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O T T A W A April 10, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1833.

Tests on Beach Foundry Limited Moulding Sands.

(Copy No. 10.)

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

CANADA

DEPARTMENT OF MINES AND RESOURCES

Mines and Geology Branch

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REPORT

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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1833.

Tests on Beach Foundry Limited Moulding Sands.

Origin of Material and Object of Investigation:

On March 17, 1945, Mr. I. C. Sheppard, plant superintendent of the Beach Foundry Limited, Ottawa, Ontario, submitted four samples of moulding sands for examination. These sands will be referred to in this report as A, B, C, and D, and are identified as follows (with Mr. Sheppard's comments re their use following in quotation marks):

Sand A. - New moulding sand from New Jersey. "When this sand was used rat-tails occurred on their castings."

Sand B. - New moulding sand from Albany, New York. "When the foundry switched to the use of this sand, rat-tails disappeared."

Sand C. - Heap sand from the foundry floor. "This was originally New Jersey sand, but now is probably about equal parts of New Jersey and Albany sand. Little trouble from rat-tails is encountered."

Sand D. - "System" sand from the conveyor system. "This sand is causing trouble from blow-holes."

An examination of the sands was requested, with

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

the object of finding:

(1) Any differences between the New Jersey and Albany sands which might account for the rat-tails when the New Jersey sand is used, and their absence when Albany sand is used.

(2) The cause of blow-holes in castings when the "system" sand is used.

PROCEDURE:

Fineness Determination:

The results of the fineness determination were as follows:

U.S. Screen No.		Sand A	Sand B	Sand C	Sand D
		- Per Cent Retained -			
6	-	None.	None.	None.	None.
12	-	None.	None.	None.	0.2
20	-	0.5	0.4	None.	0.5
30	-	0.3	0.2	None.	0.4
40	-	0.4	0.3	None.	1.0
50	-	0.4	0.4	0.1	2.5
70	-	0.5	0.4	0.1	8.8
100	-	2.1	1.2	0.1	11.3
140	-	30.1	17.0	6.5	26.6
200	-	22.7	20.0	16.4	18.0
230	-	9.0	1.7	3.7	0.5
270	-	0.8	5.2	7.3	0.5
Pan	-	16.7	41.1	55.1	16.5
A.F.A. clay	-	16.5	12.0	10.7	13.4
A.F.A. Fineness No.	-	159	207	243	135

(Continued on next page)

(Procedure, cont'd) -

Permeability:

The sand was received in the tempered condition. Moisture content and permeability were as follows:

	Sand A	Sand B	Sand C	Sand D
Moisture, per cent -	11.2	9.0	12.0	6.0
Permeability, "	17.3	9.0	12.6	21.8

Elevated Temperature Tests:

The sands were tested at elevated temperatures, using a sand dilatometer. Figure 1 is a picture of the instrument used.

Figure 1.

HIGH-TEMPERATURE SAND DILATOMETER.

Shock Test -

Sand specimens 2 inches long and 1-1/8 inches in

(Procedure, cont'd) -

diameter were subjected to the shock test by raising them into a furnace heated to 2500° F. Figure 2 is a photograph of the specimens after being subjected to this test.

Figure 2.

A B C D

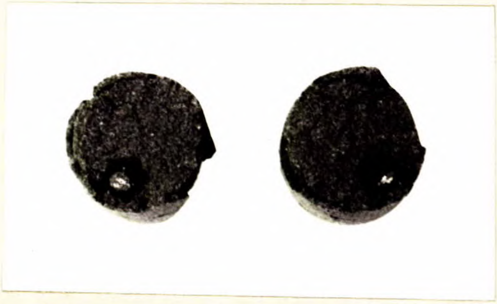
SAND SPECIMENS SUBJECTED TO THE SHOCK TEST.

Note slag bubble in specimen D (system sand).

It will be noted that the New Jersey sand (A) is the only one to withstand this test, i.e., hold its original conformation.

Note the bubble in the "system" sand specimen (D). Subsequent experiments established that these bubbles were caused by iron particles in the sand. Figure 3 is a photograph of a slag bubble in the sand which was definitely caused by an iron particle. The particle had been taken from the sand as received with a magnet, and placed in this specimen prior to ramming.

Figure 3.



SLAG BUBBLE IN SYSTEM SAND, CAUSED BY IRON PARTICLES.

(Procedure, cont'd) -

Expansion and Contraction -

The sand specimens were lifted into the furnace and the temperature was gradually raised from room temperature to 2500° F. A dial indicator, read at 100° intervals, recorded the volume change. After the furnace reached 2500° F., the dial was read at 5-minute intervals. The results of this study are graphically reported in Figure 4. It will be seen that the New Jersey sand has a higher expansion and lower contraction than the other three sands.

Discussion:

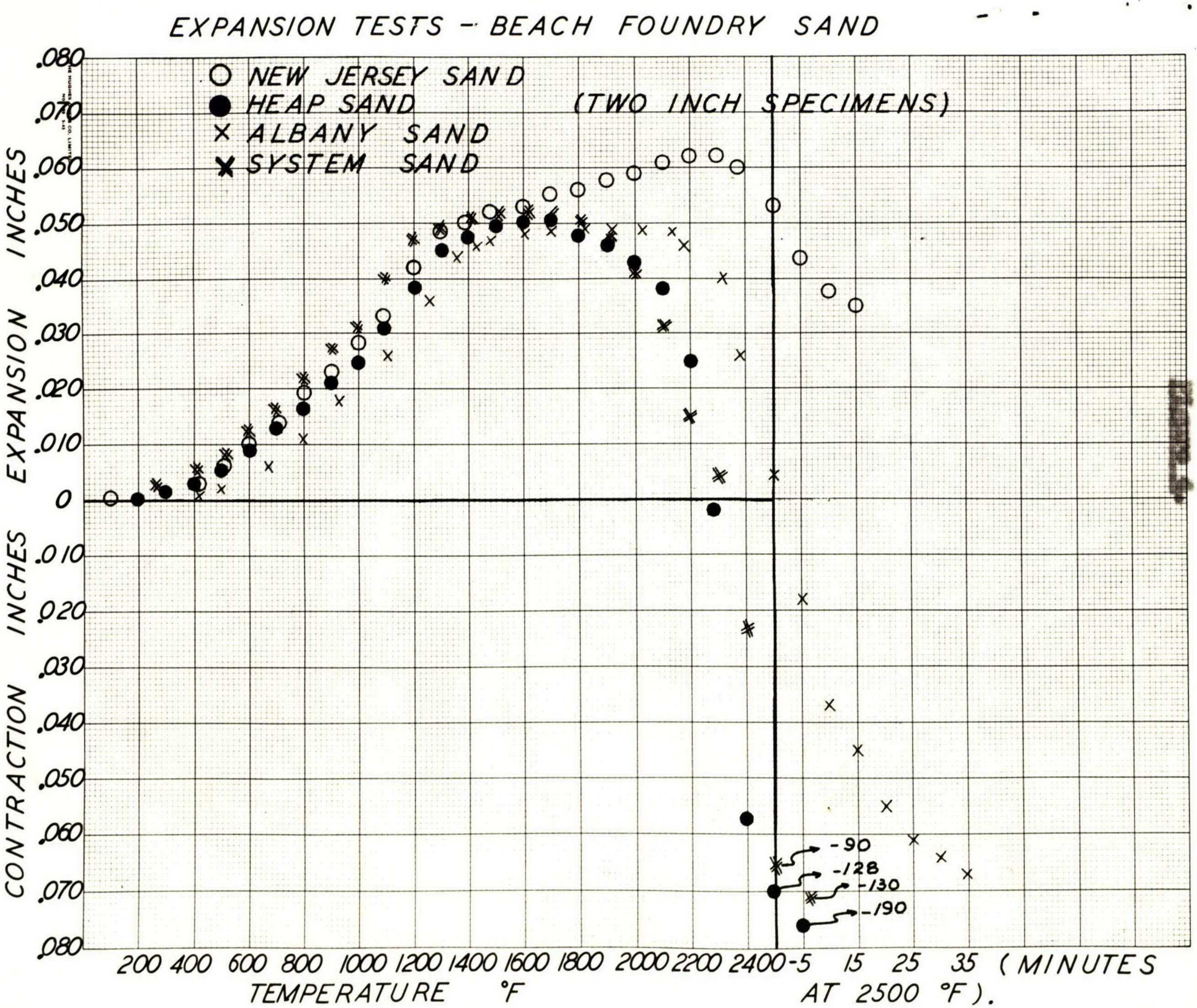
A comparison of the New Jersey and Albany sands shows the following:

1. The Albany sand is finer than the New Jersey sand.
2. The New Jersey sand contains more "A.F.A." clay.
3. The New Jersey sand withstood the shock test better than the Albany sand.
4. The New Jersey sand expanded more than the Albany sand.
5. The Albany sand contracted more than the New Jersey sand.

The New Jersey sand is definitely different from the others examined. It is actually more refractory. However, its high expansion may be undesirable for the type of castings made.

A study of the "system" sand shows it is coarser than any of the other sands submitted and that its permeability is the best of the four. However, specimens subjected to the

(Figure 4 comprises Page 6.)
(Text continues, on Page 7.)



EXPANSION TESTS - BEACH FOUNDRY SAND
NEW JERSEY SAND
HEAP SAND
ALBANY SAND
SYSTEM SAND
(TWO INCH SPECIMENS)
EXPANSION INCHES
CONTRACTION INCHES
.080
.070
.060
.050
.040
.030
.020
.010
0
.010
.020
.030
.040
.050
.060
.070
.080
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
-5 15 25 35 (MINUTES AT 2500 °F).
TEMPERATURE °F
-90
-128
-130
-190

(Discussion, cont'd) -

shock test showed slag bubbles in the sand. If these occurred near the metal-sand interface they would enter the casting and look like an ordinary blow-hole. Further research revealed that these bubbles were caused by iron particles in the sand.

CONCLUSIONS:

1. The high expansion of the New Jersey sand may be the cause of rat-tails in the castings.

2. Iron particles in the "system" sand is the cause of blows.

3. It is recommended that a magnetic separation be used to remove iron from the "system" sand.

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AEM:GHB.