

**Marfield Quarry
Masham
North Yorkshire**

Archaeological Excavation
Area 12
Kiln Excavation

January 1996
MAP Archaeological Consultancy LTD.
(Site 96.1)

Marfield Quarry - Masham
Archaeological Evaluation
Area 12
Kiln Excavation

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Marfield Quarry - Masham

Archaeological Evaluation

Area 12

Kiln Excavation

Introduction

The area of the proposed extension to Marfield Quarry known as Area 12 is comprised of a hedge bounded field located to the north-west of the existing quarry, immediately east of the A6108 road which forms the fields western boundary (SE 2085 8290 : Figs. 1 and 2).

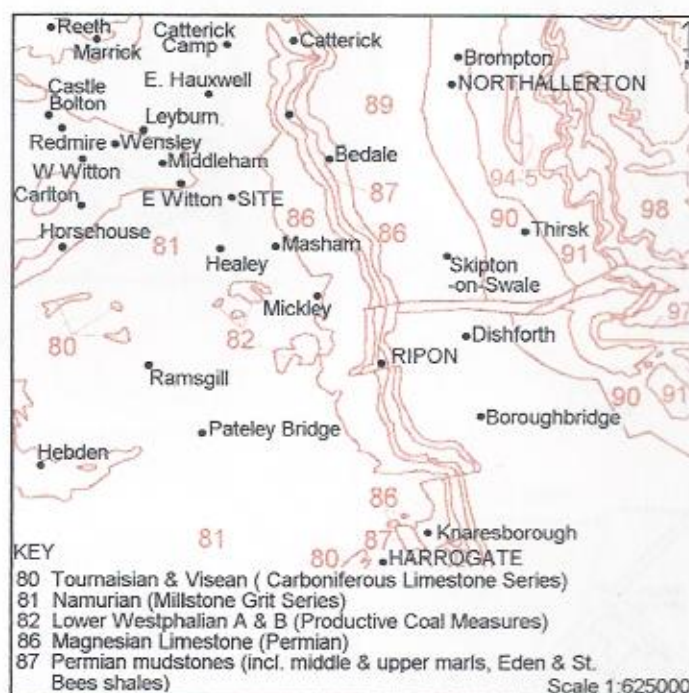


Figure 1.

The field is gently undulating, rising to the east and with a pronounced dip to the north-west corner. The solid geology of the area is Magnesian Limestone Permian and Permian mudstones including middle and upper marls, Eden and St. Bees shales with outcrops of carboniferous limestone and Lower Westphalian - coal Measures (Fig. 1). The soils at the site are brown earths of the East Keswick Association formed over a parent of drift derived from Palaeozoic and Mesozoic sandstones and shales.

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Previous Archaeological Work

As part of a pre-planning evaluation of the areas within the proposed Marfield Quarry extension, Area 12 had previously been assessed by

- a. Desktop Evaluation
- b. Fieldwalking

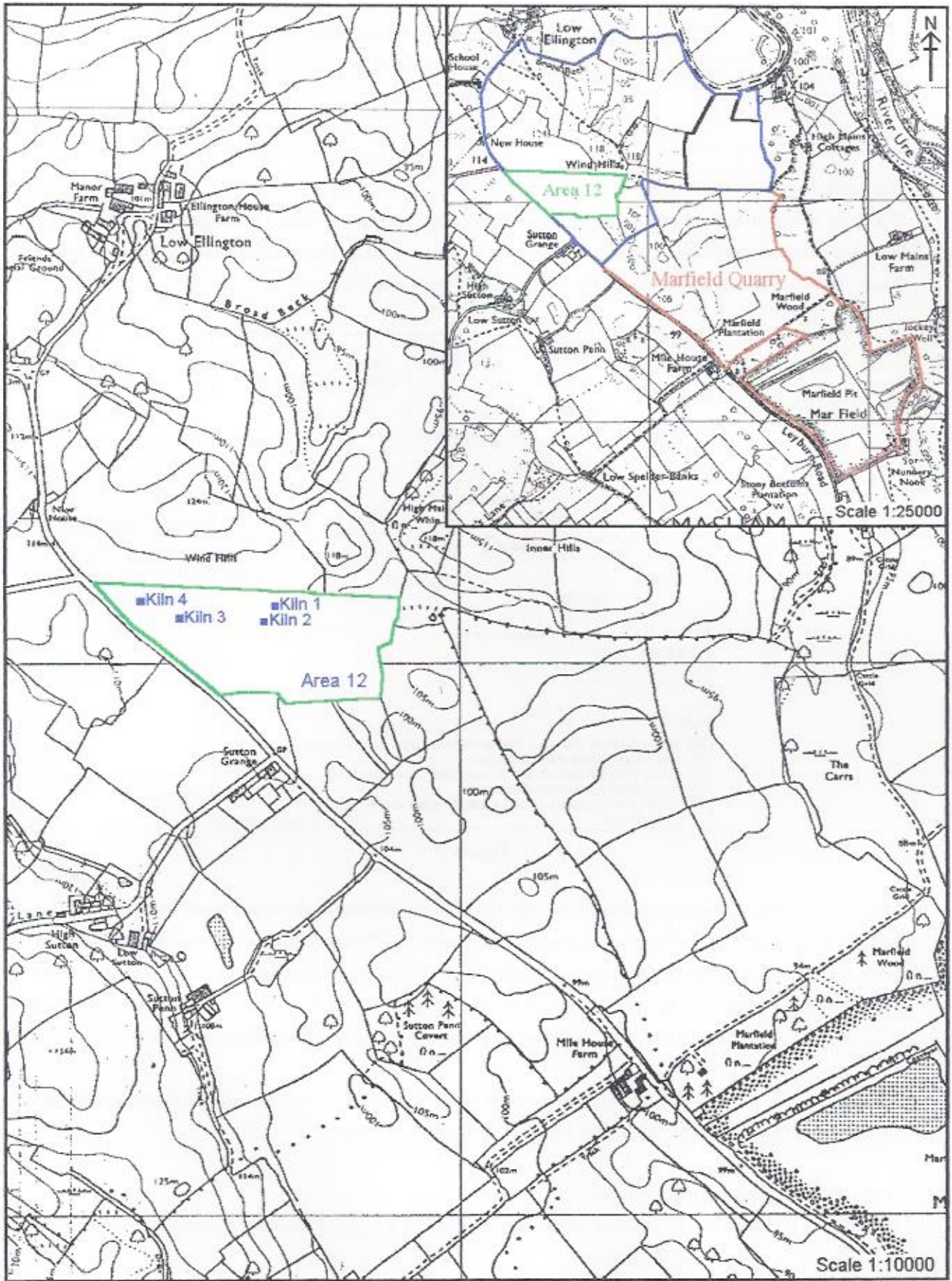


Figure 2.
Location of Area 12 and Kilns 1-4.

- c. Geophysical Survey
- d. Sample Excavation

a. Desktop Survey

The desktop survey had uncovered a number of historical references to the lost village of Swarthorpe; a vill recorded in the Domesday Survey of 1086, but not mentioned in the documentary sources since the late 12th century. Certain of the sources examined suggested that the site of Swarthorpe lay within Area 12, others that it may exist further to the north. Fieldwork subsequent to the desktop survey suggests that Swarthorpe is unlikely to lay within Area 12.

b. Fieldwalking

Intensive fieldwalking of Area 12 produced a varied collection of artefacts comprised of a small flint assemblage, pottery of medieval, post medieval and modern date, brick and tile, post medieval and modern glass, modern ironwork and animal bone. There were no indications in terms of quantity and concentrations of medieval pottery, stone and other artefacts to suggest the presence of Swarthorpe vill, indeed the general distribution of material, particularly that of post-medieval and modern date is characteristic of distribution be manuring, with little clustering apparent.

c. Geophysical Survey

A geophysical survey of Area 12 was carried out by Geophysical surveys of Bradford, using a fluxgate gradiometer. The survey revealed a number of anomalies, the most substantial of which were considered likely to be indicative of kiln type structures. Lesser anomalies suggested the possibilities of a series of linear features. No evidence was found to suggest the presence of the vill of Swarthorpe.

d. Sample Excavation

During December 1995, a series of nine archaeological evaluation trenches were excavated in Area 12. All topsoil from each trench was mechanically removed and the underlying upper surface of the exposed drift was cleaned by hand. Trenches 5, 6, 7, 8 and 9 were located to cut across certain of the suspected linear anomalies located by the geophysical survey. Trenches 1, 2, 3 and 4 were located so as to coincide with these anomalies whose high reading suggested possible kilns.

In all cases, the trenches across the linear features when examined proved that the anomalies were related merely to variations in the drift geology, probably being the result of the peri-glacial processes, and not of archaeological origin. Trenches 1, 2, 3, and 4 were proved to contain kiln type structures, all sealed beneath the topsoil.

Kiln Excavation

Excavation Methods

During January 1996 four kilns were excavated within Area 12 (site code MAP 96.1) The topsoil was removed above the kilns by mechanical excavator with a toothless bucket, with hand excavation thereafter. Kilns 1 and 3 were only half sectioned whereas Kilns 2 and 4 were fully excavated. A single context recording system was maintained (Appendix 1) and a colour and monochrome photographic

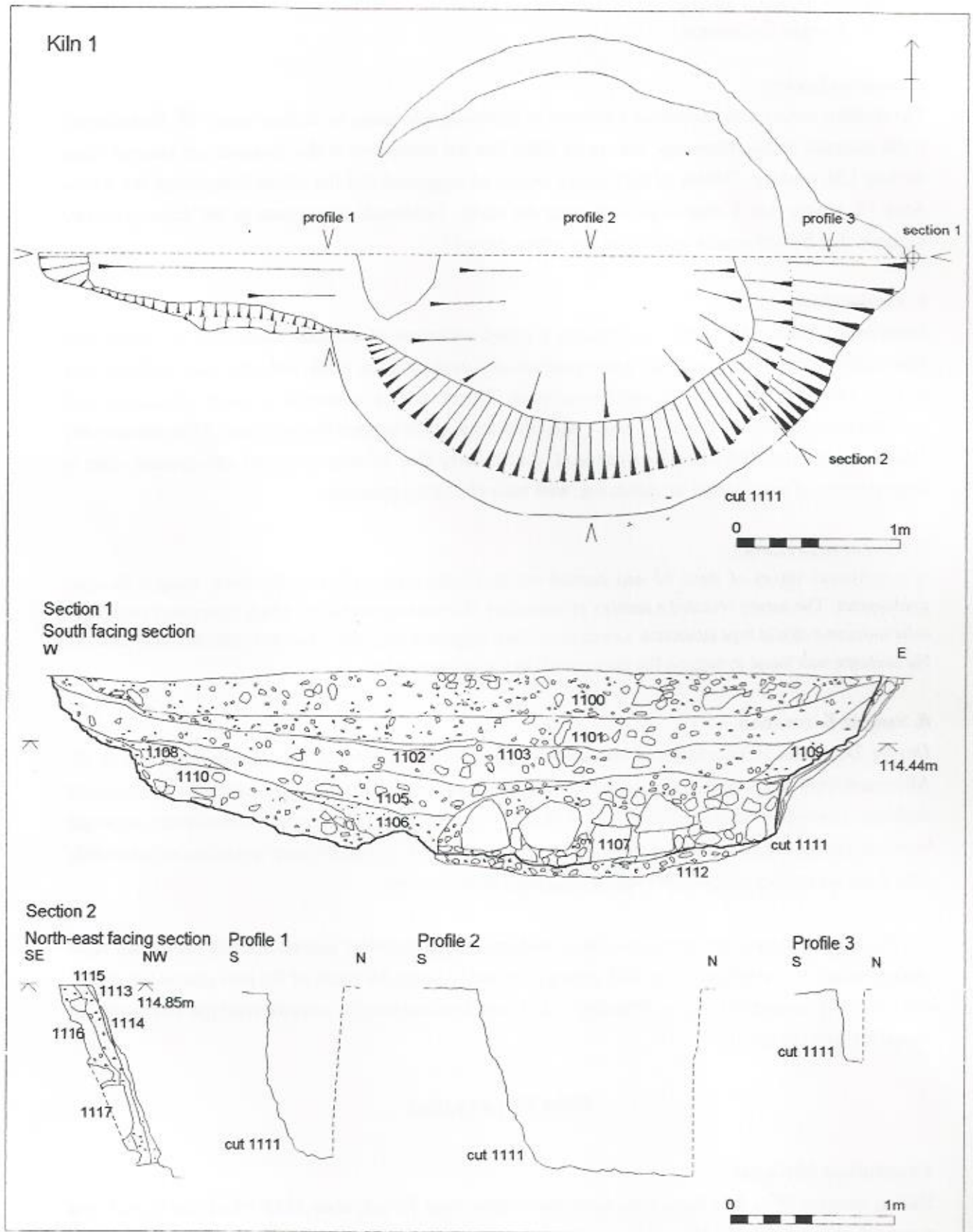


Figure 3

record was produced. Due to the lack of dating material associated with the features Kilns 1, 2 and 4 were sampled for archaeomagnetic dating (Appendix 3).

Kiln 1

Kiln 1 was half sectioned along its long axis, the south-eastern half was excavated, (Fig. 3 : Pls. 1 and 2). Kiln 1 is described by dividing it into its structural elements followed by its fills.

The Structure

The kiln structure was composed of three co-joined elements that are collectively represented by the single cut, context 1111. These components are; the stoke/raking-out hole, the kiln pot and flue.

The steeply sided stoke/raking out hole measured 2m. long, approximately 0.9m. wide and had a maximum depth of 1.08m. This tapered down towards the rear and internally sloped down gently towards the kiln pot. It was noted that no parts of the edges or base of the stake/raking-out hole showed signs of burning.

The kiln pot was sub-circular in plan with steeply sloping edges (approximately 75 - 80 degrees), and had a slightly concave base. The diameter of the pot was in the region of 2.6m and had a maximum depth of 1.2m. The point of separation of the stake/raking-out hole from the kiln pot was marked by a large boulder at the base of the feature. Evidence of considerable heat was apparent in the kiln structure. This heat had led to the interior edge of the kiln pot being baked hard, a deep pinkish red colour for a depth of several centimeters. Material behind this baked edge had also been affected by heat with the results that several bands of discolouration were visible for a width in the region of 0.25m beyond the interior kiln edge. There was no indication at the edge that clay or any other material had been adhered to the pot sides. The basal area of the kiln was burnt a deep reddish colour for a depth of only 0.12m. The comparative shallowness of burning at the base may relate to depth reduction during 'raking-out' of this part of the kiln subsequent to lime burning.

The flue of the kiln was represented by a projecting pointed nib at a point on the kiln edge opposite the stoke/raking-out hole. The flue sloped down from the top edge of the kiln to a point of just over half way down the interior edge. Similar to the kiln pot, the flue had been baked by the intense heat.

The Fills

A total of twelve separate fills were seen to occupy the structure of Kiln 1. The primary fill, context 1112, was a thin patchy deposit of ash derived material and lime located in the pot area of the kiln. To some degree this was intermingled with the burnt 'material' that formed the base of the structure. This ash and lime may relate to the last firings of the kiln and provide clear evidence of its function. Fully sealing 1112 in the pot area was a deposit of large, mostly rounded stone, context 1107. Almost all of this stone displayed clear signs of intense heating in the form of 'crazed' cracking and pinkish colouration.

The remaining fills of kiln 1, contexts 1110, 1107, 1109, 1106, 1108, 1104, 1105, 1103, 1102, 1101

and 1100 were for the most part broadly similar in texture being clayey silts containing a large proportion of rounded stone, and are interpreted as 'filling in' of the kiln. Some of the contexts did contain an amount of 'ashy' type material, contexts 1106, 1108 and 1110. All of these contexts occur early in the fill sequence and probably relate to the short period immediately after disuse of the structure. Large concentrations of kiln edge type material was noted in contexts 1102, 1104 and 1109 and is believed to relate to slumpage of parts of the kiln edge after disuse.

Kiln 2

Kiln 2 was half sectioned along its long axis, the south-east half was excavated first, the north-western section was taken down to reveal the entire structure of the kiln (Figs. 4 and 5 : Pls. 3, 4, 7 and 8). Kiln 2 is described by dividing it into its structural elements followed by the fills.

The Structure

The kiln structure was composed of four integral components that are collectively represented by a single cut, context 2116. These components are; the stoke/raking-out hole, the kiln pot, flue and clay lining.

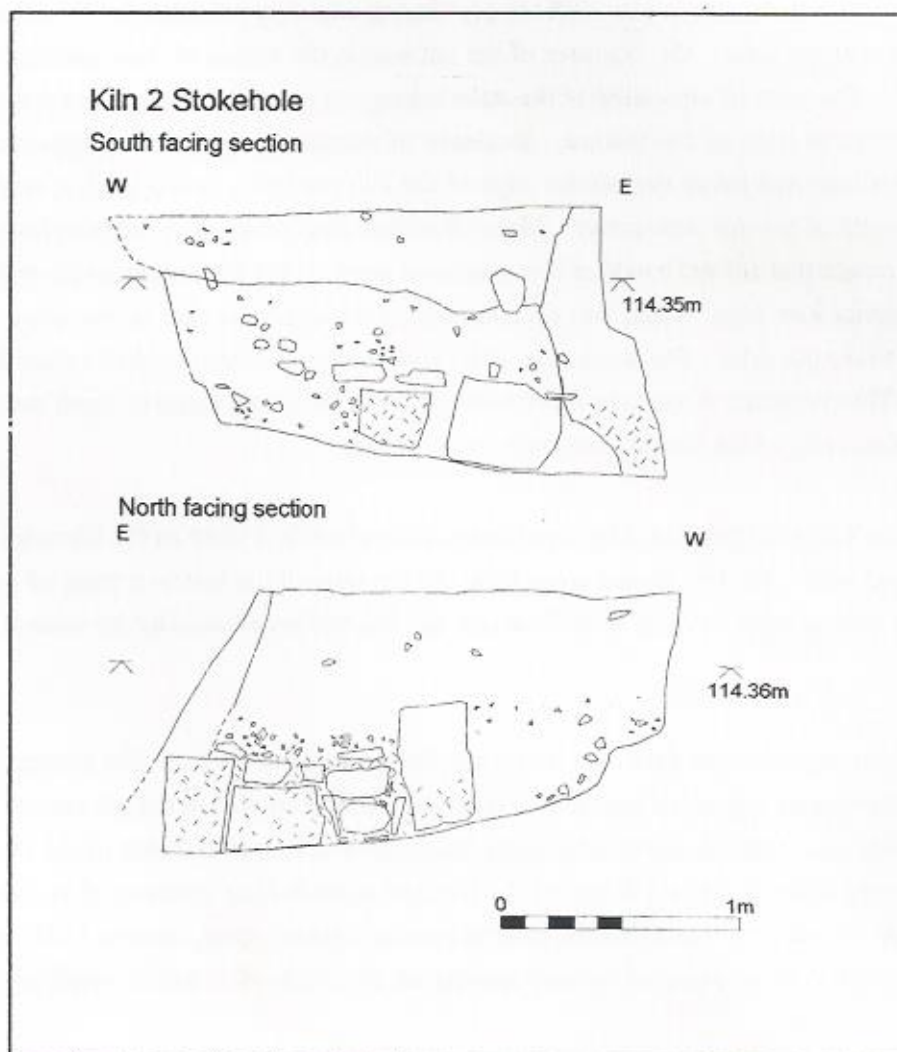


Figure 4

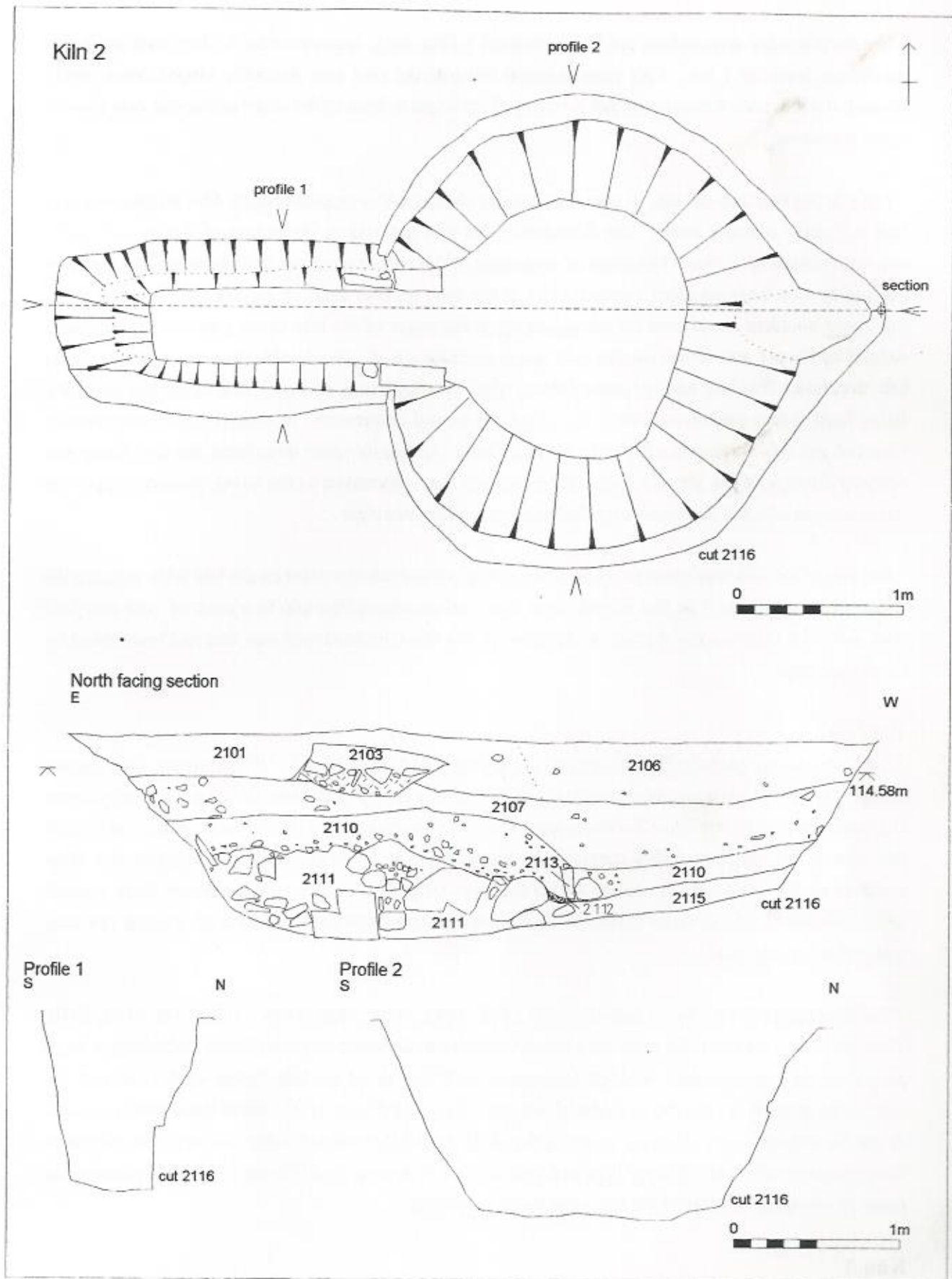


Figure 5

The steeply sided stoke/raking out hole measured 1.38m. long, approximately 0.91m. wide and had a maximum depth of 1.1m. This tapered down towards the rear and internally sloped down gently towards the kiln pot. It was noted that no parts of the edges or base of the stake/raking-out hole showed signs of burning.

The kiln pot was sub-circular in plan with steeply sloping edges (approximately 60 - 80 degrees), and had a slightly concave base. The diameter of the kiln pot was in the region of 2.95m and had a maximum depth of 1.24m. The point of separation of the stake/raking-out hole from the kiln pot, was marked by two large boulders, context 2113, at the base on both sides of the feature. It seems likely that these boulders were used for strengthening to the edges of the kiln at the potentially weak point formed by the pot and stoke/rake-out hole junction. Evidence of considerable heat was apparent in the kiln structure. This heat had led to the interior edge, the clay lining, context 2114, of the kiln pot being baked hard, a deep pinkish red colour for a depth of several centimeters. In several places lime patches, charcoal and coal fragments adhered to the clay lining. Unlike the other three kilns, the clay lining was uniform throughout the pot and flue. No excavation was undertaken to the lining, preservation of the structure was adopted due to the excellent condition of the structure.

The flue of the kiln was represented by a projecting pointed nib at a point on the kiln edge opposite the stoke/raking-out hole. The flue sloped down from the top edge of the kiln to a point of just over half way down the interior edge. Similar to the kiln pot, the flue was lined with clay that had been baked by the intense heat.

The Fills

A total of eleven separate fills were seen to occupy the structure of Kiln 2. A thin patchy clay deposit containing ash, burnt stone, coal fragments and lime, context 2112, located in the pot, stoke/rake-out hole junction area of the kiln. To some degree this was intermingled with the burnt lining that formed the base of the structure. This context may relate to the last firings of the kiln and provides clear evidence of its function. Fully sealing the pot area was a deposit of large, mostly rounded stone, context 2111. Almost all of this stone displayed clear signs of intense heating in the form of 'crazed' cracking and pinkish colouration.

The remaining fills of kiln 2, contexts 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111 and 2115 were for the most part broadly similar in texture being silty sands containing a large proportion of rounded stone, and are interpreted as 'filling in' of the kiln. Some of the contexts did contain an amount of 'ashy' type material, contexts 2108, 2109 and 2110. All of these contexts occur in the fill sequence and probably relate to the short period immediately after disuse of the structure. Large concentrations of kiln edge type material was noted in contexts 2102 and 2104 and is believed to relate to slumpage of parts of the kiln edge during 'infilling'.

Kiln 3

Kiln 3 was half sectioned along its long axis, the south-eastern half was excavated, (Fig. 6). Kiln 3 is described by dividing it into its structural elements followed by its fills.

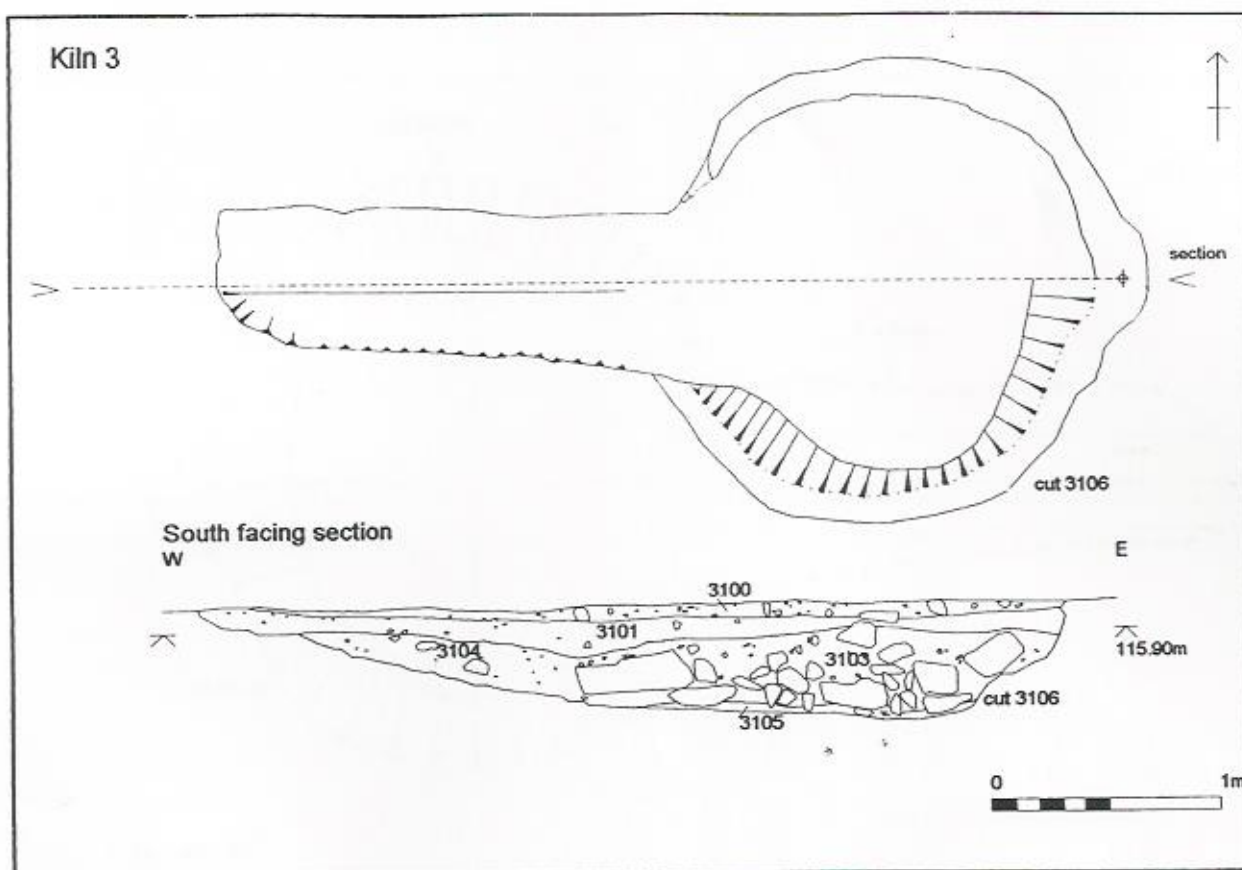


Figure 6

The Structure

The kiln structure, cut 3106, although smaller was essentially of the same pattern as the other four kilns being composed of; a stock/raking-out hole, and a central burning pot with joined flue. The steep sided raking out hole measured 1.9m. long, 0.65m. wide and had a maximum depth of 0.42m., and sloped down towards the kiln pot. No part of this component was burnt. The kiln pot was sub-circular in plan, with an approximate width of 1.72m. and a maximum depth of 0.51m. The sides were steep sloping approximately 75 degrees, and the basal part was slightly concave. A baked reddish inner edge and base with heat created bonding was evident in the pot. Although less well defined than in the other three kilns, a down sloped nib shaped flue, also heat burnt was apparent laying opposite the stoke/raking out hole. The major distinction between kiln 3 and the other kilns was that even allowing for its small size kiln 3 was very shallow. This appears likely to relate to the truncation of the uppermost parts of the structure, probably by ploughing, subsequent to its demise.

The Fills

Six fills occupied the structure of Kiln 3. The primary fill of the kiln pot, context 3105, was composed of patches of ash and lime intermingled with fragments of burnt kiln material and flecks of coal. This material may relate to debris produced by the latest firings of the kiln. The primary fill in the pot was overlain by a mass of mostly rounded boulders, context 3103, and showed signs of intense heating in the form of cracking and reddish colouration.

The remaining fills of kiln, contexts 3104, 3103, 3102, 3101 and 3100, were essentially sandy clay

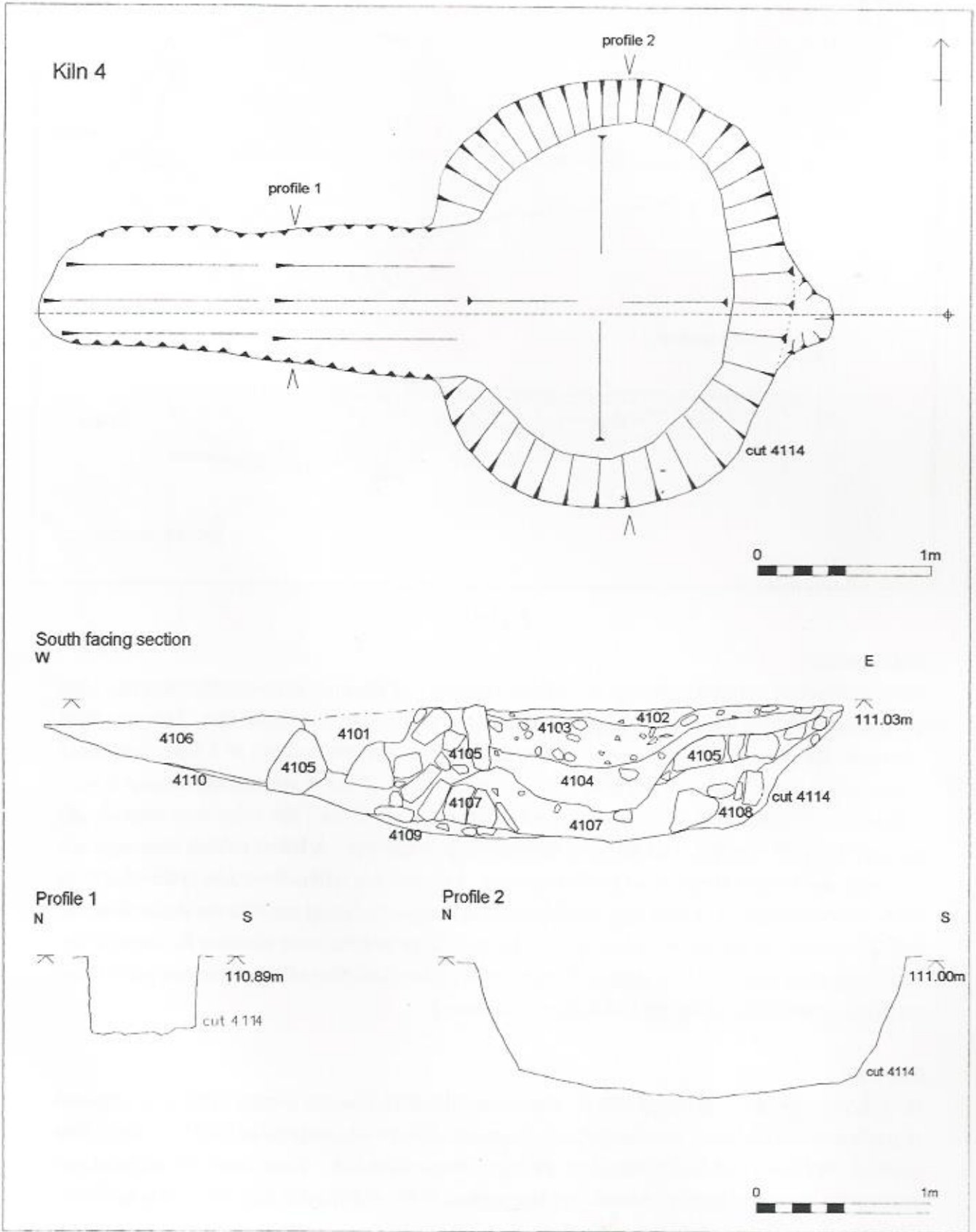


Figure 7

silts containing varying amount of rounded stone together with very small quantities of burnt 'kiln type' material and are interpreted as infilling, possibly 'backfilling', of the upper parts of the kiln. Only context 3102, showed distinct variation. 3102 lay close to the pot edge was comprised primarily of burnt kiln material and probably represents slumped structure edge.

Kiln 4

Kiln 4 was the westernmost of the excavated kilns, being situated c.115m west of Kiln 3 and 450m west of kiln 1 and 2. Kiln 4 was half-sectioned along its east-west axis (Fig. 7 : Pls. 5 and 6). Kiln 4 is described by dividing it into its structural elements followed by its fills.

The Structure

Kiln 4 was made up of a number of elements; the stoke hole/raking out hole, the pot and the flue which together formed a single unit. In addition there was a possible 'kiln arch' context 4111, and two deposits representing lining to the pot contexts 4112 and 4113.

The stoke /raking - out hole was present at the west of the feature. It tapered slightly to the west, but was basically rectangular in plan, measuring 2.2m in length, 0.8m wide and 0.75m in depth. The north and south edges were vertical, but the western edge fell gently down in a continuous slope to the natural surface. This element of the kiln did not display any signs of in-situ burning such as fire reddening of the edges.

The pot was an oval hollow, measuring c.2.5m in width, and had a depth of 0.75m. The edges fell uniformly at c. 70 degrees to the concave base. The edges and base of the pot outside the lining deposits were affected by in situ heating, evidenced by the reddish-purple colour.

The flue was situated at the eastern extremity of the pot and directly opposite the stoke/raking-out hole and measured 0.4m wide, 0.3m long and 0.26m deep. The north and south edges of the flue were lined by a 'lining' deposit, context 4112.

Two large upright boulders, context 4111, was situated at the junction of the pot with the stoke/rake-out hole. The boulders were 0.6 x 0.45 x 0.15m in size, and fire reddened. It seems likely that context 4111 was strengthening to the edges of the kiln at the potentially weak point formed by the pot and stoke/rake-out hole junction.

The two possible lining deposits to the pot, contexts 4112 and 4113 formed concentric rings around the pot. The outermost ring context 4113, a dark brown sandy silt that was present to a depth of 0.35m. Originally, it was thought that this context might have represented some form of timber or hurdle superstructure that had fired-out. However no charcoal was present. The texture was siltier than the coarse sandy natural into which the kiln was cut, which would indicate that it was an artificial lining to the pot. In places, eg. the north-west corner of the chamber it formed a coherent friable silty clay. The surface of context 4112 was uneven, with gravel and cobbles pressed into the surface, with small patches of lime and charcoal.

The Fills

The fills can be divided into two groups, those that represent the use of the kiln, (contexts 4108, 4109 & 4110), and those formed by the backfilling of the disused kiln, (contexts 4102, 4103, 4104 4105 4106 & 4107).

Context 4108, was situated at the base of the pot in the area of the flue. Context 4109, at the junction of the pot and stoke/raking-out hole. Both contexts were similar, fire-grained sandy silts, containing charcoal, coal fragments and patches of burnt lime, possibly remnants of the fired material. A deposit of brown sandy silt, context 4110, was situated at the central part of the base of the stoke/rake-out hole.

The remaining fills of kiln, contexts 4102, 4103, 4104, 4105, 4106 and 4107, were essentially sandy silts containing varying amount of rounded stone together with very small quantities of burnt 'kiln type' material and are interpreted as infilling, possibly 'backfilling', of the upper parts of the kiln.

Summary

All four kilns indicated that they had been Lime kilns more than likely for agricultural improvement in the post-medieval period (see Historical and Documentary Evidence below). Confirmation of the dating awaits the results of the archaeo-magnetic dating.

The small amounts of finds from all kilns seems to support the theory that the kilns were backfilled immediately after the last firing. The few finds also appear to support a post-medieval date with the occurrence of clay pipe in kiln 2. The occurrence of two sherds of medieval pottery could be explained by residuality due to the loose nature of the fills. All four kilns appear to have used coal as the source of fuel. The area of Masham had established coal mines in Colsterdale from the medieval period. The limestone was extracted from the areas near the river Ure (Fig. 1).

Discussion

The majority of lime kilns visible at present, date from the 18/19th centuries when the design had evolved into permanent structures. They were built into hillsides and charged from a high level approach 6-7m above the draw hole at the base. They were often substantial structures with elaborate drainage patterns internally and discharged on a continuous rather than on a seasonal basis of its predecessor. An example of such a kiln can be located on the banks of the Ure at SE 2202 8327 (Fig. 8). The continuous discharge of lime is one of the indications of the commencement of mass production as supply for the product increased with agricultural improvements and enclosure. It has been a rare opportunity to investigate simple rural post-medieval limekilns, with this state of preservation. The development of the lime burning process, from the rural Sixteenth/Seventeenth century to the present day with the mass production of lime by Redland Aggregates Ltd is an interesting parallel.

History of Lime Burning

A brief history of lime burning and the development of kilns is summarized. The earliest description of a limekiln is in Cato's 'De Agricultura' of the second century B.C., which gives advice on cultivation and land management. The earliest known limekilns in Britain are Roman in date. Lime was used for

a variety of reasons, mortar, cement and for agricultural improvement. Limited excavation has revealed the structures were built of coursed limestone blocks, with an internal ledge, long stoke hole and raking-out pit. eg Weekley, Northamptonshire.

Documentary evidence suggests that lime continued to be used in the Saxon period, a church in York was white washed in lime in 690A.D. Lime was made in pits or clamps using a method similar to charcoal burning. During the medieval period demand for lime increased dramatically with the building of monastic houses, churches and castles. During this period, limekilns are specifically mentioned in documents and excavation has confirmed the nature of the structure. The firing pit or pot was usually circular, typically measuring 1.2 - 5m in diameter at the top of the pit. The sides of the pit were either straight or tapered, and consisted of a stokehole and raking out pit. As the medieval kiln developed so did the number of flues, providing a guide to the complexity and sophistication. Excavations of the single flue kiln have taken place at Chew Valley, Avon, two flues at Erringham, Sussex, three flues at Southampton Castle, Hants and four flues, North Elmham, Norfolk.

Specific references to the use of lime as a soil improver are found in early sixteenth century sources such as Fitzherbert, an author of agricultural improvement and in 1603 George Owen gives a description of the construction of a limekiln for agricultural. The method of strip cultivation was being replaced by Enclosure as demands for food supplies increased as the population expanded. The demand for food created the need for greater productivity and rural lime burning became more common and important in the seventeenth century. Many of the Rural kiln structures were of a simplistic single flue design, with a stokehole linked to the base by a flue. The kilns were often seasonal and once out of use were usually filled in and levelled, they do not appear to have any secondary or tertiary use.

Documentary Evidence.

Historical documents are of limited use in the understanding of limekilns. As they were not taxable structures, their existence is not recorded in General Surveys. They are however sometimes mentioned in building contracts, building accounts and Estate accounts for the raw materials used in construction and the amount of fuel consumed.

Fortunately Documentary sources exist for the production of lime burning on the Swinton Estate. In 1607, the estate records reveal that from August to October, two men were employed in the lime pits for 30 days at 6d/day. The exact location of these lime pits is not mentioned but they are on the estate, ref (NY Cunliffe-Lister Archive, Northallerton).

William Danby inherited the estate in 1750, "a person of great intelligence and good taste, with active business habits of which he made full use in the improvements of his estates and the way of the people who lived in it." (Cunliffe-Lister,1978; 87). One of his improvements was to bring large tracts of moorland into cultivation. Arthur Young, an agricultural author visited the estate in 1768, and his notes reveal the extent the estate relied on limeburning for agriculture, "Pay very little attention to raising large quantities of manure- their principal dependence is upon lime, of which they lay from one to two and a half cauldrons per acre". Another reference is to a collier of Colsterdale, John Croft who was

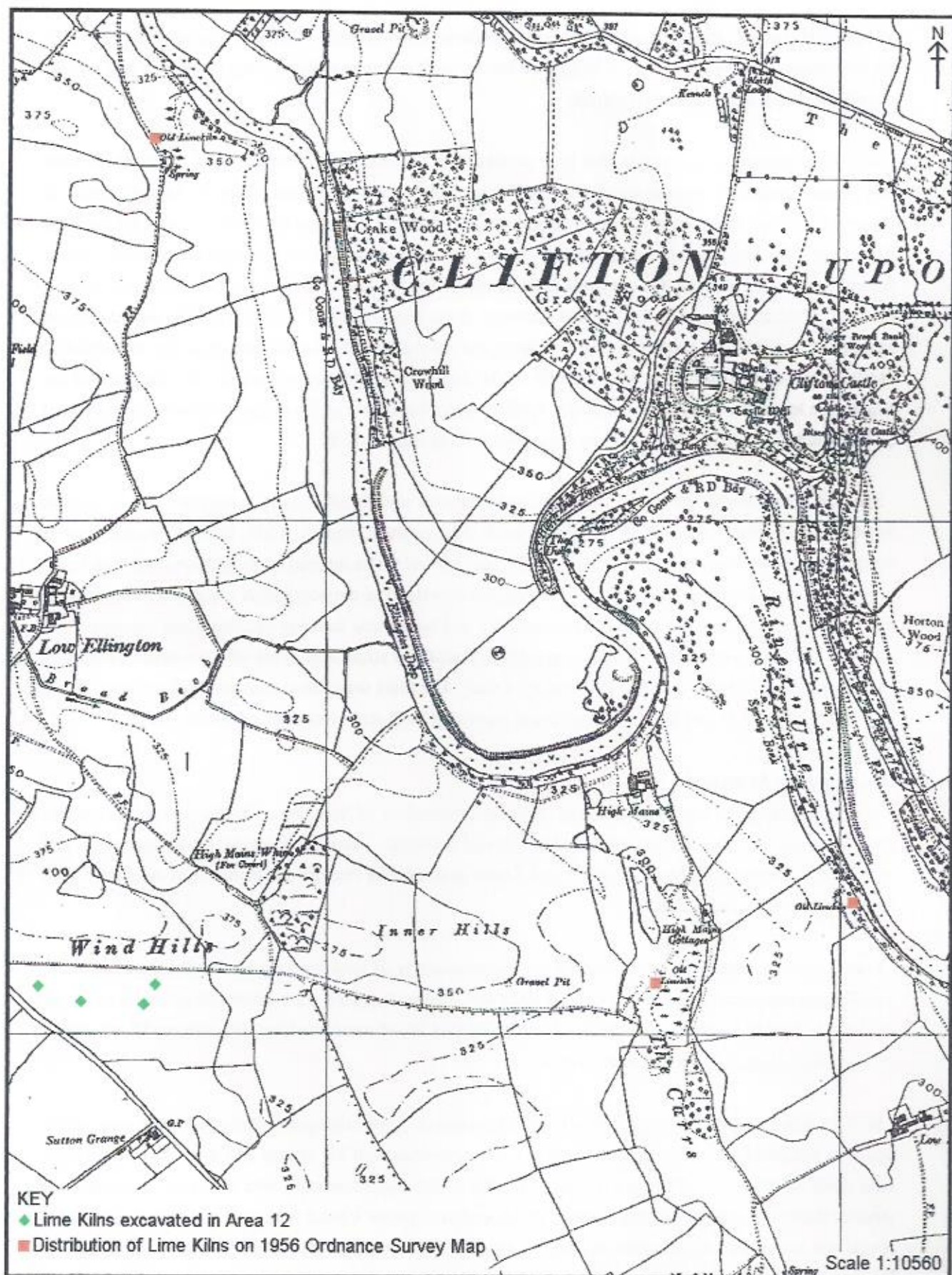


Figure 8.
Distribution of Lime Kilns in surrounding area.

enclosing moorland "burnt the heather limed and ploughed it. He continued liming, sowing a variety of crops for a number of years until he had turned it into good grassland". Young goes on to say that "He spread a great deal of lime on his land which he had to bring from six mile away". It could be possible that some sort of exchange was occurring Croft was a collier who needed lime for improvements and the lime kilns required coal for fuel. This is only a suggestion as documentary sources do not mention this sort of contract.

The source of fuel, coming from the coal measures on the estate at Colsterdale, coal extraction has been documented from the Medieval period. "In a place calleddale, two parts of a mine of sea coals (*minere carbonum marinarum*), some years worth 53s 4d and others not so much. Pannage in divers 12d in ordinary years." in Yorkshire Inquisitions, XLII. John De Walton or Wauton dated at Stryvelyn, 20 May 32nd year (1304).

In the Seventeenth and Eighteenth centuries coal extraction was at its height in Colsterdale and a great many records still survive in the Cunliffe-Lister Archive, Northallerton. Little remains of this industry today apart from a few slag heaps, old entrances, ruined buildings and tracks. There can be little doubt that the source of coal, the fuel for the limekilns came from these workings.

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APPENDIX I

Context Listing

Context	Description
1100	Deposit, clayey silt, 10YR3/4
1101	Deposit, clayey silt, 10YR3/6
1102	Deposit, Sandy silt, 10YR3/1 - 2.5YR4/6
1103	Deposit, clayey silt, 10YR3/6
1104	Deposit, burnt clay and clayey silt, 7.5YR4/4 - 5YR4/4
1105	Deposit, clayey silt, 7.5YR4/4
1106	Deposit, silt, 10YR4/4 - 10YR3/1
1107	Deposit, stoney silt, 5YR4/6 - 10YR4/4
1108	Deposit, silt, 10YR4/4 - 10YR3/1
1109	Deposit, clayey silt, 2.5YR3/2 - 10YR3/2
1110	Deposit, stone and silt
1111	Cut, kiln
1112	Deposit, sand and stone, 2.5YR4/4
1113	Structure, 2.5YR4/6
1114	Structure, 7.5YR2/0
1115	Structure, 2.5YR3/2
1116	Structure, 2.5Y3/4
1117	Natural
2100	Deposit, clayey loam
2101	Deposit, silty sandy loam, 10YR3/4
2102	Deposit, silty sandy loam, 10YR3/4
2103	Deposit, sandy clay,
2104	Deposit, silty sandy clay, 10YR3/4 - 10YR3/6
2105	Deposit, sandy clay, 10YR5/6
2106	Deposit, clayey loam, 10YR4/6
2107	Deposit, clayey loam, 10YR4/6
2108	Deposit, silty clay, 10YR2/2
2109	Deposit, silty sandy loam, 5Y2.5/1
2110	Deposit, sandy clay, 10YR6/6
2111	Deposit, silty sandy clay, 5YR4/4
2112	Deposit, clay, 2.5YR4/8
2113	Structure, stoke hole lining
2114	Structure, Kiln
2115	Deposit, slightly sandy clay, 10YR6/6
2116	Cut, kiln
3100	Deposit, sandy clay and stone, 10YR4/4
3102	Deposit, sandy clay, 10YR4/6
3103	Deposit, sandy clayey loam and stone, 10YR3/4 - 10YR3/6
3104	Deposit, sandy clayey loam, 10YR3/6
3105	Deposit, Ash and burnt clay, 2.5YR4/6 - 10YR2/1
3106	Cut, Kiln
3107	Natural
4100	Deposit,
4101	Deposit, silty clay, 10YR4/6
4102	Deposit, silty clay, 10YR4/4
4103	Deposit, silty clay, 10YR4/3

4104	Deposit, sandy silt, 2.5YR4/6
4105	Deposit, sandy silt, 10YR4/4
4106	Deposit, clayey silt, 10YR4/3
4107	Deposit, silty clay, 10YR3/2
4108	Deposit, slightly sandy silt, 7.5YR4/4
4109	Deposit, silty sand, 7.5YR3/3
4110	Deposit, sandy silt, 10YR3/3
4111	Structure, stoke hole lining
4112	Deposit, sandy clay, 2.5YR4/6
4113	Deposit, sandy silt, 10YR2/2
4114	Cut, kiln

APPENDIX 2

Finds Catalogue

- 1101 - Coal Fragments 31g
- 1103 - Coal Fragments 18g
 - Slack Shale fragment 5g
- 1107 - Slack Shale fragment 6g
 - Burnt stone lime adhering 3.5kg
- 2100 - Flint Flake SF.1
- 2101 - Coal Fragments 26g
 - 1 body sherd Tees Valley type pottery abraded 12/13th century
- 2102 - 1 body sherd Humberware 14/15th century
 - 1 rim sherd Tees Valley type 12/13th century
- 2104 - Iron object unidentified SF.2
 - 1 clay pipe stem
- 2107 - 1 body sherd Humberware 14/15th century
- 2110 - 1 body sherd Cistercian 16th century
 - Cu alloy fragments unidentified
- 3104 - Coal Fragments 21g
- 3105 - Coal Fragments 8g
- 4100 - 1 body sherd slipware 17th century
- 4103 - Porcelain object
- 4110 - Coal Fragments 75g



Plate 1.
Kiln I during excavation. Facing north-west.



Plate 2.
Kiln I. South facing section. Facing north.



Plate 3.
Kiln 2. North facing section. Facing south.



Plate 4.
Kiln 2. Stokehole. Facing south.



Plate 5.
Kiln 4 during excavation. Facing east



Plate 6.
Kiln 2 during excavation. Facing west.



Plate 7. Kiln 2. Stokehole. Facing south.

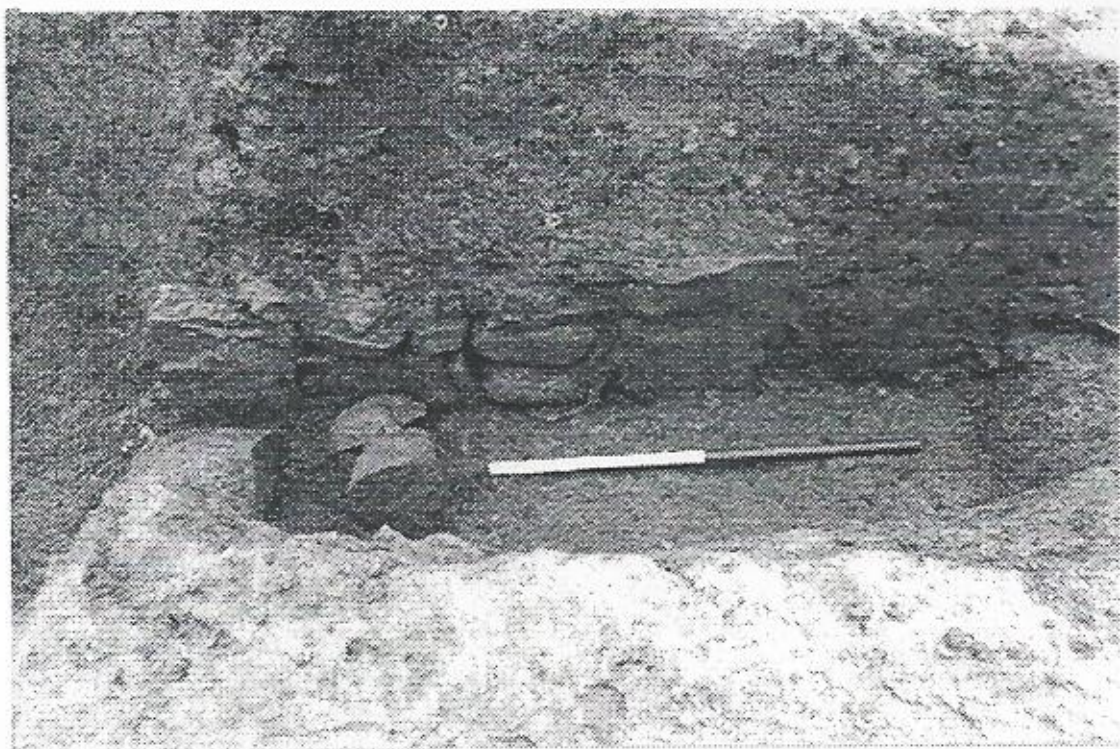


Plate 8. Kiln 2. Stokehole. Facing west.