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OTTAWA August 12th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1700.

Examination of a Manganese Steel Traylor Mantle.

(Copy No. 10.)

Bureau of Mines
Division of Metallic
Minerals
-
Physical Metallurgy
Research Laboratories

CANADA
DEPARTMENT
OF
MINES AND RESOURCES

Mines and Geology Branch

O T T A W A August 12th, 1944.

REPORT

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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1700.

Examination of a Manganese Steel Traylor Mantle.

Origin of Material and Object of Investigation:

On July 4th, 1944, the Sorel Steel Foundries Limited, Sorel, Quebec, submitted a request for an investigation into the cause of unsatisfactory service of a manganese steel Traylor mantle. This had been supplied to the International Nickel Company of Canada Limited, Copper Cliff, Ontario, and had lasted approximately one-third of the normal life of this type of mantle.

This discarded mantle was said to be in good condition and to be worn fairly evenly. The sample, identified as No. 17, was received on July 19th, 1944. The casting was 3½ inches thick.

Chemical Analysis:

The sample was found to have the following chemical analysis:

	Per Cent
Carbon -	1.06
Manganese -	10.98
Silicon -	0.39
Chromium -	0.56
Phosphorus -	0.062
Sulphur -	0.012

Hardness Readings:

The following hardnesses (average of 4 readings) were obtained:

¼ inch from casting surface - 363 Brinell.

At centre of casting - 197 Brinell.

Magnetic Test:

The steel was magnetic to a depth of about 3/8 inch from the surface but was almost non-magnetic at the centre.

Microscopic Examination:

The structure at the surface of the casting was found to differ from that at the centre. Figure 1, at X200 magnification, is a photomicrograph of the structure at the centre. Figure 2, also at 200 diameters, shows the micro-structure ¼ inch from the outside, unworked surface. Figure 3, at X1500 magnification, shows the troostitic nature of the dark particles of Figure 2.

In an attempt to obtain comparable microstructures, a section of the mantle was heated for four hours at 1900° F. and water-quenched. One sample was reheated to 850° F. for one hour, and another to 1150° for one hour. The resultant microstructures are shown respectively in Figures 4 and 5.

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Discussion:

The microstructures observed are abnormal for austenitic manganese steel, and must be the result of improper heat treatment, as the chemical composition is normal.

The absence of massive carbides indicates that the steel has been heat-treated, and that the soaking time and temperature have been sufficient to afford complete solution. The structure at the centre is typical of lower reheating than that at the surface. This indicates that external heat has been applied since heat-treating. The comparable structures obtained by reheating the properly quenched steel support this view.

Conclusions:

1. The casting was properly heat-treated but has been subsequently reheated.

2. This reheating is the cause of the unsatisfactory service of the mantle.

3. The time of reheating was too short to produce a uniform temperature throughout the section.

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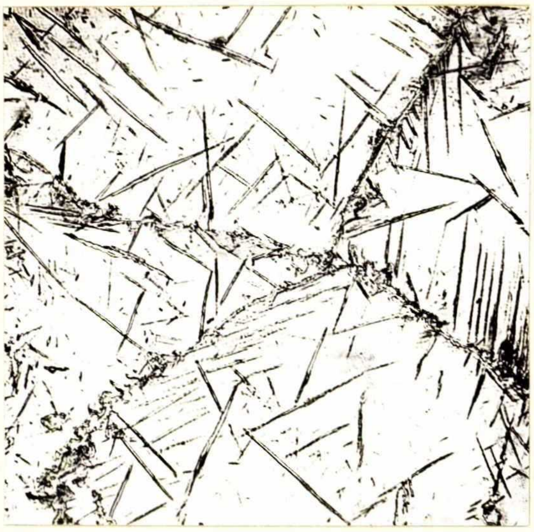
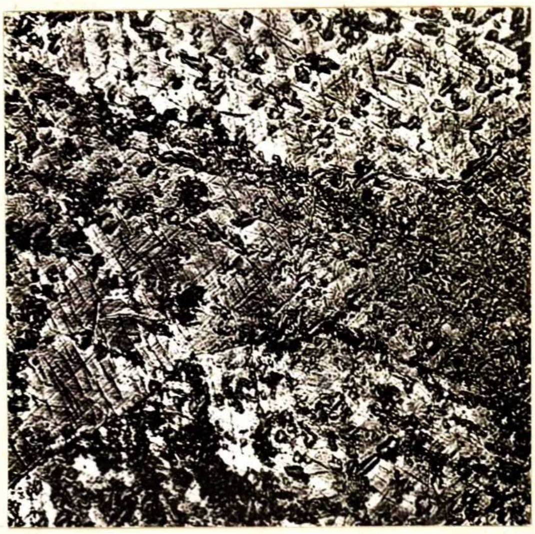
Figure 1.



X200, nital etch.

MICROSTRUCTURE AT CENTRE.

Figure 2.



X200, nital etch.

MICROSTRUCTURE ¼ INCH FROM SURFACE.

Figure 3.

X1500, nital etch.

MICROSTRUCTURE ¼ INCH FROM SURFACE.

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Figure 4.

X200, nital etch.

MICROSTRUCTURE AFTER REHEATING
TO 850° F. FOR ONE HOUR.

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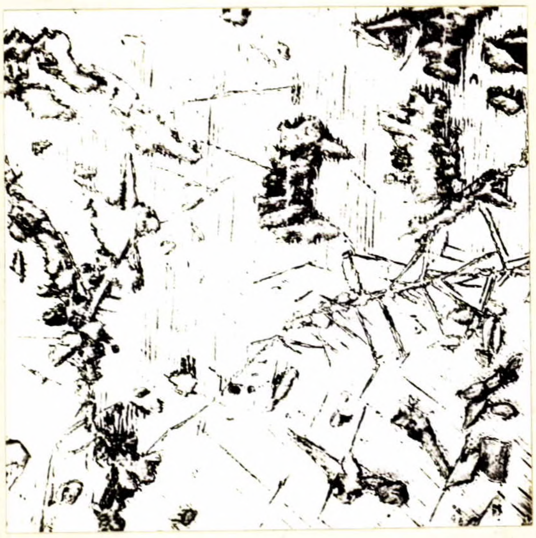
Figure 5.



X200, nital etch.

MICROSTRUCTURE AFTER REHEATING TO
1150° F. FOR ONE HOUR.

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