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BALE HILLS IN SWALEDALE AND ARKENGARTHDALE

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INTRODUCTION

In the lead mining fields of the Northern Yorkshire Dales, there is abundant evidence of man's endeavour of an early period. Trial levels, shallow shafts, small hushes on the less steep hillsides, together with later horse levels, deep shafts and numerous mills and dressing floors, give a picture of an industry which has employed Dalesmen for 800 years. Included amongst these features, but harder to find, are numerous bale hills and several elling hearths. The latter were kilns constructed to supply a fuel known as "chopwood"[1], for smelting lead in early ore hearths. Bale hills were primitive hearths used for smelting lead ore. A slight hollow, three to four feet in diameter was dug into the hillside and lined with clay, with a stone wall built around the bale with appropriate vents to catch the prevailing wind.[2] The origin of the name bale, variously described as bail, bayle, beale and bale is rather obscure, but is probably derived from the Norse word "bal" meaning bonfire. In Derbyshire, these early smelting furnaces were normally termed "boles".

There is very little documentary evidence which refers to the existence of bale hills in the area. The sixteenth century historian Leland, visited Swaledale and he noted that "The woode that they brenne their leade is brought owte of the parte of the shire, and owt of Dirhamshire". It is, however, doubtful if Leland went further up the valley than Grinton and therefore he would not necessarily be in a position to assess the amount of timber still available for smelting ore in the Upper Dales.

Although bale hills in Swaledale and Arkengarthdale are usually situated on a west or south-westerly facing hillside there are exceptions, notably those found on Grinton and Harkerside. However, these are sited in such a way - usually on a small mound - that they will catch the prevailing wind.

Ordnance Survey maps sometimes give a clue to sites, for example "Windy Beale" on Winterings Edge and Beldow Hill on Harkerside have bale hills nearby. The Beldi Hill group of mines near Keld may also have derived its name from the site of bale hills. Further evidence for the existence of sites is the use of local terms such as "smeltings" and "belland ground". Belland ground is an area which produces very little herbage and is often the cause of lead poisoning in grazing animals.

The period over which bale hills operated in the area is not easy to assess with accuracy and what is even more difficult to establish is when bales were last used. Lead is known to have been mined and smelted in Norman times, if not earlier. The earliest recorded smelt mills were in Marske and Marrick and date from 1588 and 1592.[3] However, mining was certainly being carried out on Grinton Moor and Arkengarthdale in medieval times.[4] Whilst it is not possible to say with any degree of certainty that the Old Gang Mines were operating at this time it seems certain that they were being worked in the sixteenth century. In a letter of Philip Lord Wharton in 1685,[5] John Renshaw states how Adam Barker, a partner in the mines, was working under- [49]

ground at Merryfield[6] at eleven fathoms and came across the "oulde man" but was unable to say how extensive these earlier workings were. If lead mining was a continuous operation, the oldest miners would certainly have known of the existence of these earlier workings. In addition the foundation of five houses, (one of which is Level House) dating from the mid seventeenth century, were erected on the beck-side in the middle of the deep and laterally extensive North Rake Hush; these facts would place mining activity in the area at least to the beginning of the seventeenth century and probably much earlier. The first recorded mill at Old Gang dates from 1669 so lead must have been smelted by bale hill up to this time. It would seem probable that bale hills and smelt mills would be used simultaneously and, in the remoter areas, bale hill smelting almost certainly continued at least well into the late seventeenth century.

The Bales

In an examination of 35 sites only a little evidence of stonework was visible, therefore no attempt has been made to describe the construction of a bale in detail. Dr Raistrick gives an excellent description of one situated in Gunnerside Gill which he studied in 1919.

Nearly all the sites have been discovered because of the presence of slag or of charred wood. Many of them have come to light through reports from local people engaged in field studies.

A physical examination of the slag from sites of different ages showed that the quality of the smelt was extremely variable. This itself suggested that the earlier the bale, the poorer the smelt and this theory has been borne out by a slag analysis by Dr C.B. Thomas and his staff at the Department of Chemistry of the University of York. It should be pointed out however that students using the "hand-weighing technique'" should treat it with caution since the ability of the ore dressers varied considerably and therefore much slag contained other minerals such as barytes and calcite.

Three samples of slag collected from two bale hill sites and one smelt mill site, were analysed. The samples were carefully selected from different depths so as to give information in order to cover the longest possible period during which the smelting sites were in use.

The first and poorest smelt, had slag containing 24.9% lead. This came from one of the Calva sites, i.e. Number 23. The bale hill is situated in a small mining field around Calva Hill. Dr D.L. Smith of the Botany Department of the University of Belfast, took samples of charred wood, from about one foot underground, originally for identification. These samples have since been radio carbon dated at about 1590. There is no known documentation for this field, – the mine shafts are well grassed over – and the slag heap is fairly extensive indicating a large bale. The carbon dating although early, may well be from a later phase of the bale's period of use.

The second sample was taken from bale hills Nos. 4 and 5 and contained 12.4% lead. Grinton Smeltings is probably of a later date than the Calva bale [50] and contained

a considerable amount of black vitreous slag, indicating that a more sophisticated method of smelting was used. Dr Raistrick states that foot bellows were used in Derbyshire and in Weardale, in County Durham as early as the fifteenth century. It is therefore possible that these were also employed in Swaledale in the seventeenth century. A glance of the list of sites will show that a few other bales, mainly in Arkengarthdale, also contained a percentage of black slag.

The third sample was taken from the Scotts smelt mill site near Grove Beck on Grinton Moor, and contained 3.29% lead. Evidence from other sources indicate that this was a slightly better than average smelt. This mill has been selected for two reasons. The first is that there are good samples of grey slag from conventional ore hearths and also considerable quantities of black slag from a subsequently installed slag hearth. The second reason is that the mill operated over a period in which smelting techniques in Swaledale were considered to have markedly improved. The sample from this site was a mixture (approximately equal parts in volume) of grey and black slag.

Dr Tylecote discusses the various aspects of early smelting techniques in some detail, in his paper on Lead Smelting and refining.[10]

The chief fuels for smelting lead in bale hills were branchwood and peat. Peat is of course plentiful in most mining fields and would therefore be accessible for many of the bales. However where peat was scarce and bale hills were some distance from the fell tops, branchwood was utilised. This was carried from the lower slopes of the valley where the native trees would have a favourable climate in which to regenerate. Only one of the sites studied used coal as fuel, although coal was found on one or two places where there was no evidence of slag.

Evidence of burned wood was found on several sites and Dr Smith's work on samples from the Calva bale showed that oak, ash, birch and probably rowan were used. Some of the ash was an anomalous type and Dr Smith thinks this may have been due to coppicing.

Certainly the rapid growing ash would prove ideal for providing a constant supply of fuel. Two other samples of un burned branchwood were found at bale no. 17 that of Mount Pleasant; these were identified by Mr G.F. Stevenson, the head forester of the Bolton Estate, as elder and oak. It would seem therefore, that almost any type of locally grown timber was used in bale hill smelting. All the samples were between two and three inches in diameter indicating that comparatively young trees were harvested.

Bale hill and early ore hearth smelting must inevitably have taken its toll on the woodlands of both valleys. In 1802, Richard and Francis Garth obviously saw the need to replace timber in upper Swaledale when they bought about 11,000 ash and 5,000 elm trees, many of which were planted in the area between Low Row and Keld. This process of replanting was continued by Richard Garth until about 1820.[11]

Bale hills were carefully sited and the majority were built on flat areas [51] of sloping hillsides. The flat area would serve to store bouse, fuel and, hopefully, pig

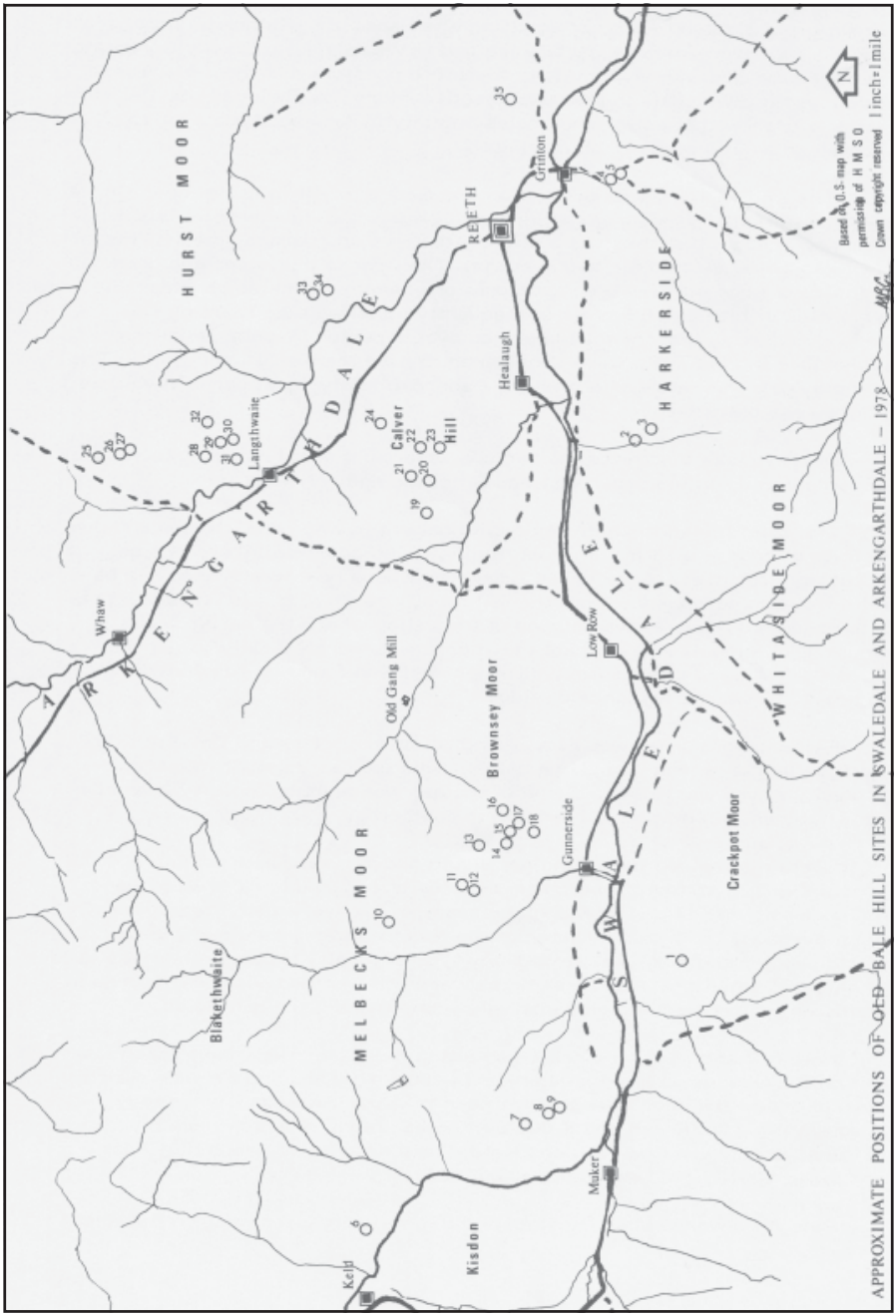
lead. The slag normally fell from the edge of the level area down the hillside, thus saving the smelter the extra task of carting it away.

No special system was employed during the search for sites, one or two, such as Grinton Smeltings, had been documented from an early period and these examples were used as guidelines for further finds.

Of the following list of 35 sites about 15 proved difficult to find. This was due to the gradual recovery of the vegetation and in some cases to the rather scanty amounts of slag.[12] However, there remain several which are comparatively easy to locate. The bales are listed working from west to east or north to south down the valley sides.

List of Bale Hill Sites

1. Satron Side SO 938968 Grey slag, traces of walling.
2. Harkerside, Blue Hill SE 010975 Grey Slag, charred wood, stones.
3. Harkerside, Shooting Box SE 011973 Grey slag, lead traces.
4. Grinton Smeltings SE 047976 Grey and black slag.
5. Grinton Smeltings SE 046977 Grey and black slag.
6. Muker, Beldi Hill NY 902011 Probable site.
7. Iveletside, Beale Hill SO 916989 Charred wood.
8. Iveletside, Kisdon Scar SO 917986 Grey slag, charred wood, poor smelt.
9. Iveletside, Kisdon Scar SO 918985 Grey slag.
10. Windy Beale (Quarry) NY 944008 Grey slag.
11. Winterings Edge SD 949998 Grey slag, grass covered circular depressions. possible bales.
12. Winterings Edge SD 948998 Grey and black slag.
13. Winterings High Scar SO 954996 Five sites with grey slag, four on lip of scar.
14. Potting Scar SO 954992 Grey slag.
15. Winterings Gill SO 956992 Grey slag, charred wood.
16. Kinning SO 958992 Grey slag.
17. Mount Pleasant (Quarry) SO 957991 Grey slag, branchwood ,stones.
18. Mount Pleasant SO 956989 Grey slag.
19. Reeth Low Moor Limekiln NZ 000003 Grey slag.
20. Reeth Low Moor Cleasby NZ 004003 Grey slag.
21. Reeth Low Moor Hill End NZ 005004 Grey slag.
22. Reeth Low Moor Calva Hill NZ 009004 Grey slag.
23. Reeth Low Moor Calva Hill NZ 009002 Grey slag, charred wood, large site.
24. Reeth Low Moor Calva Hill Quarry NZ 013009 Grey slag, charred wood.
25. Arkengarthdale, Windegg NZ 007048 Grey slag.
26. Arkengarthdale, Windegg NZ 008045 Grey slag.
27. Arkengarthdale, Windegg NZ 009044 Grey slag.
23. Arkengarthdale Langthwaite Scar NZ 008033 Grey slag.
29. Arkengarthdale Langthwaite Scar NZ 009031 Grey slag.
30. Arkengarthdale Langthwaite Scar NZ 010029 Grey and black slag.
31. Arkengarthdale Langthwaite Scar NZ 008028 Grey and black slag.
32. Arkengarthdale Tanner Rake Hush NZ 013033 Grey and black slag, coal.


HURST MOOR
ARKENGARTHDALE
REETH
Grinton
Healaugh
HARKERSIDE
Whaw
Langthwaite
Calver Hill
Low Row
SWALEDALE
WHITASIDE MOOR
Old Gang Mill
Brownsey Moor
Gunnerside
MELBECKS MOOR
Blakethwaite
Crackpot Moor
Kisdon
Muker
Keld
Based on O.S. map with permission of H M S O
Crown copyright reserved
1 inch=1 mile
APPROXIMATE POSITIONS OF OLD LEAD MINE SITES IN SWALEDALE AND ARKENGARTHDALE – 1978

33. Fremington Edge, Heggs Pasture NZ 030018 Grey slag and charred wood.
34. Fremington Edge, Heggs Pasture NZ 031016 Grey slag and charred wood.
36. Fremington West Hagg SE 068991 Grey slag.

In conclusion it should be said that this article is not intended as a comprehensive study of bale hills in the area, nor is it considered that the list of sites is in any way complete. However, it is hoped that this paper, together with the information provided by Dr Thomas, Dr Smith and Dr Raistrick will have produced a basis for further study.

References.

1. Chopwood was barked green branches of 2" to 3" in diameter, the sap of which was dried out in the elling hearth. The hearths are usually slightly oval with a draught opening to the west and are approximately 6' deep in the centre having a maximum diameter of between 10' and 16'. They were built of sandstone and have a concave base. They are usually sited in the woods at the bottom of valleys and will provide a useful subject for the mining student.
2. The Lead Industry of Wensleydale and Swaledale, Vol.1, The Mines, A. Raistrick.
3. The Lead Industry of Wensleydale and Swaledale Vol.11, The Mills, A. Raistrick.
4. A History of Lead Mining in the Pennines, Raistrick, A., Jennings, B., 1966.
6. Swale Papers. North Yorkshire County Records Office.
6. Merryfields is an area in which two important veins namely “Old Rake” and “North Rake” were mined.
7. During the sixteenth and seventeenth centuries legal documents of the area used the term “oldest miners” or “inhabitants” to mean a period of at least 60 years.
8. The Lead Industry of Wensleydale and Swaledale, Vol.1, The Mines, A. Raistrick .
9. BARKER MSS Adam Barker’s diary of 1864. Letters relating to smelt mill productivity from the late eighteenth century.
10. Lead Smelting and Refining in the Industrial Revolution 1700 - 1860, R.F. Tylecote, University of Newcastle-upon-Tyne.
11. BARKER MSS Garth Diaries.
12. Three of these on Windegg, in Arkengarthdale, are near to good tracks and it is possible that much of the slag was taken to be resmelted in one of the nearby mills.

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