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July 23, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1910.

Investigation of Striations in Welded Ice-Breaker
Ship Plate.

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Ship Plate.

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Origin of Material and Object of Investigation:

On July 3, 1945, a piece of welded ice-breaker ship plate (see Figure 1) was submitted for metallurgical examination by Mr. A. A. Young, Principal Inspector, Hulls and Equipment, Steamship Inspection Branch, Department of Transport, Ottawa, Ontario.

Striations were observed in the plate designated B (see arrows, Figure 1) and a request was made to determine the cause of their presence.

(Continued on next page)

(Origin of Material and Object of Investigation, cont'd) -

Figure 1.



WELDED ICE-BREAKER SHIP PLATE,
SHOWING STRIATIONS.

Etched in hot 50 per cent HCl.

(Approximately 2/3 actual size).

Chemical Analysis:

The following are the results of the chemical analyses made on the plates A, B, and the weld metal:

	<u>Plate A</u>	<u>Plate B</u>	<u>Weld Metal</u>
	- P e r C e n t -		
Carbon	0.24	0.26	0.15
Manganese	0.68	0.55	0.52
Silicon	0.01	0.01	0.38
Sulphur	0.040	0.021	0.034
Phosphorus	0.039	0.014	0.025
Nickel	Nil.	Nil.	Nil.
Chromium	"	"	"
Molybdenum	"	"	"
Vanadium	"	"	"

Macroscopic Examination:

The plate sample was etched in hot 50 per cent hydrochloric acid for $\frac{1}{2}$ hour, and striations in Plate B were brought up more clearly (see Figure 1). The appearance of the union weld after etching is shown in Figure 2.

(Macroscopic Examination, cont'd) -

Figure 2.



X2, etched in hot
50 per cent HCl.

UNION WELD.

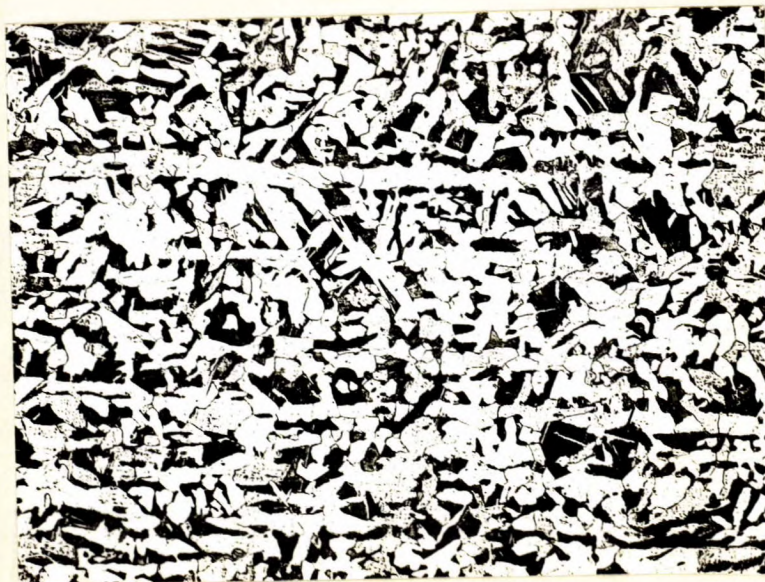
Microscopic Examination:

Figures 3, 4, 5 and 6 are photomicrographs taken at X100 magnification. Figures 3 and 4 show the normal structures of plates A and B respectively.

Figure 5 shows the concentrations of pearlite occurring in Plate B, resulting in the striations.

The structure of the weld metal is revealed in Figure 6.

Figure 3.



X100, nital etch.
NORMAL STRUCTURE OF PLATE "A".

(Microscopic Examination, cont'd) -

Figure 4.



X100, nital etch.
NORMAL STRUCTURE OF PLATE "B".

-

Figure 5.

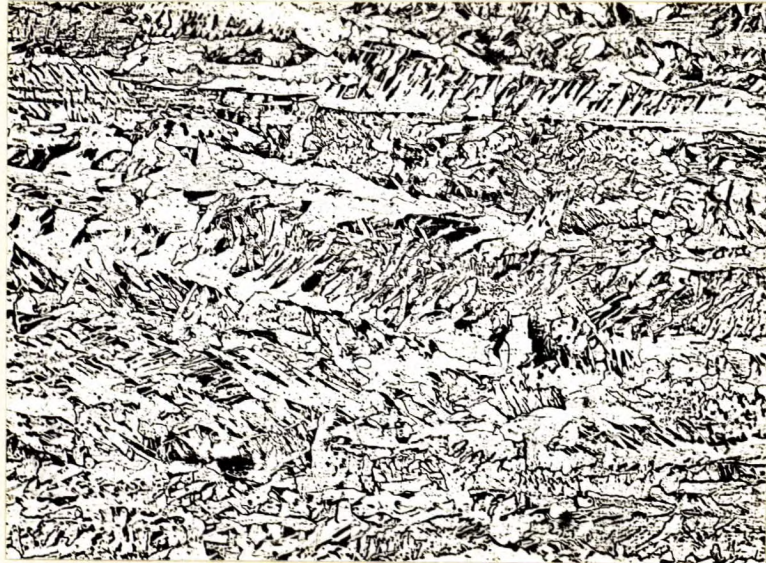


X100, nital etch.
CONCENTRATION OF PEARLITE IN PLATE
"B", CAUSING STRIATIONS.

-

(Microscopic Examination, cont'd) -

Figure 6.



X1100, nital etch.

STRUCTURE OF WELD METAL.

Discussion and Conclusions:

The chemical analyses indicate that the two plates and the weld metal are normal and satisfactory.

The striations observed in Plate B are due to a concentration of pearlite extending throughout the metal. This concentration was probably caused by segregation in the ingot which had subsequently been rolled. Hence the appearance of the high-carbon areas as lines or striations.

The mechanical properties of the plate containing the striations are practically unaffected by their presence, and the plate is considered quite satisfactory.