

1919

Metallurgical results from black copper smelting

Preston King Horner

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METALLURGICAL RESULTS FROM BLACK COPPER SMELTING

BY

Preston King Horner

A

T H E S I S

submitted to the faculty of the

SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI

in partial fulfillment of the work required for the

D E G R E E O F

ENGINEER OF MINES

Rolla, Mo.

1919

22481

Approved by

Homer T. Martin

Associate Professor of Metallurgy and Ore Dressing.

By special permission of the faculty,
P. K. Horner submitted his general reports for
the years 1913,1914,1915 and 1916 for thesis.
As these reports contained much of a confidential
nature, they were returned to him after examina-
tion.

A handwritten signature in cursive script, appearing to read "H. T. Mann", written over a horizontal line.

Secretary of the Faculty.

METALLURGICAL REPORT, 1916.

PLANT A.

Number of Blowing Hours 16,702.
 Tons of Ore (Dry Weight) smelted per 24 hours 146.3

ORES TREATED	Weight (Wet). tons	Weight (Dry). tons	Grade of Ore. %	Weight of Copper tons.
STAR: Green Ore	33,550.4	27,353.8	14.2	3,886.6
Black Ore	18,486.5	14,213.9	14.4	2,041.6
KARBOVE Lump	63,912.0	59,598.8	14.7	8,784.0
LUUSHI Lump	816.4	665.3	18.0	120.1
TOTAL	116,765.3	101,831.8	14.6	14,832.3
DOLOMITE		25,410.4	0.5	127.4
SCRAP				35.7

Total Cu. in Charge 14,995.4

INGOTS produced	10,644.2	96.6	10,270.8
MATTE do.	412.5	70.0	288.7
SLAG	116,310.0	2.8	3,239.1
Lost in DUST etc.			973.9
SCRAP			180.6
Not accounted for			42.3

TOTAL 14,995.4

	Weight (Dry) tons.	Proportion to Charge %	Proportion to Ore %	Tons per ton of Copper
FUEL Wankie	7,344.9			
Katanga	32,188.2			
TOTAL..	39,533.1	23.7	38.8	3.74
FLUX: Limestone..	2,667.0			
Dolomite ..	25,410.4			
Ironstone..	36,902.2			
TOTAL ..	64,979.6	39.0	63.8	6.15

METALLURGICAL REPORT, 1916.

PLANT A. - CHARGE SHEET.

STAR MINE.

Months 1916.	GREEN ORE				BLACK ORE			
	Wet	Dry	% Cu.	tons fine Cu.	Wet	Dry	% Cu.	tons fine Cu.
Jan.	1746.4	1378.2	14.5	200.4	1159.7	911.3	16.0	145.6
Feb.	3004.1	2416.0	15.3	371.2	1501.7	1195.1	16.2	193.9
Mar.	2792.9	2295.3	15.1	345.9	1395.5	1087.4	15.9	172.9
Apr.	3327.5	2770.0	14.6	404.3	1662.5	1330.0	14.3	190.1
May	3737.8	3022.4	13.5	407.5	1868.1	1446.4	14.1	204.5
June	3999.6	3288.8	13.5	444.8	1999.1	1598.8	13.8	220.0
July	3243.9	2729.9	14.0	382.3	1623.4	1269.1	14.2	180.4
Aug.	3289.8	2697.3	14.4	388.3	1644.7	1232.3	13.9	171.5
Sep.	3186.7	2549.2	14.2	363.1	1592.3	1190.3	14.2	169.3
Oct.	2531.1	2039.5	14.1	287.4	1271.3	959.6	13.9	133.7
Nov.	1121.8	914.5	13.5	123.2	1698.2	1235.4	13.2	163.4
Dec.	1568.8	1252.7	13.4	168.2	1070.0	758.2	12.7	96.3
TOTAL	33550.4	27358.8	14.2	3886.6	18486.5	14213.9	14.4	2041.6

	KAMBOVE LUMP.				IYUSHI LUMP.			
Jan.	3009.6	2825.4	17.5	480.8	704.8	575.5	18.2	104.8
Feb.	4913.8	4516.9	16.5	743.5	1112.6	89.8	17.0	15.3
Mar.	4570.2	4199.0	15.2	640.0	-	-	-	-
Apr.	5445.0	5073.2	15.5	789.5	-	-	-	-
May	6116.4	5671.6	14.1	802.9	-	-	-	-
June	6547.2	6183.5	13.5	832.9	-	-	-	-
July	5398.8	5203.4	14.0	728.0	-	-	-	-
Aug.	5382.8	5137.0	14.7	757.8	-	-	-	-
Sep.	5214.6	4961.4	14.9	742.5	-	-	-	-
Oct.	4138.2	3976.2	14.8	598.2	-	-	-	-
Nov.	6124.8	5621.2	14.1	792.3	-	-	-	-
Dec.	7050.6	6230.0	14.2	885.6	-	-	-	-
TOTAL...	63912.0	59598.8	14.7	8784.0	816.4	665.3	18.0	120.1

	TOTAL CHARGE (ORE).			
Jan.	6620.5	5690.4	16.3	931.6
Feb.	9531.2	8217.8	16.1	1323.9
Mar.	8758.6	7581.7	15.3	1158.8
Apr.	10435.0	9173.2	15.1	1383.9
May	11722.3	10140.4	13.9	1414.9
June	12545.9	11071.1	13.5	1497.7
July	10266.1	9202.4	14.0	1290.7
Aug.	10317.3	9066.6	14.5	1317.6
Sep.	9993.6	8700.9	14.6	1274.9
Oct.	7940.6	6975.3	14.5	1009.3
Nov.	8944.8	7771.1	13.9	1078.9
Dec.	9689.4	8240.9	13.9	1150.1
TOTAL.	116765.3	101831.8	14.6	14832.3

METALLURGICAL REPORT, 1916

PLANT A - CHARGE SHEET

Month 1916.	Dry	Dolomite		FLUXES			TOTAL tons fine Cu.
		% Cu.	tons fine Cu.	Iron. Dry	Limestone Dry	Dry	
Jan.	1028.1	4.6	4.9	2405.1	46.2	3479.4	4.9
Feb.	1234.9	0.5	6.8	2935.1	1622.2	5792.2	6.8
Mar.	2081.3	0.5	10.9	2825.2	110.5	5017.0	10.9
Apr.	2088.4	0.7	10.0	3217.8	349.0	5655.2	10.0
May	2626.1	0.5	13.3	3602.7	183.1	6411.9	13.3
June	2494.5	0.5	12.5	3852.1	356.0	6782.6	12.5
July	2532.5	0.5	12.6	3330.8	-	5863.3	12.6
Aug.	2584.5	0.5	12.6	3156.8	-	5741.3	12.6
Sep.	2461.2	0.5	12.3	3021.1	-	5482.3	12.3
Oct.	1947.0	0.5	10.4	2357.7	-	4304.7	10.4
Nov.	2126.3	0.5	10.2	2908.3	-	5034.6	10.2
Dec.	2205.6	0.5	10.9	3209.5	-	5415.1	10.9
TOTAL	25410.4	0.5	127.4	36902.2	2667.0	64979.6	127.4

	CHARGES (TOTALS)			SCRAP	FUEL		
	Wet	Dry	tons fine Cu.	TONS fine Cu	Wankie tons	Katanga tons	Total tons
Jan.	10099.9	9169.8	936.8	27.4	-	2372.1	2372.1
Feb.	15323.4	14010.0	1330.7	8.3	-	3199.3	3199.3
Mar.	13775.6	12598.7	1169.7	-	-	3135.0	3135.0
Apr.	16090.2	14828.4	1393.9	-	-	3453.7	3453.7
May	18134.2	16552.3	1428.2	-	1320.8	2698.8	4019.6
June	19328.5	17853.7	1510.2	-	2115.6	2277.6	4393.2
July	16129.4	15065.7	1303.3	-	534.1	2453.3	2987.4
Aug.	16058.6	14807.9	1330.2	-	1127.9	2420.7	3548.6
Sep.	15475.9	14183.2	1287.2	-	1016.4	2311.6	3328.0
Oct.	12245.3	11280.0	1019.7	-	268.0	2300.9	2568.9
Nov.	13979.4	12805.7	1089.1	-	168.3	2797.7	2966.0
Dec.	15104.5	13656.0	1161.0	-	793.8	2767.5	3561.3
TOTAL	181744.9	166811.4	14959.7	35.7	7344.9	32188.2	39533.1

METALLURGICAL REPORT 1916.

PLANT A. PRODUCTION.

Months 1916.	INGOTS		MATTE		TOTAL RECOVERY			
	Tons rough Cu.	% Cu.	Tons fine Cu.	Tons rough Cu.	% Cu.	Tons fine Cu.	Tons rough Cu.	Tons fine Cu.
Jan.	728.0	96.5	712.3	-	-	-	738.0	712.3
Feb.	1025.0	96.7	991.1	-	-	-	1025.0	991.1
Mar.	824.3	96.7	796.7	17.5	70.0	12.2	841.8	808.9
Apr.	1012.7	97.7	979.7	33.0	70.0	23.1	1045.7	1002.8
May	1057.3	95.9	1014.0	27.0	70.0	18.9	1084.3	1032.9
June	1079.2	96.7	1043.3	38.0	70.0	26.6	1117.2	1069.9
July	924.0	97.0	896.3	37.0	70.0	25.9	961.0	922.2
Aug.	980.0	96.8	948.5	50.0	70.0	35.0	1030.0	983.5
Sep.	940.4	95.7	900.0	70.5	70.0	49.3	1010.9	949.3
Oct.	642.3	96.9	622.3	45.3	70.0	31.9	687.8	654.2
Nov.	707.1	96.7	684.1	28.0	70.0	19.6	735.1	703.7
Dec.	704.7	96.8	682.5	66.0	70.0	46.2	770.7	728.7
<u>TOTAL</u>	10635.0	96.6	10270.8	412.5	70.0	288.7	11047.5	10559.5

Months 1916	LOST IN SLAG		LOST IN DUST		TOTAL LOST T.fine Cu.	SCRAP	Not ac- counted for.
	tons	% Cu.	tons fine Cu.	T.fine Cu.			
Jan.	6769.0	3.8	208.7	38.3	247.0	4.6	-
Feb.	10043.0	2.6	270.3	56.3	326.6	21.3	-
Mar.	9164.0	3.1	286.3	52.6	338.9	12.8	9.1
Apr.	10923.0	3.0	331.7	59.4	391.1	-	-
May	12242.0	2.7	331.8	60.2	392.0	3.3	-
June	12187.0	2.7	323.3	117.0	440.3	-	-
July	10070.0	2.7	275.2	98.7	373.9	2.0	5.2
Aug.	10025.0	2.5	252.2	94.5	346.7	-	-
Sep.	9291.0	2.6	237.8	100.1	337.9	-	-
Oct.	7631.0	2.9	218.3	79.6	297.9	47.6	20.0
Nov.	8745.0	2.8	243.6	96.4	340.0	45.4	-
Dec.	9220.0	2.8	259.9	120.8	380.7	43.6	8.0
<u>TOTAL</u>	116310.0	2.8	3239.1	973.9	4213.0	180.6	42.3

METALLURGICAL REPORT 1916.

PLANT A.

Month	OPERATION		TIME	Remarks
	Furnace.	Blowing Hours		
1916.				
Jan.	1	119		Down Jan.5th,connecting new installations & general repairs
	2	445		Started Jan. 13th.
	3	503		" " "
Feb.	2	665		Full month
	3	688		" "
Mar.	1	645		Started March 4th.
	2	531		Down Mar.24th,repairs to hood
	3	155		" 3rd, general repairs
Apr.	1	711		Full month.
	3	714		"
May	1	741		"
	2	474		Blown in May 12th.
	3	433		Blown out May 10th, repair to Jack-ets.Blown in May 23.
June	1	650		Full month.Delays a/c Incline repairs.
	2	676		" " "
	3	526		Blown out June 29th.
July	1	154		Blown out July 8th,General repairs.
	2	712		Full month
	3	554		Blown in July 8th
Aug.	2	735		Full month
	3	735		"
Sep.	2	704		"
	3	701		"
Oct.	1	194		Blown in Oct.12.Blown out Oct.22nd.
	2	693		Full month. (Short of water
	3	231		Blown out Oct.10th.General repairs
Nov.	1	571		Blown in Nov. 6th.
	2	684		Full month
Dec.	1	700		"
	2	238		Blown out December 12th.
	3	420		" " 13th.
<u>TOTAL,</u>		16,702	Blowing Hours	

METALLURGICAL REPORT 1916

PLANT B

Number of Blowing Hours 12,503.
 Tons of Ore (Dry Weight) smelted per 24 hours 179.3

ORES TREATED.	Weight (Wet) tons	Weight (Dry) tons	Grade of Ore %	Weight of Copper tons
STAR: Green Ore	27,815.2	23,225.0	14.6	3,403.0
Black Ore	18,638.3	14,758.6	14.5	2,140.8
KAMBROVE Lump	58,681.5	54,986.0	15.1	8,296.0
LIKASI Lump	477.0	434.0	31.1	134.1
<u>TOTAL</u>	185,012.0	93,403.6	14.9	13,973.9
DOLOMITE		26,522.2	0.5	131.3
SCRAP				195.9
Total Cu. in Charge				14,301.1

INGOTS produced	10,955.3	96.7	10,599.9
MATTE do.	149.5	70.0	104.3
SLAG	104,908.4	2.5	2,654.8
Lost in DUST etc.			845.5
SCRAP			87.2
Not accounted for			9.4
<u>TOTAL</u>			14,301.1

	Weight (Dry) tons.	Proportion to Charge %	Proportion to Ore %	Tons per ton of Copper
FUEL: Wankie	30,944.0			
Katanga	--			
<u>TOTAL</u>	30,944.0	20.2	33.2	2.89

FLUX: Limestone	---			
Dolomite	26,522.2			
Ironstone	33,196.3			
<u>TOTAL</u>	59,718.5	39.0	63.9	5.58

METALLURGICAL REPORT 1916

PLANT D. - CHARGE SHEET

STAR MINE

Months 1916	GREEN ORE				BLACK ORE			
	Wet	Dry	% Cu.	tons fine Cu.	Wet	Dry	% Cu.	tons fine Cu.
Jan.	-	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-	-
Mar.	1380.7	1130.1	16.2	183.7	710.0	551.8	16.2	89.4
Apr.	3179.4	2666.3	14.9	397.6	1761.4	1519.7	15.1	214.8
May	3387.4	2866.6	14.9	420.3	2295.7	1868.3	14.8	276.5
June	3312.6	2736.5	14.5	396.0	2262.7	1804.3	14.7	264.6
July	3526.2	2959.4	14.3	423.5	2409.2	1896.9	14.6	277.4
Aug.	3699.2	3058.4	14.4	439.7	2387.7	1828.5	14.7	268.3
Sep.	3369.1	2819.8	14.6	411.6	1993.7	1550.8	14.3	222.4
Oct.	2347.6	1952.2	14.5	282.3	1927.9	1518.8	13.9	211.8
Nov.	2190.6	1885.9	14.6	273.5	2096.1	1692.3	13.4	227.5
Dec.	1422.4	1209.8	14.2	172.8	793.9	627.2	14.0	88.1
TOTAL	27815.2	23225.0	14.6	3403.0	18638.3	14758.6	14.5	2140.8

	KAMBOVE LUMP.				LIKASI LUMP			
	Wet	Dry	% Cu.	tons fine Cu.	Wet	Dry	% Cu.	tons fine Cu.
Jan.	-	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-	-
Mar.	2336.3	2151.9	15.6	337.5	-	-	-	-
Apr.	5316.9	4945.0	15.9	785.4	-	-	-	-
May	5139.8	4809.0	15.1	724.8	-	-	-	-
June	5137.0	4847.3	14.9	725.8	-	-	-	-
July	5361.1	5161.1	15.5	802.5	-	-	-	-
Aug.	6823.2	6537.0	14.9	972.3	-	-	-	-
Sep.	6622.3	6360.1	15.3	971.6	144.0	130.4	38.2	49.8
Oct.	6281.0	6045.2	15.1	912.0	137.0	125.5	35.2	44.2
Nov.	6766.3	6502.7	14.8	959.8	56.0	52.6	16.0	8.4
Dec.	8297.6	7626.7	14.4	1104.3	140.0	125.5	25.2	31.7
TOTAL	58081.5	54986.0	15.1	8290.0	477.0	434.0	31.1	134.1

TOTAL CHARGE (ORE)

Jan.	-	-	-	-
Feb.	-	-	-	-
Mar.	4427.0	3833.8	15.5	610.6
Apr.	10257.7	9031.0	15.5	1397.8
May	10822.9	9453.9	15.0	1421.6
June	10712.3	9388.1	14.8	1386.4
July	11296.5	10017.4	15.0	1503.4
Aug.	12910.1	11423.9	14.7	1680.3
Sep.	12129.1	10861.1	15.2	1655.4
Oct.	10693.5	9641.7	15.0	1450.3
Nov.	11109.0	10133.5	14.5	1471.2
Dec.	10653.9	9569.2	14.6	1396.9
TOTAL.	105012.0	93403.6	14.9	13973.9

METALLURGICAL REPORT 1916

PLANT B. - CHARGE SHEET

Month 1916	FLUXES					CHARGES			
	Dry	Dolomite		Iron	Total	Wet	Totals		
		% Cu.	tons fine Cu.	Dry	Dry	tons fine Cu.	Dry	tons Cu.	
Jan.	-	-	-	-	-	-	-	-	
Feb.	-	-	-	-	-	-	-	-	
Mar.	1075.4	0.5	5.7	1377.9	2453.3	5.7	6880.3	6287.1 616.3	
Apr.	2490.3	0.49	12.1	3146.3	5636.6	12.7	15894.3	14667.6 1409.9	
May	2654.9	0.5	13.2	3445.8	6180.7	13.2	16923.6	15584.6 1434.8	
June	2601.1	0.5	12.8	3247.4	5848.5	12.8	16560.8	15236.6 1399.2	
July	2779.5	0.5	13.8	3577.9	6357.4	13.8	17653.9	16374.8 1517.2	
Aug.	3316.9	0.5	16.4	3989.4	7306.3	16.4	20216.4	18730.2 1696.7	
Sep.	3179.0	0.5	16.4	3806.1	6985.1	16.4	19114.2	17846.2 1670.8	
Oct.	2777.5	0.5	14.3	3236.0	6013.5	14.3	16707.0	15655.2 1464.6	
Nov.	2734.5	0.5	13.3	3484.0	6216.5	13.3	17327.5	16352.0 1484.5	
Dec.	2913.1	0.5	14.3	3865.5	6798.6	14.3	17452.5	16387.8 1411.2	
Tot- al.	26522.2	0.5	131.3	33196.3	59718.6	131.3	164730.5	153122.1 14105.2	

Month 1916	SCRAP		FUEL	
	T. Cu. fine	Wankie tons	Katanga tons	Total tons
Jan.	-	-	-	-
Feb.	-	-	-	-
Mar.	-	1501.7	-	1501.7
Apr.	-	3068.5	-	3068.5
May	68.0	3098.9	-	3098.9
June	27.2	3201.4	-	3201.4
July	33.7	3260.6	-	3260.6
Aug.	11.4	3754.3	-	3754.3
Sep.	8.3	3361.1	-	3361.1
Oct.	-	2808.8	-	2808.8
Nov.	15.4	3283.7	-	3283.7
Dec.	31.9	3605.0	-	3605.0
TOTAL	195.9	30944.0	-	30944.0

METALLURGICAL REPORT, 1916

PLANT B. PRODUCTION

Month.	INGOTS		MATTE			TOTAL RECOVERY		
	tons rough Cu.	% Cu.	tons fine Cu.	tons rough Cu.	% Cu.	tons fine Cu.	tons rough Cu.	tons fine Cu.
1916.								
Jan.	-	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-	-
Mar.	485.9	95.8	456.7	10.5	70.0	7.4	496.4	473.1
Apr.	1142.5	95.2	1087.8	40.0	69.0	27.6	1182.5	1115.1
May	1247.6	96.0	1197.2	-	-	-	1247.6	1197.2
June	1144.0	96.2	1100.5	16.0	70.0	11.2	1160.0	1111.7
July	1188.2	97.2	1154.6	16.1	70.0	11.2	1204.2	1165.8
Aug.	1270.7	97.6	1240.8	-	-	-	1270.7	1240.8
Sep.	1264.4	97.1	1227.2	19.0	70.0	13.3	1283.4	1240.5
Oct.	1021.5	97.4	995.3	15.0	70.0	10.5	1036.5	1005.8
Nov.	1130.0	97.2	1098.9	-	-	-	1130.0	1098.9
Dec.	1060.5	97.3	1031.9	33.0	70.0	23.1	1093.5	1055.0
TOTAL	10955.3	96.7	10599.9	149.5	70.0	104.3	1104.8	10704.2

Month 1916.	LOST IN SLAC		LOST IN DUST.		TOTAL LOST	SCRAP	Not ac- counted for
	tons	% Cu.	tons fine Cu.	tons fine Cu.	tons fine Cu.		
Jan.	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-
Mar.	4574.0	2.1	98.5	21.5	120.0	23.2	-
Apr.	10575.4	2.1	221.5	55.8	277.3	17.2	-
May	11246.0	2.3	258.9	46.7	305.6	-	-
June	10309.0	2.0	209.5	105.2	314.7	-	-
July	11080.0	2.5	278.6	101.1	379.7	-	5.4
Aug.	12685.0	2.7	349.1	116.2	467.3	-	-
Sep.	12025.0	2.7	329.9	108.7	438.6	-	-
Oct.	10429.0	3.0	309.9	98.1	408.0	46.8	4.0
Nov.	11005.0	2.7	300.7	100.3	401.0	-	-
Dec.	10980.0	2.7	298.2	89.9	388.1	-	-
Total-	104908.4	2.5	2654.8	845.5	3500.3	87.2	9.4

METALLURGICAL REPORT 1916

PLANT B.

OPERATION TIME

Month.	Furnaces.	Blowing Hours.	Remarks
1916			
Jan.	-	-	----
Feb.	-	-	----
Mar.	4	560	Blown in March 2nd. Blown out March 5th.
Apr.	4	699	" " Apr. 11 (Trouble in yard.
	5	523	" " Apr. 8th
May	4	566	" out Apr. 25th. Freeze-up
	5	727	Full month
June	4	573	Blown in June 7th
	5	694	Full month
July	5	576	Blown out July 18th. Freeze up.
	5	731	Full month. Blown in July 25th.
Aug.	4	721	"
	5	718	"
Sep.	4	702	"
	5	694	"
Oct.	4	491	Blown out Oct. 13th. Break in main water pipe. Blown in Oct. 21st.
	5	697	Full month
Nov.	4	702	"
	5	694	"
Dec.	4	727	"
	5	708	"

TOTAL

12,503 Blowing Hours

METALLURGICAL REPORT 1916.

COKE OVENS 1916

Months.	OVENS DISCHARGED			DRY COAL		TONS
	No.1 Battery	No.2 Battery	Total	1	2	Total
1916						
Jan.	290	288	578	2030	2016	4046
Feb.	311	316	627	2177	2212	4389
Mar.	333	341	674	2331	2387	4718
Apr.	323	313	636	2261	2191	4452
May	278	333	611	1744	2068	3812
June	253	315	568	1518	1890	3408
July	325	312	637	1950	1872	3822
Aug.	313	305	718	1778	1729	3507
Sep.	290	221	511	1814	1380	3194
Oct	281	223	504	1967	1540	3507
Nov.	249	254	503	1743	1778	3521
Dec.	298	294	592	2086	2058	4144
<u>TOTAL</u>	3544	3515	7059	23399	23121	46520

	<u>DRY COKE: TONS</u>		
	<u>1</u>	<u>2</u>	<u>Total.</u>
Jan.	1355.1	1345.6	2700.7
Feb.	1453.1	1476.6	2929.7
Mar.	1556.0	1593.4	3149.4
Apr.	1509.2	1462.7	2971.9
May	1165.0	1381.3	2546.3
June	1014.1	1262.5	2276.6
July	1302.5	1250.6	2553.1
Aug.	1244.3	1210.6	2454.9
Sep.	1269.8	966.0	2235.8
Oct.	1376.9	1092.7	2469.6
Nov.	1220.1	1244.6	2464.7
Dec.	1460.2	1440.6	2900.8
<u>TOTAL</u>	15926.3	15727.2	31653.5

METALLURGICAL REPORT 1916.

PLANT A. - SLAC ANALYSIS.

Date 1916	Cu. %	FeO %	SiO ₂ %	Al ₂ O ₃ %	CaO %	MgO%	Average of Samples
Jan.	3.8	33.60	38.74	9.04	4.49	8.19	26
Feb.	2.6	27.95	36.92	8.75	10.74	8.41	25
Mar.	3.1	29.93	39.01	8.73	7.06	9.24	38
Apr.	3.0	29.61	39.15	9.62	6.79	9.36	30
May	2.7	29.39	40.14	9.38	6.14	9.50	35
June	2.7	29.45	40.16	9.52	6.56	8.98	30
July	2.7	30.17	39.19	9.51	6.48	9.25	31
Aug.	2.5	29.30	40.07	10.23	6.12	8.93	31
Sep.	2.6	29.86	39.59	10.16	5.96	8.64	30
Oct.	2.9	30.08	39.29	10.10	5.76	8.46	31
Nov.	2.8	30.82	39.00	9.93	5.50	8.39	30
Dec.	2.8	30.70	39.19	10.34	5.34	8.07	31

PLANT B. - SLAC ANALYSIS

1916	Cu. %	FeO %	SiO ₂ %	Al ₂ O ₃ %	CaO %	MgO %	Average of Samples
Jan.	-	-	-	-	-	-	-
Feb.	-	-	-	-	-	-	-
Mar.	2.1	30.81	39.35	9.10	6.28	9.64	20
Apr.	2.1	29.85	39.86	9.74	6.30	9.43	30
May	2.3	30.35	39.28	9.54	6.19	9.66	33
June	2.0	30.17	39.62	10.00	6.27	9.02	30
July	2.5	30.78	38.76	9.69	6.38	9.33	31
Aug.	2.7	29.73	39.25	10.23	5.88	8.73	31
Sep.	2.7	30.34	39.29	10.25	5.72	8.60	30
Oct.	3.0	30.26	38.96	10.14	5.64	8.64	31
Nov.	2.7	30.23	39.63	10.06	5.26	8.50	30
Dec.	2.7	31.13	38.51	10.35	5.59	8.39	31