

ART. VIII.—*On the Discovery of a Bloomery at Lindale Church, near Grange-over-Sands.* By J. WILFRID JACKSON, F.G.S. (Assistant Keeper, Manchester Museum).

Read at Carlisle, April 10th, 1913.

DURING the extension of Lindale Church last year, an unexpected discovery of an ancient iron-smelting place was made not many yards from the old wall of the church.

For the details of its discovery and structure, I am indebted to Mr. T. R. Wilson, coach builder, of Lindale, who, fortunately, was on the spot when the bloomery was met with, and to him must be accorded the greatest credit for his promptitude in obtaining measurements and other necessary particulars in the short space of time that the bloomery was exposed.

Mr. Wilson states that the remains were discovered in excavating a deep trench for the foundations of the new north wall of the church, and were situated about nine feet below the ground level (=level of the floor of the church).

The structure was remarkably well preserved and appears to have been built in the north side of a mound of pinnel on which the church stands. The top of the furnace was level with the top of the undisturbed pinnel—the material above being tipped soil, etc., probably derived from previous excavations connected with the church. It measured six feet in diameter at the top and gradually curved inwards down to the hearth which was from three to four feet below: the hearth measured four-and-a-half feet in diameter. The enclosing walls

were some fifteen inches in thickness, and had originally been constructed of hard blue cobbles now changed, by calcination, to a reddish colour. The adjacent pinnel also showed signs of having been subjected to great heat.

From the bottom of the furnace, on the north side, a long shallow trough extended outwards and slightly downwards in the direction of Lindale Beck. Owing to this trough being only partially exposed in the excavations, its extreme length could not be ascertained. Sufficient, however, was laid bare to show that it extended over six feet. Its width on leaving the furnace was practically that of the hearth, viz., 4 feet 6 inches, whence it gradually narrowed to 1 foot 6 inches. The outer sides were almost vertical and backed with large stones; the inner sides sloped gradually inwards down to a depth of about 1 foot 6 inches, the width at the bottom being about the same at a point near the hearth. The accompanying plan and sections are based upon drawings and details supplied by Mr. Wilson, and are approximately correct (see next page).

The interior of the furnace on its discovery was found to be filled in with limestone; while the floor was blackened with charcoal.

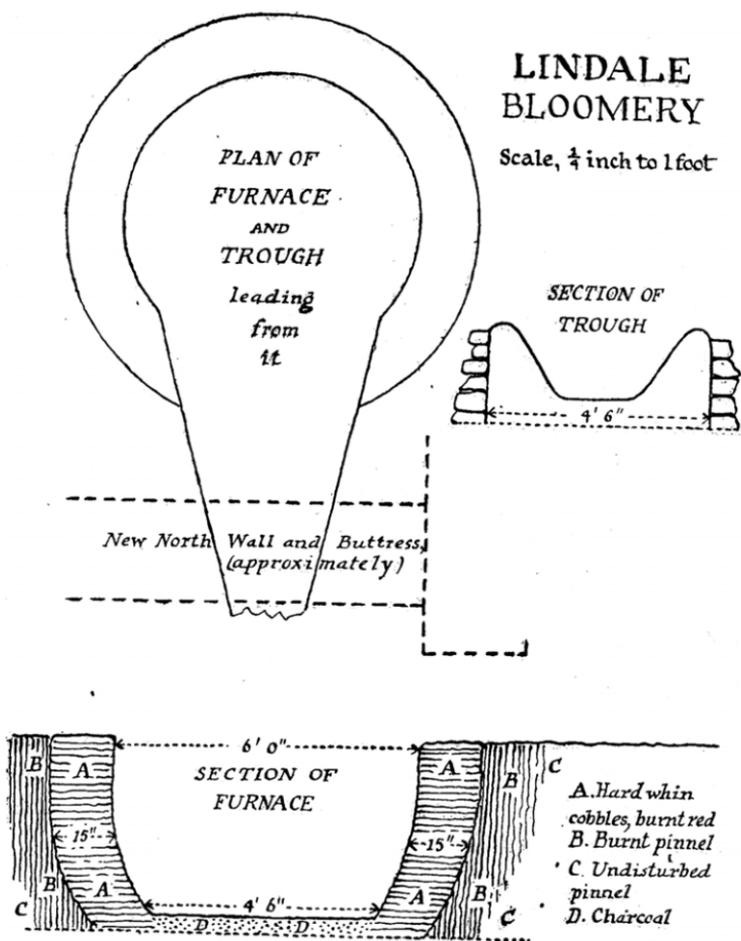
Large quantities of heavy black slag, or cinder, in large and small pieces, were met with in various places above the pinnel in the foundation trench, and at one place was a quantity of red clay having the appearance of oxide puddle. Having obtained an analysis of the slag I find it gives the following result:—

Ferrous Oxide (Fe O)	..	..	..	52.27 %
Ferric Oxide (Fe ₂ O ₃)	..	..	..	13.92 %
Silica (Si O ₂)	..	..	..	20.42 %
Lime (Ca O)	..	..	..	3.28 %
Magnesia (Mg O)	..	..	..	0.73 %
Combined Water (H ₂ O)	2.71 %
Carbonaceous Matter	2.30 %
Total Insol. Matter	23.80 %

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NOTE.—The Fe_2O_3 test contains the Fe_3O_4 , the sample being slightly magnetic.

The supposed oxide puddle yielded only 5.40 per cent. of Ferric Oxide, which equals about 3.7 per cent. of



metallic iron, so could not have been used for smelting, but was probably used for lining the interior of the furnace.

From the analysis of the slag it is evident that the

type of ore used was the richer and less refractory ore—the red oxide or Hæmatite of Furness. Had any other ore been employed, one would have expected some difference in the chemical analysis, as well as traces of impurities.

It will be of interest to compare the above with two analyses from other sources.

The first is an analysis of slag from Springs Bloomery, Coniston, and is taken from Mr. W. G. Collingwood's paper on "Ancient Ironworks of Coniston Lake."*

Silica	18.70 %
Ferrous Oxide	55.60 %
Ferric Oxide	25.50 %
Magnesia	00.18 %
	99.98 %

The above slag is of the sort common in early bloomeries and the analysis shows that it was a plain slag of the early type, which Mr. James Kerr said was identical with that of Rossendale.†

The second analysis is that of some heavy slag from a Roman smelting-hearth at Wilderspool, and is taken from *Warrington's Roman Remains*, 1904, by Thos. May, F.S.A.Scot., etc. (p. 23).

Ferrous Oxide	51.80 %
Ferric Oxide	6.73 %
Manganese .. .. .	.26 %
Alumina	5.20 %
Lime	3.00 %
Magnesia	1.17 %
Silica	28.07 %
Phosphoric Acid .. .. .	.43 %
Sulphuric Acid .. .. .	.19 %
Organic Matter and Water	1.70 %
	98.55 %

* Trans. Hist. Soc. Lanc. & Ches., vol. liii. (N.S., xvii.), 1902, p. 13.

† Collingwood, *op. cit.*, p. 13; see also Kerr, Trans. Hist. Soc. Lanc. & Ches., vol. xxiv. (N.S., vol. xii.), 1872, p. 66.

The large amount of alumina shows that it was made from clay ironstone.

It is most unfortunate that no pottery or anything to fix the date of Lindale bloomery has been met with in the excavations. This is the more to be regretted since so many bloomery sites are known in adjacent districts, but more definite information is wanted about their periods.

Compared with most of the early bloomeries of Furness Fells, especially those of Throng Moss, Torver Low Common, and Springs, near Coniston,* that at Lindale appears, from its construction, to belong to a more advanced, or, at any rate, a more permanent type; but this may be due to its better state of preservation, as so little is really known of the actual form and size of these early bloomeries.

As far as I can ascertain, there appears to be no record of iron-smelting being carried on in Lindale itself, though Stockdale in his *Annals of Cartmel* states that John Wilkinson, "the Great Ironmaster," along with his father, Isaac Wilkinson, either built or purchased a furnace or forge at Wilson House, near Lindale, about 1748, or perhaps a little later.

Their object appears to have been to utilize the large tracts of peat moss in the neighbourhood, in order to smelt without the aid of charcoal. Stockdale put the date of these operations about 1750, and believed the furnace was worked until 1756. The experiment, however, appears to have proved unsuccessful.

Fell† also refers to, and quotes Stockdale's references to Wilson House, but remarks that "the knowledge of this furnace or forge seems to be derived very largely, if not entirely, from tradition."

* See Trans. Hist. Soc. Lanc. & Ches., vol. liii. (n.s. xvii.), 1902, p. 12; Fell, *Early Iron Industry of Furness*, 1908, p. 169; etc.

† *Op. cit.*, 1908, p. 241.

That the newly-discovered bloomery antedates the first building of Lindale Church, might, I think, be reasonably inferred from its position, and, if such be the case, it places the date at some time previous to the early part of the seventeenth century, as the Registers of the Cartmel Parish Church* contain the following record under the head of Christenings :—" 1627, 15 Aug. Mary d. of Lawrence Newton Reader at Lindell Chappell."

Whether it was in existence earlier than this it is impossible for me to say, owing to the difficulty of obtaining access to reliable documentary evidence, and, consequently, the date of the Lindale bloomery must remain an open question.

* Lanc. Par. Reg. Soc., vol. 28, 1907. It is perhaps worth adding that Cartmel Registers give details of a family of Wright, of Backbarrow, Burnbarrow and Cartmel, Forgemen and Hammermen, one of whom is further described in 1610 as "Blowmer" (i.e. Bloomery-Smith).