



NEWLAND FURNACE, NEWLAND, Cumbria

Archaeological Watching Brief



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SUMMARY

The iron-working complex at Newland, Cumbria (NGR SD 2998 7970), was one of eight blast furnaces that were built in the region during the first half of the eighteenth century and, in many respects, is one of the most important. Established in 1747, the Newland Furnace remained in blast until 1891, and was the last but one charcoal-fired blast furnaces in Britain to close. The site has survived largely intact since its closure, and Newland today provides a rare example of a charcoal-based iron production centre and associated industrial hamlet, which includes charcoal barns and workers' housing. Its historical and archaeological significance is reflected in the recent designation of elements of the site as a Scheduled Monument (SM 34986).

The site is maintained by the Newland Furnace Trust, members of which have completed considerable repairs to the monument since 1989. Most recently, in 2006, the Newland Furnace Trust applied to English Heritage for funding to carry out some emergency repairs to the furnace stack. This work was necessary to prevent the further ingress of rainwater into the stack, which was having a negative impact on the surviving fabric of the monument. Initial clearance work at the upper level of the stack, carried out by members of the Newland Furnace Trust, revealed a section of a single-skin wall abutting the south wall of the furnace stack. As this wall was to be concealed by the repair works, English Heritage requested that an archaeological survey was carried out as part of the repair work. In addition, whilst clearing overburden from the upper level of the furnace stack in preparation for the emergency repair work, members of the Trust exposed other elements of historic fabric, notably a walkway around the outside of the stack, which similarly merited an archaeological survey; this was carried out by Oxford Archaeology North (OA North) between April and September 2007.

In June 2009, further works to protect the stack included the insertion of a ring beam to support a new roof, which necessitated the excavation of packing material from between the furnace stack and the furnace throat. In accordance with the conditions of Scheduled Monument Consent, the work was subject to an archaeological watching brief, which was carried out by OA North during June and July 2009.

The material excavated from between the furnace throat and the internal elevations of the stack walls comprised fragments of hand-made bricks and rubblestone of similar appearance to the stack walls; much of this material had been removed and then re-deposited during the initial element of repair works in 2007. The removal of this material revealed that the apertures recorded previously by OA North in 2007 continued down to the maximum excavated depth of 1.2m. A further aperture on the east elevation was also revealed, which may have been associated with a heat exchanger once located on the east external elevation of the furnace stack.

ACKNOWLEDGEMENTS

Oxford Archaeology North (OA North) would like to express its thanks to the Newland Furnace Trust for commissioning and supporting the project. Thanks are also due to the staff of Kendal Building Company who carried out the excavations.

The watching brief was carried out by Karl Taylor, who also compiled the report. The report was edited by Ian Miller, who was also responsible for project management.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

- 1.1.1 The Newland Furnace is a Scheduled Monument (SM 34986), and is entered on the English Heritage Buildings at Risk Register (priority three). In addition to the actual furnace, the site incorporates charcoal barns, a refining forge, a blacking mill, a smithy and several dwellings, cumulatively forming a rare example of a charcoal-based iron production centre and associated industrial hamlet. Of these structures, however, only the furnace, blowing chamber and charging house are leased by the Newland Furnace Trust.
- 1.1.2 The monument is currently managed by the Newland Furnace Trust, which has maintained a programme of consolidation and repair since 1989. In 2006, the Trust applied to English Heritage for funding to carry out some emergency repairs to the furnace stack. This work was necessary to prevent the further ingress of rainwater into the furnace stack, which was having a negative impact on the surviving fabric of the monument. Initial clearance work at the upper level of the stack, carried out by members of the Trust, revealed a section of wall between the stack and the external walls of the charging house. This wall was to be concealed by the repair works, and as it constituted an important element of the fabric of the monument, English Heritage requested that an archaeological survey was carried out as part of the repair work. It was carried out in two stages by Oxford Archaeology North: the initial stage was undertaken in April 2007, and the survey was completed in September 2007 (OA North 2007).
- 1.1.3 In June 2009, further works to protect the stack included the insertion of a ring beam to support a new roof, which necessitated the excavation of packing material from between the furnace stack and the furnace throat. In accordance with the conditions of Scheduled Monument Consent, the work was subject to an archaeological watching brief, which was carried out by OA North during June and July 2009. This report outlines the results from the watching brief in the form of a short report.

2. METHODOLOGY

2.1 METHODOLOGY

- 2.1.1 A programme of observation recorded the location of any surviving archaeological features and/or deposits exposed during the course of the hand excavation of the area around the furnace throat. All observations were recorded on OA North *pro-forma* sheets.
- 2.1.2 A photographic archive was produced utilising 35mm SLR cameras to produce both black and white contact prints and colour slides. A full complementary record of digital images was also captured using a DSLR camera with 10 megapixel resolution.

2.2 ARCHIVE

- 2.2.1 A full archive of the work has been prepared to a professional standard in accordance with current English Heritage guidelines (1991) and the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990). A copy of the report will be forwarded to the County Sites and Monuments Record (SMR), and a summary sent to the National Monuments Record (NMR).

3. BACKGROUND

3.1 LOCATION

- 3.1.1 Newland is situated 1.5km north-east of Ulverston, on the eastern edge of the Furness Peninsula, Cumbria (NGR SD 29987970). It lies at the mouth of a steep valley, which cuts through the edge of the fells. The eastern boundary of Newland Parish is marked by the rivers Leven and Crake, and the western is formed in part by Newland Beck.
- 3.1.2 The settlement is focused on the former iron-working complex, which is dominated by the blast furnace and its associated charcoal barns (Plate 1). The furnace stands at the foot of the valley slope into which the charcoal barns and charging house are terraced at a slightly higher level.



Plate 1: Recent aerial view of Newland

3.2 HISTORICAL DEVELOPMENT

- 3.2.1 The iron-working complex at Newland was one of eight blast furnace sites that were established in the region during the first half of the eighteenth century and, in many respects, is one of the most significant. Established in 1747, the Newland Furnace remained in blast until 1891, and was amongst the last charcoal-fired blast furnaces in Britain to close. Since 1891, the site has survived largely intact, and Newland today provides a rare example of a charcoal-based iron production centre and associated industrial hamlet (Plate 2). Its historical and archaeological significance is reflected in the recent designation of elements of the site as a Scheduled Monument (SM 34986).



Plate 2: Early twentieth-century view of Newland

- 3.2.2 The archaeological and historical background to the Newland Furnace has been thoroughly researched previously and presented, for instance, by Marshall *et al* (1996), and English Heritage (RCHME 1997); it is not the intention here to reiterate the same detail *per se*, but rather to summarise the historical development of the site.
- 3.2.3 A deed of partnership between Richard Ford, his son William Ford, Michael Knott, and James Backhouse was executed in 1747, which specified that the trade of casting, smelting or making pig iron, or any other sort of iron or cast metal, was to be carried on at Newland, or any other place which the partners might afterwards agree upon. This company became known as the Newland Company, and was to enjoy ‘considerable prosperity’ (Fell 1908, 218). The sole management of the business was to be in the hands of Richard Ford during the continuance of the partnership, and after his death or retirement, of his son William Ford (*op cit*, 270-2).
- 3.2.4 In addition to the Newland Furnace, the Company also operated the slightly earlier furnace at Nibthwaite, situated some six miles to the north. In 1752-3, the Newland Company established a blast furnace at Bonawe in Argyllshire, Scotland (Stell and Hay 1995), seemingly in order to secure a supply of charcoal. The four founding partners concluded two agreements for a 110-year lease of wood rights and the site of the ironworks with Sir Duncan Campbell of Lochnell on 30 September 1752, and a further contract for the supply of wood was agreed with the Earl of Breadalbane on 4 October 1752 (RCHME 1997, 3). Production at Bonawe started in 1753, and once this site was established the Company ceased iron smelting at Nibthwaite in *c* 1755 (Bowden 2000, 48), and concentrated its production of cast iron in Furness at Newland. Nibthwaite continued to be used for the conversion of cast iron to

wrought iron until 1840 (Riden 1993, 119), using a refining forge added in 1751.

- 3.2.5 The forge at Nibthwaite was not the only one operated by the Newland Company; between 1750-66, they occupied Hacket Forge, north of Coniston, and, in 1798, the Company also purchased Spark Forge, which they operated until 1848 (Bowden 2000, 67). In 1783, the Company built a forge at Newland, which incorporated a finery and a chafery (Riden 1993, 119). The exact site of the forge is uncertain, although it has been suggested that it occupied a site next to the weir across Newland Beck (Fell 1908, 218), from where the head race to the furnace and corn mill is taken off. The forge is thought to have ceased to work in 1807, although the Swedish metallurgist Gustaf Ekman is recorded to have visited Newland in 1828, where he observed an enclosed finery and chafery which provided a model for use in the Swedish industry (Trinder 1992, 393).
- 3.2.6 Richard Ford died in 1757, and the Company was run subsequently by his son, William Ford. Thomas Chadwick of Burgh and Nathaniel Tatlor of Ulverston also held shares in the Company, although these were sold to William Ford and George Knott. James Backhouse also sold his share in the Company to William Ford for £2000 in 1761 (Kelly 1998, 133). Following William Ford's death in 1769, the Company was run by George Knott, and became known as George Knott and Co. In 1784, however, the Company became known as Knott, Ainslie and Co, reflecting the involvement of Henry Ainslie in the concern. Following the death of George Knott, the Company was run by Matthew Harrison who, in 1812, bought the Knott share thus forming Harrison, Ainslie and Company. In 1818, Harrison, Ainslie and Company bought the Backbarrow Company, and completed their monopoly of Furness iron in 1828 by buying the furnace at Duddon Bridge (Morton 1962).
- 3.2.7 Detailed information about the production cycles for the latter years of the Newland Furnace is provided by the accounts of the Charcoal Iron Company Limited (CRO(B) BDB/2/7/1 and 2), which indicate that it was not in continuous use. In August 1877, for instance, the furnace was 'blown in' and was 'blown out' on 14 March 1878, after being in blast for 31 weeks and producing a total of 529 tons 15 cwt of pig iron. The next blast commenced over a year later, on 3 May 1879, and lasted for 51 weeks with the production of 950 tons of pig iron. Some six months later, on 10 October 1880, the furnace was blown in. This 70 weeks blast ended on 18 February 1882, with a total production of 1392 tons 10 cwt of pig iron. The next campaign commenced on 30 September 1882 and lasted until 30 January 1885, an astonishing 122 weeks with a total production of 3323 tons 10 cwt of pig iron. The next blast commenced over a year later, on 1 March 1886 and lasted 99 weeks until 20 January 1888 with a total production of 2590 tons 10 cwt. The final blast began on 24 October 1889 and ceased on 18 January 1891 (65 weeks), with a total production of 1620 tons 5 cwt of pig iron.
- 3.2.8 There is evidence to show that the furnace underwent some modification and that different fuels were experimented with towards the end of the nineteenth century, suggesting that some problems were experienced in securing an adequate supply of charcoal. Modifications to the furnace included the

installation of iron blowing cylinders, perhaps during the early nineteenth century (Marshall *et al* 1996, 199), an extension to the upper furnace stack, and the installation of a water-powered charging hoist. In 1873, the furnace was described as being in the process of ‘converting into hot blast’ (Griffiths 1873, 267), a system for the re-heating of furnace gases. The *Barrow Times* of 15 November 1879 noted that ‘compressed turf, etc’ had been tried by the Newland Company as a fuel, although it would seem that this experiment was unsuccessful as in 1875 it was observed that the Newland furnace ‘has undergone considerable repairs, and coal and coke have been substituted for charcoal’ (Mannex 1876, 163). In a slightly later trade directory, Mannex states that the ‘considerable alterations’ were begun in 1874 (1881, 249); the external appearance of the furnace subsequent to these modifications was captured on a photograph taken several years after the closure of the works, and published in the *North Lonsdale Magazine*, October 1897 (*Section 4.2.3 below*). This photograph shows the extension to the upper furnace stack.

- 3.2.9 The final blast at Newland ended on 18 January 1891 (Riden 1993, 119), and the site was closed due to a general depression in the iron trade, and by virtue of the growing stocks of unsold iron accumulated by the firm; by January 1891, 1071 tons of unsold iron were held at Newland (Marshall *et al* 1996, 198). These stocks continued to be sold, however, throughout 1891/2, and included the sale of 15 tons of small pigs to the Royal Arsenal in Woolwich (CRO(B) BDB/2/7/1). The last recorded delivery was to Hornby and Sons on 7 September 1892, and comprised five tons of small pigs (*ibid*). In 1903, Harrison, Ainslie and Co surrendered the lease of Newland to the Duke of Buccleuch, and the site was dismantled (Fell 1908, 218). Part of the site was occupied subsequently by James Athersmith, a local farmer. During the autumn of 1918, heavy rain and storms led to the collapse of the dam and serious flooding in the valley (Helme 2002, 68). In 1921, all the property at Newland owned by the Duke of Buccleuch was sold to Thomas Thompson, a joiner, for £1950.

4. WATCHING BRIEF RESULTS

4.1 INTRODUCTION

- 4.1.1 The programme of repair work to the furnace stack necessitated the insertion of a ring beam around the furnace throat, to provide a solid foundation for a new roof over the furnace. This required the excavation of the packing material between the stack walls and the furnace throat to a depth of 1.4m below its uppermost surface. In accordance with the conditions of Scheduled Monument Consent that was granted for the repairs, the excavation of material was monitored by an archaeological watching brief. This was intended to make a permanent record of any archaeological features that were exposed in the historic fabric of the furnace during the works, and supplemented the record compiled during an earlier watching brief that monitored works in the same area in 2007 (OA North 2007; Fig 1).
- 4.1.2 The watching brief commenced in June 2009, and initially monitored manual excavation of the packing material on the north side of the furnace throat. This material was excavated for a depth of *c* 1.2m, and revealed the large aperture recorded in Elevation 1 in 2007 (Fig 2). Material infilling this aperture collapsed (Plate 3), and further excavation was suspended pending a revision of the methodology by the structural engineers. Following this, it was decided to excavate the area to a lesser depth, and to shore any further apertures discovered.



Plate 3: Aperture in the north elevation (Elevation 1) of the interior of the stack wall showing collapsed material

4.2 RESULTS

- 4.2.1 The material excavated from between the furnace throat and the internal elevations of the furnace stack comprised fragments of hand-made bricks and rubblestone of similar appearance to the stack walls. Much of this material had been removed temporarily and then re-deposited during the initial element of repair works in 2007, which had necessitated excavation in this area to a depth of *c* 1m (OA North 2007). The material below this level similarly comprised fragments of hand-made bricks and rubblestone in a loose, sandy matrix. Material was removed to a maximum depth of 1.2m during the present works. No artefacts were discovered during the course of the works.
- 4.2.2 The exposed walls of the furnace stack are of local, roughly coursed stone construction, with face-work only surviving to depth of *c* 0.6m. The wall is of double-faced construction, 0.61m thick, with a rubble core bonded in pale lime mortar. Large quoin stones, both measuring approximately 0.61 x 0.30m, projected 0.30m above the wall top in the outer north-east and north-west corners of the stack (Fig 1), implying it to have been quoined returned. Large stone slabs were revealed at a depth of *c* 0.8m below the top of the stack walls, projecting from the wall face by up to 0.4m, bridging each corner of the stack. These were presumably intended for the structural strengthening of the walls; they did not appear to form part of any further structure (Plate 4).



Plate 4: One of the exposed stone slabs bridging a corner of the furnace stack

- 4.2.3 All of the elevations recorded during the initial element of repair works in 2007 were revealed during the present phase of work, including an aperture in the north elevation (Elevation 1) of the furnace stack (Fig 2). This aperture was 1.21m wide, and was situated below a cast-iron lintel that comprised a 1.52m length of solid rectangular-section, 0.1m deep (Plate 3). The section of the stack wall above the lintel was rebuilt, and contained refractory brick

within its fabric, demonstrating the aperture and lintel to have been later insertions. Similar apertures were exposed in the east (Elevation 2; Plate 5) and south elevations (Elevation 3; Plate 6) of the furnace stack. Both apertures were of similar dimensions to that exposed in Elevation 1, each measuring *c* 1.2m wide, and also contained evidence of rebuilding in the overlying stonework. All of the apertures in the stack wall continued below the excavated depth of 1.2m, and were thus not fully exposed.



Plate 5: Aperture in the east elevation (Elevation 2) of the interior of the stack wall



Plate 6: Aperture in the south elevation (Elevation 3) of the interior of the stack wall

- 4.2.4 The throat of the flue was also revealed during the excavations, the shoulder being clearly visible (Plate 7). Much of the exposed elements of the furnace throat had been rebuilt as part of the repair work carried out in 2007, although historic fabric was visible at the base of the excavated area. No other features were exposed during the course of the works.



Plate 7: Excavated extent of the furnace throat showing the top of the shoulder

5. CONCLUSION

- 5.1 The programme of repair work carried out on top of the stack at Newland Furnace necessitated the removal of packing material to a depth of approximately 1.2m between the furnace throat and the internal elevations of the furnace stack walls. The material excavated was composed predominately of hand-made brick fragments and rubblestone of similar appearance to the stack walls.
- 5.2 Evidence for modifications to the furnace stack was provided by several episodes of localised remodelling of the original fabric, including three apertures that had been inserted in the north, south and east elevations of the stack wall. The sections of the stack wall above the apertures had been rebuilt, and contained refractory brick within their fabric. It is tempting to associate these rebuilt sections of wall with the documented modifications to the furnace carried out during the 1870s, and particularly the installation of ‘hot blast’ technology (*Section 3.2.8 above*).
- 5.3 The precise nature of the ‘hot blast’ system employed at Newland is by no means clear although it probably relied on a heat exchange mechanism, recycling exhaust gases to pre-heat air entering the furnace. Elements of what was probably the heat exchanger mechanism are shown clearly on the late nineteenth-century photograph of the furnace, abutting the eastern side of the stack (Plate 8). It is of note that the position of the aperture exposed in the east elevation corresponds broadly with the location of the probable heat exchanger seen on the photograph of 1897.

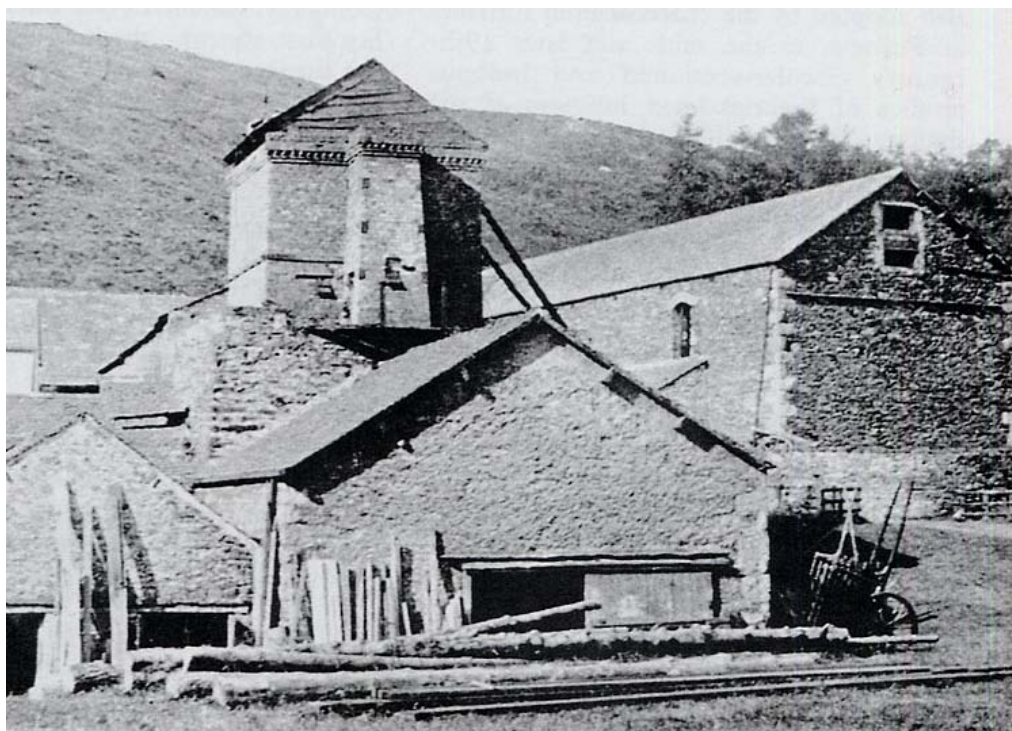


Plate 8: View of the Newland Furnace published in the North Lonsdale Magazine, 1897

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ILLUSTRATIONS

FIGURES

Figure 1: Plan of the exposed walls

Figure 2: Elevations of the exposed stack walls

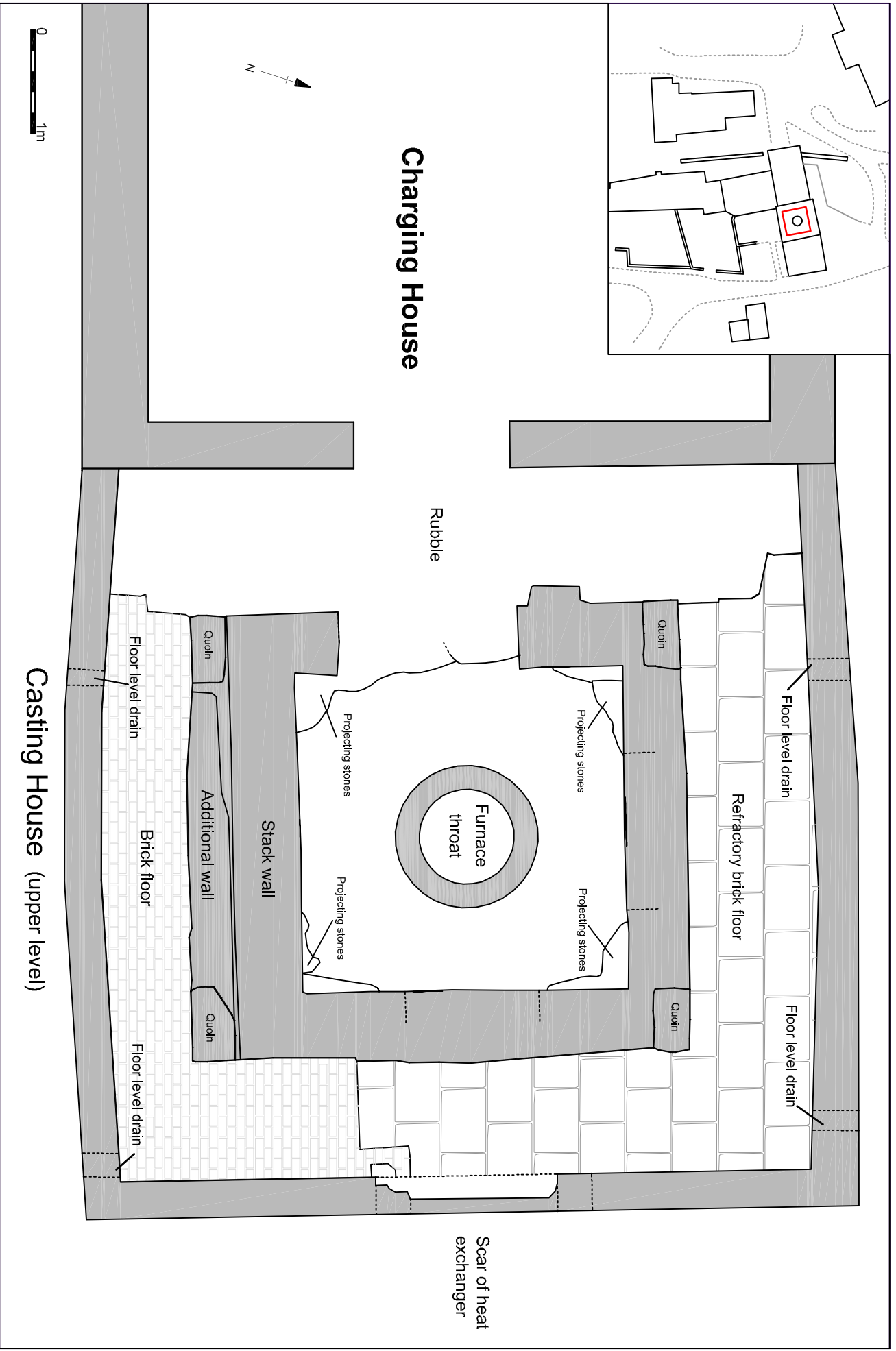
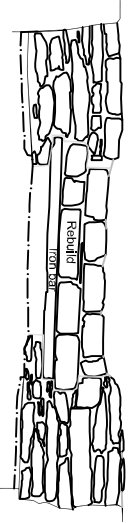


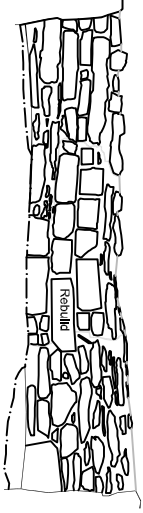
Figure 1: Plan of the exposed walls



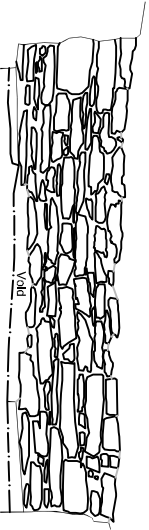
Line of rebuilding



Elevation 1: North elevation



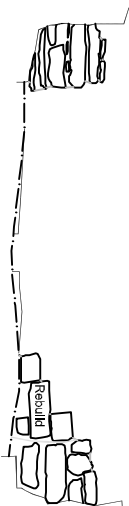
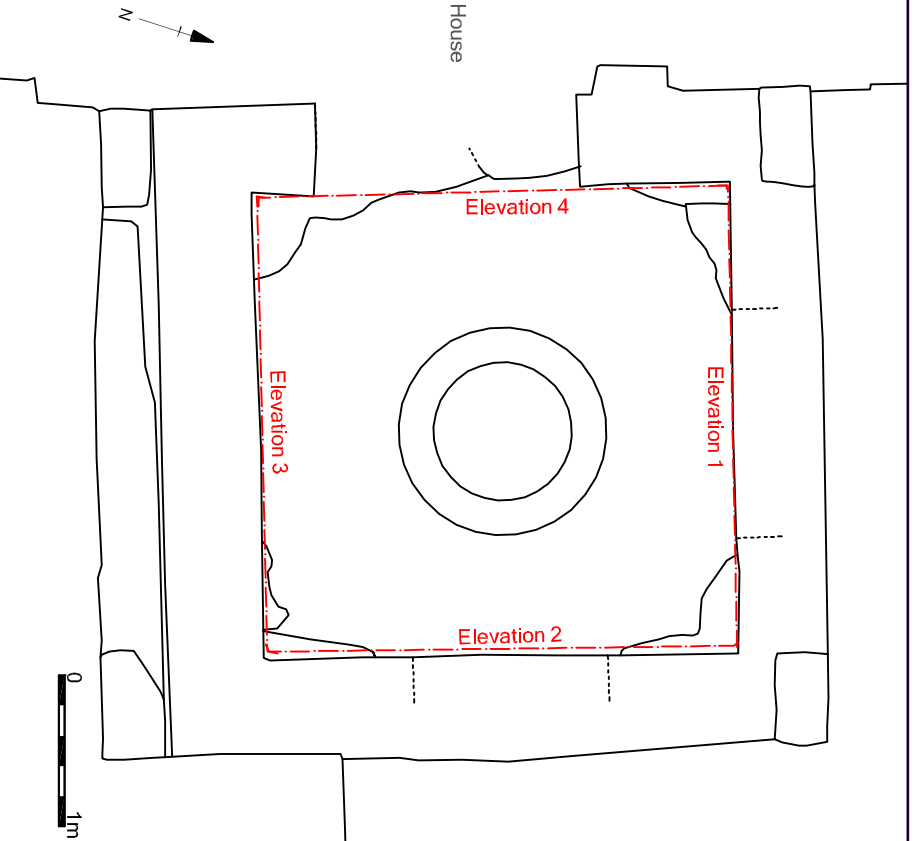
Elevation 2: East elevation



Elevation 3: South elevation



Charging House



Elevation 4: West elevation



Figure 2: Elevations of the exposed stack walls