May 4th, 1918.

Report of Ore Dressing & Metallurgical Laboratories

Test No 79

Hants County, N.S. Manganese Ore

A shipment of 160 barrels of Manganese Ore was received December 24th, 1917 from the property of E. Chisholm, Esq., Walton, Hants Co., N.S. This shipment was submitted through the Munition Resources Commission, Ottawa, Ont.

The ore was pyrolusite and Manganite in Sandstone, some of which was fairly coarsely crystalline, freeing at about 30 mesh, gradually grading to finely crystalline and disseminated through the Sandstone.

Net Weight of Ore Received		--	47,045.5	Lbs.
Moisture		--	4.88	%
Dry Weight of Ore Received		--	44,749.5	Lbs.
Analysis -	Mn	--	12.90 %	
	Fe	--	5.11 %	
	SiO2	--	69.09 %	
	P	--	0.017%	
Content -	Mn	--	5772.68	Lbs.
	Fe	--	2286.70	Lbs.

The products desired was a commercial Manganese concentrate, a chemical product, high in Manganese (over 50 %) low in Iron and Silica, and a Metallurgical product suitable for conversion into Ferro-Manganese in the Blast or Electric Furnace.

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The method of Investigation adopted was one of careful crushing and sizing and the concentration of the sized material to determine to what point crushing would have to be carried to obtain a high grade concentrate and what further treatment would be necessary to recover the Manganese values.

The ore was crushed in a Jaw Crusher set at 1" opening, elevated to Ore Bins and fed by a push feeder to a set of rolls set at ⅜" opening. From the Rolls the ore passed through a Vezin Sampler where 1/10 of the feed was cut out, thence to a Dryer and to storage Bins. From the storage bins the ore passed to a Traylor Ball Mill crushing to 18 mesh; from the ball mill to a Keedy Sizer where five sizes were made. Each size was run over a concentrating table and the product retreated where necessary.

Weights and Analysis of Sized Ore

Size	Dry Wt. Lbs.	Analysis % Mn.	% Fe.	Content Lbs. Mn	Lbs. Fe.
+ 28	2578.5	16.16	7.78	416.6856	200.6073
- 28 + 42	1839.0	15.34	6.80	282.1026	125.0520
- 42 + 62	6700.0	12.87	6.19	862.2900	414.7300
- 62 + 86	8896.0	10.36	4.07	921.6256	362.0672
- 86	24736.0	13.26	4.64	3279.9936	1147.7504
Totals & Averages	44749.5	12.88	5.03	5762.6974	2250.2069

First Concentration

Size	Dry Wt. Lbs.	Analysis % Mn	% Fe	% SiO_2	% P.	% S.	Content Lbs. Mn	Lbs. Fe.
+ 28	275.0	39.34	6.62	25.78			108.1850	18.2050
- 28 + 42	488.0	34.66	7.20	22.58			169.1408	35.1360
- 42 + 62	412.0	38.85	4.80	27.66			160.0620	19.7760
- 62 + 86	363.0	51.68	4.41	9.35	.172	.385	187.5984	16.0083
	111.0	45.90	5.18	14.66			50.9490	5.8598
	465.0	51.80	4.14	9.45	.232	.635	240.8700	19.2510
- 86	471.0	45.02	6.86	13.41	.057	.033	212.2442	100.9106
Totals & Averages	3585.0	44.046	6.03				1579.0494	216.1467

On sizes + 28; - 28 + 42 and - 42 + 62 a concentrate and middling were made, both of which were reground and retreated as the pyrolusite was not freed.

on sizes - 62 + 86 and - 86, a final concentrate practically pure pyrolusite, a 2nd concentrate lower grade of pyrolusite and manganite, a middling to be retreated and a tailing were made.

The total middlings from the first concentration were reground to 60 mesh (this mesh corresponding closely to Tyler Standard) in a Ball Mill and re-concentrated. A concentrate, a middling held and a tailing to waste was made.

The first concentrate made from sizes + 28, - 28 + 42 and - 42 + 62 was reground to 35 mesh (Tylers Standard) and re-concentrated. A concentrate, a middling held and a tailing to waste were made.

The following tables give the results obtained from the treatment of this shipment of ore:-

Table showing Weights & Analysis of Concentration Products

Weights and Analysis of Sized Ore						Concentrates Made					Middling Made - Held for Retreatment					Tailings to Waste					Slime & Handling Loss				
Size	Dry Wt. Lbs.	Analysis		Content		Dry Wt. Lbs.	Analysis		Content		Dry Wt. Lbs.	Analysis		Content		Dry Wt. Lbs.	Analysis		Content		Dry Wt. Lbs.	Analysis		Content	
		% Mn.	% Fe	Lbs. Mn.	Lbs. Fe.		% Mn.	% Fe	Lbs. Mn	Lbs. Fe.		% Mn.	% Fe	Lbs. Mn Lbs. Mn	Lbs. Fe. Lbs. Fe.	Lbs. Lbs.	% Mn. % Mn.	% Fe % Fe	Lbs. Mn	Lbs. Fe.		% Mn.	% Fe	Lbs. Mn	Lbs. Fe.
+ 28	2578.5	16.16	7.78	416.6856	200.6073	275.0	39.34	6.62	108.1850	18.2050	2303.5	13.39	7.92	308.5006	182.4023	No Tailings Made									
-28 + 42	1839.0	15.34	6.80	282.1026	125.0520	488.0	34.66	7.20	169.1408	35.1360	1351.0	8.36	6.656	112.9618	89.9160	No Tailings Made									
-42 + 62	6700.0	12.87	6.19	862.2900	414.7300	412.0	38.85	4.80	160.0620	19.7760	6288.0	11.168	6.28	702.2280	394.9540	No Tailings Made					5584.0	20.08	7.58	1121.2980	423.2189
-62 + 86	8896.0	10.36	4.07	921.6256	362.0672	363.0 111.0	51.68 45.90	4.41 6.18	187.5984 50.9490	16.0083 6.8598															
-86	24736.0	13.26	4.64	3279.9936	1147.7504	465.0 1471.0	51.80 45.02	4.14 6.86	240.8700 662.2442	19.2510 100.9106	10105.5	11.576	3.91	1169.8008	395.2717	15532.5	4.95	3.53	768.8588	548.2973					
Totals & Averages	44749.5	12.88	5.03	5762.6974	2250.2069	3585.0	44.046	6.03	1579.0494	216.1467	20048.0	11.44	5.30	2293.4912	1062.5440	15532.5	4.95	3.53	768.8588	548.2973	5584.0	20.08	7.58	1121.2980	423.2189
Retreatment of Middlings	20048.0	11.44	5.30	2293.4912	1062.5440	1480.0	36.01	13.20	532.9480	195.360	145.0	19.48	9.80	28.246	14.210	12506.0	5.25	3.75	656.565	468.975	5917.0	18.18	6.49	1075.7322	383.999
Retreatment of 1st Concentrates	1175.9	37.22	6.22	437.3878	73.1170	935.0	38.95	6.40	364.1830	59.840	140.0	16.50	6.42	23.10	8.988	No Tailings Made					100.0	50.11	4.29	50.1058	4.289

Note:- The above meshes referred to are a special mesh size used for screening and do not correspond to any Standard.

Summary and Tabulation of Final Products

Final Concentrates										Middlings Held	Tailings to Waste	Slime & Handling Loss
Dry Wt. Lbs.	Analysis							Content Lbs. Mn	Recovery of Mn Values	Dry Wt. 285 Lb.	Dry Wt. Lb. 28038.5	Dry Wt. 11601 lb.
	% Mn	% Fe	% SiO_2	% P	% S	% CaO	% MgO			Analysis	Analysis	Analysis
465	51.80	4.14	9.45	0.232	0.635			240.8700	4.18	Mn - 18.02%	Mn - 5.08	Mn - 19.37 %
363	51.68	4.41	9.35	0.172	0.385			187.5984	3.26	Fe - 8.14%	Fe - 3.63	Fe - 6.995%
111	45.90	6.18	14.66					50.9490	0.88	Content	Content	Content
1471	45.02	6.86	13.41	0.037	0.033			662.2442	11.49	Mn - 51.346 Lb.	Mn 0 Lb. 1425.4288	Mn - 2247.1355 Lb.
935	38.95	6.40						364.1830	6.32			
1480	36.01	13.20	21.03					532.9480	9.25	%age Mn Values	Loss Mn Values	Loss Mn Values
4825	42.254							2038.7926	35.38	0.89 %	24.74 %	38.99 %

Conclusions:-

From the above tables, it has been proven that it is necessary to crush the ore to about 40 mesh of the ordinary screen scale, in order to free it and affect any kind of a concentration. Crushing to this mesh 10 % to 12 % of the Manganese values should be obtained of a grade 50 % Mn.

It will then be necessary to pass both the Middlings and tailings separately over a second set of tables where a concentrate and middling will be made in one case and a concentrate, middling and tailing in the other case. The concentrate made in both cases should be of a grade 45 % Mn. and represent a recovery of from 20 % to 25 % of the Manganese values in the crude ore; the middlings would be retreated and the tailings discarded.

The middlings from this second concentration will have to be reground to from 60 to 80 mesh, (ordinary screen scale) and reconcentrated. The middlings from this third concentration should go over a second set of tables before returning to the regrinding circuit and the tailings from both sets of tables discarded. A concentrate of a grade 40 % Mn. with a recovery of 20% of the manganese values in the crude should be obtained.

By the method of treatment outlined above it is possible to make commercial products on this ore and that it should be possible to make a recovery of between 50 % and 60 % of the Manganese values in the ore.

In the treatment of this ore at the Testing Laboratories the products had to be handled so often and in such a manner that the handling and slime loss was very high. With a proper installation, the handling loss would be nil and the slime loss eliminated to a large extent. From the above tables it will be

noted that the actual loss in Tailings sent to the waste dump contained 24.74 % of the Manganese values in crude ore with an analysis of 5.08 % Mn. Allowing for a slime loss of 20 % of the Mn values in the crude ore the Recovery would be 55 % of the Manganese values in the crude ore.