. There are therefore 173 electric furnaces altogether.

✻

Extracting Potash from Salines of Low Potash Content

While the admixture of previously cooled solutions of nitrate of soda and of chloride of potassium results in the formation of a precipitate of nitrate of potassium, the sodium chloride remaining in solution, if the product to be treated contains slight amounts of chloride of potassium mixed with, for example, large quantities of salt, the reaction may be invisible. It is not possible to secure the precipitation of the potassium nitrate, because its solubility is increased by the presence of the salt. M. M.-E. Pichard proposes to turn this to account in the extraction of potash from saline deposits poor in potash, the method of working on the industrial scale being given thus by the *Chemical Trade Journal*:

In a saturated and cooled solution of NaCl is dissolved the small quantity of nitrate of soda necessary for the conversion of the KCl contained in the crude salt to be treated, over which this solution is passed, keeping the whole at a low temperature. KNO₃ is formed and is carried away by the solution of NaCl. The foreign elements of the crude salt, NaCl, Na₂SO₄, CaSO₄, remain insoluble. The potassium solution containing KNO₃ in presence of NaCl is evaporated down, and deposits a mixture of these two salts. Separating them is most easily effected by warm water, which dissolves the potassium nitrate and leaves undissolved the sodium chloride which has acted as a vehicle, and is used again. The residuary salts are dissolved, and the cold produced by their solution is utilized in the application of the process.

✻

The Philippine Bureau of Science Reports that examinations have been made of the discoveries of iron ore recently reported from Surigao Province. Samples were taken by drilling over an area of 100 sq.km. The deposit was found to be singularly like the Mayari iron ores near Nipe Bay, Cuba, in its occurrence; that is, it is a great surface blanket of iron-bearing clay, which has resulted from the weathering and decomposition of the original rock. In the case of the Surigao deposit the parent rock is made up principally of the mineral serpentine. The ore deposit is of varying thickness, in many places entirely carried off by erosion. Further investigations are being made; also analyses of the iron ore samples.

Details of Practical Mining

Automatic Signal System Used in Stockpiling Iron Ore

BY JOHN F. MURPHY*

During the winter operations of underground iron mines in the Lake Superior district, it is necessary to stockpile ore until shipping begins in the spring. With usual practice, shafts have two hoisting compartments where the skips are hoisted in balance. The ore is dumped directly from the skip into a car on the stockpile trestle. Consequently, the hoisting engineer must know that the skip is loaded and also that a car is in the proper place on the trestle.

At one of the large underground mines on the Mesabi Range in Minnesota the following signal system was used for this purpose: A bell operated by the under-

ground storage room would become filled and mining operations delayed until hoisting was resumed.

The following automatic-signal system was devised and installed to eliminate the man employed as car-spotter and signalman on the trestle, and also the trouble resulting from cars being spotted incorrectly. A red light on the trestle in front of each skip road indicated to the motorman the next skip to be hoisted. These lights were operated automatically by the skip. A white light at the side of each red light indicated that a car was spotted correctly under the skip road. Each of these white lights was operated by a spring which closed a circuit with the car wheel. A red light and a white light burning side by side showed the motorman that the car was in the proper place to receive ore from the next skip to be hoisted. Two red lights in the engine house on either side of the indicator disk showed the hoisting engineer that the car was in place and which skip it was under. The red lights in the engine-house were on the same circuit as the white lights at the trestle.

The accompanying diagram, with description, illustrates more clearly the manner in which the system operates: An electric switch *S* controlled by the lever *L* is located between the two adjacent skip guides. When the skip *A* is at the bottom of the shaft a red light *R* burns in front of the *A*-skip road. When the *A* skip strikes the triangular lever *L* the switch *S* is pushed over on the other line, extinguishing the red light in front of the *A*-skip road and lighting the one in front of the *B*-skip road, thus showing that the skip *B* is at the bottom of the shaft.

The white lights *W* are controlled by the springs *C*, which complete a circuit through the car wheel to the rail. Springs *C* are so located that when a wheel is in contact the car is correctly spotted to receive the ore from the skip. The red lights for *A* and *B* skips in the engine-house are operated by the connection *C*.

The advantageous results of this system were at once apparent. Work on the trestle ran smoothly and steadily. Cars were spotted quickly and in the proper place. Signals from the trestles were received by the engineer the moment the cars were spotted. A man was required at the shaft only an hour or so a day to remove the small amount of ore spilled over the tops of cars while loading. Loss of time by contract miners was thus eliminated.

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Rubber Belting Briefs

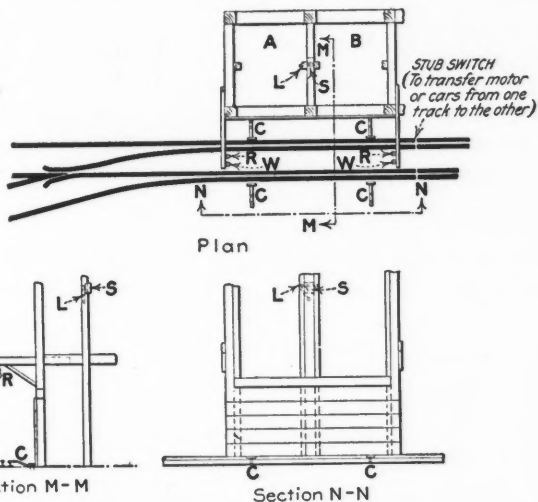
A Goodyear trade publication gives the following suggestions regarding the care and use of rubber belts:

Belts should not run less than 200 ft. per min.

Average velocity of belts should be 2000 ft. per min.

Maximum velocity of belt should be between 5000 and 6000 ft. per min.

When running at high speed the centrifugal force of the belt has a tendency to remove it from contact with the pulley, thereby lessening the horsepower transmitted.



DETAILS OF AUTOMATIC SIGNAL SYSTEM

ground skip-tender indicated to the hoisting engineer that the skip was ready to be hoisted. A red electric light, operated by a man on the trestle, showed in the engine house that a car was correctly spotted under the skip road. This system was used only during the first winter of operation—an unusually cold winter. Work was plentiful, so that all the experienced men found employment underground. Only an inferior class of labor could be procured to work on the trestle. It was unusual for work to be carried on continuously for two weeks without hiring a complete new trestle crew. Thus, because of the inexperience and negligence of the trestle gang, several times each day the spotter would spot the car under the wrong skip road, signal the engineer, and the skip would be hoisted and its load dumped on the rails, usually between two cars or between a car and the motor. This spilled material was difficult to remove on account of the limited space between the cars. Often so much time was lost that all available under-

*Civil engineer, University of Minnesota, Minneapolis, Minn.

All animal oils and grease are injurious to rubber belting.

Shifters should not be used on rubber belting. Once the edges are worn through the plies readily separate.

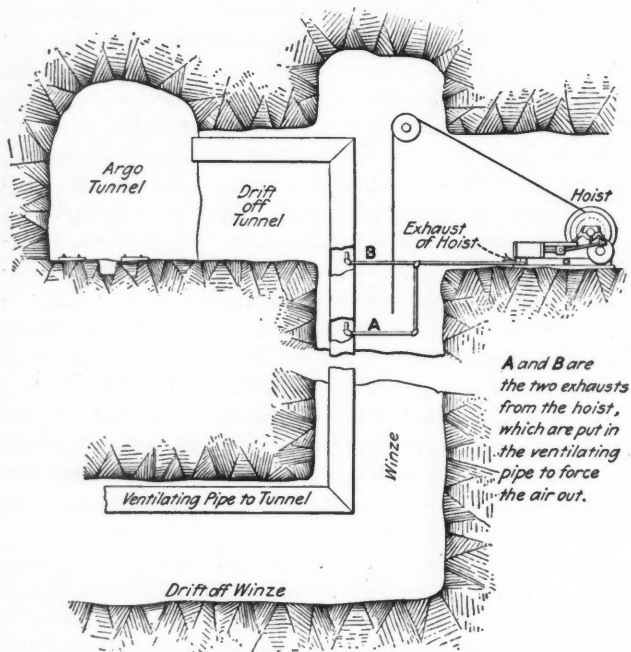
Large face pulleys and normal speeds, proper tension and plies of fabric give best service.

Vertical belts require extra tension to obtain sufficient friction on the lower pulley.

Ventilating a Dead Heading

By P. RUTH, JR.,*

Having bad air and rock gas at the end of a drift from the bottom of a winze, a 10-in. ventilating pipe was installed from the breast of the drift to and up the winze and connected with the main tunnel above. The natural circulation of air through this ventilating pipe, contrary to expectations, would not move the gas and bad air,



VENTILATING A DEAD HEADING

which were as troublesome as before. At the top of the winze was a small hoist operated by compressed air. By running the exhaust from this air hoist into the center of the ventilating pipe a draft was created which did the work as well as a blower and gave satisfactory results in the way of ventilating the drift below. The hoist is working almost all of the time, so that the benefit is continuous. The exhaust from an air-driven mine pump could also be used for the purpose.

Rate of Hand Trimming

At the Colby iron mine, Bessemer, Mich., when trimming was done on straight company account the trammers were handling on an average $12\frac{1}{2}$ tons per man per shift. This system was changed to a straight contract system, with a fixed price per ton, which was not changed throughout the year. Under this system an average of 21.4 tons per man per shift were handled regularly.

*Idaho Springs, Colo.

Two trammers constituted a gang. The size of the car was 1-ton capacity, and the average length of tram was 100 ft., it varying from 25 ft. to 275 ft. The length of tram made little difference apparently, as the superintendent of the mine states that for short trams the speed was 80 ft. per min. and for the long trams 330 ft. per min. The ore was loose and freshly broken and the ventilation was fair.

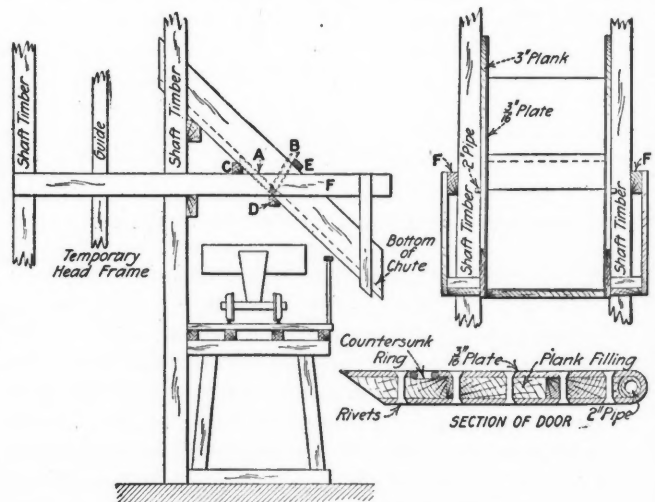
During 10 months 30,318 tons of ore was trammed in 1419 8-hr. shifts. The lowest number of tons trammed per man per shift was 18.6, the highest 23.2 and the average 21.4 tons.

Rock- and Ore-Chute Door

By D. E. CHARLTON*

The accompanying sketch shows a combination rock- and ore-chute door that was made use of at one of the Mesabi Range mines. The shaft had been sunk the required depth and guides were placed in the hoisting compartments. Two drifts were started in rock, and one shortly afterward encountered ore of a merchantable quality. The ore demanded as early a shipment as possible. Because of this and the nonarrival of the headframe that had been ordered, the arrangement described was devised to be used with the temporary or sinking headframe, so that the ore might be hoisted and placed in the cars for shipment without interfering with the hoisting of the rock.

A Kimberley dump skip was substituted for the regular sinking bucket, and dump plates were placed on the temporary headframe. The position of the door when ore was being dumped is shown at A, the ore passing down the chute to the ore cars. When rock was hoisted



DETAILS OF DOOR AND CHUTE

the door was swung back to the position B, so that the rock passed about half-way down the chute and thence into the dump car and was trammed to the rock pile. The lower side of the door in this case acted as a buffer. A small trestle was built to bring the dump car to the required height, so that the rock in falling would do no damage to the car.

The bottom and sides of the chute were of 3-in. plank, lined with $\frac{1}{8}$ -in. iron plate. In the construction of the

*Virginia, Minn.

door, as shown in the sketch, the plate was formed into an extended U-shape and filled with plank, the lower end of the U and a 2-in. pipe forming the hinge on which the door could swing. The plate was firmly fastened to the plank by means of countersunk rivets. At the upper end, a countersunk ring placed on the upper side of the door served as a means of lifting it. The door extended the entire width of the chute, and when open gave an aperture of 2 ft. 3 in. Crosspiece *D* served as a bearing piece for the chute and for the hinge of the door, the pipe extending through the main support, which was tied to the main shaft uprights. Crosspiece *C* served as a support for the door at the upper edge, which was beveled to meet the bottom of the chute at this point. The door, when thrown into position for dumping rock, had a backstop *E*.

An Improved Chute Hook

A serviceable and durable chute hook may be easily made as indicated in the accompanying drawing, Fig. 1. The chute hook is made of 2x1/2-in. or 2x5/8-in. iron, as shown. Connected to this, by a pair of iron plates, riveted or bolted, is another 2x1/2-in. iron strip which is fastened to the cap above by lagscrews. This brace strengthens the hook and allows a backing for the chute plank entirely to cover the chute mouth. The object in this break in the

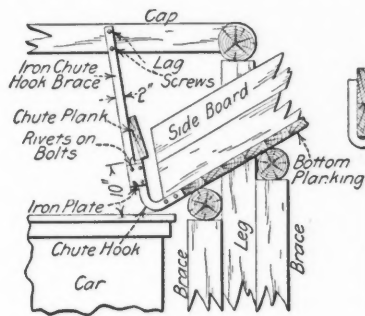


Fig. 1

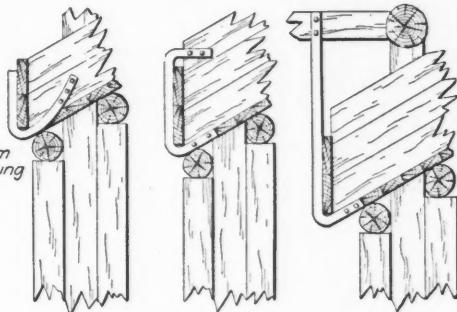


Fig. 2

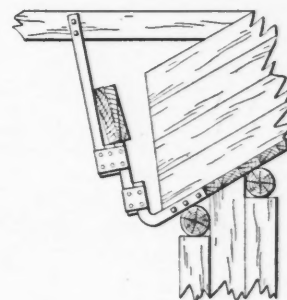


Fig. 3

TYPES OF CHUTE HOOKS

hook is to allow a resting place for the chute plank. There should at all times be a plank in the chute to prevent runs of rock. If no place for the plank is provided the trammer will take it out, set it beside the car and use the bar, causing frequent runs of rock, which necessitate shoveling up the track. To most miners the value of this rest is self-evident; but too many chutes have hooks as indicated in Fig. 2, which necessitate removing the plank entirely or require one chute man on each side to hold the plank up while running out the rock.

A second rest may be provided like the first by inserting a 10-in. piece of brace iron and a second pair of plates. A rest for two planks may be made as indicated in Fig. 3.

Too Short Steel Piling

In a test pit at an iron mine near Riverton, Minn., sheet-steel piling arranged in circular form was used, and it was found that too short lengths of piling made it very unsatisfactory and difficult to handle. Although the Riverton country is sandy, the piling in this pit was not satisfactory after the water level was reached on account of considerable buckling of the piling sheets.

Relocation of Mining Claims

By A. L. H. STREET*

The Arizona Supreme Court dealt with questions concerning the sufficiency of notices of relocation of mining claims in the recent case of *Stratton vs. Copper Queen Consolidated Mining Co.* (149 Pacific Reporter, 389). Referring to the Federal statute which authorizes a relocation where an original locator has failed to perform the required annual work, and has not resumed operations, the court said:

The only restraint the statute places upon a relocation of the land after an original location has been made is such as prevents the relocater by his relocation from depriving the former locator of any of his rights. But when, as here, all of the rights of the original locator have been abandoned or forfeited, and no claim of such rights is asserted by the original locator, his heirs, assigns or legal representatives, and the contesting parties to the action concede that all rights that ever existed by reason of such prior location ceased to exist before any relocation of the ground was attempted, then it is clear that, under the statute and its unquestioned meaning, the land was open to relocation in the same manner as if no location of the same had ever been made. . . . In order to complete a valid location of the ground in question the locators were not required to state if the whole or any part of the location was located as abandoned property, because they were not in fact locating the ground as abandoned property, but were locating the ground in the same manner as other public mineral ground is located—that is, as an original location. . . . If the location is located as abandoned property, under the local statute (Para-

graph 3241, Revised Statutes of Arizona, 1901) before its amendment, then in that case only the location was required to state the fact. But the statute never required the location notice of an original location so to state.

Proportion of Surface to Underground Men

At 58 different mines in Arizona there are employed 1917 surface men and 7505 men underground, according to the annual report of the State Mine Inspector for 1914. This is at the rate of 1 surface man for each 3.9 men underground. This includes all of the larger operations; also many small ones in which the proportion of surface men to underground men is much greater, and may vary from 1:1, to the average given. At the Morenci mines of the Arizona Copper Co. the ratio is 1 surface man to 4.2 men underground; at the Calumet & Arizona, Bisbee, the ratio is 1:6.5; at the Copper Queen, Bisbee, the ratio is 1 to 12.2; at the Inspiration, 1:4.8; at the Ray, 1:2.2; at the United Verde 1:9.3; at the Miami 1:7.4.

*Attorney, St. Paul, Minn.

Details of Milling and Smelting

Barth Slide Rule for Pulp Measurement

By CARL G. BARTH, JR.*

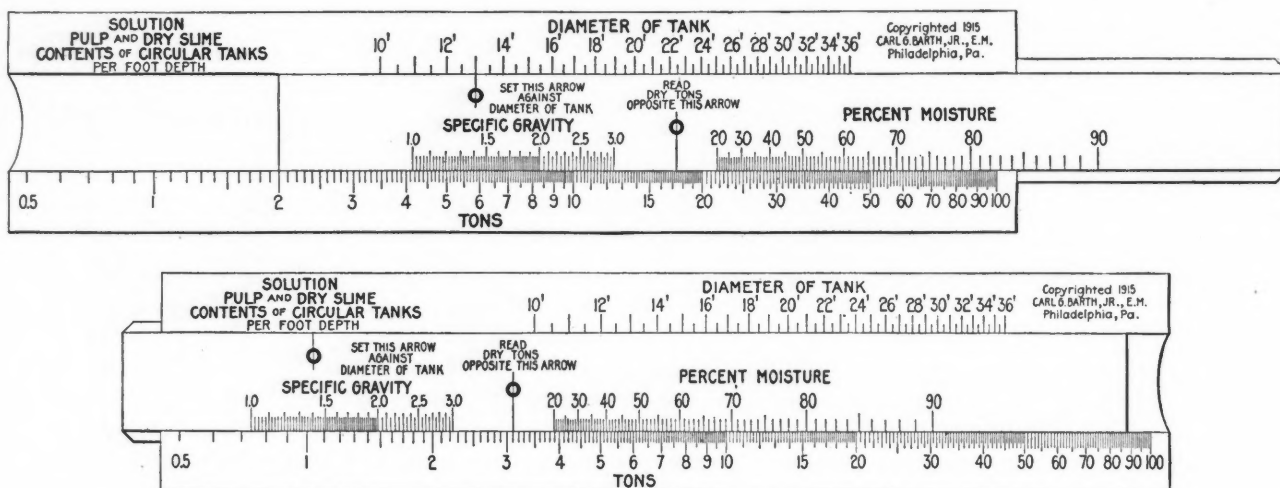
This slide rule gives the contents, in tons, of tanks ranging in diameter from 10 to 36 ft. and in specific gravity from 1 to 3. The rule consists of four scales—one giving the diameter of the tank by 6-in. intervals, a specific-gravity scale ranging from 1 to 3, a scale giving the percentage of moisture from 20 to 90 and a scale giving the tons of 2000 pounds.

To operate, the arrow is first set against the diameter of the tank, and opposite the specific gravity is read the contents in tons for one foot of depth—if for water, opposite specific gravity 1; if for pulp, of specific gravity 1.5, opposite 1.5. When the dry-slime content is desired,

Don'ts in the Designing of a Smelting Works

The bare description of the plant of the Ohio & Colorado Smelting & Refining Co. at Salida, Colo., with the dimensions of apparatus and appliances, cannot be very instructive to beginners, nor interesting for those who have been long in the work, writes F. D. Weeks.¹ However, it seems that some of the peculiarities of the Salida plant as originally built should serve to prevent the younger men from making similar mistakes; the older men can get their satisfaction by reflecting that they never did anything quite so far removed from good practice as some of the things done here.

Originally, a brick wall, with a narrow door in front of each blast furnace, was constructed. How the work



METHOD OF USING THE SLIDE RULE

the percentage of moisture contained in this pulp must previously be known. This might be 50%. Remembering or marking the point, read opposite the pulp of specific gravity of 1.5; next move the slide until the number 50, representing the moisture on the scale so indicated, coincides with this, and then read opposite the arrow the tons of dry slime.

As an illustration the problem for which the slide rule is set herein is used. Given a tank of 13-ft. diameter, what is its content per foot-depth in tons of water, tons of pulp of a specific gravity of 1.5 having 50% moisture and in tons of dry slime?

Set the arrow against 13 on the scale showing the diameter of tank. Opposite specific gravity 1, read 4.15 tons water. Opposite specific gravity 1.5, read 6.22 tons pulp. Move the slide so that 50 on the scale, showing percentage moisture, coincides with 6.22. Read opposite the arrow 3.11 tons of dry slime.

*Consulting engineer, 6151 Columbia Ave., Philadelphia, Penn.

was to be done behind this wall is not known, but it shows that the designer did not know how to do the work.

The water jackets were held in place by a 12-in. I-beam running the length of the furnace, thus effectually preventing anyone from examining a tuyere or jacket.

The shaft walls on the feed floor were so thick that the feeders were shoving ore into one end of a tunnel and, since the opening was not so wide as the shaft, the ends of the furnace could not be fed except by throwing the charge around a corner—which, of course, was not done.

The proposal to concentrate matte, carrying 20% lead and 5% copper, in a copper-matting furnace was intended to do away with the necessity of buying roasting equipment.

The largest corliss engine on the plant was the exhibition engine at one of the world's fairs held some

¹Excerpt from a paper entitled, "The Salida Smelter," to be read before the San Francisco meeting of the American Institute of Mining Engineers, Sept., 1915.

years ago. When repairs were needed, it was discovered that this was the only engine of the kind ever built, and the drawings of it were lost; so each repair part called for an accurate drawing.

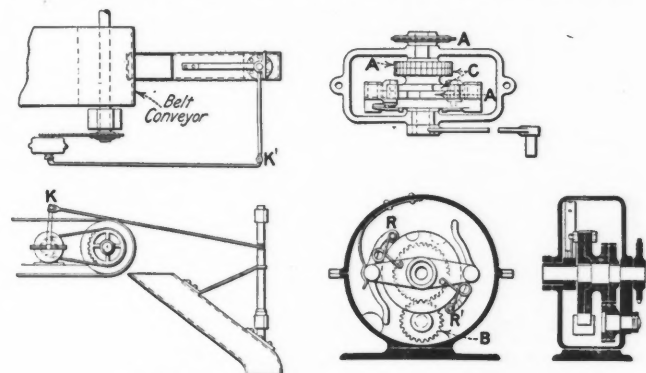
In the track plan of the works, all the ore, coke and limestone had to be unloaded from one track. This track also held the cars which were to be unloaded at the oxide crusher as well as at the sulphide mill. The problem of dispersing some of this congestion was not simple. It was solved by building two trestles in place of one; by having the limestone brought in dump cars so that unloading took little time; and by building an oxide crushing and screening plant on new tracks.

Mechanical Ore Sampler

By J. H. TAYLOR*

The apparatus here described is not intended to take the place of a sampling plant, but where a mill man wants to have confidence in his sample and the expenditure for a plant to handle 20% of the ore is not warranted, it is much better than hand-sampling.

The device here shown will cut about 0.5% of the ore passing over the end of the belt conveyor, without selection. The sample so taken will not be so accurate for a given day as if taken by cutting 20% each time, but at the end of a week the errors will be largely compensated.



USEFUL MECHANICAL ORE SAMPLER

I have had a mechanical sampler in use for the last 18 months, with excellent results.

The operation of the device is as follows: The sprocket wheel A, gear A and disk A are keyed to the shaft and driven by a sprocket wheel on the shaft of the driving pulley of the belt conveyor. The gear A drives an idle gear B, which in turn drives gear C. Gear C and disk C are of one piece. As gear A has 31 teeth and gear C has 30 teeth, disk A will revolve 30 times while disk C revolves 31 times. At the beginning of one revolution of each 30, the recesses in disks A and C will coincide and roller R or R¹ will engage disk A for half a revolution, when it will be released. Hence a sample will be taken once in 30 revolutions. The lengths of the cranks are such that crank K passes through the middle 60° of the 180° while the sample is being taken, so that the increment of the swing of the sample chute is nearly constant, while the stream of flow is actually being cut.

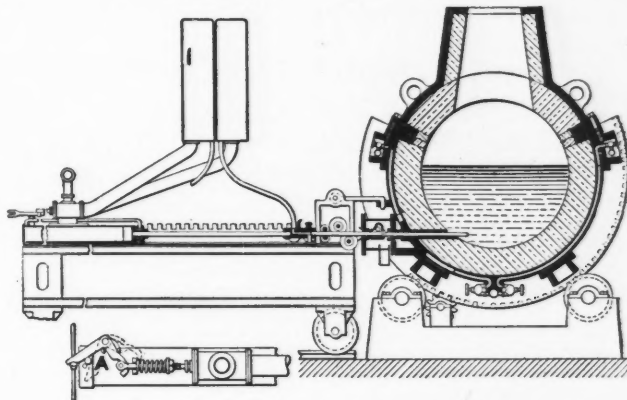
With disks 4½ in. in diameter and a crank 12 in. long this device will successfully sample ore crushed to

*Isabella, Tenn.

4 in. from the end of a belt conveyor 2 ft. wide. The finer the ore the more accurate the daily sample will be, as is usual in mechanical sampling.

Mechanical Tuyere Puncher for Copper Converters

Ralph Baggaley, of Pittsburgh, Penn., has patented (U. S. Pat. 1,135,489) an apparatus for automatically punching the tuyeres of converters and furnaces, the general form of which is shown in the accompanying sketch. An air-cooled punching rod is used, and as many rods are provided as there are tuyeres on the converter, each punching bar being actuated by a separate motor or cylinder. The punching device is mounted upon a movable carriage that may be temporarily fixed in position. The punching rods are operated successively



BAGGALAY MECHANICAL TUYERE PUNCHER

by means of an endless rope, which engages one arm of a bell crank connected with the valve stem of each motor.

The motors or air cylinders that actuate the punching rods are reciprocated by means of air at 70-lb. pressure. This air escaping to a large receiver is cooled by expansion and is then utilized to cool the punching rod. However, water cooling may be used if desired. When repairs are to be made, any actuating cylinder may be stopped by engaging the arm of the bell crank with the special pin A.

Recovery of Elemental Sulphur

A new solution for the problem of recovering elemental sulphur from blast-furnace gases is given by W. F. Lamoreaux and C. W. Renwick, of Isabella, Tenn., in U. S. Pat. 1,140,310. Their process consists in passing these sulphur-bearing gases through a red-hot carbon column, which reduces the sulphur dioxide or sulphur trioxide to sulphur. They call attention to the fact that this reaction has its velocity enormously increased by increase in temperature. For instance, in some gases from pyritic smelting, 5% of the sulphur dioxide was reduced at a temperature of 800° C. in 5 sec.; 34% was reduced at 900° in 5 sec.; 63% at 1000°; 91% at 1100°; 96% at 1200°; 98% at 1300°.

It is not possible to keep up a temperature in the coke column high enough to perform this reduction in a sufficiently short space of time without the use of external heat. This is obtained by passing an electric current through the coke column, using this current to obtain the required temperature.

Company Reports

Alaska Treadwell in 1914

The report of the Alaska Treadwell Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of \$1,351,403 from the treatment of 910,285 tons of ore, before providing for \$250,953 depreciation charge. Receipts aggregated \$2,435,375, made up of \$1,264,945 from bullion, \$1,102,617 from sulphurets treated, \$24,017 from interest receipts and \$43,795 from commercial profits. The following table is a summary of operating costs per ton of ore treated:

Operating costs:	
Mining; development, 5934 ft.; stoping, 301,491 tons	\$0.6896
Milling, 910,285 tons	.2572
Sulphuret expense, 19,324 tons treated	.0850
San Francisco office	.0191
London office expense	.0014
Paris office expense	.0003
Legal expense	.0018
Taxes	.0125
Bullion charges	.0113
Total operating costs	\$1.0782
Construction costs and repair costs	.0344
Total operating and construction charges	\$1.1126
Sundry charges:	
Boarding-house loss	.0057
Dwellings loss	.0115
Wharf loss	.0007
Sundry adjustments	.0603
	\$1.1908
Depreciation charged off	.275
Total cost with depreciation	\$1.4658

Ore reserves for tons in place are estimated to contain 6,604,086 tons, compared with 4,978,759 in 1913, but ore reserves of broken ore in stopes are estimated at 555,167 tons, compared with a reserve of 1,114,549 in 1913. The decrease in reserves of broken ore in stopes accounts for the difference between tons reported stoped and tons milled. The average value per ton estimated for all reserves was \$2.48, compared with \$2.67 in 1913.

The average number of men employed per day for the year was 733 and the average wage was \$3.51. The assay office made 41,224 assays at a cost of 23.6c. per sample; of these 9748 samples were for the Alaska Treadwell mine and mills. Dividends amounting to \$1,100,000 were paid during the year.

Broken Hill Proprietary Co.

The Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, for the half-year ended Nov. 30, 1914, reports a working income of \$1,079,469 from which other charges amounting to \$522,971 are deducted, leaving \$556,498 balance from which \$286,984 in dividends were paid. After adding \$53,971 for miscellaneous income, there was a balance of \$323,485 left after dividend payments. There were 121,316 tons of ore raised from the mine. The crude-ore sections of the mills handled 111,489 tons of sulphide ore, producing 18,586 tons of lead concentrates, assaying 61.48% lead and 27.41 oz. silver per ton. The regrinding section dealt with 56,600 tons of tailings and produced 1474 tons of lead concentrates assaying 52.02% lead and 26.33 oz. silver per ton. The zinc-flotation plant treated 78,124 tons and

produced 15,851 tons of zinc concentrates assaying 46.86% zinc, 6.41% lead and 12.78 oz. silver per ton.

The lead smelteries produced 43,553 tons of bullion. The Ropp roasters treated 33,564 tons of concentrates and slimes and the Dwight-Lloyd plant 30,849 tons. The refinery dealt with 39,200 tons of bullion, including some concentrates from other companies, resulting in 1,546,238 oz. of silver, 699 oz. of gold, 33,507 tons of soft lead and 309 tons of antimonial lead. The spelter plant handled 7773 tons of concentrates and slimes, and produced 2341 tons of spelter and 342 tons of blue powder.

Alaska United

The annual report of the Alaska United Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of \$247,938 from 458,314 tons of ore treated, before deducting \$81,153 for depreciation of property and plant. Receipts totaled \$975,329, made up of \$534,407 from bullion sales from the Ready Bullion claim, \$431,384 from bullion sales from the 700-Foot claim, and \$9538 from interest receipts. Expenditures aggregated \$727,391 and consisted of: Operating and construction on Ready Bullion claim, \$342,580; operating and construction on 700-Foot claim, \$365,272; dwelling loss for year, \$1228; coal loss, \$1642; sundry adjustments, \$16,669. Dividends amounting to \$162,180 were paid. The following tables are summaries of costs per ton treated on the two claims:

READY BULLION CLAIM

Operating costs:	
Mining, development, 3569 ft.; stoping, 249,545 tons	\$1.0550
Milling, 233,100 tons	.2641
Sulphuret expense, 5700 tons treated	.0933
San Francisco office expense	.0111
London office expense	.0017
Paris office expense	.0003
Legal expense	.0034
Bullion charges	.0100
Taxes	.0104
Total operating cost	\$1.4493
Construction	.0204
	\$1.4697
Sundry losses and adjustments, less interest receipts	.0218
Depreciation charged off	.1750
Total cost, including depreciation	\$1.6665

700-FOOT CLAIM

Operating costs:	
Mining, development, 8528 ft.; stoping, 106,002 tons	\$1.2302
Milling, 225,214 tons	.2638
Sulphuret expense, 4409 tons treated	.0797
San Francisco office expense	.0115
London office expense	.0017
Paris office expense	.0002
Legal expenses	.0035
Taxes	.0108
Bullion charges	.0082
Total operating costs	\$1.6096
Construction	.0123
	\$1.6219
Sundry losses and adjustments, less interest receipts	.0218
Depreciation charged off	.1750
Total cost with depreciation	\$1.8187

The Ready Bullion mine is estimated to have 1,835,650 tons of ore in place compared with 1,433,334 tons in 1913; broken ore in stopes amounted to 308,412 tons, compared with 275,328 tons for the previous year. The total ore reserve of both classes amounted to 2,144,062 tons having an assay value of \$2.68 per ton.

The 700-Foot claim ore reserves are estimated to contain 2,542,477 tons of ore having an assay value of \$2.35 per ton, as compared with 1,281,475 tons at \$2.46 per ton, in 1913. The reserve at the end of 1914 was made up of 2,359,495 tons of ore in place and 182,982 tons broken in stopes. Broken ore in stopes shows a decrease of 92,678 tons during the year.

An addition of 30 stamps was made to the Ready Bullion mill and the same number were added to the 700-Foot claim mill. The average number of men employed was 246 at an average wage of \$3.49 per day. Employees were charged \$25 per month for meals at the company's boarding house and \$2 per month for a room in the lodging house.



Mount Morgan Gold

The Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, for the half-year ended Nov. 29, 1914, reports that revenue from all sources amounted to \$2,441,574. Expenses charged off were \$2,131,332, thereby leaving a balance of \$310,242, of which \$243,000 was paid in dividends. All ore treated amounted to 179,939 tons, yielding 4,593.58 tons of copper and 58,309 oz. of gold. Of this ore, 13,039 tons were purchased and miscellaneous ores. The mines produced 196,965 tons of rock of which 25,610 tons were waste and the remainder ore. Ore reserves are estimated to contain 1,123,000 tons of high-grade and 1,849,000 tons of medium-grade ore. Development work totaled 2484 ft. and consisted of 1394 ft. of drifts, 110 ft. of recessing, 865 ft. of sinking and 115 ft. of raising.

The new smelting furnaces were started in July. The present cost of coke per ton of Mount Morgan ore smelted is \$2.19 but this cost it is expected will be reduced. The handling of flotation concentrates has been a source of trouble on account of their fineness. Laboratory experiments indicate that this trouble can be overcome. The following table gives details of concentration results:

	Weight, Tons	Assays		Recovery	
		Cop- per, %	Gold, Dwts.	Cop- per, %	Gold, %
Ore treated.....	31,274	2.365	5.36		
Table concentrates produced	5,993	3.29	11.44	26.68	40.89
Flotation concentrates produced	3,026	13.94	18.85	57.02	34.00
Total concentrates produced	9,019	6.86	13.93	83.70	74.89

The working cost of Mount Morgan ore treated, inclusive of development and estimated realization charges, amounted to \$11.49 per ton.



Le Roi No. 2

The Le Roi No. 2, Rossland, B. C., for the year ended Sept. 30, 1914, reports that as a result of mining operations \$39,386 was remitted to the London office of the company. The mine produced 43,908 tons of rock, consisting of 22,479 tons of mixed ore, 1689 tons of second-class ore, 5689 tons of mill ore and 14,051 tons of waste. After hand-sorting, this tonnage was disposed of as follows: 17,566 tons of shipping ore, 12,113 tons of milling ore, 11,178 tons of waste to dump and 3051 tons of waste to fill old workings. Stopping costs totaled \$95,089, or \$3.32 per ton of ore. Diamond drilling amounted to \$19,957, or 70c. per ton of ore. Mining costs in all aggregated \$4.02 per ton for the following charges: Ore production, labor, 83c.; explosives, 35c.;

illuminants, 3c.; sundries, 6c.; ore sorting, 19c.; general expense, 47c.; power plant, labor, 10c.; supplies, 49c.; mine general, labor, 70c.; supplies, 10c.; diamond drilling, labor, 35c.; carbon, 21c.; supplies, 14c. Depreciation amounting to \$2.51 was charged off, but not included in the costs just stated.

The gross value of 17,014 tons shipped was \$20.19 per ton, made up of \$12.13 in gold, 93c. in silver and \$7.13 for copper. The mill concentrated 12,170 tons of ore averaging 0.132 oz. gold and 10.44 lb. of copper per ton. From this ore 1322 tons of concentrates were produced containing 0.754 oz. of gold, 0.756 oz. of silver and 20.7 lb. of copper per ton. The smelting charges amounted to \$4.98 per ton of concentrates. Development work aggregated about 3794 ft. at a cost of \$21.45 per ft. There were 67 diamond-drill holes drilled totaling 12,249 ft. at an average cost of \$1.63 per ft.



Broken Hill South Silver

The report of the Broken Hill South Silver Mining Co., Broken Hill, N. S. W., Australia, for the half-year ended Dec. 31, 1914, shows a balance from the working account of \$297,199, and receipts of \$901,376. After providing for all other charges and income the net balance for the year was \$88,965. The mine produced 111,891 tons of ore averaging 15.3% Pb, 7.1 oz. Ag and 14.2% Zn. Of this ore 96.8% was mined on contract, 0.4% by miners on wages, and 2.8% from development work. The average earnings of contract miners was \$4.41 per 8-hr. shift and of truckers \$3.52 per shift. There were 417 surface employees of whom 404 were in daily attendance and 779 underground employees of whom 734 were in daily attendance. All employees totaled 1196 and averaged 1138 in daily attendance. There were 25,698 cu.yd. of loose material sent below to fill stopes at a cost of 92c. per ton of material used for filling, or 21.6c. per ton of ore extracted. The following gives a tabulation of the classification effected by the concentrating plant:

	Net Weight, Tons	Pro- portion	Assay Value			Proportion of Metal Contents, per Cent.		
			% Pb	Oz. Ag	% Zn	Pb	Ag	Zn
Concentrates	20,375	18.1	64.9	21.6	8.3	76.7	54.9	10.6
Tailings:								
Zinc	69,943	61.9	3.1	3.3	16.9	12.5	29.0	73.8
Quartz ..	5,942	5.3	1.7	1.6	4.1	0.6	1.1	1.5
Slimes	16,490	14.7	10.8	7.3	13.7	10.2	15.0	14.1
Total ore.....	112,750	100	15.3	7.1	14.2	100	100	100

Working costs amounted to \$4.88 per ton and consisted of \$3.15 for mining, 22c. for filling stopes, 49c. for development and \$1.02 for concentrating. Total mine cost per ton of concentrates was \$27.56. In treating this ore 26,675,000 gal. of water was consumed.



Van Roi Mine

The Van Roi Mining Co., Silverton, B. C., for the year ended Sept. 30, 1914, reports that the mill ran 3457 hr. and treated 16,025 tons of ore averaging 13.85 oz. Ag, 2.69% Pb and 6.64% Zn. Lead concentrates to the amount of 588 tons were produced, averaging 192.08 oz. Ag, 54.75% Pb and 11.15% Zn per ton. Zinc concentrates produced amounted to 1096 tons, averaging 54.91 oz. Ag, 3% Pb and 39.47% Zn. The cost of mining was reported at \$2.57 per ton and \$1.61 for concentrating. Development work consisted of 2087 ft. at an average cost

of \$13.66 per ft. The average cost of drifts was \$13.04 and raises, \$15.42 per ft. The results of development during the year did not justify any further expenditure in this direction and no attempt will be made to extract ore from the mine during the continuance of the European war.

Alaska Mexican

The report of the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for 1914 shows a profit of \$170,202 from the treatment of 233,457 tons of ore, before providing for \$25,451 depreciation charge. The average yield was \$2.18 per ton of ore. Total receipts were \$513,318, of which \$238,756 came from bullion sales, \$270,267 from concentrates treated and \$4295 from interest receipts. Dividends during the year aggregated \$144,000. The following table gives details of costs per ton of ore treated:

Operating costs:	
Mining; development, 2952 ft.; stoping, 167,274 tons	\$1.0188
Milling, 233,457 tons	.2457
Sulphuret expense, 4340 tons treated	.0798
San Francisco office expense	.0225
London office expense	.0030
Paris office expense	.0005
Legal expense	.0057
Taxes	.0087
Bullion charges	.0082
Total operating costs	\$1.3929
Construction	.0211
Boarding-house loss for year	.0062
Dwellings loss for year	.0175
Sundry adjustments	.0328
	\$1.4705
Depreciation charged off	.1090
Total cost with depreciation	\$1.5795

Ore reserves are estimated to contain 688,738 tons of ore, having an assay value of \$2.68 per ton, consisting of 327,426 tons of ore in place and 361,312 tons broken in stopes; compared with 816,882 tons having an average assay value of \$2.53 per ton and consisting of 430,939 tons in place and 385,943 tons broken in stopes at the end of 1913. The average number of men employed was 159 at an average wage of \$3.28 per day.

Arizona Copper

The report of the Arizona Copper Co., Clifton, Ariz., for year ended Sept. 30, 1914, shows a production of 38,756,000 lb. of bessemer copper. Ore mined from the company's properties amounted to 1,079,950 dry tons and the smelting returns indicated an average contents of 36.17 lb. of copper per ton. About 95% of the ore mined was concentrating ore. Of the copper produced 81.4% came from the sulphide ores and 18.6% from oxidized ores. The financial statements show that the profit from operations in Arizona was \$1,400,919. After payment of \$119,221 in dividends, satisfying bond interest and other charges and adding other income, the net surplus carried forward for the year was \$713,837.

The Humbolt mine produced 527,730 tons of ore during the year. The second-class ore at this mine averaged 2.47% against 2.87% during 1913. The Clay mine produced 140,712 tons of ore of which 695 tons were smelting and 140,017 tons concentrating ore. The production at the Petaluma and Carrasco mines amounted to 17,074 tons of which 5001 tons were smelting and the remainder concentrating ore. The Yavapai mine produced 597 tons of smelting ore, 31,226 tons of concentrating ore and 5191 tons of pyrites. The Longfellow

North Extension mine production amounted to 61,433 tons concentrating and 1360 tons of smelting ore. The Coronado mine produced 145,352 tons of concentrating and 7756 tons of first-class smelting ore. The Metcalf mines produced from surface and underground 87,297 tons of oxide and concentrating ore. The King mine produced 36,441 tons of which 27,823 tons were sulphide concentrating and 3740 tons oxide concentrating and 4918 tons oxide smelting ores.

The sulphide concentrators treated 932,954 dry tons of sulphide ore of which 76.8% were treated at No. 6 and 23.2% at the Clifton concentrator. The average ratio of concentration was 8.42 tons of ore into one ton of concentrates. The oxide concentrator and leacher treated 87,875 dry tons of ore, producing 5414 tons of concentrates sent to the smelter and 72,649 tons of tailings treated in the leaching plant. Of the total copper production 5.7% came from these ores.

The report states that after the first few months of breaking in the new smelting plant, it has operated smoothly and well. It also mentions the fact that in 1910 the total taxes for state and county purposes in Arizona amounted to \$65,060, while in 1914 they were \$180,157.

Canada Copper Corporation

The Canada Copper Corporation, Greenwood, B. C., was organized in March, 1914, with an authorized capital of \$5,000,000, made up of 1,000,000 shares. There was also authorized at the time of organization an issue of \$1,000,000 6% convertible debentures. On Dec. 31, 1914, 600,200 shares of the stock had been issued and 200,000 shares were held for the conversion of the bonds; \$600,000 of the bonds had been negotiated, and the remaining \$400,000 of bonds and 199,800 shares of stock may be used for future requirements. Under the plan of organization the stockholders of the British Columbia Copper Co. were invited to subscribe for the bonds and to exchange their shares for shares of the Canada Copper Corporation. There were exchanged 444,952 shares of the British Columbia company. The Corporation also holds a first mortgage on the British Columbia Copper Co. to secure a loan of \$340,000.

Some details of operating costs at the mines are given in this report. At the Motherlode mine the cost of placing the ore on board the railroad cars at the mine was 85.43c. per ton. This cost includes ore sorting at 4.55c. per ton; development, at 8.7c. per ton, or \$5.97 per ft. of work; and diamond drilling at 6.48c. per ton of ore or \$2.38 per ft. drilled.

At the smeltery 299,928 tons were handled consisting of 193,512 tons of British Columbia Copper Co.'s ore and 106,416 tons of custom ore. There were 5129 tons of converter slag made and smelted which contained 1627 tons of custom ore and 466 tons of clay. There were 41,026 tons of coke used, which was equal to 13.52% of the entire charge fed to the furnaces. The average grade of the matte was 39.7% copper. The blast furnace slag contained 0.251% Cu, 0.0039 oz. Au, and 0.07 oz. Ag per ton. The average analysis was 41.9% silica, 18% iron and 22% lime. The production of fine copper was 4,116,190 lb.; gold, 14,442 oz., and silver, 63,501 oz. The company closed the year with \$181,106 in cash on hand.

Correspondence and Discussion

Proposed Memorial to Doctor Holmes

I have just returned from Washington, where I was in attendance at the funeral of Dr. Joseph A. Holmes, on Saturday. The services at the church and at the grave in Rock Creek Cemetery were dignified, but perfect in simplicity, as befitted his character. The arrangements were made by his loyal friend and assistant, Van H. Manning. The flowers were beautiful, and included a wreath from President Wilson. Each of the bureau's chief stations, Pittsburgh, Denver, San Francisco and Washington, was represented by set pieces, including an exquisite reproduction of the bureau's emblem of the eagle, the crossed hammer and pick and the Doctor's own motto, "Safety and Efficiency." Secretaries Lane, Daniels and Wilson, Gifford Pinchot, and other prominent persons were honorary pallbearers; the bureau division chiefs were active pallbearers.

In talking with a number of Doctor Holmes' personal friends, both in and outside of the bureau, views were expressed that there should be some permanent memorials for so big and unique a man as Doctor Holmes, who covered so wide a range of scientific activities, but most of all who touched the humanitarian side of the thousands with whom he came in contact—from the most successful mine operators to the humblest among the miners. It was a matter of regret to all that he could not have seen in life some of the larger fruits of the work which he inspired among many.

Two plans were suggested which seemed to meet general approbation, including that of Mr. Manning, acting director; and I was informally asked by several to bring the matter before a number of my friends, also friends of Doctor Holmes, who would be in better position than any persons within the bureau to sound out by discussing each in his own special circle of friends in the mining and metallurgical industries the merits of the following or alternative proposals, and the possibility of carrying them out effectively:

The first, the erection of an appropriate monument at the grave in Rock Creek Cemetery, Washington, to be of a simple yet beautiful character, such as the statue of "Grief," by Saint-Gaudens, in the same cemetery, which in itself attracts thousands of visitors. It is thought that there will be tens of thousands of miners, operators, metallurgical workers in the great mining and metallurgical industry, who would gladly contribute the individual small amount needed for such a memorial.

The second, a memorial volume, to contain: (1) A sketch of Doctor Holmes' life; (2) views of his work by a number of selected persons, each representing some phase of the professions and industries with which Doctor Holmes has had to do, such as safety in mining, conservation and efficiency in mining and metallurgy, educational work, geology, as a friend of labor, and as a man; (3) resolutions of various societies and associations, which are now beginning to pour in to the bureau, and to

his family; (4) selected writings and addresses by Doctor Holmes. The volume to be carefully edited by some friend of Doctor Holmes who has literary ability, and to be handsomely bound.

It is believed that there would be thousands of subscribers, who for a moderate subscription would at once do honor to Doctor Holmes' memory and at the same time furnish themselves with a book which each would be glad to possess.

It has seemed to a number of those with whom I talked that both the above proposals could be carried out, the first by a large committee under the leadership of some prominent person who would be in position to give some of his attention to it; the second project to be undertaken under the auspices of one of our national engineering or chemical societies, such as the American Institute of Mining Engineers, though of course without financial obligation, the subscriptions in cash to be first obtained. The assembling of the various engineering societies in San Francisco in September would be an admirable time to bring this matter to a climax; but it is well that both the projects, if they seem feasible, should be started as soon as possible.

The replies will probably throw some light on the best manner of proceeding. It will be appreciated that it would not be possible for anyone connected with the bureau to follow the matter up to a finality, but I know all the bureau men will do all they can in a personal, private way to assist those or any other projects to honor the memory of a man who was so much beloved by every one of them.

GEO. S. RICE, Chief Mining Engineer.
United States Bureau of Mines.

Pittsburgh, Penn., July 19, 1915.

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Recent Progress in Flotation

I have noticed in the *Journal* of May 29, 1915, an article by O. C. Ralston and F. Cameron on ore extraction by the so-called oil-flotation process which seems to be quite to the point on the question. May I add a few suggestions on what is worth while. I commenced in the oil-refining business almost at the first of refining petroleum, extracting all of the many products, and became interested immediately in the oil part when oil flotation of minerals first came out.

I concluded then as I do now, that complete success must depend upon holding the temperature of the oil at all times the same as the temperature of the ore and mill water used, or as the atmosphere, by interlocking automatic temperature gages. The oil should be held in something like an oil still, so that the temperature of the whole contents of the still can be changed quickly to correspond with the atmosphere, ore and water. Nothing is more susceptible and sensitive to heat and cold than oil.

A practical oil refiner would surely build his stills and appliances to adapt his oil closely and quickly to

the temperature of the mill whether run at midnight, midday, or in wet, damp, cold or stormy weather. Without doing so, the tailings value is bound to go up and down and the extraction be unsatisfactory.

JAMES A. FLEMING.

Globe, Ariz., July 22, 1915.

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The Case of Spelter

Producers and sellers of zinc, known in the trade as spelter, are taking advantage of the lull following spelter's advance to unprecedentedly high prices to make careful inventory of the situation. The important query current in zinc circles is: "Will the war demand for the metal be sufficient to absorb the very considerably increased production which is on the way, and will it be able to make up for the falling off in the peace demand for spelter?"

Action brings reaction. The shutting off of zinc supplies from Germany, Austria and Belgium, producers of 50% of the world's spelter, and the demand for the metal by makers of war munitions produced a temporary pinch in the supply which drove its price from about 5c. to nearly 30c. a lb. The importance of the three nations mentioned as producers is seen from the following table, which gives their 1913 spelter production in tons of 2000 lb.:

	Tons
World's production.....	1,100,000
Germany	312,000
Belgium	218,000
Austria	24,000
Total	554,000
Consumption of these three nations	387,000
Available for export.....	167,000

With 167,000 tons or 334,000,000 lb. of export metal cut off from the world's sources of supply at one fell swoop, higher prices were inevitable. Fear of a corner rather than an actual corner impelled manufacturers, especially those with war contracts, to rush into the market and bid for the metal almost without regard to price. Undoubtedly they bought more metal and paid much higher prices than the situation warranted.

Since the war began our exports have averaged and are still running at the rate of 10,000 tons per month, or only 120,000 tons per annum. Apparently the warring nations do not need now as much as they required in peace times. The requirement now is chiefly for brass. To make brass two tons of copper are used for every ton of spelter. We have no statistics of copper consumption, but we have statistics of copper exports. They have fallen off, which confirms the theory that less rather than more spelter is being used abroad.

Two important reactions followed the abnormal advance in price as inevitable corollaries. The first was a sharp decline in what may be termed the peace demand for the metal and the second was a tremendous stimulation of production. Galvanizers who in normal times use 60% of the spelter consumed in the United States, doing business on comparatively narrow margins of profit and unprotected by the large profit margins of war orders, simply could not afford to pay the piper. It is conservatively estimated that the demand from galvanizers has decreased at least 50%, or, say, 100,000 tons per annum.

Producers, fired by the golden lure of prices such as no man has ever seen before, and probably never will see again, are straining every nerve to increase production. Smelteries are operating at capacity, thousands of additional workmen are busy in these plants and at the mines, and millions of dollars are being spent in enlargement of existing zinc smelteries and the building of new ones.

The Steel Corporation is building two large plants, one at Donora, Pa., and one at Gary, Ind., at an estimated cost of \$5,000,000 and with a combined production of 50,000 tons per annum. Together with the corporation's present capacity to produce, this will practically remove from the market this large buyer, whose total consumption has heretofore taken about one-fourth of the country's output.

A canvass of the zinc smelteries of the country shows that the operative capacity at the end of 1914, which amounted to 114,000 retorts, as shown by Government survey, has been or will be by Jan. 1 increased to 154,000 retorts. A low estimate of the capacity of these retorts to produce zinc is 4 tons per annum, or, say, a net annual output of at least 600,000 tons. Theoretically the capacity is really about 10% in excess of this quantity, and if anything like current conditions continue to prevail, making it desirable to push operations, at least 650,000 tons per annum can easily be made. This would mean an increase of 300,000 tons over last year's production, thereby making up for the loss of shipments from Germany, Austria and Belgium, with 133,000 tons per annum to spare.

Under these circumstances it is only a matter of time, and a short time at that, when an equilibrium between supply and demand will be reestablished. When the war is over and Europe is again producing and exporting spelter, this country will find itself with a smelting capacity two to three times greater than any possible demand. Then will come a struggle for existence, with the fittest surviving, and an era of low prices resulting from keen competition such as threatened bankruptcy to many concerns before the war.

Perhaps this readjustment, which is bound to come and which will eliminate the weaker producers, is one good reason why the zinc companies are going slowly in the matter of distributing the large surplus which they are piling up in these piping times, and why conservative investors feel that current prices for zinc shares have sufficiently discounted the situation in spite of present plethoric profits.

J. P. B.

New York, July 29, 1915.

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Drilling Campaign of the Consolidated Copper-mines Co.

Recently returning from an absence of several weeks, in an out-of-the-way place, I find my issues of the *Engineering and Mining Journal* awaiting me. Heretofore I have considered the *Engineering and Mining Journal* to be an un-owned, unprejudiced standard of modern mining.

Were it not for the fact that I am sure that the *Journal* has committed a carelessness, not usually characteristic

of it, I would be tempted to suspect that I had been under misapprehension.

The error occurs in the issue of June 19, 1915 (Vol. 99, No. 25), on p. 1069 and is entitled "Drilling Campaign of the Consolidated Coppermines Co.". The *Journal*, having unfortunately omitted the author of this article, would be held responsible for it by anyone who was unfamiliar with the *Journal's* high standards.

As this before-mentioned article appears to be merely a deliberated and undeserved attack upon Colonel Wall, and in no way represents the facts about the Consolidated Coppermines Co., it would be pre-assumed that the *Journal* is not personally responsible for it. On p. 1070, the resources of the great Morris mine are either deliberately misrepresented, or so diluted with waste, that they give no resemblance to the original values. Concerning the Brooks mine, the location of the drill-holes, as shown in the appended plat, vastly discredits that mine; at no place are the drill-holes (put down by former General-Manager F. P. Mills, of the Giroux Co.), which lie to the south of the Bunker Hill, even indicated. This is a severe depreciation as these drill-holes promised that the orebody of the Brooks-Bunker Hill would swing to the south and meet the large bodies of concentrating (largely native copper) ore which underlie the rich zones of the Alpha mine. Neither are the drill-holes shown to the east of the Bunker Hill, indicating a connection with the orebody which follows along, or overlaps the Butte & Ely line, and connects with the Liberty Pit of the Nevada Consolidated Co.; nor is any mention made of these orebodies. Also, no mention is made of the so-called "Old Glory porphyry ore," which is in no way related to the "territory served by the Old Glory shaft"; a large part of the sampling of which was personally supervised by a United States geologist, and which acts as a connecting link between the Morris mine and the rich Veteran orebody of the Nevada Consolidated Co. Nor is mention made of the orebody penetrated in the neighborhood of the Dewey shaft (independent of "the territory served by the Taylor shaft"). Nor is any mention made of a fairly large tonnage developed in the Butte & Ely property, and allowed by as ultra-conservative an engineer as Henry Krumb, of Salt Lake City. To appreciate fully the seriousness of these discrepancies, I will call your attention to the Giroux ore reserves as estimated above the signature of Thomas F. Cole, in the annual report of the Giroux Consolidated Mines Co. for 1911, and reaffirmed by the annual report of 1912; or even as far back as the annual report of the Giroux Consolidated Mines Co. for 1910.

Since, in this article of unknown authorship, no definite value is claimed for the development of the Alpha-Giroux shafts, I will call your attention to the records of the office of the Surveyor-General of the United States, where sworn statements are given in connection with the patenting of the Mammoth and other groups south of the Alpha-Giroux shafts.

Also, in this same deceptive literature, it is interesting to note that the only apparent method of financing the Consolidated Coppermines Co., is by a proposed sale of bonds; and nothing is said of the one million dollars promised by those most interested in the consolidation, which was the most vital element guaranteed in the formation of the Consolidated Coppermines Company.

I think, when you look into the facts of this situation, you will make haste to correct the unfortunate mistake of bearing the responsibility of an apparent attempt, if not conspiracy, to depreciate a very valuable property.

A. J. SALE.

Battle Mountain, Nev., July 24, 1915.

[It is not unusual for persons who read in a newspaper something that they do not like, or something with which they disagree, to charge that it was put in by someone who "owns" the paper, or in pursuance of a conspiracy, etc. The article with which Mr. Sale finds fault was published as a matter of news, and consisted of the summary of a statement by E. F. Gray, the manager of the Consolidated Coppermines Co., to his directors, followed by a brief account of the annual meeting of the stockholders, and concluded with a summary of what President Boynton said in his annual report. All of this was made clear enough in the article.

Mr. Gray in his report of the ore reserves said: "No allowance has been made for any direct-smelting ores known to exist in the Old Glory, Taylor, Giroux and Alpha shafts, or the territory contiguous thereto, as these openings—except on the 770- and 1000-ft. levels of the Giroux shaft—are at present inaccessible."

There was no animadversion about Colonel Wall. The only reference to him was in the account of the stockholders' meeting, in connection with which it was remarked that "No opposition developed from the fiery attack made on the management recently in a circular by Col. Enos A. Wall." The nondevelopment of opposition was a mere statement of fact. Anybody who read Colonel Wall's circular will concede that the characterization of it as "fiery" was very temperate.

We print Mr. Sale's letter for it gives another side of a controversy that appears to have developed, as to the merits of which the *Journal* offers no opinion. Mr Sale's reference to the Giroux report of 1910 is not a happy one, however, the official figures published therein having been rather emphatically discredited.—Editor.]

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Fineness of Crushing for Assaying

Will not the readers of the *Journal* give some data on the cause of the differences in assays produced by variation in the mesh to which the ore is crushed before assaying it? Apparently there is a point of maximum recovery; that is, up to a certain point the assays increase as the mesh diminishes, after which the assays decrease as the fineness of sample increases.

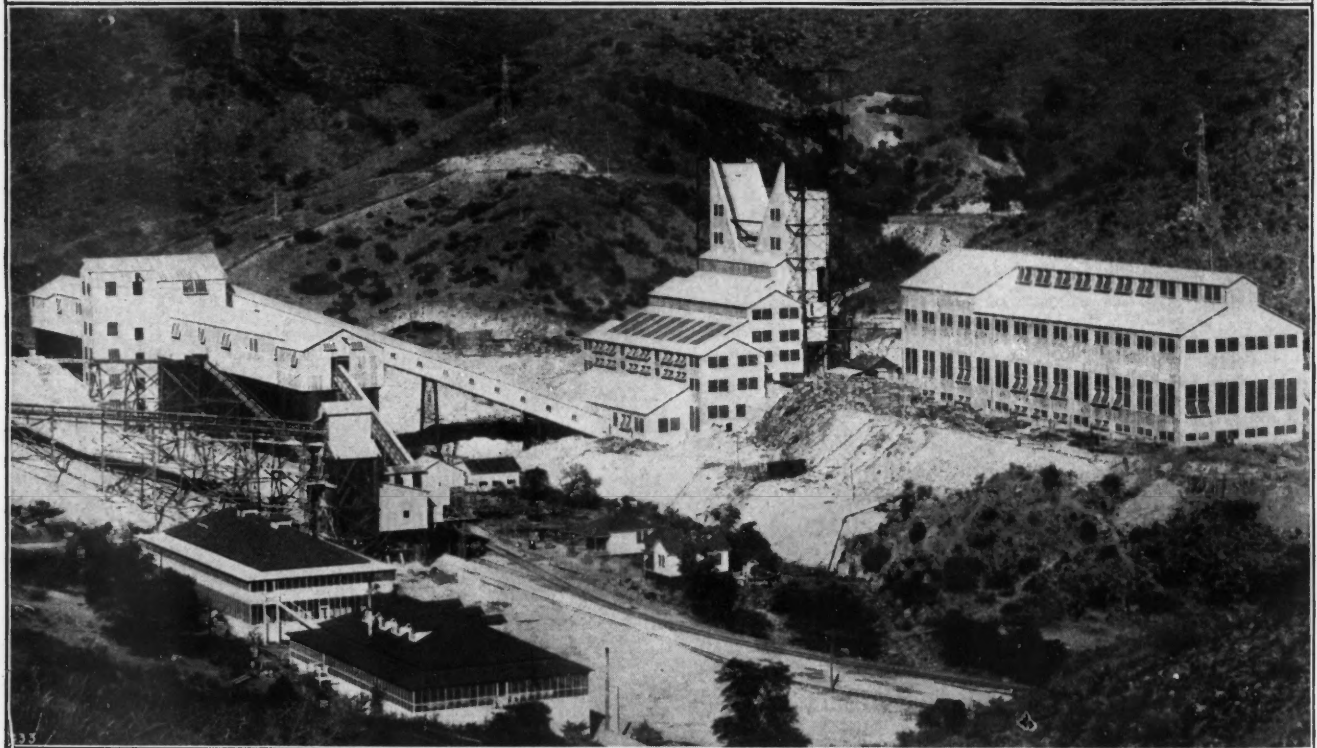
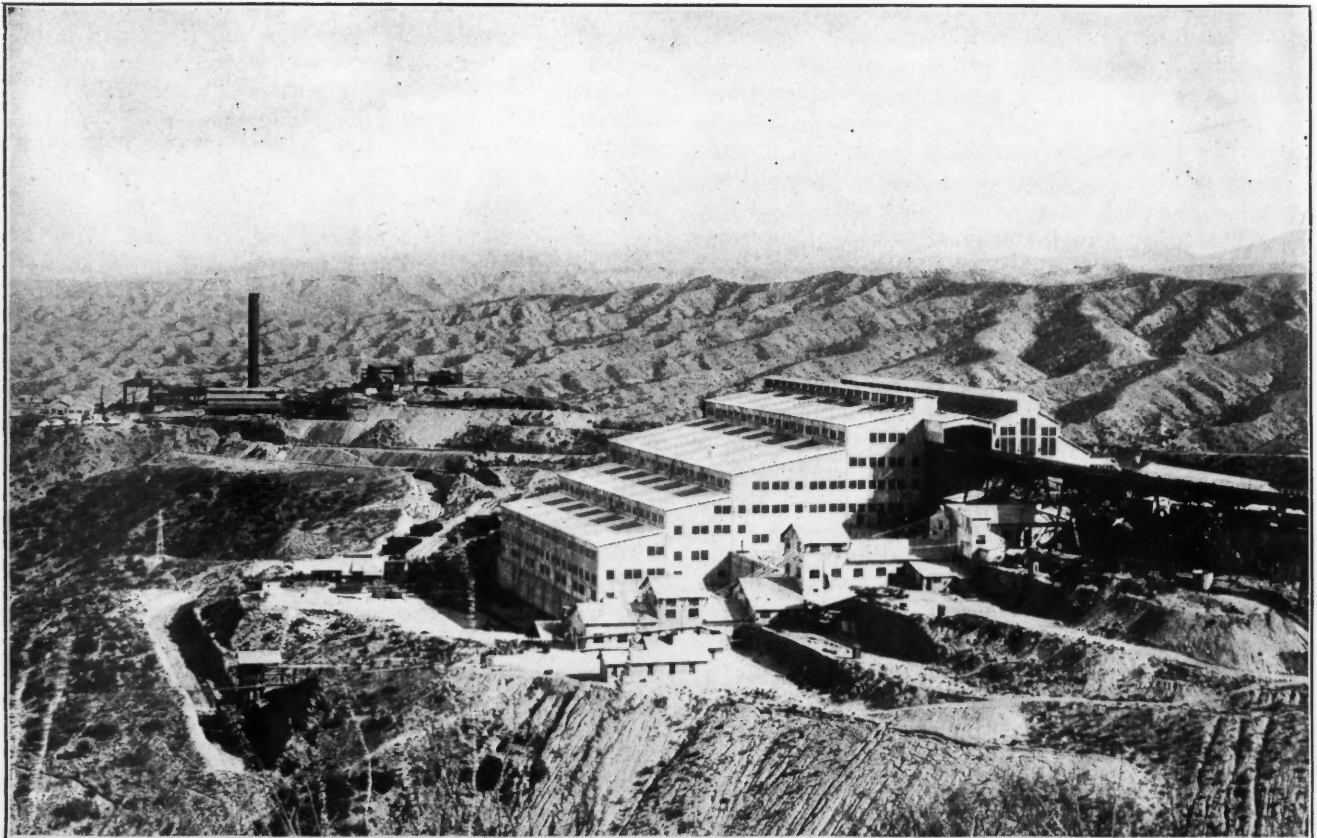
I have always supposed the low results with too coarse ore were due to the collector (reduced litharge) going down through the charge before complete fusion had taken place and that the low results with too fine ore were owing to the introduction of extraneous material from the crushing machinery.

Some weight is lent to this view by the fact that the point of maximum recovery is reached—according to my own experience—at a lower mesh on hard ores than it is on soft. But one man's experience and his time and opportunity for experiment are limited, so I should like to hear of other experimenters' work and conclusions.

A. A. NASON.

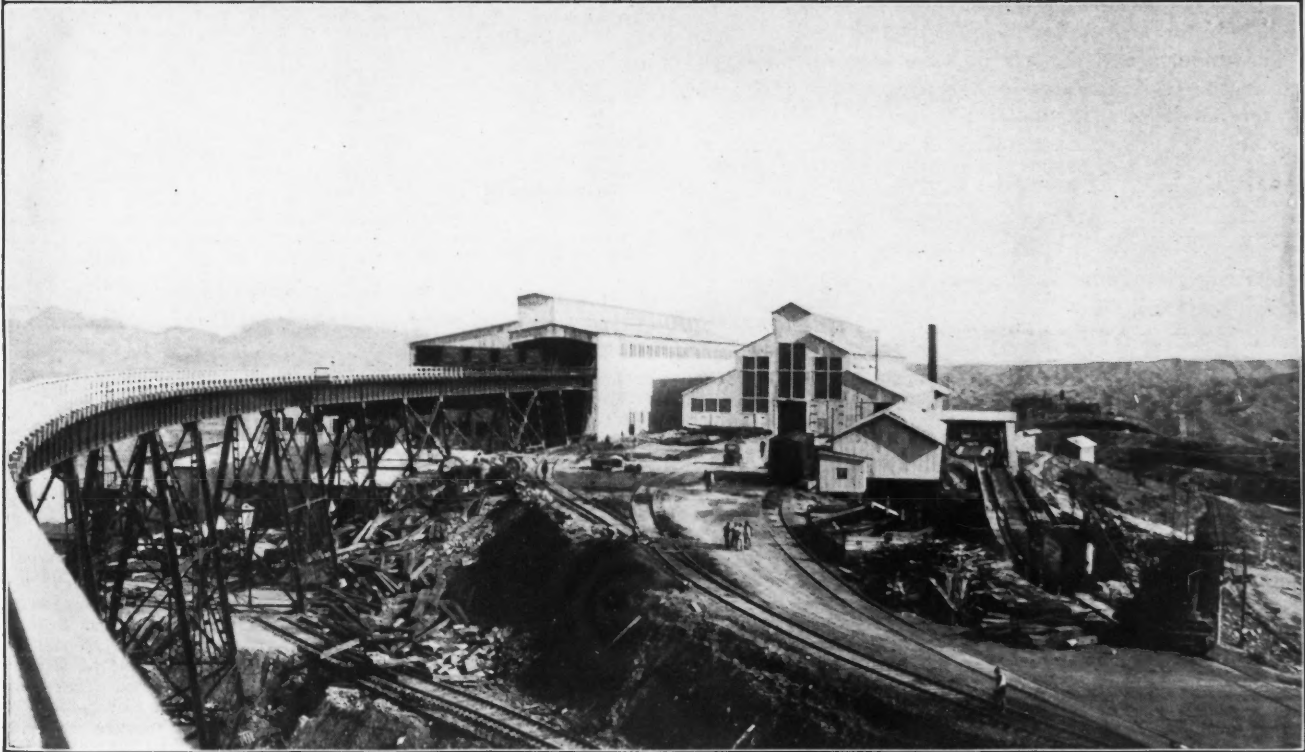
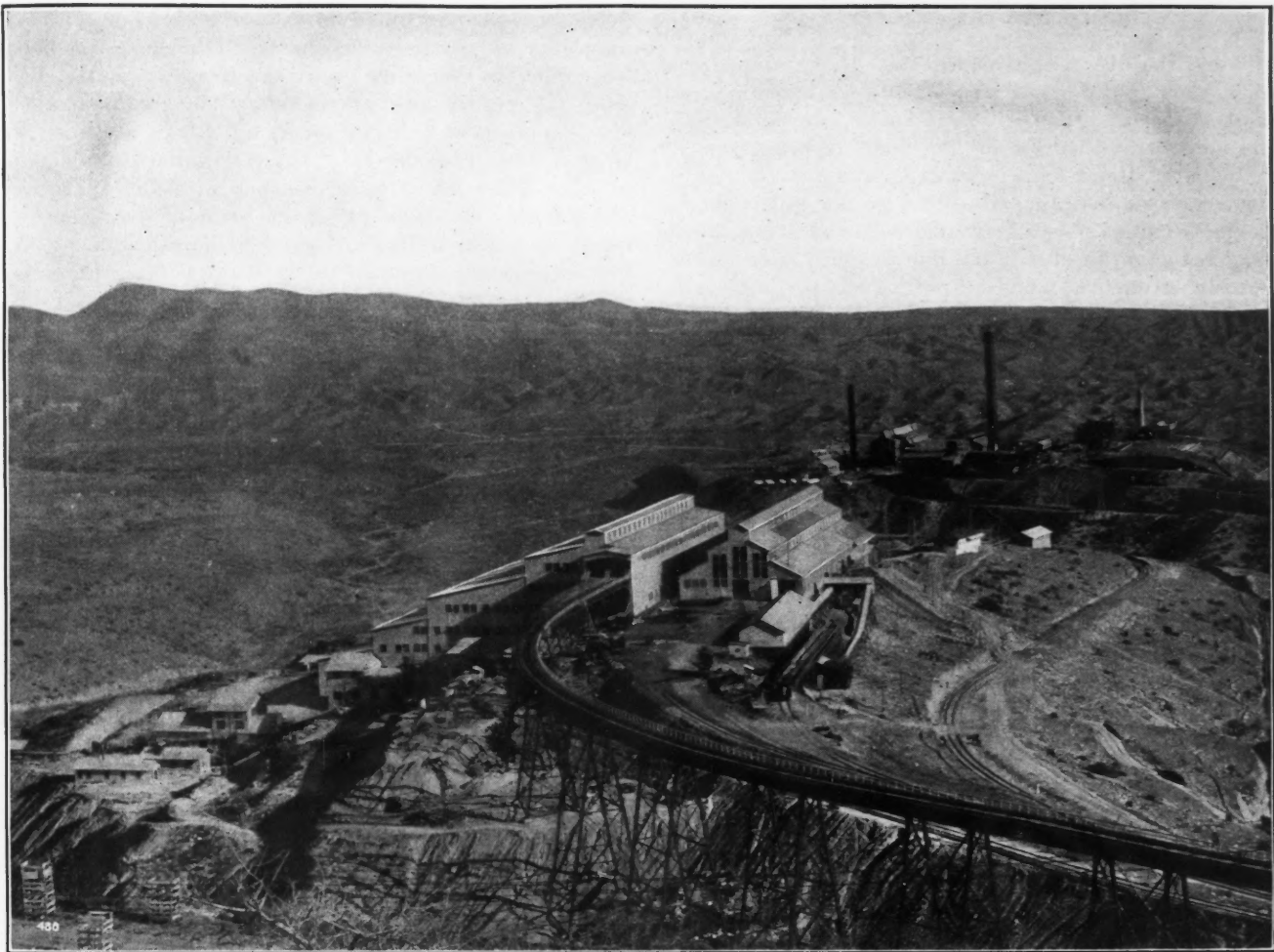
New York, July 18, 1915.

Photographs from the Field



INSPIRATION CONSOLIDATED COPPER CO., MIAMI, ARIZ.

Upper view shows concentrator, test mill and trestle, with smeltery in the background. Lower view shows the hoist house, headframes for the twin shafts, crushing plant and loading station at the mines



INSPIRATION CONSOLIDATED COPPER CO., MIAMI, ARIZ.

Upper view shows the general arrangement of smeltery (right background), concentrator (foreground), and wells and pump station (left background). Lower picture shows a close view of trestle, concentrator, shops and yard

Imports and Exports of Metals

The United States returns of exports and imports for May and the five months ended May 31, as summarized below, show considerable change this year, mainly on account of the conditions arising from the war in Europe. The noteworthy changes in the more important metals are the large decrease in copper exports and the extraordinary increases in lead and zinc. In the minor metals the chief changes were a large increase in antimony and a heavy reduction in aluminum, due to the foreign embargoes placed on that metal.

United States foreign trade in the chief metals, other than iron and steel, is reported as follows for the five months ended May 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons.....	187,993	134,607	67,761	43,628
Tin, long tons.....	344	308	19,879	18,308
Lead, short tons.....	7,858	67,906	10,346	28,607
Zinc, short tons.....	588	59,263	471	326

Copper includes contents of ore and matte. The imports of zinc ore in 1915 were 40,183 tons, containing 32,362,875 lb. zinc. No exports of ore have been reported in 1915. Exports include reexports of foreign material.

The exports and imports of the minor metals in the United States for five months ended May 31, as reported by the Department of Commerce, were as follows:

	Exports		Imports	
	1914	1915	1914	1915
Nickel, lb.....	11,603,325	12,629,241	17,093,496	19,403,608
Antimony, lb.....	3,122	302,625	6,293,503	7,367,600
Aluminum, lb.....	5,114	28,772	6,511,104	3,323,275
Quicksilver, lb.....	6,776	120,112		
Platinum, oz.....	143		34,548	7,749

Nickel and antimony include metallic contents of ore, matte, regulus, etc. Exports include reexports of foreign material. Exports of aluminum in manufactured forms, not included in the foregoing figures, were valued at \$423,855 in 1914 and \$1,933,055 this year.

The imports and exports of secondary metallic products in the United States for the five months ended May 31 were as follows, in pounds:

	Exports		Imports	
	1914	1915	1914	1915
Copper sulphate.....	6,348,208	9,317,066		
White lead.....	7,284,563	11,118,184		
Zinc oxide.....	12,224,827	18,159,460		
Zinc dust.....	34,212	139,178	2,197,965	770,176
Zinc dross.....	572,477	4,738,324		

The exports of zinc dust given above are reexports of foreign material.

California Petroleum Production, First Half of 1915

SPECIAL CORRESPONDENCE

The production of petroleum in California in the first half of 1915 is estimated at 44,600,000 bbl. On this basis the total production for the year would amount to 89,200,000 bbl., which would mean a decrease of 14,800,000 bbl. from the total of 104,000,000 bbl. produced in 1914. This decrease in oil production is directly traceable to the European War. There was in June some prospect, however, that the market would improve, as there was a noticeable increase of shipments of crude oil from the fields to the marketing and refining centers. But there is not at present anything in the situation of marked encouragement to independent producers. The production in June was 7,458,600 bbl., showing a small

increase over the May figures. Total shipments from fields in June amounted to 7,662,629 bbl., which was approximately an increase over May shipments of 200,000 bbl. The shipments in June were the heaviest recorded since the war began, but not large enough to diminish stock appreciably. Total crude oil stocks at June 30 amounted to 60,616,289 bbl. The average daily production in June, 1915, was 248,620 bbl. and in June, 1914, was 302,400 bbl. In June, 1914, the prices in San Joaquin fields ranged from 40c. to 75c. per bbl. In June, 1915, the prices ranged from 32½c. to 50c. per bbl. in the same fields. One encouraging feature during the past six months is that the increase in stocks on hand totaled only 2,090,000 bbl., which would not have been possible if the Independent Agency had not insisted upon curtailing production.

World's Petroleum Production

The quantity of petroleum entering the markets of the world in 1914 amounted to 400,483,489 bbl., according to statistics compiled by J. D. Northrop of the Geological Survey. Of this record-breaking output the United States is credited with 66.36%, representing in quantity a trifle less than double the output of all the other oil-producing countries combined. Changes in rank during the year affected only Japan and Peru, the former superseding the latter by a narrow margin.

The accompanying table shows the marketed production of petroleum in the world in 1914, and for purposes of

WORLD'S PRODUCTION OF PETROLEUM—1913 AND 1914

Country	1914		1913	
	Bbl. (42 gal.)	Per-centage	Bbl. (42 gal.)	Per-centage
United States.....	265,762,535	66.36	248,446,230	64.59
Russia.....	67,020,522	16.74	62,834,356	16.34
Mexico.....	21,188,427	5.29	25,902,439	6.73
Roumania.....	12,826,579	3.20	13,554,768	3.52
Dutch East Indies.....	12,705,208*	3.17	11,966,857	3.11
India.....	8,000,000†	2.00	7,930,149	2.06
Galicia.....	5,033,350†	1.26	7,818,130	2.03
Japan.....	2,738,378‡	.68	1,942,009	.51
Peru.....	1,917,802	.48	2,133,261	.55
Germany.....	995,764†	.25	995,764†	.26
Egypt.....	777,038	.19	84,635	.03
Trinidad.....	643,533	.16	503,616	.13
Canada.....	214,805	.05	228,080	.06
Italy.....	39,548	.01	47,256	.01
Other countries.....	620,000§	.16	270,000†	.07
Total.....	400,483,489	100.00	384,667,550	100.00

* Includes British Borneo. † Estimated. ‡ Includes Formosa. § Includes 600,000 bbl. produced in Argentina.

comparison the corresponding output in 1913. The total world's production from 1857 to 1914 is estimated at 593,262,936 bbl., of which the United States has produced practically 60%.

Mineral Oil in Queensland

The Prime Minister of Queensland, Australia, recently made the following statement as to the deposits of oil in Queensland, about which so much has been said:

It is possible that we have large deposits of mineral oil in Queensland, but, while recognizing the necessity for urgent prospecting for it, the Government considered that before committing itself to the large expenditure which would be necessary to carry out operations, it would be well to obtain the opinion of persons who had special knowledge of the oil fields worked in other parts of the world. On my last visit to Europe I was able to bring the matter before several experts, who, before expressing an opinion, desired information as to the geographical formation of the country proposed to be tested. On my return to Queensland an officer of the Geological Survey was instructed to make a thorough inspection of the Roma district, which from present knowledge is the most promising locality, and his report was sub-

mitted to the experts, and their recommendations are about to be carried out. The acting hydraulic engineer is now on his way to America for the purpose of obtaining personal and practical knowledge of the methods adopted in the oil fields there, and, if he thinks advisable, to secure the services of a thoroughly qualified oilborer as his assistant, and also to negotiate for the purchase of an up-to-date oil-boring plant.



Revision of Mining Laws Urged

Revision of Federal mining laws that they may encourage the prospector and not discourage him, as is the case at present, will be one of the paramount issues to come before a special meeting of the Mining and Metallurgical Society of America, which will open in Washington, D. C., Dec. 18, according to Horace V. Winchell, says the Salt Lake Tribune. Mr. Winchell arrived in Salt Lake, Wednesday, July 28, in connection with apex litigation. He is chairman of the committees on mining law of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, and, in consequence, is greatly interested in the present agitation for revision of federal mining laws. He said:

Salt Lake City's Commercial Club and Chamber of Commerce and all other Utah organizations interested in the development of the mining industry in this state and the West, will be asked to adopt resolutions for presentation to the American Mining Congress, asking that organization to make an organized effort to accomplish the revision of Federal mining laws. We are determined to bring this matter before the national congress at its next session in such a direct and forceful manner that it will find it imperative to heed our demands for new and better laws.

PRESENT LAWS FORTY-FIVE YEARS OLD

The present laws under which claims are located were enacted in 1872, and since that time they have been in force practically unchanged. These laws were well adapted, probably, to conditions as they existed then, but they come far short in meeting conditions as they exist today. Mining men, generally, have condemned the operation of these laws, and there has been much agitation, but no organized effort to obtain action by Congress which would change the laws so as to encourage the prospector and not discourage him.

At the last session of Congress a bill was introduced in the Senate which received the general approbation of mining men. This bill provided for the appointment of a commission of three to investigate conditions in mining sections and to suggest amendments to the present laws. The proposed act passed the Senate with the hearty approval of the Committee on Mines and Mining, Secretary of the Interior Franklin K. Lane, the director of the Bureau of Mines and of the Geological Survey, and was recommended for passage in the House of Representatives by the House Committee on Mines and Mining. Western representatives, however, did not take the interest in the measure which Western senators did, and the bill died without action.

REVISION ENDORSED BY ALL THE LARGE MINING SOCIETIES

This movement for the amendment of mining legislation has the approval of the various different organizations of mining men throughout the United States. The American Institute of Mining Engineers, the Mining and Metallurgical Society of America and the American Mining Congress all have important committees at work on the subject. It is a matter of really great importance. The last report of the Bureau of Mines calls attention to the relative importance of mining and agricultural industries of the country and shows that although each laborer in a mine or smelter contributes an average of \$2000 per annum to the wealth of the nation, each agricultural laborer contributes only \$800 in the same length of time. Although the agricultural industry is everlasting and the mining industry is only temporary, so to speak, Congress appropriates thirty-five times as much money for the encouragement and development of the agricultural industry as it does for the mining industry.

In the report it is also shown that 65 per cent. of the freight business of all our railroads is in handling raw and manufactured products of mines, and that the standing of the United States among other nations as a manufacturing nation depends more largely upon mineral products than upon

any other. But in spite of this fact it is singularly difficult to legislate wisely in the interest of the mining communities.

ACTION TO BE TAKEN IN DECEMBER

The pertinence of these remarks at this time lies in the fact that there is to be held in Washington, D. C., beginning Dec. 18, a meeting of the Mining and Metallurgical Society of America, to which will be invited representatives and delegates from all Western mining and commercial organizations interested in the development of the resources of the respective communities of the West. It is hoped that the meeting will be largely attended and that matters will be brought through this organized effort so directly and forcefully to the attention of Congress that it will result in the much-needed revision.

It is unnecessary to specify in what particulars revision is required, because every mining man and others conversant with the situation know that the law requiring a discovery of metal in places before a valid location can be made is not only absurd, but operates to discourage the prospector. Mining men universally condemn the apex law, which is the direct cause of so much litigation in all our camps and furnishes such fat fees to attorneys and experts at the expense of the mining companies.



Accident Rate at Various Hours of the Day

The accompanying table of accident frequencies is taken from the Raritan Copper Works *Ingot*, and appears to show the effect of tiredness toward the end of the shifts on the accident rate.

NUMBER OF ACCIDENTS OCCURRING EACH HOUR OF THE DAY

1915	1915					No. of Accidents	Per Cent. of Total
	Jan.	Feb.	Mar.	Apr.	May		
3 (a.m.) to 3:59.....		1				1	4.
4 (a.m.) to 4:59.....					1	1	4.
5 (a.m.) to 5:59.....			1			1	4.
6 (a.m.) to 6:59.....	1					2	12.
7 (a.m.) to 7:59.....			1			1	4.
8 (a.m.) to 8:59.....			1			1	4.
9 (a.m.) to 9:59.....	1					1	4.
10 (a.m.) to 10:59.....	2			1		3	12.
11 (a.m.) to 11:59.....		3				4	16.
12 (noon) to 12:59.....	1					1	4.
1 (p.m.) to 1:59.....					2	2	8.
2 (p.m.) to 2:59.....				1		1	4.
4 (p.m.) to 4:59.....			1		1	2	8.
7 (p.m.) to 7:59.....	1					1	4.
8 (p.m.) to 8:59.....				1		1	4.
Total.....	6	4	4	4	4	25	100.



Exports and Imports of Lead

In the *Journal* for July 24, p. 156, was given the statement of lead imports for May and the five months ended May 31, as furnished by the Department of Commerce. The statement is now completed by the report of the exports for the same period. The shipments for May included 15,312 short tons of domestic lead exported and 3021 tons of foreign lead reexported; a total of 18,333 tons. This makes the full report for the five months ended May 31 as follows, in short tons:

	1914	1915	Changes
Imports	10,346	28,607	I. 18,261
Exports	7,858	67,906	I. 60,048

In 1914 the imports exceeded the exports by 2488 tons; but in 1915 the exports have exceeded the imports by 39,299 tons, an average of nearly 8000 tons per month.



U. S. Bureau of Mines Car Touring Idaho

The itinerary of the Bureau of Mines Car No. 5, in charge of John Boardman, will be as follows for the next two months: Burke, Idaho, Aug. 8 to 14; Mace, Idaho, Aug. 15 to Aug. 21; Success, Idaho, Aug. 22 to 28; Kellogg, Idaho, Aug. 29 to Sept. 11; Wallace, Idaho, Sept. 12 to 15; Spokane, Wash. (shops for repairs), Sept. 16 to Oct. 9.

Editorials

The Independent Powder Companies and Their Chance

The manufacture of high-explosives in the United States has heretofore focused in a small group of big companies. There have been a good many small companies, far more than the consuming public has known. The United States Bureau of Mines not long ago listed 29 manufacturers of high explosives in the United States. Most of the small producers, however, have hid their light under a bushel. Their product has gone chiefly into local consumption. Talk with mining men generally—the great consumers of explosives—and few can tell the names of any dynamite-manufacturing companies other than those which arose through the dismemberment of the so-called powder trust.

The big companies are now absorbed in filling their great war contracts, in supplying high explosives to the armies of Europe. They are making fabulous profits, selling for about \$1 per lb. what costs them about 30c. to make, so it is said; and the quotations for their shares have soared. While they are thus engaged there is a remarkable chance for their competitors, large and small, to make themselves known and capture a large share of the domestic business. For this there is every inducement. The peaceful business is not immediately so profitable as the military business, but it is more permanent. With mining going on at the high rate at present—copper mines, lead mines, zinc mines and gold mines being worked at their utmost capacity, while iron mining is rapidly rising to normal—there is no sense in anybody shutting his eyes to the possibilities of expansion with the excuse that times are dull.

It is not healthful for any industry to have its supply of an essential commodity centered in one place, or in only a few. More active competition in the supplying of dynamite would be welcomed. Every purchasing agent likes to shop and the existence of shopping tends to improve not only the feelings of the shopper but also the product that is offered to him. If, however, manufacturers want to give the shopper a chance to shop, they have got to let him know about themselves—they have got to kick the bushel off their light. In other words, they've got to advertise.

Those engineers who have broken away from the traditional routine and have tried the dynamites manufactured by the smaller independents find that, though less well known, they do work equal to the old standard brands, that their technical divisions are equally keen to supply the right powder to suit their customers' varying conditions, and that almost invariably the independent powder can be bought for less money. The mining engineers would welcome the widening of their field by the independents for the further reason that the restrictions of some of the dismembered companies have too often been irksome and the subject of complaint.

New Metallurgical Construction

With the practical completion of the New United Verde and Miami copper smelters, the Inspiration and the Alaska Gastineau mills, the Anaconda and Chuquicamata leaching plants, the Rose Lake and Langeloth zinc smelters, an extensive program of new construction begun two or three years ago is drawing toward a close. Several of these plants, however, are still lacking their final units, and work on these will be going on during the remainder of 1915, and even in 1916. Among such plants are the Inspiration, Chuquicamata, Alaska Gastineau and Langeloth, which will engage the attention of their builders for a long while yet.

The building of new metallurgical plants is, however, a never-ending process. About as fast as one group is completed another is started. The doubts and uncertainties of the first nine months following the beginning of the war caused a halt, but things are now active again, and probably metallurgical building is going on at as high a rate as previous to the war.

First and foremost is the reconstruction of several of the Anaconda plants, carrying out plans that involve the expenditure of millions of money. In gold milling, the Alaska Juneau mill is the big thing; in zinc smelting, the Donora and Gary plants of the Steel Corporation; in copper metallurgy, the leaching plant of the New Cornelia company. The Tacoma Smelting Co. is adding largely to its electrolytic refining capacity.

There are a great many small plants being put up in all directions, especially to supply the minor metals and various commodities whereof the prices have risen to high levels. In such operations speed of construction is a highly important consideration, and it is to be expected that many old records will be broken.

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American Zinc Smelting Capacity

The recent editorial in the *Journal* on the subject of increased zinc-smelting capacity in the United States elicited some corrections from well-informed quarters, the general tenor of which was to show that the *Journal's* estimate was too low. This was not surprising. There appears to be an aversion on the part of the smelters who have been making increases to letting it be known, wherefore tentative lists are likely to be characterized by important omissions.

The following is a revised estimate: At 12 works listed Jan. 1, 1915, new retorts to the aggregate of 16,762 are being added. Five old works, not then listed, have been put in operation, with a total of old and new retorts amounting to 6604. Three new plants are being built with a total of 14,160 retorts. Therefore the total addition to American zinc-smelting capacity will be about 37,600 retorts, corresponding to capacity for about 160,000 tons of spelter per annum, which will give a total

smelting capacity for the production of about 660,000 tons of spelter per annum.

The new capacity will probably become available to its full extent a good deal sooner than was previously estimated. It turns out that the United States Steel Corporation is building not only at Donora, Penn., but also at Gary, Ind. It is said that the production of spelter at Donora is to begin about Nov. 1, and at Gary about Jan. 1. If those dates are lived up to, all records in building smelteries fired with coal will be surpassed. The managers of the Steel Corporation appear to have confidence in this inasmuch as its purchasing agent is reported to be buying no spelter for delivery after November. It is clear that these new plans are going to put the zinc-smelting industry into a new phase. When the largest consumer—a concern that uses about 110,000 tons of spelter per annum—puts itself into a position to supply about 70,000 tons of its requirement there will be a void in the general market that it will not be easy to fill.

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Nevada Consolidated

About eight years after beginning production, the Nevada Consolidated company is taking steps to obtain ore from its Ruth mine. Heretofore its production has been made by the Eureka, Hecla and Liberty pits, with a little coming from the Veteran mine, which, however, has lately been idle. The Veteran orebody is relatively small and mining it is relatively costly, but the extraction of ore from it will be resumed later. The Ruth mine has a large body of high-grade ore, comparatively speaking. It will be mined by underground methods, which in this case figure out a little cheaper than stripping and steam-shoveling.

The Nevada Consolidated is an excellent example of the principle that great, flat-lying orebodies are usually underestimated. In the Eureka, Liberty and Hecla pits the fringes of the huge ore mass have been found to extend outward farther than ever was reckoned. A result is that after eight years of ore extraction this company is still able to figure its ore reserves at a larger quantity than ever. However, the average grade of the present ore is lower than was originally reckoned and the cost of producing copper from it has increased, though not in direct proportion to the diminution of grade of the ore which has been partially offset by improvements in the arts of mining, milling and smelting.

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Mining Shares of No Par Value

The Kennecott Copper Corporation, the shares of which were recently introduced to the public, is unique in having a capitalization of shares which have no par value. This is a good idea to follow in the organization of mining companies. In former times it used to be the custom to capitalize a mining company at \$100 per share, let us say, and offer the stock at \$10 per share, the promoters and the public both hoping that development in the mine might cause the stock to grow up to its par value. Sometimes it did, but more often it did not, causing the stock to look rather ridiculous ever afterward.

In the more modern cases of the porphyry coppers the idea was to capitalize at the real value in the young days of the mine. Thus, Miami was brought out when it had about 2,500,000 tons of ore developed and the shares were made of \$5 par value. As the known ore resources

of the mine gradually increased to about 20,000,000 tons, the value of the stock increased more or less in proportion thereto, and in fact that company is now paying dividends at the rate of \$3 per share per annum, which is 60 per cent. on the par value. This experience (that of Utah, Chino, Ray, and the rest of the porphyry coppers are similar) causes persons inexperienced in mining to wonder. In fact, the par values of these securities ceased long ago to have any significance (except for Federal- and state-taxation purposes). It would have been just as well if they had not been marked with any par value in the first place.

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Metal Loss in Copper Slags

The important subject of metal losses in copper slags is taken up this week by Frank E. Lathe in the first of three articles dealing with the principal source of loss in copper smelting. Mr. Lathe reports the result of a long series of investigations of the Granby slags, and the conditions under which they are formed. While primarily concerned with the conditions at Grand Forks, he also made examinations of slags from other works, and his article is one of the important contributions on this subject and will, we feel sure, receive careful attention from copper metallurgists. The first installment deals almost entirely with a review of the literature of the subject.

After an exhaustive examination of the losses in copper slags, Mr. Lathe has come to the conclusion that in most instances improvement can be effected by a careful study of conditions. It may be mentioned that he dismisses as unimportant the loss from dissolved cuprous sulphide, and considers that the two great factors are suspended matte particles and oxidized copper. After examining many Granby slags and others from various works, he concludes that the loss from oxidized copper amounts to one-half or three-quarters of the total loss in the slag.

At many plants the metallurgists get into a sort of auto-hypnotic state with respect to the metal content of the slag, once its tenor has been established at what is regarded as the practical minimum with the equipment at hand. The metallurgist in charge may have a theory that a little more settling or some other slight change in practice would reduce the metal losses in the slag, but as this may be only a theory, in support of which he can submit no incontrovertible evidence, he hesitates to ask his directors for an appropriation for experimental purposes. And even while he hesitates, he perhaps receives instructions to proceed with some less promising experiment that has appealed to the vision of one of the lay directors of his company. The metallurgist, after having studied his slag losses and having become convinced that they are about as low as possible with the equipment available, eventually directs his efforts toward keeping the metal tenor of the slag at the conceived minimum.

The Granby Co. attacked the slag-loss problem in an aggressive way and made a decided betterment in this practice by deepening its furnaces and improving the settling conditions. The problem was studied persistently over a series of years, and the results at the Granby works, where over a million tons of slag is produced annually, are noteworthy. Every 0.01% of copper saved from the slag represents an amount equivalent to 200,000 lb. of metal per year; in other words, the 1914 practice at Grand Forks was better than that of 1907 by 2,640,000 lb.

At many other works the study of the slag losses on an exhaustive scale would probably repay the expense. The metallurgists in most instances are handicapped by the prevailing equipment, but were it shown that a marked saving could be made annually the funds would probably be forthcoming for such changes as were desired. At all events, we think that the subsequent installments of Mr. Lathe's article will stimulate metallurgists to an examination of their slag losses to see if only the irreducible minimum is going over the dump.

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The index for Vol. 99 of the *Engineering and Mining Journal* will be mailed with this issue. Any subscriber not receiving a copy of it should notify the subscription department at once.

BY THE WAY

The Allis-Chalmers Co. is not so well known in Wall Street as it is in the mining industry. The following story is from the *New York Sun*:

Allis-Chalmers used to be described for the sake of convenience as the company which made everything in the world except money. But now that it is a war stock nobody alludes to it flippantly any longer. A broker just back from a holiday met one of his old customers. "Say, what is this 'war bride' they call Allis-Chalmers?" he called out. "Why?" asked the broker. "Oh, just curiosity. Last week I called up your office and they told me Allis-Chalmers was a hot one. So I bought a hundred. Now I have six points profit in it and I haven't the faintest idea whether it's a motor company, a street railway or a combination of barber shops."

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A concession which ought to interest some people is now being offered in New York by Belgian parties, who obtained it from the Russian Government some time ago. It is for an electric power and light plant and a trolley line in the ancient and mysterious city of Samarkand. The introduction of the trolley car and electric light in that city of Oriental tradition seems to be an anachronism, but we suppose such things have to come, even if Kublai Khan turns in his grave. Samarkand is now the terminus of one branch of the Russian Transcaucasian R.R., and is capital of the Russian Central Asiatic provinces.

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A few years ago the press throughout the country announced the salvation of the lay mining investor through the operation of the so-called "Blue Sky" laws, by which all mining securities offered for sale were first to be approved by a state commissioner—who was sometimes the bank commissioner, often merely a political appointee, but in no case a mining engineer, so far as is known. Shortly after the Kansas "Blue Sky" law was passed the *Journal* commented on the flotation of a certain company which had its prospectus, gold bonds and "guaranteed stock" approved by the "Blue Sky" commissioner in Kansas. Its name does not yet appear in this paper's dividend list, and it is doubtful whether buyers of the guaranteed stock have received their interest guarantees. Recently a correspondent sent in an item about Field's Process Smelter Fumes Co., which proposed to save the "vaporized metallics" and other elements of value in the fumes much better than the

regular operators had been able to do it. This company was said to be selling stock to farmers and other residents in Shasta County, California, where there has been much "smoke talk." The "Blue Sky" commissioner of California is reported to have approved the sale of this company's securities. A decision in such matters involves technical judgment and experience. "And he spoke a parable unto them, can the blind lead the blind? shall they not both fall into the ditch?"

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July Mining Dividends

Exclusive of the dazzling \$25,000,000 stock dividend of the New Jersey Zinc Co., disbursements to stockholders by 38 United States mining companies making public reports reach \$11,052,732, as compared with \$7,654,337 in July, 1914. Industrial and holding companies allied to mining paid \$2,469,821 in July, 1915,

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c.	Mich.	10.00	500,000
Allouez, c.	Mich.	1.00	100,000
Anaconda, c.	Mont.	0.50	2,331,250
Anchor, s.	Nev.	0.03	15,000
Arizona, c.	Ariz.	0.24	368,849
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,750
Bunker Hill Con., g.	Calif.	0.02½	5,000
Caledonia, l.s.	Ida.	0.03	78,150
Camp Bird, pfd., g.	Colo.	0.17	110,565
Center Creek, z.	Mo.	0.15	15,000
Champion, c.	Mich.	5.00	500,000
Continental, z.	Mo.	0.50	11,000
Daly-Judge, l.s.	Utah	0.25	75,000
Ernestine, g.s.	N. M.	0.10	30,000
Goldfield, g.s.	Nev.	0.10	355,915
Golden Cycle, g.	Colo.	0.02	30,000
Hecla, l.s.	Ida.	0.02	20,000
Homestake, g.	So. Dak.	0.65	163,254
Interstate-Callahan, z.	Ida.	1.25	575,000
Iron Blossom, s.l.g.	Utah	0.05	50,000
New Jersey Zinc, z.	U. S.	30.00	3,000,000
New Jersey Zinc, z.	U. S.	250.00*	25,000,000*
North Butte, c.	Mont.	0.40	164,000
Osecola, c.	Mich.	3.00	288,450
Parrot Silver & Copper, s.c.	Mont.	1.63	374,650
Plymouth, g.	Calif.	0.24	58,520
Portland, g.	Colo.	0.03	90,000
Prince Con., z, l.s.	Utah	0.02½	25,000
Silver King Coalition, l.	Utah	0.15	187,500
Silver King Con., l.s.	Utah	0.10	63,758
South Eureka, g.	Calif.	0.03	9,900
Stewart, s.l.	Ida.	0.35	433,392
Success, z.	Ida.	0.04	60,000
Tennessee, c.	Tenn.	0.75	150,000
Tonopah Belmont.	Nev.	0.12½	187,500
Tonopah Extension.	Nev.	0.10	94,343
Tonopah Mining.	Nev.	0.25	250,000
Utah Con., c.	Utah	0.50	150,000
Vindicator, g.	Colo.	0.03	45,000
Wasp No. 2, g.	So. Dak.	0.01	6,000

*Stock dividend

Iron, Industrial and Holding Companies

Am. Smelters Securities, pfd. A.	U. S.	1.50	252,450
Am. Smelters Securities, pfd. B.	U. S.	1.25	375,000
Bethlehem Steel.	Penna.	1.75	239,625
Brier Hill Steel, pfd.	Penna.	1.75	83,452
Guggenheim Exp.	U. S., Mex.	1.00	833,732
Pennsylvania Salt.	Penn.	2.00	100,000
St. Mary's Mineral Land.	Mich.	1.00	160,000
U. S. Sm. Ref. & Min., pfd.	U. S., Mex.	0.87½	425,562

Canadian, Mexican and Central American Companies

Con. Min. & Sm., l. e.g.s.	B. C.	2.00	116,098
Crown-Reserve, s.	Ont.	0.02	35,376
Esperanza, s.g.	Mex.	0.24	165,848
Hollinger, g.	Ont.	0.20	120,000
La Rose, s.	Ont.	0.05	37,466
Lucky Tiger, g.s.	Mex.	0.09	64,380
McKinley-Darragh-Savage, s.	Ont.	0.03	67,341
New York & Honduras Rosario, g.s.	C. A.	0.30	60,000
Nipissing, s.	Ont.	0.25	300,000
Porcupine-Crown, s.	Ont.	0.03	60,000

as compared with \$3,320,245 in 1914, while Canadian and Mexican companies paid \$962,129 as compared with \$1,605,950 a year ago.

The totals for the first seven months of the year are as follows: Mining companies, \$37,053,776, as against \$40,580,220 in 1914; metallurgical and holding companies, \$36,633,973, as against \$45,034,348 in 1914; Canadian and Mexican mines, \$4,497,751, as against \$11,500,862 in 1914. The accompanying table shows details of the month's payments.

PERSONALS

Edwin Northey, of Calumet, Mich., has been appointed clerk at the White Pine Mine.

Frank M. Woods has returned to Colorado Springs, Colo., after making examinations at Oatman, Arizona.

Arthur J. Hoskin has been in the Taos district, New Mexico, inspecting placer property along the Rio Grande.

Sir Richard McBride, premier and Minister of Mines of British Columbia, has returned to Victoria after a European trip.

Edwin E. Chase, of Denver, has been making a trip into the northern part of Ontario and will return to Denver this week.

J. A. Durfee has been appointed by the Jones & Laughlin Steel Co., Pittsburgh, to the position of metallurgical engineer.

M. C. H. Little, representing the Lewisohn interests, is sampling the St. Anthony gold mine in the Sturgeon Lake area in Ontario.

Robert H. Stewart, general manager of the Consolidated Mining & Smelting Co., of Canada, is in Eastern Canada on a business trip.

Ivan P. Tashof is at Morenci, Ariz., working on flotation in the mill of the Miami Copper Co. He expects to remain there most of August.

Frank H. Siermans has returned from his trip to the Piz-Piz district of Nicaragua, and will be at his headquarters in El Paso, within a short time.

Robert S. Lewis, of the University of Utah, has just returned to Salt Lake City from a visit to the mines at Juneau, Alaska and Dawson, Yukon Territory.

D. C. Stapleton, general manager of the Anglo-Colombian Development Co., Ltd., has been in New York for a few weeks and has gone to Omaha, Nebraska.

J. G. Sipprell, formerly manager of the York Ontario, Cobalt, is now in charge of a molybdenite prospect, near Renfrew, Ont., from which high-grade ore is being taken.

Morton Webber, who obtained a commission in the British Royal Field Artillery and was wounded in France, has now recovered and has joined the British forces at the Dardanelles.

Frank J. Hambly, president of the Cerro Gordo Mining Co., has returned to San Jose, Calif., from a two months trip to New York and Boston, returning by way of Toronto, Seattle and Portland.

Walter E. Burlingame announces that from Aug. 1 the business of E. E. Burlingame & Co., assayers and chemists, will be conducted under his name at the old office 1736 Lawrence St., Denver, Colorado.

Dr. A. C. Lane, formerly state geologist of Michigan, but now one of the faculty of Tufts College, Massachusetts, is making a geological examination of the Indiana Mine in the Michigan copper region.

Dr. F. W. McNair, president of the Michigan College of Mines, has returned to Houghton after a visit to Cobalt, Porcupine and Sudbury. At each camp he was entertained by graduates of the college.

Robert T. Hill, who has been engaged in making a geological survey of Southern California during the last three years, spent a few days in New York this week. Mr. Hill has lately been in Washington, working on his report.

P. K. Horner, manager of the Union Minière du Haut Katanga, who has been visiting in the United States for several months, sailed for London on July 31 on the S.S. "Philadelphia" and will return soon to the Belgian Congo.

L. A. Friedman of the Rochester Mines Co., was in San Francisco recently closing his deal for the purchase of the Four-J lease at Rochester, Nev., and to arrange for listing stocks of the mines in that camp on the San Francisco Exchange.

F. A. Thompson, for three years past superintendent of the Triumph Gold Mining & Milling Co., Lumpkin, Calif., resigned Aug. 1, and will spend some time looking into mining propositions in Nevada and Arizona. His temporary address is at Goldfield, Nevada.

David A. Thomas, the British coal operator, has arrived in Canada on a special mission representing the British Minister of Munitions, and is making a tour of inspection of the factories in Eastern Canada, to ascertain their capacity for producing shells and other war supplies.

A. J. Beaudette, of Vancouver, B. C., is now retained by the Pacific Great Eastern Ry. Co. to advise and assist prospectors relative to the development of mining property along the company's line from Vancouver through Lillooet and Cariboo districts to Prince George.

E. J. W. Donahue, of the Locker-Donahue Co., formerly controlling Cuyuna-Mille Lacs, Cuyuna-Duluth, Duluth-Brainerd and other Cuyuna range stock companies has resigned as an official in the above corporations. He intends to devote his time to private interests on the Cuyuna range.

Roy Reynolds has been appointed captain at the Tri-mount mine of the Copper Range Consolidated in Michigan, succeeding Captain Richard Bowden. Reynolds was assistant under Bowden. He is a Michigan College of Mines man. Richard Martin, mining captain, who resigned with Bowden is succeeded by Captains Letcher and Lambert, both capable and experienced men.

OBITUARY

Frank W. Heimick, mining man and capitalist, died at his residence, Duluth, Minn., July 19, from pneumonia. He held many interests on the Mesabi Range and undeveloped property on other Minnesota ranges. He was best known locally for his philanthropical activities.

Henry Anthony de Meli died at Catania, Italy, July 20, aged 73 years. He was born in New York and studied at Columbia University, being a member of the first class graduated by the School of Mines. After leaving college, Mr. de Meli became interested in mining properties at Georgetown, Colo., but he retired in 1870 and went to Europe. He had a home in Dresden, Saxony, as well as in Catania.

James W. Weaver, secretary and treasurer Thomas Iron Co., Easton, Penn., who died July 8, had been in the service of the company 45 years. He began as an apprentice in the machine shop at Hokendauqua, Penn., in 1867, at the age of 15. Later he had positions as clerk and telegraph operator at various plants and became secretary and treasurer in 1892. He was also secretary and treasurer of the various railroad subsidiaries of the Thomas Iron Co. His father was a pioneer iron manufacturer in the Lehigh Valley.

Theodore Bryant Comstock died at Los Angeles, Calif., July 25, aged 66 years. He had a high reputation as a geologist and was well known in the scientific world. He was born at Cuyahoga Falls, Ohio, 1849, educated in the public schools of that state and Pennsylvania and obtained a degree of bachelor of agriculture at the Pennsylvania State College in 1868, bachelor of science from Cornell University in 1870, and doctor of science in 1886. He married in 1880. When but 21 years old he participated as assistant and photographer in the Morgan expedition to Brazil, and in 1873 served as geologist and assistant to the Capt. W. D. Jones, expedition into Northwestern Wyoming and Yellowstone Park. He led a scientific expedition into the Northwest Territory of Canada in 1877. Dr. Comstock was also prominently identified with educational work. He was the founder and director of the Kirtland Summer School of Natural History, Cleveland, 1875; founded the department of economic geology, Cornell University, and was professor of geology and paleontology there from 1875 to 1879; founder and director of the Arizona School of Mines from 1891 to 1895, and president of the University of Arizona, 1893 to 1895. He acted as manager and consulting engineer of several mining companies also. He also occupied many prominent official and public positions. He was assistant state geologist of Texas from 1889 to 1891, and contributed many notable additions to knowledge of the geology of that state; was vice-president of the National Irrigation Congress in 1893; secretary and chief engineer of the Los Angeles Board of Public Utilities, 1910 to 1912; director of the Arizona Agricultural Experiment Station, 1894; assistant state geologist of Arkansas, 1887-88. Dr. Comstock was an original Fellow of the Geological Society of America; original member of Sigma Xi; founder of the Cornell Chapter, Delta Upsilon; and charter member of the Mining & Metallurgical Society of America. He was a frequent contributor to many technical and scientific magazines and journals; also to the transactions of the Mining & Metallurgical Society and the American Institute of Mining Engineers. He served as chairman of the Southern California section of the last-mentioned and was one of its founders. "An Outline of Geology," published in 1878, was his work and he was editor of the "Bulletin" of the Southern California Academy of Sciences. He held membership in several local clubs and lodges. No immediate family, except the widow, is left. He was a man of high attainments and untiring industry.

Editorial Correspondence

SAN FRANCISCO—July 28

Gold Production in California for the first half of 1915 is equal to about \$700,000 more than the production in 1914 in the same period, or a total for the first half of 1915 of approximately \$11,400,000. It is believed the increase will continue in the second half of the year so that the total production for 1915 will probably reach \$23,000,000. Surface placer mining increased in production owing to the abundance of water, and the season for hydraulic mining has been extended for the same reason. There was also plenty of water for mill purposes. The dredge-mining industry was prosperous and productive and some new dredges were put in commission, and others that went into commission late in 1914 added to the production for the first half of the present year. There has been a large amount of new mining and metallurgical machinery installed, chiefly in Nevada, Shasta, and Amador Counties. Copper mining has largely improved, chiefly in the mines of the Mammoth Copper Co. and the Mountain Copper Co. in Shasta County. The production of copper was very appreciably reduced in the last half of 1914 owing to war conditions but in the second quarter of 1915, there has been a notable advance in the demand for, and the production of copper. The report of the Selby Smelter Commission in the latter part of 1914 had a good effect upon the farmers who have largely withdrawn from the fight against the smelters, and there is not great probability that the fight will be effectively renewed. New investments in California mines have not been as encouraging as was hoped for at the beginning of the second quarter of the year. There were some old mines reopened which will probably add to the gold output for the last half of the year. The outlook for production of potash in Searles Lake region is encouraging and there has been some encouraging prospecting done for antimony ores. Quicksilver has advanced steadily in price in the first half of the year but the total production has not increased. Some of the quicksilver mines have increased production but the promised reopening of old mines has not been equal to the expectation in the last of 1914.

Protests of Farmers in Campo Seco District against the Penn Mining Co. have been renewed by application to Governor Johnson. The farmers urge that some action be taken upon the report of the commission appointed by the Governor in 1913. This commission found something wrong with the crops in the various sections it investigated and under the law providing for the appointment, the attorney general is authorized to bring suit against all persons whom the commission reports in violation of the smelter-waste law. This commission made its report about the time that the Selby commission reported; but the findings were never made public. Some persons believe that the findings were not important enough to make public. At any rate there seems to be no good reason why the copper-mining industry should not be made fully acquainted with the results of an investigation which the taxpayers of California paid for; the copper mine operators being among the taxpayers. This subject of smelter fumes affecting the farms and the farmers in Calaveras and Amador Counties in the region of the Campo Seco smelter has been presented in the "Journal" a number of times. The most recent mention of affairs in this region referred to a number of suits brought by a law firm in San Francisco in behalf of farmers who really had no complaint to make but were willing that suits should be brought in their names, accepting the proposition of the attorneys that the farmers would be out no expense for filing or trying the suits but would share in whatever profit might be gained through verdicts in their favor. These suits are about ready for trial. In the meantime the Penn Mining Co. has employed experts who are making examinations of soil, also studying the pest subject in the belief that it will be shown that much, in fact most, of the damage done to crops has been done by unfavorable soil conditions and certain pests, probably the aphids. It is quite probable that one fact will be brought out in the trial that may be useful in teaching some of the farmers the value of a course in an agricultural college. Much of this land is worn out. It has been tilled to death, and the process has been going on for the last 40 years. The few farmers who practise rotation in crops and the use of fertilizers are still prosperous in spite of the small amount of fumes from the smelter. It is hardly believed probable that Attorney-

General Webb will order suits brought upon the complaints made to the Governor. One thing is certain, the Penn Mining Co. has done everything possible to prevent damage to the crops and will continue experiments until a satisfactory method shall have been adopted. The thiothen process had its first practical demonstration at the Campo Seco smelter. That process has since been taken over by the American Smelting & Refining Co. and may yet be adopted by the Penn Mining Co.

BUTTE—July 29

In The State First-Aid Contest held at Billings, Mont., July 23 and 24, the team from the Leonard mine in Butte won first prize after having been disqualified from entry in the elimination contests held in Butte. The teams sent from the Anaconda mines were those from West Colusa and Anaconda, and two more from the Washoe and Boston & Montana reduction works. The Leonard mine team went to Billings at its own expense. It had done good work in the elimination contests, but a comparatively slight error spoiled its chances of winning, but because of its interest in first-aid work it decided to go to Billings at its own expense, and there they won the first prize, a silver medal, given by the American Mine Safety Association. The Leonard team was composed of G. Ethier, captain; H. Hagens, J. E. McCloud, W. E. Barraugh, Ryan Gaul and F. C. Deakin.

Members of the United Mine Workers of America, who are employed in the Butte copper mines, must deposit their working cards with the local union of the Western Federation of Miners or they will be rated as labor outlaws. That was decided on at a conference between a committee representing both national miners' organizations in Butte, July 28. There are about 700 men with United cards working in Butte and if they obey the orders of the joint committee they will join the remnant of the local Federation union, which already has about 200 members out of the 12,000 miners working in Butte. Miners, with former experiences fresh in mind, are reluctant to join any union of miners in Butte and the action of the 700 United Mine Workers will be watched with some interest. There is expectation that many of them will ignore the orders of the committee. The conference held in Butte was called to act on the proposition to amalgamate the Western Federation of Miners and the United Mine Workers of America, but the committee decided that the project was premature and impractical at this time, probably because of the discredited state of the Western Federation and its officers. The two organizations will continue to exchange working cards, but that is all.

SALT LAKE CITY—July 30

The New Wage Scale in Bingham which went into effect Aug. 1 is as follows: Machine men, \$3.50 per shift; machine helpers, \$3.25 per shift; steel miners, \$3 to \$3.25 per shift; maximum wages to apply only to skilled miners. Timber men and timber men helpers increased 25c. per shift, with maximum for timber men of \$3.50 per shift. Hand trammers, \$3 per shift. Horse and mule trammers, \$3.25 per shift. Horse and mule trammers' helpers, \$3 per shift. Nippers, \$3 per shift. All other day labor now being paid \$2.50 or more per day will receive an advance of 25c. per day; and all day labor, now being paid less than \$2.50 per day, will receive an advance of 20c. per day, while the above scale is in effect. The employees of the Salt Lake smelteries and the Bingham & Garfield railway will likewise receive an increase. The new scale is based on a sustained price of 17c. per lb. for copper—New York quotation—and 5.25c. per lb. for lead. About 7000 men are affected. The raise will add about \$750,000 a year to the payroll.

Zinc-Producing Properties in Utah in the last three weeks have been able to market ore running as low as 28 or 29% zinc, as compared with a minimum of 30% or over previously. There appears to be a somewhat better inquiry for this ore, as evidenced by the number of buyers, though the prices paid are not high. Twenty-nine per cent. zinc ore is worth about \$1 a unit f.o.b. Salt Lake, the buyer paying the freight. The following companies have men in the field: The Granby Mining & Smelting Co., the Empire Zinc Co., of Colorado, Consolidated Ores Co., representing the Edgar Zinc Co., and Beer Sondheimer & Co. The production of zinc ore at present from

Tintic is about 500 to 600 tons a month of carbonate ore; from Park City, 600 tons, all concentrates, and this should be increased in the near future through the operation of two new mills to work tailings. Stockton produces about 200 tons of zinc ore a month—the Hidden Treasure and Queen of the Mills in Dry Cañon being the principal shippers. Ophir is not producing any zinc at present. Bingham is producing little straight zinc ore, though mixed zinc ores are mined and treated by the United States Co. The Horn Silver in Beaver county ships a mixed zinc ore to Midvale. The Cedar-Talisman in Beaver county produces one or two cars of carbonate zinc ore a month. Most of the ores are shipped to Missouri river points and farther east.

JUNEAU—July 17

Fire at Valdez destroyed approximately \$800,000 worth of property on July 15 at 4 a. m. Stiff breeze blowing off the glacier toward open water fanned the fire but saved the town on account of the direction in which it was blowing. U. S. Road Commission office burned with maps and records of 10 years' accumulation. Residents of Valdez started to rebuild at once. Only a small part of loss covered by insurance.

KELLOGG, IDA.—July 21

The Stewart Mining Co. has obtained control of the Cœur d'Alene Development Co. by the purchase of 229,000 shares of stock from Frederick Burbidge, of Spokane, and C. W. Beale, of Wallace. The Cœur d'Alene Development Co. was organized in 1899 by Burbidge; it was capitalized for 1,000,000 shares, par value \$1. F. Augustus Heinze bought 330,000 shares, which were turned over to the Stewart company in 1908. Since that time the Stewart has been trying to get control, and they now have all the issued stock except that held by Fred W. Bradley, president of the Bunker Hill & Sullivan, Albert Burch, of San Francisco, and Joseph McDonald, former superintendent of the Treadwell mines. The holdings of the Cœur d'Alene Development Co. include 10 patented claims near Kellogg and adjoining the Stewart mine. The company also owns the concentrator now being used by the Stewart, which was built at a cost of \$70,000. Considerable development work has been done on the claims and a gross production of more than a million dollars is reported. There is a block of unexplored ground that will probably be prospected at once by the Stewart. The Ontario Mining Co., composed of Stanley A. Easton, general manager of the Bunker Hill & Sullivan mine, M. A. Folsom, and associates, lessees of the Ontario mine, have a working privilege on the lower tunnel of the Cœur d'Alene Co., and are taking out ore under an agreement whereby they must do a certain amount of development work each month.

ASHLAND, WIS.—July 31

On the Gogebic Range the C. & N. W. Ry. officials report extraordinarily heavy tonnage. Thus far, 1,317,000 tons have gone over Ashland docks, as against 1,062,790 for same period 1914.

HIBBING, MINN.—July 31

Militia Has Been Requested by the village council of Hibbing which has asked Governor Hammond to establish martial law in the village. The request has been denied. Iron-mining companies holding valuable property within the village limits have refused to pay \$750,000 taxes and the village is without funds to pay police or firemen.

ISHPEMING, MICH.—July 31

Serious Consideration to Leaching Processes to recover copper from the tailings is being given at the present time by the managements of many of the copper companies in Michigan. The Calumet & Hecla company has erected a leaching plant to treat the tails from the new regrinding plant at Lake Linden and is recovering copper by means of the ammonia process. At Winona a 20-ton experimental plant is now being erected to treat the tails, which carry from five to seven pounds of copper per ton. The solvent will be ferrous chloride, hypochlorous acid and chlorine. The copper will be precipitated by iron. The solution is subject to regeneration by the use of salt, 20 lb. of which will be required per ton of tails treated. Laboratory experiments have shown a recovery of 95% of copper in the tails, and it is believed that almost as good results can be obtained in a plant working on a large scale. The Copper Range company is considering a number of different processes for leaching its tails, of which it has a large stock on hand. All of the tails from the White Pine mill are being saved, with a view of leaching at some future time. The oil-flotation process is also being looked into by Michigan companies, and it is thought that it may work at such properties as the Nonesuch, White Pine and White Pine Extension.

HOUGHTON—July 31

The Workmen Employed at the Isle Royale and the shareholders residing in this district are gratified to learn that the Isle Royale is to remain under Calumet & Hecla management. They realize that the Isle Royale at best is a low-grade proposition—at present running under 13 pounds refined copper—and can operate successfully on a low copper market only by extensive tonnages. It is generally believed that the Isle Royale's new stamp mill will be put in running order at a cost of under \$40,000 and it will be the most modern and most economical mill in the district. Of course the long haul on the rock tonnage, made necessary by the fact that Isle Royale rock has been milled at Point Mills and at the Tamarack mill since last December, adds materially to the cost of putting the copper on the market. At the same time the affiliation with the Calumet & Hecla interests was the only thing that made it possible for Isle Royale to maintain operations at all during this present prosperous copper-producing period. Two heads now are working at the new Isle Royale mill and the third will be within a month. This new mill was erected in speedy time and is a credit to the methods and ability of the Calumet & Hecla construction crews. The operation of two heads here released the one head at the Tamarack mill. It is supposed that two heads at Point Mills plant will continue on Isle Royale rock and two at the Isle Royale mill. When the third is ready to go into commission it is hoped that Isle Royale will then be in shape to keep five heads going. This will require about twice the tonnage of rock that Isle Royale formerly produced but will be the solution of the Isle Royale problem, no matter what the price of the metal.

JOPLIN—July 28

Rapid Mill Building is being done by three 9-hour working shifts in the construction of the 500-ton concentrating plant of the Haywood Scott Mining Co., at Duenweg, six miles east of Joplin, Mo., this being the first mill in the history of the Missouri-Kansas-Oklahoma district to be constructed in this manner. Powerful electric lights illuminate the grounds while within the mill-building proper there are scores of brilliant incandescent bulbs, making the work after nightfall just as expeditious as in the day time. Night workmen receive 50 per cent. additional wages. The shifts are so arranged that they overlap, each succeeding shift thereby being enabled to pick up the work quickly. Work on the big plant begun about middle of June will be finished by July 31. The Scott mill will have the largest crusher capacity of any plant in the district, two sets of 14-in. crushers and five sets of 30-in. rolls having been installed. In addition there are two sets of 24-in. rolls for grinding chats. The mill building proper is 100 ft. wide by 140 ft. long and so arranged that either half of the equipment can be run independent of the other half, with the exception of the cleaner jig, of which there is only one installation. Electric power is to be used in the operation of the plant. Four sludge tables will be installed at first and others placed in later if necessary. At the ends of all jigs, dewatering screens will be placed, the water being conveyed to four settling tanks, two of which are on one side of the mill and two on the other. High concrete piers hold the mill building well above the ground and underneath the entire structure a concrete floor will be constructed to catch any fine ore that may sift through. This is a decided innovation as the custom that has prevailed throughout the district is to permit the fine ore to settle through onto the ground and when this becomes sufficiently enriched to warrant it, it is cleaned up and milled. The "dog house" is divided into two apartments, both floored with concrete. One is to be used as a dining room, the other as a bath and dressing room. The latter is equipped with ventilated steel lockers, two shower baths and a swimming pool, 15x26 ft. and 5 ft. deep at one end by 6 ft. at the other. This is the first natatorium to be installed in a Joplin district "dog house."

TORONTO—July 31

Information Regarding the Big Duck Lake Gold Area, lying some 13 miles north of Schreiber on Lake Superior, embodied in memorandum has been issued by Dr. Willet G. Miller, of the Ontario Bureau of Mines. Not much development has been done, but superficial sampling shows encouraging results. The J. Johnson claim south of Little Duck Lake gave \$7.60 from a sample across 5 ft. The Coco-Estelle claim, gave \$8.60 from a sample across 4 ft. of quartz and pyrites. The McCuaig claim is said to contain rich gold ore, some of which was hand-picked and shipped during the winter. The Sjolander-McKirdy claims are said to have a large vein which has a pay-streak near the hanging wall. The Bustrom claim is reported to have a large vein, samples from which gave 2% copper and 20c. gold.

The Mining News

ALASKA

THE REPORT THAT PLATINUM HAS BEEN DISCOVERED on the hill back of the town has caused considerable excitement in Dawson. A stampede took place from Dawson and the entire hill was located and the assay plants have been running night and day to determine the value of the ores.

CHARLES HERRON (Six Mile, via Seward)—New mill being installed at Herron's quartz property in the Sunrise-Hope district. Mine shows promise.

KENSINGTON (Juneau)—Hayden-Jackling interests said to be planning reopening of these mines near Juneau and construction of 1000-ton milling plant.

ANACONDA COPPER (Whitehorse)—Ore from this property is now being shipped over railroad to Skagway en route to Tacoma smeltery and is first ore to be shipped from Whitehorse district since Pueblo closed down six weeks after beginning of war in Europe.

TREADWELL (Juneau)—Portion of big plant is shut down owing to breaking of shaft at central hoist. Shaft is 20 in. in diameter and 40 ft. long; new one will have to be brought from Atlantic coast before operations can be resumed. This is most expensive delay ever experienced by this company since its operation during which time it is said to have produced over \$200,000,000.

ALASKA GOLD (Juneau)—Original hydro-electric power project on Salmon Creek to deliver 6000 hp. is being supplemented by development of another hydro-electric proposition at Annex Creek, which will give 4000 hp. additional. This will give 10,000 hp. for the 10,000-ton mill or at rate of 1 hp. per ton, but operations indicate that this estimate will be reduced to ¾ hp. per ton actually required.

ALASKA JUNEAU (Juneau)—Consulting Engineer J. H. McKenzie announces plans for the development of Alaska Juneau mine and estimates that by Oct. 1, 1916, all development work to bring tonnage up to 8000 tons daily will be finished. When that work has been finished all hands will be put to widening drifts and crosscuts to 9x14 ft. It is planned to install a 7500-kw. power plant, consisting of oil-fired boilers and steam turbine. Location of plant not yet decided upon.

NORTH STAR GOLD (Port Wells)—Sixteen tons of machinery and construction materials have been shipped from Seattle for new stamp mill to be installed on this property. Carl Staps, officer of company, will leave for Atlantic coast shortly to place contracts for equipment. Ore on this property averages about \$20 per ton in gold and some has run as high as \$120 per ton. Property consists of two claims and enough ore, it is stated, has been blocked out to keep proposed stamp mill running for years. Gus Ohm is president of company.

ARIZONA

Cochise County

PRIMOS CHEMICAL CO. is reported to be actively engaged in mining tungsten ores in Dragoon mountains. About 60 men are at work. Ore is sacked and shipped to company's plant at Primos.

RINE PLATE (Bisbee)—Development work in new shaft has opened up \$80 ore. Compressor and hoist are to be installed. Property located in Ash Cañon.

Gila County

SLEEPING BEAUTY (Globe)—Arizona Eastern has constructed good approach to Burch spur, which has been repaired, and ore can now reach that point on railroad by two-mile haul. From there it is not much over three miles to International smeltery to which plant McClure and Miner will ship. They have been delayed considerably in securing teams, but finally have two six-horse outfits working and will soon be shipping. Fifteen men are now being worked at property and force will be increased as fast as faces are opened.

OLD DOMINION (Globe)—At Old Dominion smeltery during July, copper production has been averaging about 50 tons per day; four furnaces have been in operation entire month. Old converter shell, which has been in operation over two years, is still treating entire output of the furnaces. At central power plant new stack is being erected over one of boilers and plans are being made to install new economizers in some boilers. At concentrator daily tonnage has exceeded 600 tons per day for entire month. Some experimental work is being done with new air-flotation machine. Third compartment has been installed in Woodbury jigs at top of mill, with view to improved efficiency and old shaking screens have been replaced with two new Cole shaking screens. Big pocket below 16th level, on north side of station, has been completed and is already being used. Its use relieves congestion of cars on 16th level and also facilitates hoisting operations. Small churn drill hole has been put down for ventilation from 16th to the 18th level and others will be drilled in various parts of mine where occasion demands. On surface a 3x3-ft. flume is being constructed to carry water from concrete dam, above Maurel hotel, past Old Dominion's property and down to Hamm Ponds, with view to letting as little water as possible get into sands of creek above company's workings.

Mohave County

GOLDEN GEM (Cerat)—Mill being overhauled. Pipe line is to be laid from mine to mill for water supply.

GOLD REED (Oatman)—Main shaft now down below 330 ft. Station is to be cut at 400 ft. L. L. Moore, of Bisbee, is in charge.

Santa Cruz County

AUSTERLITZ (Oro Blanco)—Recent developments in upper levels have opened up some important orebodies. Mill is to be put in operation soon.

SAN JORGE (Alto)—C. V. Hudson, owner, has opened up wide ledge of copper ore on this property, but is bothered with water. He has commenced a shaft, and will proceed as long as water does not drive him out.

TRENCH (Patagonia)—Now being reopened by sinking a 500-ft. shaft. Property owned by Clark interests, who have organized Trench Consolidated Mining Co., of which Charles Clark, of Jerome, is president. John Hoy, formerly of Butte, Mont., is manager.

FLUX (Patagonia)—This mine lately equipped with mill now in full operation, sending out ore and concentrates at rate of 25 tons per day. Mill is a dry-crushing plant, using Stebbins table, and is reported as running smoothly. An Ambursen tram connects mine and mill and loading bins.

CALIFORNIA

San Bernardino County

TWIN PEAKS MINING CO. (Hart)—Thomas A. Hine, of 100 William St., New York City, has exercised his option on Sunnyside Group of claims, and has organized Twin Peaks company, a New York corporation, to operate same. Pay ore is exposed at four different points on property, and work of sinking 200-ft. shaft will be undertaken immediately. F. E. Browne is manager.

Shasta County

DREDGING GROUND SOUTH OF REDDING acquired recently by Lawrence Gardella, dredge operator, of Oroville. Ground purchased was McCormick-Saeltzer ranch of 2250 acres, four miles south of Redding.

BULLY HILL (Kennett)—Stated experimental zinc plant is entire success and commercial-size plant may be installed.

SPREAD EAGLE (Kennett)—Development work on this group owned by Mammoth Copper Mining Co. is progressing with satisfactory results. Highly mineralized fissure cut recently in main tunnel; drifting for oreshoot now under way.

MAMMOTH COPPER (Kennett)—Stated contract made to sell all baghouse residue to eastern zinc smelter for \$8 per ton. Baghouse installed in 1910, at cost of \$250,000, on account of state law and farmers' "smoke suit." Since then no market found for residue until recent high price of zinc made product of commercial value. Eighteen to twenty thousand tons have accumulated.

Sierra County

SECRET CANON (Downieville)—From shaft being sunk on manganese ledge by George Henk, assays run from \$38 to \$81 per ton.

SACRED MOUNT (Sierra City)—Cyanide plant installed and in operation by J. C. Folsom upon tailings of many years accumulation, which assay well.

SOVEREIGN (Sierra City)—Morse Bros. and Meany operating under lease are recovering \$2.50 per ton, free gold, from roller mill, and \$4 per ton additional through cyanidation.

BIGELOW (Sierra City)—Quartz mine owned by W. H. Martin, Nevada City, Calif., bonded to Croesus Mining Co., of New York. Development work under Manager W. B. Pearson, of Croesus Company.

YOUNG AMERICA (Sierra City)—Dump containing 50,000 tons tailings assaying from \$1.50 to \$2.50 per ton, gold, purchased by Bonlay & Zachert, of San Francisco, who will construct reduction plant.

OXFORD (Downieville)—Vein cut by crosscut shows well, and extensive drifting being done by Cliff Mining Co. who are operating this and Gold Bluff quartz property together under bond. Grant Snyder is in charge.

Sonoma County

SEBASTOPOL MINING CO. (Sebastopol)—Incorporation of company contemplated. Stated that London men are negotiating for purchase of, or an interest in, the property.

Trinity County

DREDGING-GROUND OPTION extended from July 1 to Nov. 1. This option is on 1500 acres ground on Trinity River from above Carrville to four miles below Trinity Center, and some ground up both sides Coffee Creek. Consideration involved stated to be in neighborhood of \$1,000,000. Churn-drill prospecting will be resumed under direction of E. A. Wiltsee. Stated \$75,000 already expended in work. Placer ground near Igo, Shasta county, will also be prospected by same company.

Tuolumne County

KNOWLES (Sonora)—John Parsons, who recently leased this property, will install mill immediately.

NORWEGIAN (Tuttle town)—W. E. Booker has installed a hoist and small compressor and will put in power drills. Work will be continued on 100-ft. level, where large amount high-grade ore has been mined.

BUCKEYE (Sonora)—Machinery and supplies have been purchased, and grading for mill site and straightening main gangway and rebuilding track in inclined shaft are nearly completed. Compressed-air drills will be used, and steel cars will displace wooden ones.

COLORADO**Boulder County**

LIVINGSTON (Sugar Loaf)—Rich gold ore has been struck in vein that years ago yielded famous Nyanza oreshoot on surface. New disclosure is in workings of United Gold Corporation whose officers claim to have 5-in. streak averaging 10 oz. gold, accompanied by 1 ft. running 2 oz. gold per ton.

BRAINERD TUNNEL (Ward)—Years ago, Col. Wesley Brainerd drove adit about one-half mile for drainage and transportation for mines of Ward district. Death terminated his enterprise, relatives declining to push it. With revival of interest in district and success met in various other mining tunnels of state, movement is on foot to revive this project. This adit would cut principal veins of district at depths varying between 1000 and 1500 ft. below outcrops and would shorten railway hauls on ores about six miles.

Chaffee County

TABOR (Monarch)—F. C. Watson and Harry E. Mathews have taken a 10-year lease on this mine which has been closed 30 years through litigation with owners of adjoining Columbus mine. Vein is 10 to 15 ft. thick and carries gold, silver and lead.

Clear Creek County

PRIMOS CHEMICAL (Empire)—Is working 45 men in molybdenite mine in Daly district about 11 miles above Empire. Crude ore is sacked, packed down hill on burros, hauled to Empire Station in wagons, and shipped to Pittsburgh for treatment.

Gilpin County

OLD TOWN (Russell Gulch)—Iron City Concentrator has run 26-cord lot of ore from Hutchens lease in deepest workings where 20-ft. shoot is shipped without sorting. Lot produced gold retorts weighing 85 oz. and 58 tons of concentrate assaying 1.45 oz. gold and 2 oz. silver.

Gunnison County

CARTER (Ohio City)—Sellers and Watzling, leasing 400 level, shipped 150 tons of \$11 gold ore, while Little & Co., leasing 100 level, produce ore running about 4 oz. per ton.

DOCTOR (Crested Butte)—This mine was closed down 15 years ago because of obnoxious zinc content of ore. It is now under lease by group of railroad conductors who are putting it in shape to produce 65 tons of ore per day under selling contract that calls for delivery of 5000 tons of 30% zinc ore before Nov. 1. A 12-mile wagon-road is being built from mine to station of Almont on Gunnison branch of the D. & R. G. Ry. George Runtz is superintendent.

Lake County

PENN (Leadville)—Lamphier Brothers maintain heavy shipments of iron ore—suitable for smeltery flux—and zinc ore.

VALLEY (Leadville)—Warren F. Page continues to push this adit into Prospect Mt. and has reached distance of 1200 ft. According to original estimates, breast is near expected ore-bearing contact in virgin portion of this district.

LILLIAN (Leadville)—This once-famous mine in Iowa Gulch has been idle for years, but J. Clarence Hersey, manager of property, has recently granted several leases and shipments have been resumed. Ore carries carbonate of zinc and free gold.

GORDON-TIGER (Twin Lakes)—Old mill is being remodeled and will be ready to run within few weeks with capacity of 30 tons daily. Manager George W. Boyce has mine workings reopened and in shape to keep mill supplied to capacity. He also has a force of men developing the Bwicheogh mine and is running its 10-stamp mill.

San Miguel County

SUFFOLK (Ophir)—Mine has been taken over by new company known as Ophir Range Gold Mining Co. and will be operated under management of W. H. Staver with Thomas Ivey as superintendent. Mill will be remodeled and enlarged.

Summit County

FRENCH GULCH DREDGING CO. (Breckenridge)—Dredge is digging in good ground, recovering about \$1000 per day. Production during last week in June was over 400 oz. of gold. Hermann J. Reiling, manager, has placed wager that last 15 days of July will show recovery of over \$15,000. Accepting rated capacity of his dredge as 2000 cu.yd. per day, this gravel is yielding approximately 50c. per yd.

IDAHO**Shoshone County**

NONPAREIL COPPER CO. (Mullan)—Directors of Nonpareil have decided to sell 207,750 shares of treasury stock to raise money for further development. Call has also been issued for bids to continue driving No. 4 tunnel westward along vein. When driven 880 ft. farther this tunnel will have depth of 770 ft. and will be directly under promising surface showing.

LOGAN & PIKE (Gem)—Logan & Pike are installing two jigs, a rougher and a cleaner, about three miles above Wallace for purpose of reworking old tailing deposits of Cañon Creek. Tailings carried by creek at present will be avoided as far as possible, as they are too low-grade to yield profit. Operators expect to recover 40 tons of lead concentrates a month.

SILVER MOON MINING CO. (Wallace)—Company owns nine claims on Cañon Creek, adjoining Frisco on north, and containing two known veins, one of which is near creek and other 2000 ft. up ridge. Shaft sinking on the right limit of the creek is down about 140 ft., which makes it considerably below the creek level. Water is handled by bailing without difficulty. The equipment includes a small air compressor driven by a 35-hp. motor, air hoist, and drills.

HYPOTHEEK (Wallace)—It was announced by management on July 22 that shipments of high-grade ore from 900-ft. level would commence within two weeks, a contract having been let for hauling ore to the railway station at Enaville. Survey will also be made at once for tramway from mine to Enaville, distance of 2½ miles. Company has millsite at

Enaville and plans erection of mill. Meanwhile high-grade ore only will be shipped, and ore of lower grade stored. Crosscut on 1100-ft. level being driven to vein, which is supposed to be 160 ft. from shaft. As soon as 1100 is opened sufficiently for production, large electric hoist will be substituted for air hoist now in use. Mine will then have ore available for stopping on four levels—500, 700, 900 and 1100.

KENTUCKY**Hopkins County**

WESTERN KENTUCKY SMELTING CO. (Dawsonsprings)—Has been incorporated with capital stock \$20,000 to develop zinc and lead deposits at Dawsonsprings.

MICHIGAN**Copper**

KEWEENAW (Mandan)—Has levied assessment of \$1 payable Sept. 1.

NEW ARCADIAN (Houghton)—Is now making a second mill shipment.

PHOENIX (Calumet)—Has levied assessment of \$2 a share, half payable Sept. 1 and balance Jan. 1.

LA SALLE (Calumet)—Continues to ship 450 tons of rock per day, most of it coming from No. 1. It is better than La Salle's previous average.

QUINCY (Hancock)—Is using steel tubes in conical mills at stamping plant as substitute for pebbles and finds them successful, covering a test of seven weeks.

FRANKLIN (Hancock)—It will be two weeks before Franklin has electric haulage on 37th level in shape for handling rock. A 10-ton skip will be used and shipments then will run to 1200 daily.

CALUMET & HECLA (Calumet)—Regrinding of tailings will commence as soon as power is furnished from Ahmeek mill turbine. It will be at least six weeks before regrinding plant on dredge output can be in running order.

ISLE ROYALE (Houghton)—Third stamp head at Isle Royale mill will be operated Aug. 15 as will also sixth head at Ahmeek mill. Other two heads at Ahmeek will not be put into commission until some later date.

SOUTH LAKE (Houghton)—Shipped two carloads of rock from stockpile to Franklin mill; is beginning of further regular shipments from this property. More drills are going to work and good rock is being taken out.

CHEROKEE (Houghton)—Has uncovered five lodes, by trenching. Two contained a little copper, showing width of 30 ft. They will be opened farther by blasting. Years ago when former organization had charge of work they opened what was supposed to be Winona lode. Captain Dunn had charge but three shafts that were opened were not deep. As matter of fact it is now believed that Winona formation is carried in these newer openings.

MICHIGAN (Michigan)—Recent \$1 assessment called by Michigan will not pay outstanding indebtedness. Understood that creditors will permit use of portion—about half—for exploratory work along lines suggested by management. There are two possible opportunities for Michigan, which owns large acreage. One is development and operation of same formation as Mass is working so successfully, dependent largely upon substantial tonnage. The other is development of some of lodes which South Lake has found so rich.

MINNESOTA**Cuyuna Range**

CUYUNA-SULTANA (Ironton)—Test shaft now down 100 ft. Soo Line about to construct 1½-mile spur to property. Portion of orebody will be stripped.

CUYUNA-MILLE LACS (Ironton)—Work resumed; 175 men will be employed. Company has sold large tonnage of manganese ore to Pittsburgh Steel Co.

Mesabi Range

CORSICA (McKinley)—Resumed July 26, employing 200 men.

LEONIDAS (Eveleth)—Last week 1002 cars were loaded out, being largest shipment ever made from a state-owned iron mine.

MONTANA**Madison County**

BEAR GULCH DISTRICT—Bielenberg & Higgins mill in Bear Gulch near Twin Bridges, has been started up and will continue operations through season. From 20 to 25 men will be employed at present; number may be increased as conditions warrant. Tunnel is being extended under contract.

Park County

MONTANA SCOTCH BONNET (Cooke City)—In "Journal" of July 3 stated to be 60 miles from Cooke City; should have read 6 miles.

Silver Bow County

DAVIS-DALY (Butte)—Satisfactory progress made in opening orebodies recently discovered on 2500 level of Colorado mine. Last assays showed 5.6% copper and 6½ oz. of silver per ton. About a carload per day is being shipped from 2500 and 1700 levels. Southwest crosscut on which strike was made on 2500 level is being continued to intersect Hesperus orebody.

TIMBER BUTTE MILLING CO. (Butte)—The zinc concentrator of this company is again running at capacity and handling between 400 and 500 tons of ore per day. It confines its operations to output of the Elm Orlu mine. Concentrates are being shipped to the Oklahoma smelters which are under contract to take 6000 tons per month. Attempts to secure additional smelting facilities have so far not been successful, as a result of which company has been compelled to pile up considerable amounts of concentrates awaiting shipment. About 125 men are employed at company's mill.

TUOLUMNE COPPER MINING CO. (Butte)—President Hickey, being of the opinion that operations at the Tuolumne can be profitably carried on at present, sent a letter to stock-

holders a few weeks ago asking for contributions to the amount of \$35,000 for resuming operations. Stockholders have volunteered to lend company \$20,000, while Mr. Hickey has advanced \$5,000. The necessary balance of \$10,000 will be forthcoming by the time of starting operations by the end of the month. This will mean that from 75 to 150 men will be put to work causing an addition to the Butte payroll of from \$7500 to \$15,000 per month.

ANACONDA (Butte)—Company has taken lease on Emma mine of Butte Copper & Zinc Co., and holds option to purchase stock of latter company. Emma is promising zinc mine, located in heart of city of Butte, at Colorado and Silver streets. Some time ago Butte Copper & Zinc Co. gave option to American Zinc Co., which was unable to finance deal and it fell through. Lease and option entered into with Anaconda company is for period of five years, with additional five years to be granted upon complying with certain conditions. Combined with lease is option for 88,300 shares of treasury stock and 100,000 shares of owners' stock, at \$1 per share. According to agreement Anaconda company is to unwater mine to 800-ft. level and keep it pumped out at that level for 45 days. Anaconda company is at present making thorough investigation of the mining properties at Nelhart in Cascade County with view to reopening Nelhart camp. Mines in that camp are low-grade properties; ore carries lead, silver and zinc. One of difficulties of camp in past has been presence of large quantities of zinc which, with processes then in vogue, could not be handled profitably. It is believed that by flotation this ore may be made to yield profitable results and it is with this expectation that Anaconda has taken option on mines where large amount of such ore is blocked out.

NEVADA

Clark County

WHALE (Goodsprings)—At distance of 300 ft. development tunnel has intersected main vein, carrying high-grade zinc-carbonate ore, and it is expected that property will begin shipments in near future.

BULLION (Goodsprings)—Construction work on new 50-ton concentrator being rushed; expected plant will be in operation within 30 days. Force at mine has been increased. Only high-grade lead ore is being shipped, pending completion of mill.

GREEN MONSTER (Goodsprings)—After being idle several years on account of difficulties of transportation, large force of men is now at work getting mine in shape for active production. Considerable tonnage of zinc-carbonate ore is blocked in mine and it is planned to maintain monthly production of 500 tons. In conjunction with Azalia Mining Co., motor truck road is to be built through Wilson Pass to connect with Yellow Pine R.R. above Goodsprings.

ORO AMIGO (Goodsprings)—Ore containing 150 oz. gold and 15 oz. platinum per ton has been discovered on upper tunnel level and is now being sacked for shipment. Occurrence is similar to that at Boss mine, where rich gold-platinum ore was discovered last summer and which produced only platinum in United States recovered in 1914 from a lode deposit. Ore occurs along fracture-zone in limestone; gangue being oxidized quartzose material, carrying some copper and considerable iron; mineral carrying platinum has been identified by U. S. Geological Survey as cupro-jarosite. Discovery at Oro Amigo is especially important, since property is situated two miles from Boss mine, and it introduces possibility of further discoveries along zone of considerable area. Discovery has resulted in increased activity in vicinity.

Nye County

TONOPAH ORE PRODUCTION for week ended July 24 totaled 11,137 tons valued at \$226,426, compared with 10,307 tons week previous. Producers were: Tonopah Belmont, 3551; Tonopah Mining, 3150; Tonopah Extension, 1820; West End, 1314; Jim Butler, 1100; North Star, 56; and miscellaneous leasers 146 tons.

TONOPAH MINING (Tonopah)—For quarter ending May 31 net earnings of Tonopah Placers Co., 83¼% of which is owned by Tonopah Mining, amounted to \$63,005.

OREGON

Baker County

BEN HARRISON (Baker)—Will make extensive improvements to cost \$100,000.

UTAH

Juab County

TINTIC ORE SHIPMENTS for the week ended July 23 have exceeded those of any week in two years, having amounted to 193 cars or about 9650 tons of an estimated value of \$240,000.

GODIVA (Eureka)—Lead-silver ore is reported to have been opened recently on 200- and 400-ft. levels.

MAY DAY (Eureka)—The 500-ft. level is being worked by leasers, and 800 is to follow. Good profits are being made, and dividend is expected in August.

NORTH CLIFF (Silver City)—Dump of low-grade ore has been sampled, and it is hoped that it can be treated by new mill, which is in process of construction by Tintic Milling Co.

SELMA (North Tintic)—Crosscut from 200 level has been advanced over 600 ft., and face is in limestone showing some mineralization. Six men are working.

SIoux MILL DUMP (Mammoth)—About 30,000 tons of low-grade ore have been shipped from this dump, purchased by A. S. & R. some time ago; in another month it is thought dump will be exhausted.

EAGLE & BLUE BELL (Eureka)—Bingham Mines Co., controlling this property as well as Commercial and Dalton & Lark mines in Bingham, has acquired Victoria ground adjoining Eagle & Blue Bell through which property work will be carried on.

MAMMOTH (Mammoth)—Will soon begin shipments from dump left on old millsite southwest of Tintic. There are several thousand tons of this material, which is low-grade copper ore, which will be hauled two miles by wagon to tracks of San Pedro railroad for shipment.

TINTIC MILLING (Silver City)—Preliminary work being done for new mill which is to be built here by Knight-Dern interests; and good progress is being made. Machinery from plant of Mines Operating Co., at Park City, is being shipped to Silver City, to be used in construction of new mill.

CHIEF CONSOLIDATED (Eureka)—This company has recently issued a map of Tintic drawn to scale, 800 ft. to the inch, showing holdings of various companies, and table of production of camp from 1877 to 1914. Map shows company's own property in eastern and northern ends of district, which has recently been increased by 250 to 300 newly acquired claims. Latter will be prospected by diamond drilling with view to study of formations and mineralization and locating shafts and tunnels.

Salt Lake County

EMMA COPPER (Alta)—New lens of ore up to 2 ft. thick has been opened in raise above crosscut. In second or south raise silver-lead ore 6 in. thick has been opened.

ALBION (Alta)—Small seams of ore and copper staining show in face of drift being driven from Quincy tunnel of South Hecla to reach Kate Hays fissure. Leasers are mining ore from old workings.

SOUTH HECLA (Alta)—Stock has been listed on Salt Lake Exchange. Capitalization is \$500,000, of which 237,839 shares, par value \$1, are unissued. Company owns 41 claims comprising 550 acres in Little Cottonwood and Alta district; eight miles from railroad. Twenty-six claims are patented. Development consists of about 14,000 ft. of workings. Ores carry silver, lead, gold and copper. George H. Watson is president. Property is making regular shipments of one carload a day.

Summit County

BIG FOUR EXPLORATION (Park City)—New mill, seven miles north of city began work July 16. Company has added to its holdings by securing lease on lower half of deposits on Homer ranch.

WASHINGTON

King County

UNIVERSITY OF WASHINGTON (Seattle)—College of Mines, Minor Roberts, dean, will erect coal-washing plant on campus. Plans have been prepared, work expected to start soon.

Pierce County

TACOMA SMELTERY (Tacoma)—Owing to rapidly increasing copper production of Alaska it is reliably reported that Tacoma smeltery will make extensive additions to increase capacity.

WISCONSIN

Zinc-Lead District

CLIMAX (Platteville)—Is unwatering Homestead mine and will operate Acme property adjoining.

HODGE (Platteville)—Ben Webster & Co. is unwatering this mine and will commence milling within next few days.

KLAR PIQUETTE (Platteville)—Mine closed down for two years and said to have been exhausted, has again been placed on dividend basis.

GRANT COUNTY (Platteville)—H. E. Stephens and Chas. Kistler have taken option on this property and are overhauling milling equipment.

POLLARD & SAXE (Linden)—Has acquired Hinkle and Kickapoo properties at Linden and O. P. David mine and milling equipment at Montfort.

CANADA

Ontario

CASEY-SENECA (Cobalt)—Plant has been installed and shaft is down 30 ft.

McINTYRE EXTENSION (Porcupine)—This company capitalized at \$2,500,000, has been incorporated to take over Pearl Lake property recently acquired by McIntyre.

PRESTON EAST DOME (Porcupine)—Diamond-drilling will shortly be started on north claim of company immediately adjoining Dome, in hope of striking some of orebodies coming in from latter.

GOULD (Cobalt)—Lease of this property owned by Peterson Lake has been turned over to Mercer Silver Mines and operations have been resumed with W. E. Segsworth as managing director and A. C. Bailey, manager.

TOUGH OAKES (Kirkland Lake)—Application has been made to English courts for winding up of Tough Oakes Gold Mines, Ltd., which was formed in England to acquire these claims, but could not meet payments.

TEMISKAMING (Cobalt)—Half yearly report of company says: In order to carry out our policy of deep mining, it was found necessary to install a new hoist. This we expect to have installed and running within 60 days. This hoist will enable us to reach the lower contact between the diabase and the Keewatin formations (a depth of between 1600 and 1700 ft.) and it is believed that as rich values will be encountered at the lower contact as have been developed at the contact above. This work will be pushed forward as rapidly as conditions will permit.

Yukon

CANADIAN-KLONDYKE (Dawson)—No. 2 dredge, which overturned last autumn, was righted and drydocked on July 20, but an accident on July 23 will prevent its going into commission as early as expected. One man was killed and two were seriously and one slightly injured. The yields from the other three dredges have lately been the highest ever recorded. For the week ended July 20, 3407 oz.; July 27, 3436 oz.

SOUTH AMERICA

Colombia

ANGLO-COLOMBIAN DEVELOPMENT (Istmina)—The new dredge completed its preliminary run successfully on July 20 and is now operating regularly near the mouth of the Condoto. The camp name has been changed to Andagoya, Boca de Condoto.

The Market Report

Metal Markets

NEW YORK—Aug. 4

Copper and tin declined during the early part of the week and then rallied. Lead experienced a sharp decline and the course of spelter was steadily downward.

Copper, Tin, Lead and Zinc

Copper—During the early part of the week the copper market was only nominal, there being no buyers but plenty of sellers who made offerings at concessions from day to day. In the latter part of the week some sales were effected, but business was not general. However, there were some inquiries in the market toward the close both from domestic and foreign quarters, and there was a feeling of hopefulness that these would shortly result in business. The pressure of Australian and Japanese copper in the European markets appears to have relaxed and sales of American copper for export were made at about 17.60c., New York. For domestic shipments copper was offered at the close at 17½@18c., regular terms.

Copper production at Katanga during the first six months of 1915 was slightly in excess of 15,000,000 pounds.

Copper Exports for the week ended July 24 are reported by the Department of Commerce at 11,352,552 lb.; the chief items being, 7,492,788 lb. to France, 1,906,316 lb. to Russia and 1,308,704 lb. to England. Imports were 1,880,454 lb. metal and 981,316 lb. in ore and matte; 2,861,770 lb. in all, chiefly from Canada.

Copper Sheets bring 24@25c. per lb.; no base quotations are made by the principal maker. Wire is quoted at 20@20½c. per lb., carload lots at mill.

Tin—After an early decline this market rallied a little. There were no features of special interest.

Visible Stocks of Tin on Aug. 1 are reported as follows, including tin afloat: London, 7352; Holland 41; United States, excluding Pacific ports, 8691; total, 16,084 long tons, an increase of 157 tons during July.

Lead—Opinion which was optimistic at the date of our last report suddenly turned pessimistic. The price of the A. S. & R. Co. had previously been cut by dealers, but at the beginning of our week of record lead was offered at sharp concessions by outside producers, and on July 30, the A. S. & R. Co. reduced its price to 5.50c. This was immediately shaded by other sellers and on Aug. 2 the A. S. & R. Co. reduced to 5.25c., its competitors following with further cuts, and at the close of the week lead was available in large lots at 5c. per pound. Small sales were reported at that figure and a great deal offered for which buyers could not be found. This lead was offered by dealers, by consumers who wanted to resell, and by producers. The opinion is expressed in the trade that consumers overbought themselves in their recent operations in the market.

Spelter—The course of the zinc market was steadily downward throughout the week. Large supplies are being offered from numerous quarters. Transactions were light. The differential between prices for early and late deliveries contracted further. At the close contracts for delivery during the remainder of the year, including both near-by and later deliveries, could be made at 14½@15c. There appears to be some speculative spelter hanging over the market and it appears also that certain manufacturers who overbought their requirements and offered their surplus for resale have not yet disposed of all they want to.

Zinc Sheets are in good demand and sales are steady. The base price is \$24 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras are charged.

We understand that the U. S. Steel Corporation expects to be able to begin the production of spelter at Donora before the end of this year. However, the production in 1916 will be very small, even if there be no miscarriage of plans.

According to the London "Financial Times," the Vieille Montagne company is running its smelters in Belgium almost as usual. With a view to keeping the staff together and the works in good order, the direction has been treating accumulated concentrates and stacking the zinc produced in default of any facilities for shipping it.

Other Metals

Aluminum is steady and in fair demand, but with no material change in prices. Current quotations are 31@33c. per lb. for No. 1 ingots, New York.

Antimony has been dull with very little business forward. Prices are hardly more than nominal. Ordinary brands being 35@37½c. per lb. For Cookson's 48@50c. is asked.

Quicksilver shows a moderate business chiefly of a small order. New York price is \$92@94 per flask of 75 lb. for large lots, \$95@98 for smaller orders. San Francisco reports by telegraph \$92.50@95 per flask, with a quiet market. London price is rather higher, £18 12s. 6d. per flask being named.

DAILY PRICES OF METALS IN NEW YORK

July-Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper		Tin		Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.		
29	4.7638	46½	17.50 @17.75	35½	5.45 @5.55	5.35 @5.40	15.25 @16.50	15.00 @16.00	
30	4.7613	47½	17.35 @17.55	35½	5.35 @5.50	5.25 @5.35	15.00 @16.00	15.00 @15.00	
31	4.7600	47½	17.35 @17.55	35	5.25 @5.50	5.25 @5.35	15.00 @15.00	15.00 @15.00	
2	4.7606	47½	17.50 @17.60	35	5.00 @5.25	*5.00 @5.10	14.50 @15.00	14.50 @15.00	
3	4.7606	47½	17.50 @17.60	35½	5.00 @5.12½	*4.90 @5.10	14.50 @15.00	14.50 @15.00	
4	4.7606	47½	17.60 @17.80	35½	5.00	*4.90 @5.00	14.50 @15.00	14.50 @15.00	

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver. Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July-Aug.	Silver	Copper				Tin		Lead		Zinc	
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
29	22 1/8	71½	72½	87½	18.64	158½	158½	23½	5.09	92½	19.70
30	22 1/8	71½	72½	87½	18.64	155	155½	23½	5.01	92½	19.70
31	22 1/8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	22 1/8	72½	73½	87	18.53	157	157½	23½	5.04	91½	19.48
4	22 1/8	73	74½	87	18.53	156½	157½	23½	5.04	91½	19.48

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Gold, Silver and Platinum

NEW YORK—Aug. 4

Gold and Silver Movement in the United States, six months ended June 30, as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports.....	\$83,974,535	\$7,582,527	\$25,510,170	\$24,819,297
Imports.....	30,743,422	144,924,436	12,590,464	14,741,600
Excess.....	E.\$53,231,113	E.\$137,341,909	E.\$12,919,706	E.\$10,107,697

Exports of merchandise for the half-year in 1915 were valued at \$1,701,862,297; imports, \$860,821,865; excess of exports, \$841,040,432. Adding the gold and silver leaves \$718,806,220 as the net export balance.

Silver—Under date of July 22 London writes that the silver market shows no animation. The dominant factor is still the very restricted amount of selling from America, which offsets the sluggish disposition of buyers. Cables of later date confirm substance of mail better.

Platinum—The market continues quiet and business is moderate, as it has been for some time past. Quotations are about \$37@39 per oz. for refined platinum and \$41@44 per oz. for hard metal.

Our Russian correspondent reports under date of July 9 that there is no change. In Petrograd there was demand for some quantities for export, but no actual sales. At Ekaterinburg buying from the mines and sales by speculators have gone on as usual. Quotations for crude metal, 83% platinum, are 33,000 rubles per pood at Petrograd; 8.20 rubles per zolotnik at Ekaterinburg—equal to \$32.34 and \$30.73 per oz., respectively.

Zinc and Lead Ore Markets

JOPLIN, MO.—July 31

Blende, high price, \$112; base price per ton of 60% zinc, premium ore \$110, medium \$107@100; \$98@80 lower grades; Calamine, base per ton of 40% zinc, \$50@56; average, all grades of zinc, \$103.30. Lead, high price, \$60.50; base, \$60 per ton of 80% metal content; average, all grades of lead, \$58.08 per ton.

SHIPMENTS, WEEK ENDED JULY 31

	Blende	Calamine	Lead	Values
Totals this week..	10,649,660	511,400	1,719,700	\$627,350
Total 7 months..	332,826,660	28,312,770	50,482,880	\$14,418,020
Blende value, the week,	\$562,890; 7 months, \$12,464,080.			
Calamine value, the week,	\$14,530; 7 months, \$164,820.			
Lead value, the week,	\$49,930; 7 months, \$1,339,120.			

PLATEVILLE, WIS.—July 31

The base price paid this week for 60% zinc ore was lowered to \$100 per ton. The base price paid for 80% lead was \$60 per ton.

SHIPMENTS WEEK ENDED JULY 31

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,138,360	.....	714,800
Year	107,900,580	4,083,160	15,916,450

Shipped to separating plants during week, 5,120,500 lb. zinc ore. Shipments light because of rains.

Iron Trade Review

NEW YORK—Aug. 4

The market is in an unprecedented condition for July, usually a dull month. Export orders show a large increase and there is a steady gain in domestic business. Recent price advances are well held and further ones in bars and plates will be made, it is said.

Pig iron is stronger and more business is reported, while in some cases there are larger takings under contract. There is talk, as there has been for some time, of speculative buying of pig. These rumors are not usually easy to confirm, but there is probably some truth in them.

Imports at Baltimore for the week included 3928 tons of ferromanganese from Middlesboro, England, and 1050 tons manganese ore from Rio Janeiro, Brazil.

PITTSBURGH—Aug. 3

The steel mills are now filled with business, except for a limited tonnage of bessemer which could still be produced, and buyers of some finished products will be urged to take bessemer instead of openhearth, when it can be shown that the former is equally serviceable for the purpose. The delivery promise on new specifications for steel bars has been lengthening rapidly, and is now at a minimum of six weeks. On large steel rounds, for shrapnel, the mills are almost entirely filled for more than six months, but are still in receipt of large orders. A curious result is that they are quite the reverse of eager to accept orders for rails, though they accept them as a matter of trade ethics. A large part of the rail capacity of the country is now rolling steel rounds for shells.

New orders for steel products have become relatively light, but specifications on contracts are as heavy as ever, and even the increased steel production does not prevent the mills from accumulating shipping orders on books.

Steel prices continue to harden. There are prospects of an early advance in steel bars from 1.30c. to 1.35c. In shapes the 1.25c. quotation has disappeared, the market now being 1.30c., while in plates the tonnage offered at 1.25c. has become limited. Black sheets have stiffened to 1.80c., but this is no higher than the market at the beginning of the year.

Pig Iron—W. P. Snyder & Co. announce their computations of average realized prices, on all sales of Valley iron 1000 tons and over, for July at \$13.991 for bessemer, an increase of 24.1c. over June, and 12.959 for basic, an increase of 23.5c. over June. The market has become rather excited and while no large sales have been made in the past week some Valley furnaces have advanced their quotations 50c. on basic and 25c. on bessemer. It is reported that the Tennessee company has advanced its price on foundry iron to \$12.50, Birmingham, which means that it has withdrawn entirely from the market, which has lately advanced from \$9.50 to \$10. Some large purchases in the local market are expected this month, particularly of steel making grades. We quote: Bessemer, \$14.25@14.50; basic, \$13@13.50; No. 2 foundry, \$12.75@13; malleable, \$13; gray forge, \$12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The ferromanganese situation is made particularly uncertain by the recent order of the British government, requiring the English producers to carry three months' stock of ore and three months' stock of ferromanganese, and the British consumers to carry three months' stock of ferromanganese. This may seriously affect our imports. On the other hand, however, our imports of ore have been much larger in the past three months than in the first four months of the year, when they were almost negligible. Small prompt lots are held at \$100@105, while there is no regular contract market.

COKE

Coke production for the week in the Connellsville region was 367,095 short tons; shipments, 360,852 tons. Production of Greensburg and Upper Connellsville districts was 43,565 tons.

Chemicals

NEW YORK—Aug. 4

The general markets are quiet, and more or less affected by the seasonal conditions.

Arsenic—Only about the usual trade is being done. Supplies seem to be sufficient for all demands. Quotations are about \$4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady but not particularly active. Quotations show little change, \$7.25 per 100 lb. being named for carload lots and \$7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is fair for the season, and is steady, with prices unchanged. Quotations are 2.35c. per lb. for spot and for all positions this year.

Pyrites—Imports at Baltimore for the week included 3222 tons of pyrites from Huelva, Spain.

Potash Salts—Imports of potash salts in the United States for June and the six months ended June 30 are reported by the Department of Commerce as follows, in pounds:

	June		Six Months	
	1914	1915	1914	1915
Carbonate of potash.....	1,385,750	588	11,252,825	8,396,622
Hydrate of potash.....	740,930	7,000	4,203,568	2,023,942
Nitrate of potash.....	479,881	.....	1,558,926	6,855
Cyanide of potash.....	22,400	.....	298,377	828,577
Other potash salts.....	540,295	11,275	3,244,686	2,075,535

Imports of the crude or manure salts were as follows, in long tons:

	June		Six Months	
	1914	1915	1914	1915
Kainit.....	17,891	2,860	257,253	6,646
Manure salts.....	33,151	.....	114,820	12,456
Sulphate of potash.....	16,473	1,095	37,786	9,901
Muriate of potash.....	3,000	320	108,759	56,455

The changes were due to the interruption by the war to shipments from Germany.

PETROLEUM

Oil production in California, six months ended June 30, was 44,677,443 bbl. The stocks reported on June 30, 1915, were 60,616,286 bbl., an increase of 2,090,012 bbl. over those at the opening of the year.

Shipments of oil from Mexico in May were 2,378,848 bbl. of which 1,504,629 bbl. went to the United States. For the six months ended June 30, the total shipments were 10,438,528 bbl., a decrease of 212,094 bbl. from last year.

Assessments

Table with columns: Company, Define, Sale, Amt. Lists various mining companies and their assessment details.

N. Y. EXCH. Aug. 3

Table with columns: Name of Comp., Clg. Lists various companies and their closing prices.

BOSTON EXCH Aug. 3

Table with columns: Name of Comp., Clg. Lists various companies and their closing prices.

COPPER

Table with columns: Month, New York, London. Sub-headers: Electrolytic, Standard, Best Selected. Shows monthly copper prices.

TIN

Table with columns: Month, New York, London. Shows monthly tin prices.

LEAD

Table with columns: Month, New York, St. Louis, London. Shows monthly lead prices.

SPELTER

Table with columns: Month, New York, St. Louis, London. Shows monthly spelter prices.

Stock Quotations

The New York Stock Exchange listing in the first half of 1915 shows the following mining securities: Alaska G. M. 6% debentures; Chile Copper conv. 7s; Butte & Superior stock, Dome Mines stock.

Table with columns: Name of Comp., Bid. Lists stock prices for Colorado Springs and Salt Lake.

Table with columns: Name of Comp., Bid. Lists stock prices for Toronto.

Table with columns: Name of Comp., Bid. Lists stock prices for San Francisco.

N. Y. CURB Aug. 3

Table with columns: Name of Comp., Bid. Lists commodity prices for New York Curb.

BOSTON CURB Aug. 3

Table with columns: Name of Comp., Bid. Lists commodity prices for Boston Curb.

LONDON July 22

Table with columns: Name of Comp., Bid. Lists commodity prices for London.

BOSTON CURB Aug. 3

Table with columns: Name of Comp., Bid. Lists commodity prices for Boston Curb.

Monthly Average Prices of Metals

Table with columns: Month, New York, London. Shows monthly average prices for silver.

PIG IRON IN PITTSBURGH

Table with columns: Month, Bessemer, Basic, No. 2 Foundry. Shows monthly pig iron prices.

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, † London Exchange closed.

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown, inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for \$1, 33 for \$5, and 100 for \$15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

- 1504—ARIZONA—Progress at the Old Dominion Mine, Mill and Smelter. C. A. Tupper. (Min. and Eng. Wld., June 19, 1915; 5½ pp., illus.) 20c.
- 1505—ASSAYING—A Method of Assaying Copper. Arthur Fraser. (Journ. Soc. Chem. Ind., May 15, 1915; 1½ pp.)
- 1506—CENTRAL STATES—Silver, Copper, Lead and Zinc in the Central States in 1914. B. S. Butler and J. P. Dunlop. (Mineral Resources of the U. S., 1914, Part II; 98 pp.)
- 1507—CONCENTRATION—Bolivian Copper Concentration by Cia. Corocoro de Bolivia. F. A. Sundt. (Eng. and Min. Journ., July 17, 1915; ¾ p.) 20c.
- 1508—FLOTATION at the Inspiration Mine, Arizona. (Min. and Sci. Press, July 3, 1915; 4 pp., illus.) 20c.
- 1509—FUEL—Anaconda Coal-Pulverizing Plant. E. P. Mathewson. (Eng. and Min. Journ., July 10, 1915; 3 pp., illus.) 20c.
- 1510—HYDRO-ELECTROLYTIC TREATMENT of Copper Ore. Robert Rhea Goodrich. (Advance copy, A. I. M. E., Sept., 1915; 44 pp., illus.) Account of experiments on a porphyry ore from Bisbee, Ariz.
- 1511—ORE BEDDING and Reclaiming at Copper Smelters. W. A. Clay. (Min. and Eng. Wld., July 17, 1915; 3½ pp., illus.) 20c.
- 1512—ORE HANDLING—Handling Ore at the Calumet & Arizona Smelter. C. A. Tupper. (Min. and Eng. Wld., July 3, 1915; 6 pp., illus.) 20c.
- 1513—PORPHYRY COPPERS, The. Percy E. Barbour. (Eng. and Min. Journ., June 26, 1915; ¾ p.) Data on ore reserves, and milling result. 20c.
- 1514—PYRITIC SMELTING—Beobachtungen beim Pyritschmelzen. R. Stören. (Metall u. Erz, May 22 and June 8, 1915; 12¼ pp.)
- 1515—SANTO DOMINGO—The Copper Deposits of San Cristobal, Santo Domingo. Thomas F. Donnelly. (Advance copy, A. I. M. E., Sept., 1915, 1915; 10 pp., illus.) 40c.
- 1516—SHAFT-ROCKHOUSE PRACTICE in the Copper Country. L. Hall Goodwin. (Eng. and Min. Journ., June 19, 26, July 3 and 10, 1915; 18¼ pp., illus.)
- 1517—SMELTER—The British Columbia Copper Co.'s Smelter, Greenwood. B. C. Frederic K. Brunton. (Bull. A. I. M. E., July, 1915; 17 pp., illus.) 40c.
- 1518—THICKENER—Arizona Copper Co.'s Dorr Thickener. David Cole. (Eng. and Min. Journ., July 24, 1915; 3¾ pp., illus.) 20c.

GOLD AND SILVER—GEOLOGY

- 1519—ARIZONA—Geology of Gold Road District. Howland Bancroft. (Min. and Sci. Press, July 3, 1915; 1 p., illus.) 20c.
- 1520—NEVADA—Volcano, a New Nevada Strike. Francis Church Lincoln. (Eng. and Min. Journ., July 10, 1915; ¾ p., illus.) 20c.
- 1521—QUEENSLAND—The Mount Taylor Gold Mine, Kingston. Lionel C. Ball. (Queensland Govt. Min. Journ., June 15, 1915; 3¼ pp., illus.) 60c.

GOLD DREDGING, PLACER MINING, ETC.

- 1522—ALASKA—Flume-Type Elevator Dredges in Alaska. Lewis H. Eddy. (Eng. and Min. Journ., June 26, 1915; ¾ p., illus.) 20c.
- 1523—DEBRIS—A Novel Debris-Dam. Leroy A. Palmer. (Min. and Sci. Press, July 10, 1915; 3¾ pp., illus.) Notes on a dam designed by J. M. Howells constructed at the Omega mine, Nevada Co., California. 20c.
- 1524—DREDGING COSTS. James Wilson Neill. (Min. and Sci. Press, June 12, 1915; ¾ p.) Data regarding the Oroville Dredging, Ltd., operations completing an article previously published. 20c.
- 1525—FINE GOLD SAVING—Undercurrents. B. T. Ulrich. (Min. and Sci. Press, June 5, 1915; 1½ pp., illus.) 20c.
- 1526—METALLURGY of Alluvial Mining. John M. Nicol. (Min. and Sci. Press, June 5, 1915; 4 pp., illus.) Continuation of article previously indexed. 20c.
- 1527—SAMPLING—Relative Error in Alluvial Sampling. Charles S. Haley. (Min. and Sci. Press, July 17, 1915; 1½ pp.) 20c.

GOLD AND SILVER—CYANIDING

- 1530—COLORADO—Cyanidation of Low-Grade Sulphide Ores in Colorado.—I. H. C. Parmelee. (Met. and Chem. Eng., July, 1915; 4¼ pp., illus.) 40c.
- 1531—HOMESTAKE MINE—Notes on Homestake Metallurgy. Allan J. Clark. (Bull. A. I. M. E., July, 1915; 20 pp., illus.) 40c.

- 1532—JAPAN—Cyanide Plant at Kushikino, Japan. (Min. and Sci. Press, June 19, 1915; 2 pp., illus.) 20c.

- 1533—OREGON—The Rainbow Mill, Oregon. W. M. Dake, Jr. (Eng. and Min. Journ., June 26, 1915; 4 pp., illus.) 20c.

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- 1535—SOLUTION—The Precipitating Action of Carbon in Contact with Auriferous Cyanide Solution. W. R. Feldtmann. (Bull. 129, I. M. M., June 17, 1915; 3½ pp.) Further contributed remarks on paper previously indexed.

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