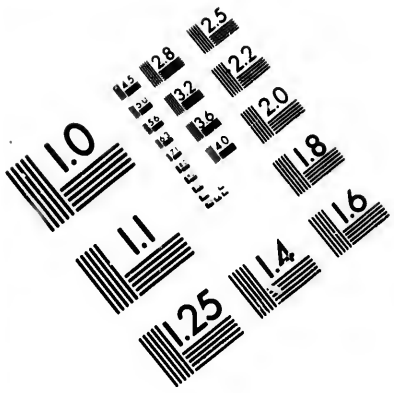

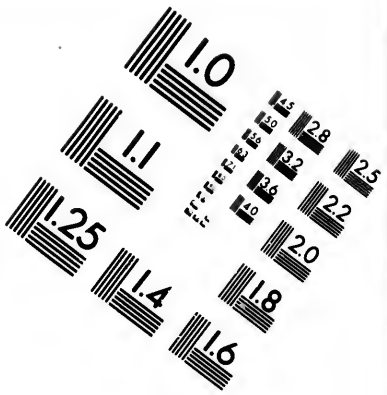

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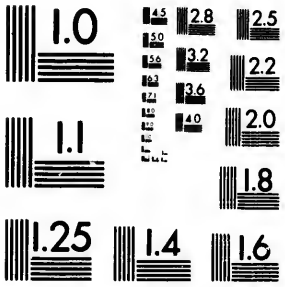

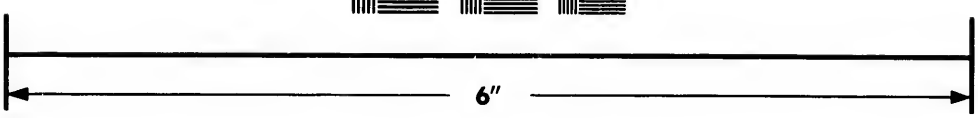

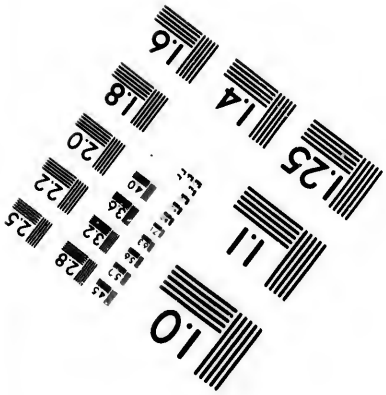

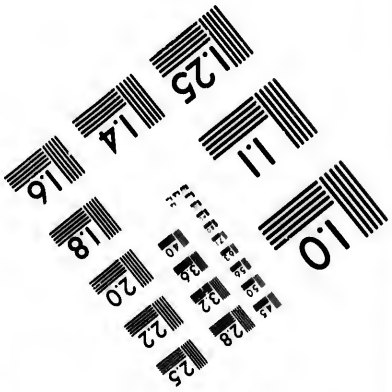

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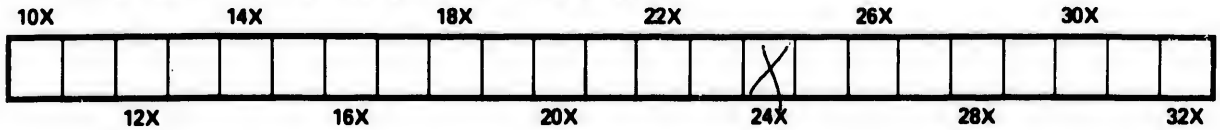

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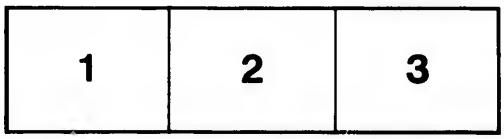

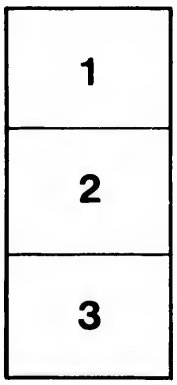

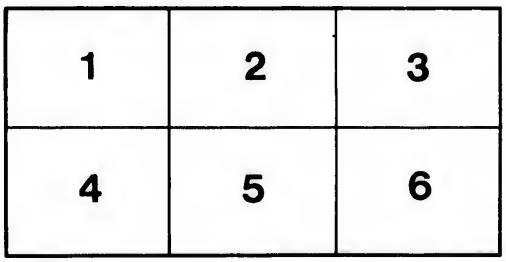

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McGILL UNIVERSITY

PAPERS FROM THE DEPARTMENT

OF

BOTANY.

No. 3.—PECULIAR BEHAVIOUR OF CHARCOAL IN THE BLAST FURNACE AT RADNOR FORGES, QUE.

BY

J. T. DONALD, M.A.

CHARCOAL IMPREGNATED WITH SLAG.

BY

D. P. PENHALLOW.

[Reprinted from the Canadian Record of Science, January and April, 1896.]

MONTREAL, 1896.

"*Reprinted from the Canadian Record of Science, Jan. and April*, 1896."

Peculiar Behaviour of Charcoal in the Blast Furnace at Radnor Forges, Que.

By J. T. Donald, M.A.

In October last the Canada Iron Furnace Company sent the writer a sample of what they termed partly consumed charcoal, containing a large percentage of siliceous matter, and which they stated "had been thrown out at the cinder notch of the furnace in large quantities, unconsumed, and showing fibres, or threads, of a yellow colour, and similar to mineral wool." It was further stated that "the coal, which was made from oak, and, apparently, basswood and elm, seems unfit for furnace work." A superficial examination was sufficient to show that this charcoal was very peculiar indeed. Its unusual weight at once challenged attention; and a closer inspection showed in the specimen a framework in the form of a fibrous mass—not unlike a piece of harsh fibred asbestos. Analysis showed that this fibrous matter amounted to no less than 41.16 per cent. of the coal. The question now was, to account for this large percentage of mineral matter. The only explanation I could offer was to suggest that it might be the result of charring wood that had been partially fossilized, for it was well known that such silicified wood is not uncommon. At the same time this suggestion did not satisfy me; it did not, I thought, cover the fibrous or rod-like structure of the mineral matter—for I had never seen a similar structure in silicified wood. I therefore decided to send portions of the sample to Prof. Penhallow, of McGill, and Mr. W. F. Ferrier, of the Geological Survey. These gentlemen are authorities in their own departments—the former as a botanist, and the latter as a mineralogist and lithologist. It appeared to me that the question of the origin of the siliceous matter of this coal was one of either botany or mineralogy, and not of chemistry. Prof. Penhallow,

having examined the specimens, reported that "it seems difficult to think that these rods are the result of natural processes of growth." Mr. Ferrier said he thought the siliceous matter had not been present in the original charcoal, but that it was slag that the coal had absorbed in the furnace. Then, next, word came from the furnace at Radnor that similar fibrous charcoal had again been expelled from the slag notch, and this whilst charcoal from a totally different locality was being used in the furnace. The evidence was thus strongly against the view that the siliceous matter was part of the original coal, and in favour of Mr. Ferrier's suggestion. The question was thus again, as it were, thrown back into the sphere of chemistry, and it appeared probable that an analysis of the fibrous matter would settle it. After much care and labour, a quantity of fibre sufficient for analysis—and free from the ash naturally present in the charcoal—was obtained. The difficulty of securing a satisfactory sample lay in the fact that the alkali of the true ash caused the fibres to fuse, forming little glassy globules. It was desirable to avoid these, in order that the analysis might show the composition of the fibre itself. The analysis of the fibre is stated in column 2; column 1 is the partial analysis of a sample of Radnor slag made by myself in January, 1891:—

	(1) p.c.	(2) p.c.
Alumina	13.52	18.15
Ferrous oxide	1.44	.51
Manganous oxide	3.48	Traces
Lime	23.89	25.44
Magnesia	.74	1.47
Sulphuric anhydride	1.52	Traces
Silica	54.00	42.18
Alkalies — Phosphoric anhydride, etc., by diff.	2.41	2.25

It is very evident, then, that the fibrous matter of this charcoal is simply absorbed slag. Two questions of interest then arise. What were the conditions in the furnace that caused charcoal in large quantities to absorb and retain the liquid slag? How did it happen that only on two occasions had the production of this slag-saturated coal been observed?

The following particulars regarding the furnace are data that must be taken into consideration in any theory put forth to explain the peculiar behaviour of the charcoal under consideration:—

Four 3½ inch tuyeres are used.

The average pressure of blast is about 5¾ lbs.

The average temperature of blast, 900 degrees Fahr.

The quantity of air, as a rule, is 2,638 cubic feet, but at times it has run to as high as 2,827 cubic feet to the minute.

Cubical contents of furnace, from stock-line down, is 1,264 cubic feet.

Charcoal Impregnated with Slag.

By D. P. Penhallow, M.A.Sc.

On the 8th of October last I received from Prof. J. T. Donald a sample of charcoal, together with some peculiarly fibrous silicious matter, accompanied by the statement that the coal was received from "clients who use charcoal in the production of charcoal iron," and that "when the coal is burned it leaves an ash consisting of long fibres. This material was thrown out at the cinder notch in large quantities unconsumed. The coal was made from oak and apparently bass-wood and elm."

Upon submitting the coal to examination, it became evident that it was derived from the wood of an elm—probably the common white or American elm (*Ulmus*