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On: 11 February 2015, At: 11:13

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number:
1072954 Registered office: Mortimer House, 37-41 Mortimer Street,
London W1T 3JH, UK

Archaeological Journal

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/raij20>

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Published online: 16 Jul 2014.

To cite this article: H. S. Cowper F.S.A. (1898) Excavations at Springs Bloomery (Iron Smelting-Hearth) Near Coniston Hall, Lancashire, with Notes on the Probable Age of the Furness Bloomeries, *Archaeological Journal*, 55:1, 88-105, DOI:

[10.1080/00665983.1898.10852764](https://doi.org/10.1080/00665983.1898.10852764)

To link to this article: <http://dx.doi.org/10.1080/00665983.1898.10852764>

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EXCAVATIONS AT SPRINGS BLOOMERY (IRON SMELTING-HEARTH) NEAR CONISTON HALL, LANCASHIRE, WITH NOTES ON THE PROBABLE AGE OF THE FURNESS BLOOMERIES.

By H. S. COWPER, F.S.A.

Heaps of slag, the *debris* of old iron smelting operations, are very numerous in High Furness, and have for many years attracted the attention of the curious, including the Cumberland and Westmorland Antiquarian Society, which has on more than one occasion visited such sites. Nevertheless, no attempt has hitherto been made to obtain, by the use of the pick and shovel, any information as to date, or methods in use: both of which have in consequence remained obscure. With this object in view the large bloomery at the Springs near Coniston Hall was trenched and examined this year, under the superintendence of Mr. W. G. Collingwood and the present writer: and although the excavations lacked any sensational discoveries, it is thought that the results should be recorded. To this report of work are added notes of certain analogies, and a list of bloomeries known to the excavators is also given. This last could no doubt be supplemented.

I. *Previous Literature.*

In Vol. VIII of the *Transactions of the Cumberland and Westmorland Antiquarian and Archæological Society*, p. 85, is a paper by the Rev. T. Ellwood, rector of Torver, on the "Bloomeries of High Furness." This should be read before perusing the present paper.

II. *The Excavations.*¹

Work was commenced on May 12th with five men, and carried on on the 13th and 17th with two men. During the

¹ The excavators are indebted to Mr. S. H. le Fleming, of Rydal Hall, for permission to dig.

week ending May 29th also, several days were occupied by two men on the site, and the trenches thus formed are shown in the plan here given.

PLAN OF EXCAVATIONS AT A BLOOMERY NEAR CONISTON HALL.

It will be seen that the mound is of oval form, lying with its narrower end towards the west. There are five trees growing upon it, and the surface is fairly covered with turf. The trenches cut show, however, that the material of which the mound is composed is not homogeneous over its entire area, and that it varies somewhat in depth.

The exact measurements of such a mound are of but small importance, and it suffices to say that its entire length is 115 feet, and its central width 69 feet.

The trench A B passes through the deepest part of the mound, being in places about 4 feet deep. The northern half of it was cut through charcoal, with little or no slag; but on the southern side the trenching revealed slag only, loosely packed together, and very little bound with mould.

At 1 burned clay was found at the bottom, but there was no other evidence to show that there had ever been an actual hearth at this spot. The radial trench to C passed through slag, but nothing was found.

At 2, in a shorter radial trench, an undoubted hearth was found—a circular foundation of rough stones, about 7 feet in internal diameter, with a flooring of stones packed with clay. Although poorly preserved, there could be no doubt as to the original purpose of this structure.

The remaining trenches shewed a less depth of material—generally 1 to 3 feet. That ending at D passed through slag, but revealed nothing.

At 3, in mixed earth and slag, another hearth, the best preserved of all—was laid bare. It was a roughly-built circular foundation of stones, the external diameter of which was 6 to 7 feet, and within about 4 feet. On the north side there was an opening in the walling, and on the south-west an arrangement of large stones forming low radiating walls with apparently a pit between them. This arrangement, which we also found elsewhere (at 4), was probably to run off the molten metal, and should be compared with the Mashonaland hearth mentioned further on.

The only other discovery was at 4, where a very much-destroyed foundation 4 to 5 feet in diameter was laid bare. The segmental or radiating walls, with enclosed pit, were here on the east side. Mr. Collingwood thinks that this was another furnace like that at 3, but that, with No. 2, it had been disused, and the refuse over it came from later-used hearths. Throughout the diggings no relics which bore decisively on the question of age were found.¹

The site of this bloomery has been described by Mr. Ellwood and elsewhere, so we need only notice here that Hoathwaite Beck, which runs out to the lake, is about 50 yards from the mound. At the nearest point by the

¹ See Appendix.

beck-side is a small heap of slag and charcoal which could not be dug into, as a boundary wall crosses it; but between here and the bloomery the space is strewn with slag. We should note also that the beck does not run here in a gully or gorge.

During the excavations, however, visits were made to neighbouring bloomeries, and two other smelting-hearths were discovered in fair condition, uncovered by slag or rubbish. Both were close to the margin of the lake, of similar construction, with a diameter of about 9 feet, at about 3 feet from where the floor was estimated to be. The first is at Nappingtree, half a mile south of the excavated bloomery, and the other in Harrison Coppice, about two-thirds of a mile from the same place. In each case there is a small "syke" joining the lake at about the same distance from the hearths, as Hoathwaite Beck is from the Springs bloomery.

Bloomeries and Smelting Hearths.

As the construction of smelting-hearths in ancient times, or amongst semi-civilised races at the present day, may not perhaps be familiar to everyone, a few notes will now be given which will serve to explain the subject, affording as they do some clue to the methods adopted at our own local bloomeries; for the working of metal is one of the oldest of human industries, and it is only within quite modern times that new processes have completely replaced in civilised States those archaic appliances which were universal amongst both ancient civilised peoples and modern barbarous and semi-civilised communities.

Roman Bloomeries.

These have been to some extent examined in the Forest of Dean, and in the Forest of Anderida, in Sussex and Kent. A Roman bloomery is believed to have been a small walled building (probably circular in form) covered with clay, with holes left near the bottom to admit the wind, and to allow the metal to run out. They were usually placed upon sloping ground, and bellows for creating an artificial draught are supposed to have been sometimes used. In Sussex and the Forest of Dean, water

tanks have been found, but the exact method in which they were used does not seem to be known.¹ The Egyptians in smelting certainly used bellows for the operation, as depicted upon a tomb of Thothmes III., c. B.C. 1500,² and the Greeks seem to have been far advanced in iron manufacture, for a passage in Aristotle is thought to prove that they made "cast" as well as "wrought" iron.³ Cast-iron is, however, almost or quite unknown amongst collections of ancient objects.

Europe.

The richness of Spain as an ore-bearing country is well known, and iron has been for ages worked there. So much is this the case that a particular form of smelting-hearth—the "Catalan"—has received its name from the province of Catalonia, where, no doubt, it was first noted. It does not, however, follow that the type emanated in Catalonia, for it is widespread both in remote parts of Europe and elsewhere. It may well be a modification or possibly improvement on the Roman bloomery.

The Catalan hearth is described as a rectangular hearth in a permanent building without a chimney, but with a hole in the roof, and the smelting operations will give employment to about ten men. In charging the furnace, dry wood is first put in, then an 18-inch layer of charcoal, then alternate layers of charcoal and ore. As in Roman bloomeries, holes were left at or near the ground level, and into these were inserted earthen "tuyeres" or blast pipes, which were removable. Until about the seventeenth century, the blast was applied through these by hand-worked bellows; but it is now obtained by a downward suction of air in a falling column of water, and directed on to instead of through the incandescent mass.⁴

Writers differ somewhat in their descriptions of the Catalan hearth. Mr. Starkie Gardner says that six hours

¹ See Wright's *Celt, Roman, and Saxon*, 1861, p. 238.

² Burton, *Book of the Sword*, p. 119.

³ Starkie Gardner in South Kensington art handbook *Ironwork*, p. 13, quoting Dr. Percy. Mr. Gardner says that in Britain and Gaul exposed places were selected, and the holes were left upon the windward side.

⁴ For the ingenious method by which this water-power air blast was obtained see the diagram in Mr. W. Iveson MacAdam's "Notes on the Ancient Iron Industry of Scotland," printed in the *Proceedings of the Society of Antiquaries of Scotland*.

after the blast was turned on the iron is found separated, and manipulated until it coalesces into a lump, when it is levered out of the furnace ready for hammering.

Mr. Thomas Roper, however, who was formerly manager of some of the Furness charcoal smelting works, says that the furnace was kept going several days. On the second night some of the tubes or "tuyeres" were removed and the air allowed free access. On the third night the remaining tubes were extracted, but the metal was left for several days until all was cool. He estimates the result of the operation, occupying three days and nights, as one hundred-weight.¹

The Prussian Stückerfen or improved Catalan Hearth.

In this type a chimney or shaft is substituted for the simple air-hole, and the whole stands 10 to 16 feet in height. Agricola, the metallurgist, describes it in use in Prussia in the sixteenth century, and it was capable of producing both malleable and cast iron, the latter being run liquified from the furnace into moulds. The type, as we shall see, was not confined to Europe.

Asia.

In Asia and Africa very rude smelting hearths have been observed by travellers, though, wherever the industry is carried to any extent, the Catalan type is more or less followed. Charcoal is always used for the fuel, and where an artificial blast is attempted, tuyeres, and either rude bellows, force pumps, or palm-leaf fans.²

In India Dr. Percy enumerates three types:—1. Rude, like chimney pots: used by the hill tribes of Western India, the Deccan, and Carnatic. 2. Simple Catalan forge. 3. Early form of Stückerfen, both in use in Central India and the North-West provinces. The same

¹ Mr. Roper's description was given in a lecture in 1867, and is quoted in Tweddell and Richardson's *Furness, Past and Present*, Vol. II, p. 181. It is, however, not quite clear whether he meant his description to be that of a pure "Catalan" hearth, a similar African form, or a suggestion as to the

old Furness type. The text reads as if he meant the first. He describes, however, a circular clay tower ten feet high, three feet in diameter, bound with withe bands to keep it from cracking.

² *Iron Work*, p. 9; Burton, *Book of the Sword*, p. 117.

authority gives a detailed description of a hearth 2 to 4 feet in height set up against a rock, on three sides of which were two holes for blast pipes, while the fourth side had a hole for the removal of cinder. The charge was the same as the Catalan, and bellows were worked all the time. In this hearth the metal was only rendered malleable, and the smelters were itinerant, setting up their hearth where it was required, and where fuel was forthcoming.

Mr. Wright has quoted a description of a smelting-hearth in the Himmaleh mountains in Central Asia. In this case there was a clay chimney $4\frac{1}{2}$ feet high, 15 to 18 inches in diameter, erected on a stone stage over a fireplace. The metal was apparently liquified, for it flowed through an opening left below the stage: which could be plugged with clay or earth. The charge of charcoal and ore was inserted apparently into the mouth of the chimney, and for a blast two pair of goatskin bellows were in use.¹

Africa.

Burton mentions very rude South African hearths, consisting only of small clay furnaces 4 feet high and 1 or 2 feet wide: and he gives a most interesting illustration of one in use by the Maravé people north of the River Zambesi.² It appears to be of the improved Catalan type, with a chimney, and worked with three bellows. There are projections between the bellows which he does not explain. They may be additional plugged holes, if during a wind the natural blast is found sufficient.

Mungo Park found in Africa a similar clay tower to the Himmaleh mountains hearth, only it appears to have been more rude, as they trusted partly to the wind for a blast.

A small smelting furnace was noticed by the late Mr. Theodore Bent in Mashonaland.³ Unfortunately the author gives us no measurements; but it is very low in

¹ Wright, *The Celt, Roman, and Saxon*, p. 240n.

² Burton, *Book of the Sword*, p. 118. The writer notes that he borrows the illustration from *O Muata Cazembe*, a

publication or MS. of which he gives no further mention.

³ *Ruined Cities of Mashonaland*, 1896, p. 308.

comparison to its width, and is probably of rather small dimensions. Mr. Bent's description does not, unfortunately, go far. He tells us that it is "heated with charcoal and kindled by two men with four bellows, each worked by one hand." He describes the blowing process, and we infer from the text that the ore is rendered only malleable, not liquified. The mouth of the furnace is shewn in the figure very wide and the chimney very low, but we are not told how the furnace is charged. Neither is the object of the two radiating walls in front explained. Nevertheless, the Mashonaland forge seems to be a simple form of the improved Catalan type.

America.

The Peruvian silver smelting-hearths described by early Spanish writers are worth mention. They were built on eminences because the air was freest. No artificial blast was used, but holes were left on all sides, and operations only carried on in a wind. A peculiar feature was that ledges were left under each hole, on which were placed burning coals to heat the air.¹

Local History.

Having now glanced at the different sorts of smelting-hearths formerly, and still, in use, let us see what local history has to tell us about the Furness bloomeries. On this question we find a certain amount of evidence—not very definite, but still valuable—in the Abbey Coucher Book. What there is, however, points to the fact that the industry was of a valuable and important character in pre-Reformation times. It was no doubt one of the Lord Abbot's sources of revenue. The ore was mined in Low Furness, and then conveyed to the fells, because the plentiful supply of fuel made it worth while. Transport would be partly by pack-horse and partly by the waterways of Coniston and Windermere.

On this subject Mr. Atkinson has in his preface to the Chetham Society edition of the Coucher Book some interesting remarks.² He points out, however, that

¹ *The Celt, the Roman, and the Saxon*, p. 240n.

² Vol. XIV, p. xii. *et seq.*

in this book we get no information as to the extent to which the iron was worked by the Convent, what the fuel was, or where it was obtained; while from the Gisburne (Guisborough) Chartulary we learn that there no limit was placed to the use of timber and wood; and at Rievaulx that the monks might use deadwood only. At Gisburne, too, we learn from him that the furnaces (*astra*, *favercae*, *fabricae*, *forgiæ*) were built in groups of three, four, or more; and that water was a desideratum, if not a necessity; although how it was used is not exactly ascertained. In the Furness Charters, however, we hear of water privileges, the water being "*ad lavandum*," *i.e.* for washing the ore. The Convent also bestowed on their tenants yearly one ton of *livery* iron for repairing their ploughs and farm gear.¹

All this, however, does not take us very far, and we have to wait till Reformation days for more definite information. In the certificate of the revenues of the Abbey in 1537, it is stated that the King's Commissioners were able to lease sufficient wood in Furnessfells to maintain three bloomsmithies only to William Sandes and John Sawrey for £20, a considerable sum in those days. It appears that the lessees in this case took up the manufacture of iron with the intention of supplying the forged metal to the tenants of the Abbey manors, their needs in this respect having been satisfied, at any rate to some extent, direct from the Abbey prior to the dissolution. But this speculation—for a speculation it undoubtedly was—was not destined to be successful; for in the 7 Elizabeth (1564) the smithies were put an end to by a Royal decree, in consequence of the destruction to the woods, which were required by the flocks of High Furness. That there was much truth in this we need not doubt; but it is also probable that the tenants were naturally somewhat aggrieved at finding themselves compelled to buy from a private firm what up to that date they had probably received freely from their feudal lords in payment for their services. So long as the destruction of the woods entailed by the manufacture directly benefited the Abbey, and indirectly themselves, they had not

¹ Atkinson, *Furness Coucher Book*, also Beck, *Annales Furnesienses*, p. Chetham Society, Vol. XIV, p. xv.; 14.

grumbled, but they naturally found the case altered when the profits were passing into the pockets of private individuals.

The decree by which these bloomsmithies were abolished is, like the Commissioners' Certificate of 1537, useless for identifying the sites of the hearths. It is printed in full, as Appendix No. IX, in the first edition of West's *Furness*, and as it is extremely diffuse and technical it is unnecessary to give here more than the briefest abstract. We find first that the rent of the smithies to be abolished was to be made good to the Crown by the tenants of Hawkshead and Colton; and at the same time certain regulations concerning musters and fines were enacted; and because after the closing of the bloomsmithies the tenants "shall hardly come by iron, by reason that seldom any is brought from the partes beyond the seas, into any of the coasts near adjoining . . . and when any shall happen to be brought . . . yet the same cannot . . . be carried . . . because the ways . . . be so straight and dangerous, and do ly over such high mountains and stoney rocks, that no carriage of any weight can there pass"; it was further enacted that the tenants themselves were to be at liberty to make iron for themselves, using only the "shreadings, tops, lops, crops, underwood," but not the timber, "at or in any iron smithys, or other convenient place, at or upon *any water, stream, or beck.*" Hence arose the bloomsmithy rent, payable until recently by the tenants of High Furness, which, in some townships, is not yet extinguished. It was payable on the feasts of the Annunciation of the Virgin Mary, and St. Michael the Archangel—Lady Day and Michaelmas.

In the middle of the seventeenth century charcoal smelting furnaces were reintroduced into the district as private ventures, and wood for charcoal becoming valuable, the tenants enclosed portions of their woods to preserve them for this purpose. Ironworks were commenced at Force Forge by Captain William Rawlinson, of Rusland, who died in 1680, and soon after at Cunsey by Myles Sandys, of Graythwaite, the last being, we believe, on the site of one of the old ones abolished by the Elizabethan decree. The Backbarrow Furnace was founded in

1710,¹ and still works; that at Newlands, in Ulverston Parish, in 1747, and this was in use as late as 1880. The Lowwood Ironworks were, we believe, erected at about the same time as those at Backbarrow; at any rate they were in blast in 1766, at which date also were those at Low Nibthwaite. The Duddon Bridge Works, it is supposed, date from about 1745.²

There is very little history to be found about these bloomeries which are outside the Abbey Estates: yet probably a complete search would reveal numerous sites. William de Lancaster granted to the Canons of Conishead for their bloomeries all the dead wood in Blawith, and we know from the report of the Keswick German miners that a smelting hearth was in operation close to Coniston about 1650; and in 1674 we have the following entry from Sir Daniel Fleming's account book: "March 24, 1674-5. Given as earnest unto Charles Russell, hammer man, now at Conswick,³ to be hammer man at Coniston Forge, for 35s. per tun, to have grease for the bellows, and leave for some sheep to go on the fell, £00 05s. 00d." This forge, which still bears the name, was in use in 1750; but of the numerous sites on the lake margin we have no sort of record, and it remains to consider if anything in the excavations justify any inferences as to date and origin.

Summary of Evidence.

Upon the bloomery excavated, and also upon another within the old park of Coniston Hall, there are a few well-grown oak and timber trees; and it has been argued that this is a proof that these bloomeries existed long anterior to the formation of the deer park. But these trees on the excavated bloomery are, in the opinion of competent judges, not over fifty years of age, and it is doubtful if any within the park exceed a hundred years. Therefore they are quite useless for fixing a date to these hearths,

¹ The Backbarrow Works were probably on the site of an older bloomery. The furnace has just been under repairs and alterations; but part of the original hearth remains, and over it an iron plate inscribed "T.M.W.R.S.C. 1711 * H.A. & Co. 1870."

² Mr. Roper says 1747, but they are shewn in West's Map, which is dated 1745.

³ A clerical error for "Consey," as the Parish Register shews.

for in the absence of all local tradition we may feel quite certain they have not been in work during the past century.

The absolute lack of any certain relics is unfortunate; but we are hardly justified from this in concluding that the bloomeries were worked by poor and savage tribes, who would have few manufactured objects. Iron smelting did not necessitate the use of fictile vessels as some industries did, nor can we expect rubbish heaps such as accumulate near inhabited sites. The furnace master who smelted, and the forge master or smith became in England distinct callings.¹ Furnaces and forges were, however, often together; and we shall shew that there is reason to believe that this was the case at many, if not all, of our local bloomeries.

Though the bloomery is turfed over, and soil has penetrated the slag for 12 to 18 inches, the loose condition of the material generally seems to argue against a high antiquity.² But it is very singular that there is absolutely no known record of the use of these sites. Mr. S. le Fleming believes that amongst his numerous documents relating to the manor there is no reference to iron smelting; and it must be allowed that when the Flemings lived at the Hall, they would hardly approve of smelting operations of any extent in their park. The size and shape of the hearths seem to shew that they were rude simple erections, in no way superior to those described as in use till recently by semi-barbarous races; and as the foundations are only a course or two high, and but few stones of size were found near them, it may be concluded that they were not lofty erections with tall chimneys. The fact that several hearths were found in the same bloomery indicates probably that as work went on it was easier to build new hearths, utilising as far as possible the material of the old ones, than to clear the *debris* and rubbish from the site. Possibly it may also mean that to extract the bloom it was necessary to partly destroy the hearth.

The next questions that arise are, how the blast was

¹ Starkie Gardner, *Iron Work*, p. 11.

² Though such a matter is difficult to judge, the writer, if suddenly confronted with a section of the bloomery, having

had no previous knowledge of the subject, would certainly have said that in his opinion it had been made within at least the last 300 years.

obtained, and for what reason the smelting was performed in the vicinity of a running stream?

In the case of the bloomery examined, the stream could hardly have been intended for washing only, because the lake is close at hand; though it is possible that running water would be more effective. Yet we can hardly suppose that, as the ore had to be carried all the way from Low Furness, this would have been done without first cleansing it to lighten weight, and lessen bulk. It has occurred to us, indeed, that a small waterwheel may have been erected near the bloomery to press the bellows, and a little millrace carried from the stream for power. The fact that there is no trace of an embanked race proves nothing, because it might be contrived of wooden troughs carried a short distance on trestles.¹

There are, however, in the opinion of the writer, objections to this explanation. At Farra Grain Bridge, near Satterthwaite, the slag heap of a bloomery is of large dimensions, and placed on the summit of a steep knoll above the stream. The smelting was of course on the summit of this knoll; and though a millrace could be brought from a considerable distance up stream, it is almost certain that if the water was thus utilised the smelting-hearth would have been placed close down by the water-side.

Exactly the same thing is found at a bloomery at Tarn Gill; and the distance between the hearths at Springs bloomery and the beck side adds to the objection.

In fact, from the small size of the hearths and their rude construction, we would rather believe that hand-bellows or natural air blasts were in use; so that if the streams were used neither for washing nor blast, what was their purpose?

The conclusion seems to the writer almost inevitable, that in all these smaller bloomeries there was a small smithy at hand for working up the metal on the spot. This would account for the necessity for running water; for the manufacturers would be saved the labour of

¹ Charcoal hearths, as used last century, had a millrace and waterwheel. Traces of one can be seen at Cunsey, and such is the system at Backbarrow, the only charcoal hearth in use. The ob-

jections noticed above apply equally to the supposition that the draught was obtained by a falling column of water such as was in use in some Catalan forges.

carrying their blooms to distant centres. This system was undoubtedly the one in use in the larger works of known date, the sites of which are still universally called "forges."

Though there is therefore no evidence to put an actual date to the Coniston Hall bloomery, and still less to the numerous other slag heaps in the district, the result of these excavations tends to place them at a more recent epoch than has sometimes been suggested. We have seen that by the Elizabethan decree the tenants of the Abbey were left at liberty to make iron for their own use; and the writer inclines to think that these rude smelting-hearths are in most cases the sites of the operations thus carried on by the inhabitants of the fell districts since that period.¹ Some of course may be earlier; but the Commissioners' Certificate of 1537 states that the Convent had had a smithy, or sometimes two or three, so that probably these pre-Reformation bloomeries were on a considerable scale, as so few were in operation. It is probable that they were on the Crake and Leven, where fuel was plentiful and water power excellent; and possibly at Cunsey, where the Sandys family erected their bloomery in later times. The extreme rudeness of the methods adopted must not be taken as evidence of early date. It should be remembered that in 1564, the fell-side farmers had to turn to an industry of which they had hitherto had no experience. In the seventeenth century the reintroduction of commercial smelting put an end to these local hearths, which would soon be forgotten. So far we have not one tittle of evidence that any hearths in the fells of Lancashire date from Roman or pre-Norman times; and we cannot refrain from expressing a doubt if such evidence will ever be forthcoming.

APPENDIX.

Mr. W. G. COLLINGWOOD, M.A., who with the writer conducted the excavations, went to Iceland immediately after their conclusion, and the foregoing paper was written in

¹ This appears also to be the opinion of Mr. MacAdam in the paper before referred to.

his absence. As he differs materially with the writer in his conclusions as to the age of this bloomery, these, and the reasons for them, are here recorded.

Mr. Collingwood would relegate this bloomery to an earlier date than has been suggested above, because the deer park would not be made before the fifteenth century, and was in use until the end of the seventeenth century. He does not think it likely such an industry would be permitted at that time, and he believes that a later date is even more unlikely, as the great furnaces were then established. From this evidence he would accordingly date the bloomery before the fifteenth century. He points out that Mr. J. C. Atkinson has, in his preface to the Furness Coucher Book, estimated that Furness Abbey had forty furnaces at work,¹ and, although out of the Abbey lands, Mr. Collingwood thinks that this site may have been a hearth of the same sort. Such a date (*i.e.* prior to the fifteenth century) he considers would explain, or account for, the lack of evidence or tradition of its use.

During Mr. Collingwood's journey in Iceland he noted similar heaps of iron slag, and on this question he sends me this interesting note :—

“ Though the exact construction of the Viking Bloomery is not known, the early Icelanders were great ‘smiths,’ and smelted ore with charcoal. Many notices of their work are given in the Sagas referring to the tenth and eleventh centuries, and at one site, Ljárskogr in Hvammsfjord, specimens of slag were found identified by tradition with the work of a well known historical character who lived in the tenth century. If, as is believed, our district was settled by members of the same race, which at the same period colonized Iceland, there is no reason to doubt that they might have carried on the art of iron smelting in this country.

No remains have been found, however, to support this view, nor anything to disprove it.”

¹ We have pointed out above that in 1537 the Commissioners reported that the Abbey had had a smithy, or sometimes two or three, in Furness Fells;

and if anything like Mr. Atkinson's estimate ever existed many must have been in portions of the Abbey possessions outside the fells.—H.S.C.

*Note on the character of the Slag, Clay, etc., found :
by W. G. Collingwood.*

Ironstone.—A very few bits of hematite.

Slag.—Mostly black and heavy ; some red ; some light black dross ; and a few pieces of the purple dross—light like Pumice—found also at recent excavations at Peel Island. This last seems, from an analysis made by Mr. T. Barlow Massicks, to be dross from the flux used in smelting. At the western end of the mound a few pieces resembling copper slag were found.

Clay.—The stones of the furnaces were packed with blue clay, but the inside was lined with a reddish-yellow clay, of which much was also found in broken pieces with charcoal mixed in it, and trodden into the floor round the furnaces. Sometimes slag and baked clay adhere together, showing that the furnace was broken after smelting. This clay was dug in Waterpark Field close by, which adds to the argument that the bloomery was used before the park was formed.

Iron.—Two bolt-heads about an inch across were found, and were similar to many found at Peel Island. Also a bolt or nail with metallic iron core in the middle of the mass of rust, like those of Peel Island. This suggests a contemporary date for the Island remains and the bloomeries, *i.e.* early mediæval.¹

List of Charcoal Smelting-hearths in High Furness and neighbourhood.

Ancient Chapelry of Hawkshead.

						Ordnance 6-inch maps
Backbarrow*	...	...	...	...	...	12 N.W.
Beck Leven, W. side of Coniston Lake	...	...	...	...	...	4 S.E.
Blelham Tarn	...	...	...	...	...	2 S.W.
Colthouse Heights	...	...	...	...	...	5 N.W.
Cunsey Forge*	...	...	...	...	...	5 S.E.
Cunsey Mill*	...	...	...	...	...	5 S.E.
Elinghearth	...	...	...	...	...	8 S.W.

¹ The Peel Island is a small rocky islet once inhabited, and recently excavated by Mr. Collingwood. Many rusty nails and pieces of iron were found, but the only articles to which

any date could be put were fragments of earthenware considered by competent judges to be thirteenth century, or at any rate early mediæval.—H.S.C.

Ordinance 6-inch maps.

Finsthwaite "Cinder Hill," near Finsthwaite House	8 S.W.
Force Forge*	8 N.W.
Nibthwaite (Low Nibthwaite Forge)* ...	7 S.E.
Penny Bridge Furnace ?	11 N.E.
Rusland, near Bethacar Moor (? Ashslack)	7 S.E. or 8 N.W.
Rusland and Grathwaite (between) "Cinder Hill"	8 N.W.
Rusland near, "Cinder Hill"	8 N.W.
Rusland, $\frac{3}{4}$ mile S.E. between Birch Parrock and Walker Parrock	8 S.W.
Satterthwaite ("Cinder Hill," Farragrain Bridge)	5 S.W.
Satterthwaite, Low Dale Park	8 N.W.
Stott Park near, "Smithy Haw" wood ? ...	8 S.E.
Tarn Gill, Tarn Hows, Monk Coniston ...	2 S.W.
Yewdale, near the Limekiln, Low Yewdale ? ..	1 S.E.

Lancashire Fells outside the Chapelry of Hawkshead.

Coniston, The Forge*	4 N.E.
Coniston Lake, below Fir Island	4 S.E.
Coniston Lake, The Springs Deer Park, Coniston Hall	4 N.E.
Coniston Lake, Water Park, Coniston Hall ...	4 N.E.
Coniston Lake, Harrison Coppice	4 S.E.
Coniston Lake near, Stable Harvey	7 N.E.
Coniston Lake, Moorgill	4 S.E.
Dunnerdale, Cinderstone beck, near Stonestar	6 N.E.
Spark Bridge*	11 N.E.

Ancient Parish of Ulverston.

Newland in Egton*	11 S.E.
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Ancient Parish of Cartmel.

Lowwood, River Leven*	12 N.W.
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Westmorland on confines of Hawkshead Chapelry.

Colwith forge*	25 S.E.
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Cumberland on confines of Lancashire.

Duddon Bridge, the Forge*	88 E.
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Of those starred there is historical record of smelting operations. Backbarrow turned out about 260 tons of bar-iron in 1750, and 769 of cast-iron in 1796 (J. D. Kendall, *Iron ores of Great Britain*).¹ At Cunsey Forge and Cunsey Mill there are separate heaps of slag: at the former a charcoal store barn, remains of a mill-race, and, it is said, circular hearths. Mr. Collingwood

¹ And in 1738 only 16 tons of pig-iron. See Mr. MacAdam's paper already referred to.

says the landing-place on the Lake (Windermere) for these two was at Hammerhole, close to Holme Well. Eling hearth is doubtful; but West, in his *Antiquities of Furness* (1st Ed., Appendix No. IX), says: "Eling" signifies "wood ashes." Spark Bridge Furnace turned out 120 tons in 1750; and Newland, in 1796, was making 700 tons of cast-iron. Mr. Collingwood says that the ore for Coniston Forge was landed at Robin Wray, near the present gondola (steamer) station, and for Tarn Gill (or Tom Gili) at the head of the lake near Mr. Marshall's boathouse; which accounts for occasional pieces of slag and ore at each place. Colwith Forge is mentioned by the Rev. T. Robinson in 1709 in his *Natural History of Cumberland*. Duddon Bridge Furnace was in existence about 1745, and was worked till about 1866 (T. Barlow Massicks in *Transactions Cumberland and Westmorland Antiquarian and Archæological Society*, XIV, p. 448). Coniston Forge in 1750 was turning out 80 tons of bar iron in the year.