Brora Back Beach, Sutherland
Data Structure Report
2010

Scottish Coastal Archaeology and the Problem of Erosion

University of St Andrews

Back Beach, Brora, Sutherland

report by
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The SCAPE Trust

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SUMMARY PROJECT INFORMATION

Period of fieldwork	15th July – 9th August 2011
Local Authority	Highland
Parish	Clyne
NGR	NC 90470 03307

The 2010 excavations were coordinated and supervised by **Jacquie Aitken** (Clyne Heritage Society); **Cathy Dagg** (Archaeologist); **Joanna Hambly** (SCAPE Trust) and **Janet Hooper** (Archaeologist).

Our **Volunteers** in 2010 were:

Brian Adams	**George MacBeath**
Leoma Aitken	**Allan Mackenzie**
Beth Blackburn	**Calum Mackinnon**
Jean Bowker	**Janice Mackinnon**
Ken Bowker	**Karl Major**
Steve Clark	**Cait McCullogh**
Anne Coombs	**Karen Oglseby**
Ruaridh Coombs	**Penny Paterson**
Sholto Dobi	**Marion Ruscoe**
David Findlay	**Jean Sargent**
Susan Findlay	**Roger Smith**
Lyn Fraser	**Sue Walker**
Joni Guest	**John Wombell**
George Gunn	**Trina Wombell**
Nick Lindsay	

The site drawings were digitised by St Andrews University students: **Caroline Lill**, **Sarah Salem** and **Annelies Van de Ven**. **Tanya Freke**, a graduate of Cardiff University carried out all of the video editing.

ACKNOWLEDGEMENTS

This project is funded by **Historic Scotland** and particular thanks go to **Noel Fojut** for his continuing support and interest. The **Sutherland Estates** and **Malcolm McCall** kindly allowed access to the Back Beach for the excavations. The **Brora Community and Learning Centre** provided excellent space and facilities for finds processing and for hosting the project finds workshop evening. The **Sutherland Inn** provided accommodation for visitors to the project and meals for many at short notice. **NOSAS** provided site accommodation and equipment and their members, as always, gave invaluable support to the excavation. Particular thanks go to **John Wombell** for the loan of his pole cam, and for his experimental lime kiln and salt pan reconstruction, both of which greatly enhanced the Open Day. Our thanks go to **Jonie** and **Richard Guest** for transferring the datum with sub-centimetre accuracy. **Tom Dawson** of the SCAPE Trust supervised the machining, landscaping and carried out the initial surveying. **Nick Lindsay** carried out additional surveys. **Jacquie Aitken**, **Leoma Aitken** and Nick Lindsay organised and hosted the Open Day and Finds evening. A special mention goes to **George Gunn** for his brilliant site tours that were much appreciated by a great many visitors and passers-by.

Contents

1. Introduction

The SCAPE Trust and the Clyne Heritage Society undertook a fourth season of excavation at the Back Beach in Brora East Sutherland. The excavation was funded by Historic Scotland and their support is gratefully acknowledged. The site was excavated by volunteers who, once again, made the most significant contribution to the success and the outcomes of this important project.

The main focus of this year's excavation was the site of the 'Old Salt House', marked on John Farey's 1813 *Mineral Map of the Coal Field at and near Brora* (Hooper, *et al*., 2009, Figure 13). For some years a ruinous wall, a flagstone floor and quantities of stonework and burnt material has been eroding from the dune face in the immediate vicinity of Farey's 'Old Salt House'. The dune suffered particularly badly from erosion over the winter of 2009, and so our 2010 fourth season of excavation at Brora's Back Beach focussed on investigating and rescuing information from the site before it was too late.

Documentary evidence records that Lady Jane Gordon, Countess of Sutherland, established a salt pan here in 1598. In 1618, there is a reference to the iron of the pans being sold, probably to help pay off Estate debts following the death of her son John the 12th Earl in 1616. For fuller historical background see previous DSR's and http://www.shorewatch.co.uk/brora/

2. Summary of principle outcomes

The principal outcomes of this season's work were:

- the total excavation and recording of the critically at-risk parts of the 16th/17th century building;
- recovery of evidence showing the quality and uniqueness of the building for the historical period in this area;
- recovery of evidence showing that the excavated building was contemporary with large quantities of industrial midden material that has been eroding from the coastal section for a number of years, and with the remains of a substantial building (now mostly eroded) previously recorded in Trench 3 by the Clyne Heritage Society (2004 and 2007);
- the unexpected discovery, excavation and recording of a limekiln built into the ruinous remains of the salt works building.

3. Community and events

Over 30 volunteers, mainly drawn from the local community, collectively contributed more than 200 person days over the 3 week excavation. This commitment is directly responsible for the significant achievements of the 2010 season. As well as local participation, the 2010 excavations enjoyed a very high local profile. This is largely due to the Clyne Heritage Society and Jacquie Aitken who continue to raise awareness of the project through talks, displays and published articles throughout the year. In 2010, the location of Trench 9 meant that the site was highly visible to everyone who walks along this popular beach and hundreds of people from the local area, and those on holiday from further afield, encountered Brora's earliest industrial heritage in this way. George Gunn, our youngest volunteer, enthusiastically embraced the role of site guide, and provided excellent guided tours to a great number of these visitors and passers-by. The regular site Open Day attracted around 30 visitors, who enjoyed a site tour by Nick Lindsay and a chance to look at a display of finds and information from this and previous years put together by Jacquie and Leoma Aitken. In 2010, the

finds from the 2007-2009 excavations of the 18th century salt works were sent out to specialists for analysis. During the fieldwork period, the project invited these specialists to Brora to visit the site and to tell us about their preliminary findings. David Cranstone, George Haggarty, Andy Heald (AOC Archaeology) Robin Murdoch and Catherine Smith (Alder Archaeology) generously gave their time and shared their knowledge and expertise with an audience of over 60 people involved in the project in a hugely enjoyable and interesting evening.

The project achieved national coverage on BBC Scotland's television series Landward, broadcast in November, and we were delighted to receive the prestigious **Main Fieldwork and Recording Award 2010** from the Association of Industrial Archaeology in recognition of all of the work carried out to date, in the investigation of Brora's early industries at the Back Beach.

4. Methodology

4.1. Trench location

A 12m x 8m trench (**Trench 9**) was opened up by machine over the site of the visibly eroding building. In addition, an approximately 30m long, narrow strip of the dune face extending westwards from the main trench was opened up by hand (Figure 2). The purpose of the extension was to ascertain the full length of the eroding building in Trench 9, which extended beyond the area of excavation into the dune to the west; to further investigate industrial midden deposits occasionally exposed in the coast edge here; and to investigate the relationship between these, the building in Trench 9 and the remains of the substantial building formerly visible on the beach.

A small 2m x 5m trench (**Trench 8**) was opened up by machine 10m east of the building fully excavated in 2008 and 2009 in Trench 4 (Figure 2). The purpose of the trench was to identify any surviving remains and so confirm the location of the easternmost of the pair of buildings depicted by Kirk on his 1772 map of the 18th century salt works.

In addition, an approximate 3m x 3m trench was opened by hand over the western central hearth structure of the building previously excavated in Trench 4. The purpose of this small trench was to fully excavate this complex structure in order to achieve a better understanding of its function and phasing.

4.2. Excavation

A mechanical excavator fitted with a 2m wide toothless bucket was used to open up Trenches 9 and 8 and remove the majority of the clean sand overburden. In the vicinity of Trench 9, a considerable amount of landscaping was carried out to ensure safe working conditions and to achieve a stable and accessible coast edge after the excavation was complete.

Following machining, the trenches were cleaned by hand and a multi-context plan of visible deposits drawn. In Trench 9, the eroding dune section, safely accessible for the first time since the start of the project, was cleaned and recorded. This provided a valuable cross section through the entire sequence of the eroding part of the building. At a later phase of the excavation, under the supervision of George MacBeath, the coastal section extending westwards from Trench 9 was also, for the first time, cleaned back to *in situ* deposits throughout the entire length, and recorded (Figure 6).

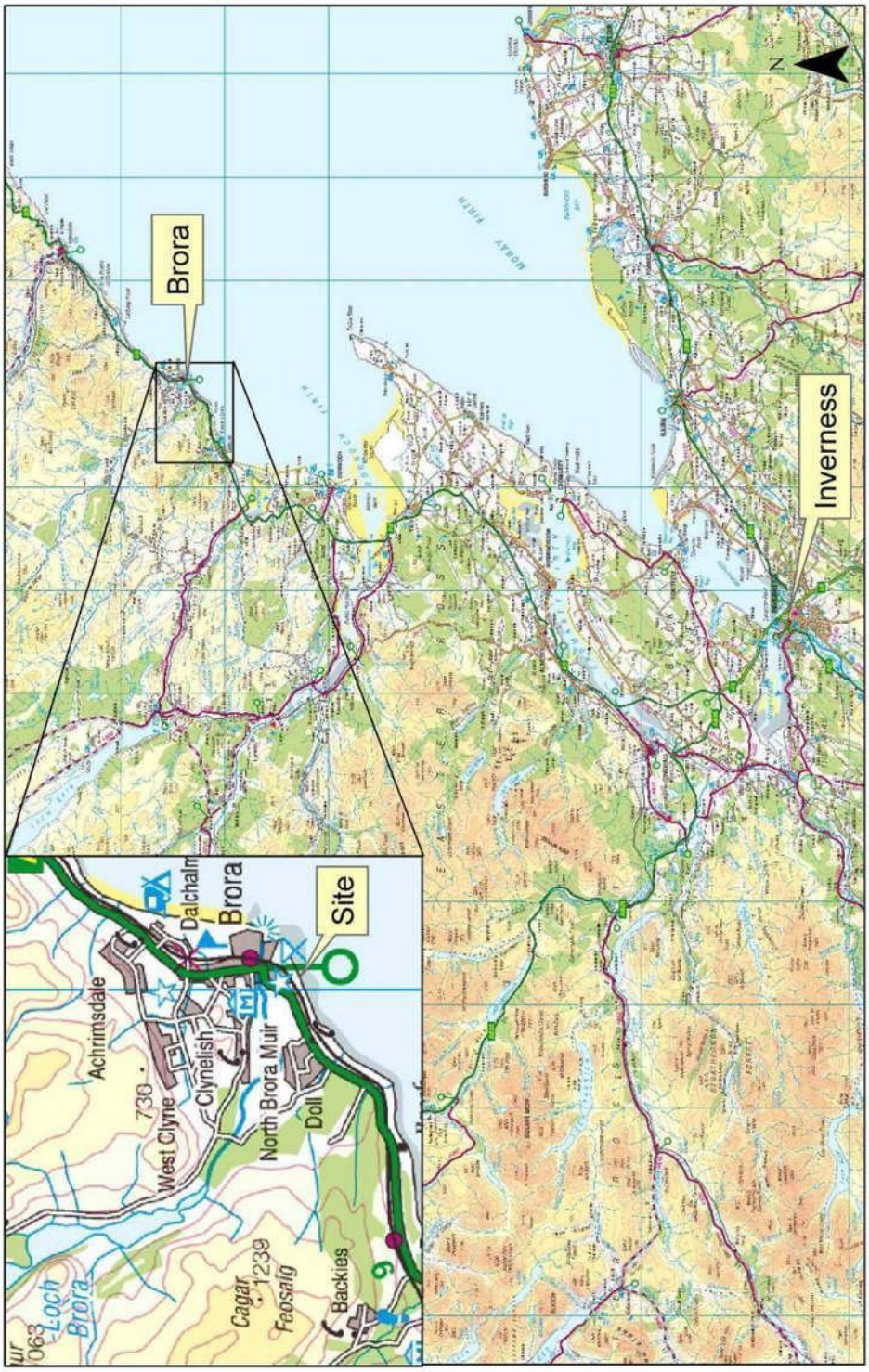

Figure 1. Location of study area. Map Courtesy of Highland Council. Not to scale.

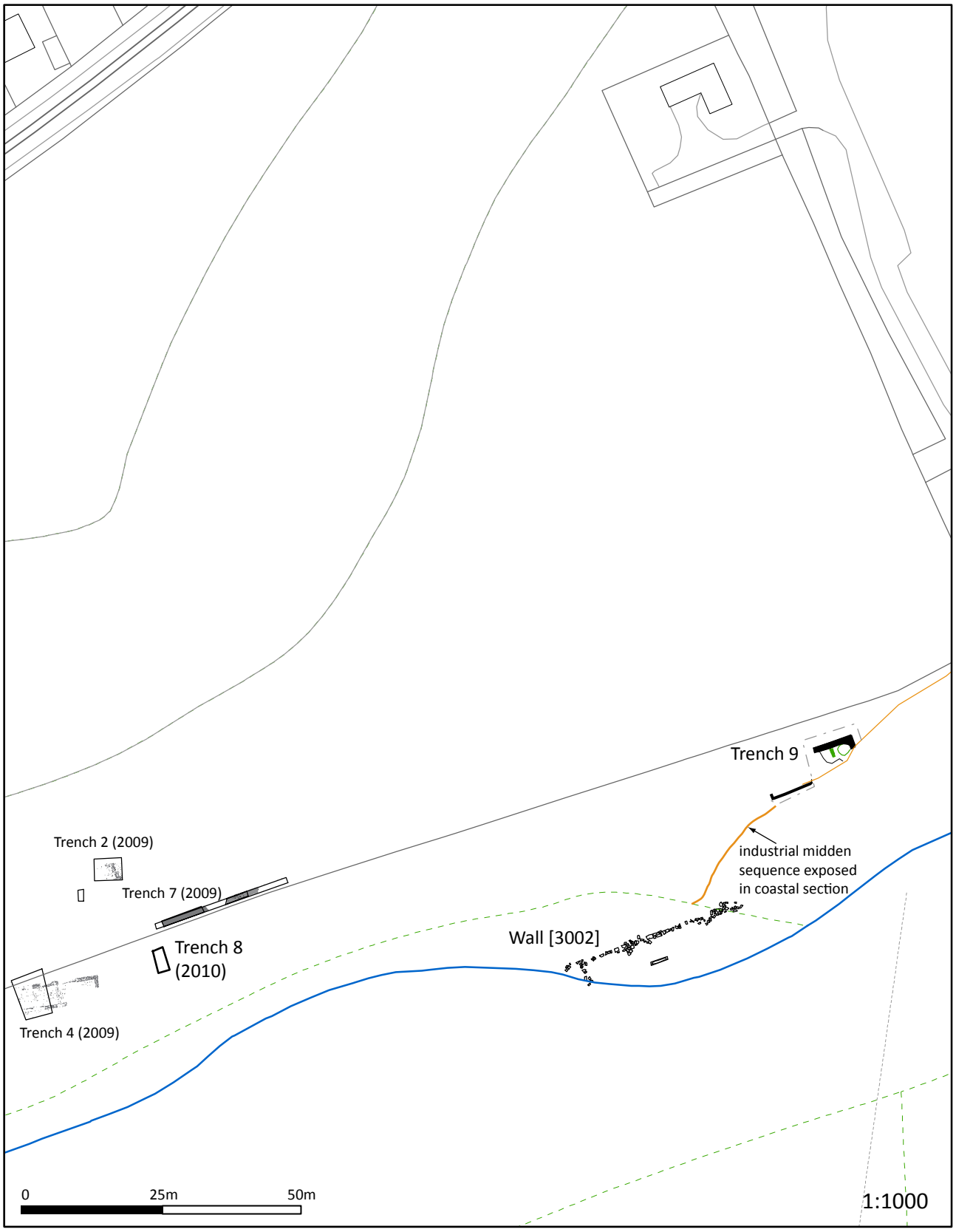

Figure 2. Trench location.

Deposits and features were identified in plan and excavated as single contexts wherever possible. Stratigraphic control was maintained by sections at the limits of excavation supplemented by temporary sections where appropriate.

Finds from each context were bagged separately. Samples for further analysis (environmental, mortar, etc.) were taken from relevant contexts.

Volunteers undertook all aspects of excavation under supervision from the site archaeologists and experienced non-professional archaeologists. Training at the Bora excavations was tailored, as in previous years, to meet individual requirements, the most common method being to team a less experienced volunteer with a more experienced individual.

Health and safety was paramount. Every volunteer and member of staff received a health and safety induction where site rules to ensure safe working were clearly explained. Hardhats were worn at all times. Goggles and gloves were available and worn for all heavy lifting and mattocking.

4.3. Recording

A site grid was established using a Leica TC407 total station theodolite, and tied into the national grid using previous fixed survey stations and fixed easily identifiable points on current OS mapping. A site datum was established and reduced to ordnance datum by transferring the bench mark from the Free Church on Gower Street.

A standard single context recording (using pro forma context sheets), and planning system, based on that developed by the Museum of London Archaeology Service, was used. All plans, sections and elevations were drawn at a scale of 1:20. Photographs were taken of every excavated context; of phases of site development; and general working shots. The photographic record was greatly enhanced by the use of a pole cam, developed, constructed and operated by John Wombell.

Registers were maintained for all contexts, drawings, photographs, finds and samples. All finds were processed and catalogued during the excavation period.

Volunteers carried out every aspect of site recording. Specific one-to-one training was given as required and as for excavation; less experienced volunteers were teamed with more experienced individuals.

4.4. Post-excavation

All records were checked, cross referenced and the data input into excel. All drawings were digitised directly into Illustrator (CS2 and CS4). Layers were used to maintain the single context plans. Survey data was processed and added to the project GIS. Finds had already been processed on-site, and these were sent to relevant specialists for analysis. Relevant extracts from the finds catalogues and reports are appended with this report.

5. RESULTS: Description

5.1. Trench 9

PHASE 1

5.1.1. Construction and use of the building in Trench 9

Overlying natural sand, the earliest cultural deposit recorded in Trench 9 was a loose, pale greyish yellow, coal flecked, fine sand (**975**) containing remnants of the raw materials used to construct the building. These remnants comprised occasional sandstone chippings; lumps and spills of mortar; beach boulders; lumps of clean yellow clay; occasional burnt shale/coal fragments and 3 fragments of slag or clinker-like material. This deposit extended as an uneven 0.2m – 0.3m thick layer throughout the interior of the building and was also recorded outside the building (**914**), between the north wall [**902**] and the northern limit of excavation. The deposit is typical of a construction horizon. It incorporates a range of raw materials used in the construction of the building, as well as small quantities of trampled material such as coal and burnt fuel.

Cutting the trampled sand of construction horizon (**975**), were 3 sub circular pits [**962**], [**957**] and [**952**] (Figure 3).

Cut [**962**] had vertical sides and a flat base and measured 1.10m in diameter and 0.6m. The primary fill (**981**) comprised mottled pale yellowish brown and darker brown re-deposited sand containing rare fragments of mortar, chips of sandstone and small lumps of clean yellow clay as well as fishbone, shell and 2 iron objects. The secondary fill (**961**) was black coal rich sand, containing occasional lumps of clean yellow clay, sandstone chips, fragments of shale and flagstone and burnt shale/coal (Plate 1). The deposit spread out beyond the boundaries of the cut extending over an area of 1.4m x 1.6m. It contained a relatively high concentration of artefacts to most other deposits associated with the building, including 18 iron objects, slag-like material (probably smithing slag), fishbone, shell and animal bone

Cut [**957**] was also vertical sided and flat bottomed, measuring 0.6m in diameter and 0.6m deep. The single fill (**956**) comprised a loose to friable, dark brown and black sand, containing frequent large pieces of broken paving stone (Plate 2) and, moderate amounts of burnt coal/shale. This deposit also contained a relatively high concentration of cultural material, including numerous fishbone, mussel shell, clinker-like material, 19 iron objects and a single body sherd from the shoulder of a Scottish post-medieval reduced ware jug; lead glazed on its exterior.

Cut [**952**], excavated in half section only, was vertical sided, 0.7m-0.9m in diameter, and a minimum of 0.4m deep, though not fully excavated. The single fill (**959**) was composed of compacted blackish brown sand containing lenses of clean yellowish sand and moderate amounts of large broken paving stone pieces. Five iron objects were recovered from the fill.

The surviving masonry of the building exposed within the area of excavation of Trench 9, represents the eastern half of an east-west oriented rectangular stone building (Figure 4). The structural remains exposed in plan comprised the north wall [**902**] (Figure 5 i and 5 ii) and the northern half of the east, gable end wall [**903**] (Figure 5 iii). The face of the surviving 8.7m long, 1.0m high western half of south wall [**904**], was exposed and recorded in the section extending beyond the south western limit of excavation (Figure 5 iv). The eastern half of this wall and the southern half of [**903**] have been lost as a result of coastal erosion (Plate 3).

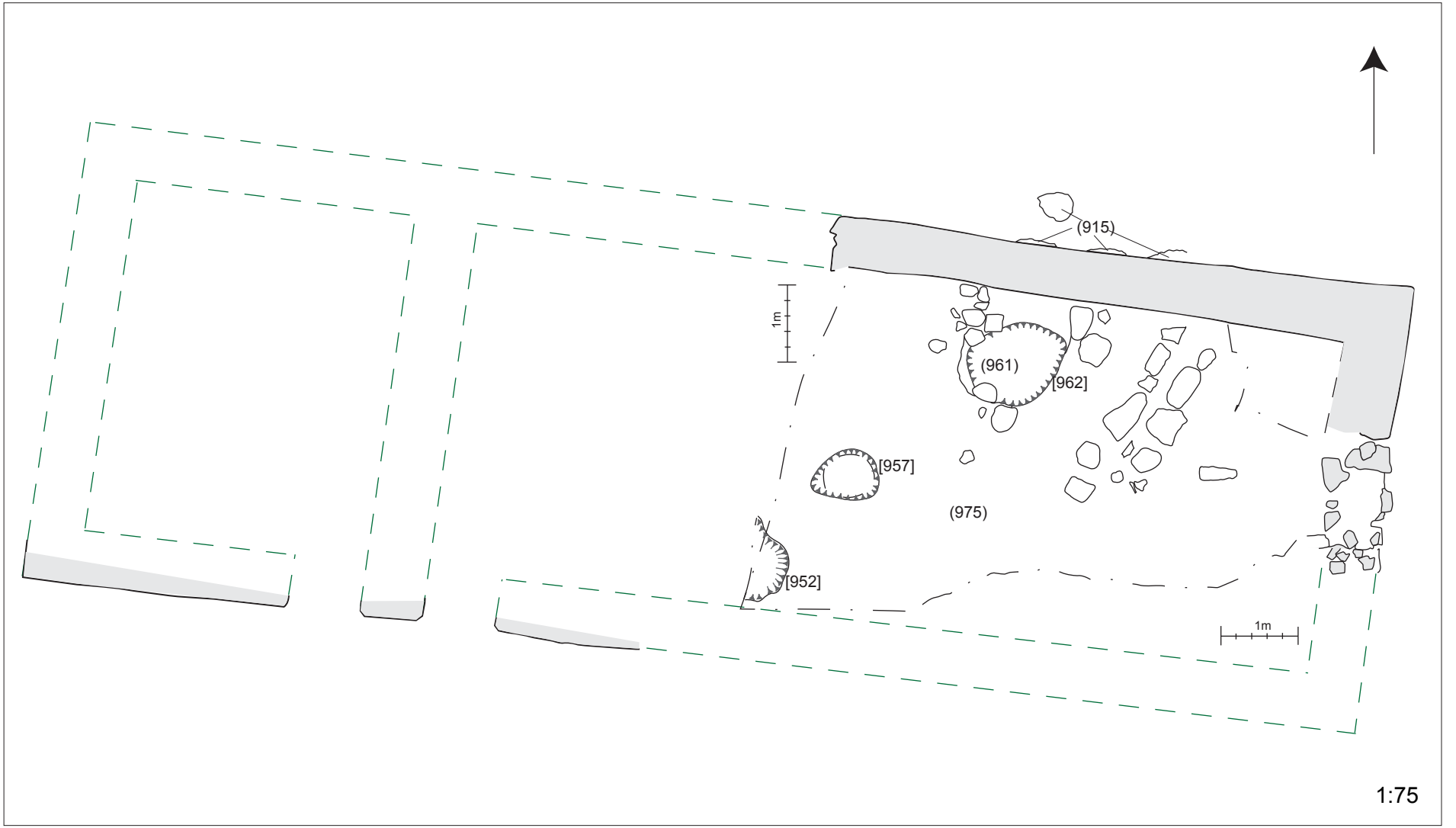

Figure 3. PHASE 1A: Features and deposits revealed beneath the paved floor, associated with the construction of the building in Trench 9

Plate 1:
Deposit (961), upper fill of cut [962]. The deposit spread below an area of boulders within the floor and contained frequent fish bone and slag. The clean beach sand (976) used to bed the floor slabs is visible in section between the dirty construction layer (975) and paving [919].

Plate 2:
Fill (956) of posthole [957] to show probable packing material.

Plate3:
View of entire east-west length of building exposed in 2010 looking north.

The west half of south wall [904] is on the left. The eastern half of the wall and southeast corner of the building have been lost due to coastal erosion.

The walls of the building were constructed predominantly from fine-grained, hard, greyish white siliceous sandstone boulders (Callovian stage Clynelish Quarry Sandstone Member), with less commonly occurring blocks of quartzite; Old Red Sandstone; conglomerate; granite; moine schist; and red flag-like sandstone. The size of the masonry blocks generally fell between 0.15m – 0.5m, each block commonly surrounded by smaller angular packing stones. The walls were constructed of two parallel skins of facing stones infilled with a generously mortared rubble core, the final width of each wall measuring approximately 0.7m (approx. 2 feet). The finish was random uncoursed rough face, with stressed quoins. A foundation cut was not visible, but there was a clear foundation course of unmortared large unworked beach boulders, presumably laid into a shallow trench in the sand. Although the hard white sandstone was quarried (e.g. at Clynelish) in later periods, the rounded form of the boulders and chatter-marked cortex provides evidence that the masonry used to construct the walls of the building, of both local and glacially derived lithologies, was collected as boulders from the adjacent shoreline.

The surviving section of south wall [**904**] incorporated two 0.94m (3 feet) wide door openings located 3.4m and 5.2m from the southwest corner of the wall, and situated on either side of the internal dividing wall. The openings were flanked with pale yellow, fine grained friable sandstone door jambs with carved chamfered corners. This is the only masonry encountered in the building that was quarried, and is probably Brora Sandstone (Oxfordian stage), which outcrops at Sputie just west of the site. A mason's mark, consisting of an 8cm x 6 cm bisected inverted triangle, was carved onto the outside face of the western jamb of each door at ground level (Plates 4; 5; 6). A hard white sandstone threshold or sill stone [**948]** was present in the eastern doorway.

All masonry was bonded with a weakly cemented white lime mortar (**984**), speckled with yellow and orangey brown coarse sand/fine grit and shell fragments. The mortar was generously applied to bond the inside of the facing blocks with the angular sandstone rubble core of the walls, and also used to harl the external and internal faces of the walls. Drops and splashes from the harling of the external face of north wall [**902**] formed discontinuous narrow spreads of lime mortar (**915**) upon the external ground surface. For approximately 0.5m above this level, the harling survived as a relatively continuous covering surrounding the larger masonry blocks. Above this it was weathered and fragmentary revealing the small packing stones that surround the facing blocks. A similar pattern of survival and wear was observed on the external face of south wall [**904**], the harling becoming more fragmentary higher up the wall face. On the interior face of wall [**902**], the harling survived well for the lowest 0.5m forming an almost continuous covering of the bottom 0.3m of wall face (Figure 5 ii) obscuring the masonry.

The overall interpolated external dimensions of the building measure 17.5m x 5.8m (57 feet x 19 feet). An internal wall, flanked on either side by the doorways, divided the building into two rooms; a larger eastern room with internal dimensions of 11.5m x 4.5m (38 feet x 15 feet), the eastern half of which was fully excavated during 2010, and a smaller western room with internal dimensions of 3.6m x 4.5m (12 feet x 15 feet) (Figure 4).

The floor of the eastern half of the east room of the building exposed in Trench 9 was composed of very large (0.5m-1.5m longest edge), angular bituminous shale slabs (**919**) bedded onto clean beach sand (**976**/**918**) and packed with beach cobbles and pebbles (Figure 4, Plates 7;8). The slabs were disturbed and partially absent at the eastern end of the room. A 1.5m x 1.5m, area of the floor adjacent to north wall [**902**] was composed of beach boulders, 0.3m-0.5m in diameter, of varying lithologies. The location of the area of boulders coincided with, and sealed, cut [**962**]. Elsewhere, the shale paving slabs respected the edges of the cuts for postholes [**952**] and [**957**].

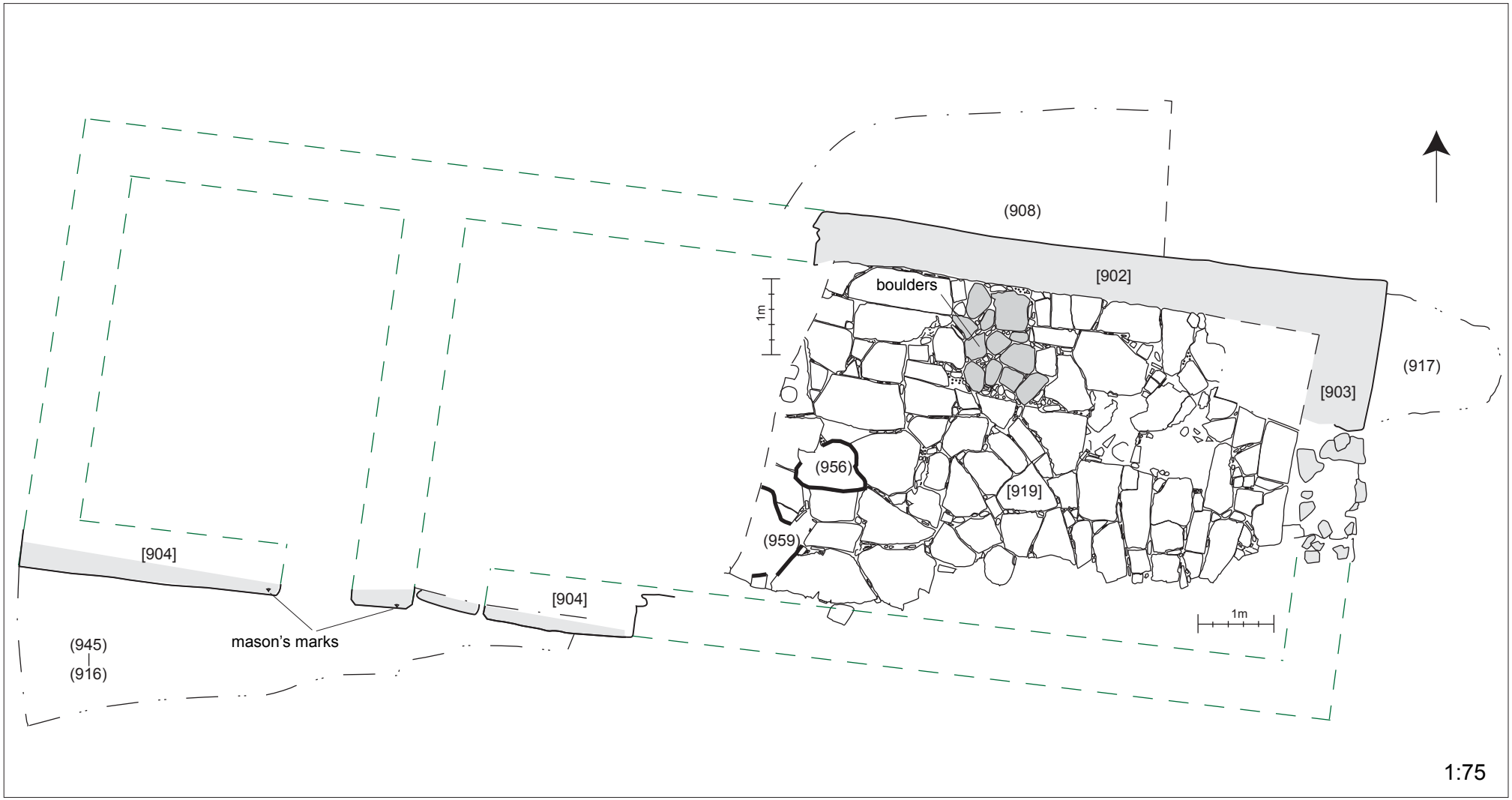

Figure 4. PHASE 1B: Features and deposits associated with the use of the building in Trench 9

Plate 4:
Mason's mark carved into the western door jamb of the east door at ground level.

Plate 5:
The eastern doorway and threshold stone [948]. The mason's mark is on the left hand door jamb when looking at the doorway.

Plate 6:
The western doorway showing the second identical mason's mark on the left hand door jamb.

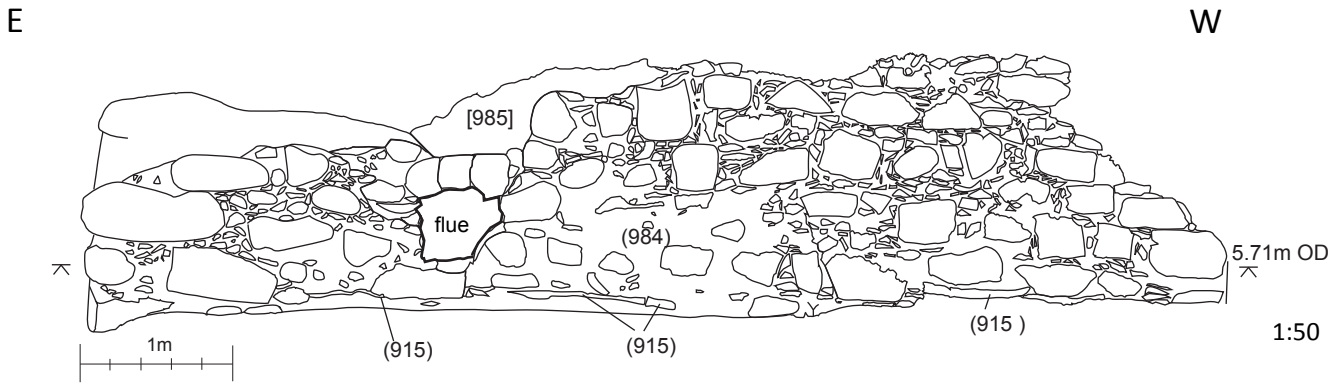

Figure 5i. North facing elevation of external face of north wall [902]

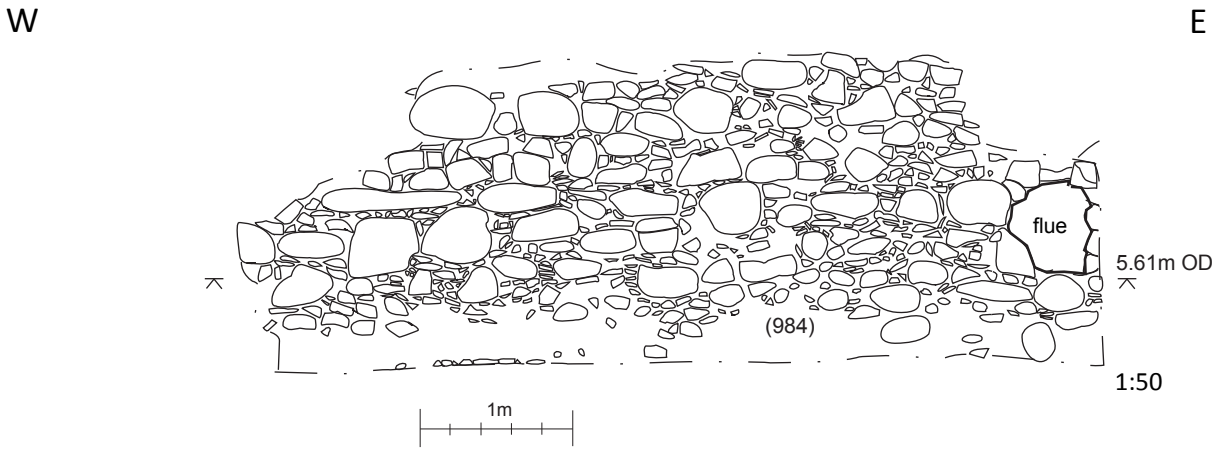

Figure 5ii. South facing elevation of internal face of north wall [902]

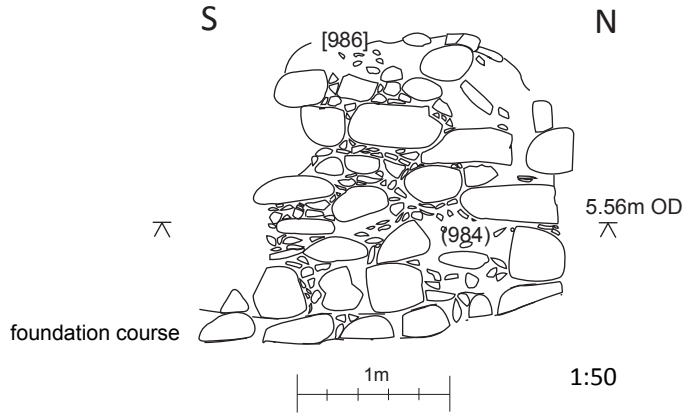

Figure 5iii. East facing elevation of external face of gable end wall [903]

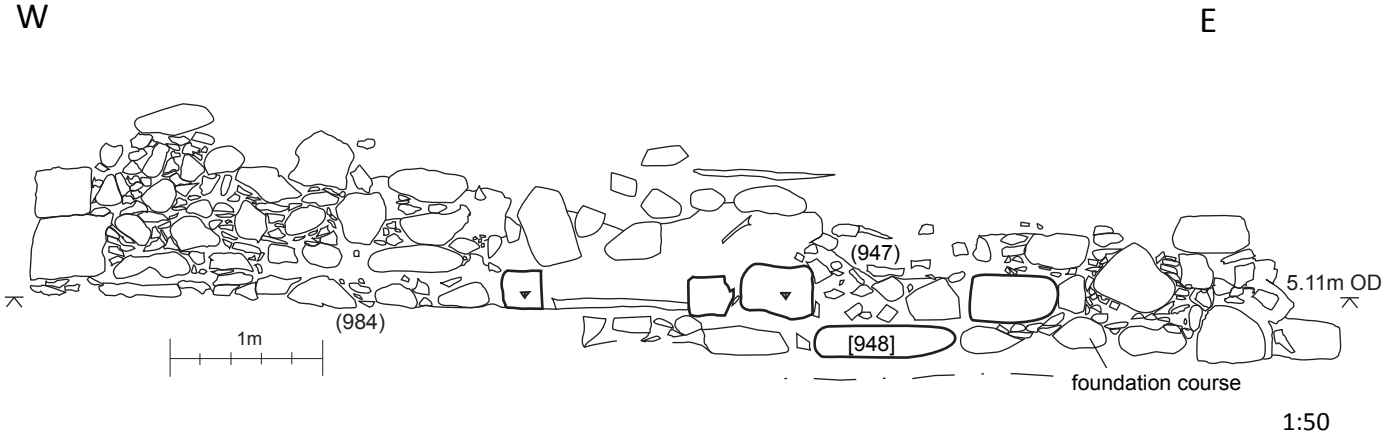

Figure 5iv. South facing elevation of external face of wall [904] showing doorways and position of mason's marks [12]

Many of the bituminous shale paving slabs of the floor proved to be extremely friable, and a few days trampling by members of the excavation team caused significant damage. It is unlikely that the floor would have been able to bear heavy or even moderate traffic during the use of the building, without incurring damage, yet the floor appeared to be in good condition when first exposed. This could indicate that it was covered with a protective layer of material (see (**920**) below), or that there was very little traffic associated with the use of this room.

Inside the room, and directly overlying paving (**919**) was a variable deposit of loose to compacted dark brown, dark reddish brown, black and sometimes greyish soil-like and peat-like material 3cm-14cm thick (**920**). It extended as a continuous layer except where it had been disturbed at the east end of the room (Plate 9). The deposit contained very frequent small fragments of coal, and fibrous organic material and low quantities of cultural material including shell, fishbone, animal bone, a single sherd of lead glazed Scottish post medieval oxidised ware, wood, iron objects and clinker fragments.

Outside the building, ground surfaces contemporary with its use could be identified on the basis of composition, elevation and extent. North of the building, a poorly preserved thin layer of compacted dark brown sand, (**908**) with a very uneven surface, was composed of numerous interleaving lenses of dark brown organic rich and coal stained sand separated by very thin layers of clean sand. The layer was relatively sterile and possibly represents a former tussocky vegetated ground surface, contemporary with the building. East of the building, a poorly preserved patch of compacted, black coal stained sand, clay, and area of burnt clay (**917**), survived adjacent to east wall [**903**]. The northern limit of this deposit was removed by machine, and by a test pit excavated in 2007, and the east and southern extent lost through coastal erosion. However, during machining, it was observed as a discontinuous spread extending up slope northwards to form a continuous layer with [**908**] to the north of the building. This relationship can be seen as a black stain on the external face of walls [**902**] and [**903**].

The best preserved area of external ground surface known to be contemporary with the building were layers (**916**) and (**945**/**965**), recorded in plan in front of the south western half of south wall [**904**], and recorded in the coastal section (described below) extending westwards from Trench 9. Layer (**916**) was composed of highly compacted fragments of shale, coal, clay and clinker burnt pink, purple, black, and dark red in a sandy matrix (Plate 10). The surface of the layer was extremely hard, although it fragmented easily when excavated. (**916**) was clearly identified in the coastal section as a continuous layer extending westwards over 30m to the site of the 'long wall' [**3002**], recorded in Trench 3 in 2007 (Hooper & Aitken, 2007) (Plate 11). The altitude of the surface of the layer declined gently from approximately 5m OD at the west doorway of wall [**904**] in Trench 9 to approximately 4m OD at wall [**3002**], which is now located below the high tide mark on the beach. A single piece of Scottish post medieval oxidised ware with a lead glaze was recovered from the deposit immediately outside the eastern doorway in south wall [**904**]. Other finds included a small assemblage of animal and fish bone, shell, three iron objects and a possible piece of slag.

Directly overlying (**916**) in Trench 9, although separated by additional intervening deposits in section to the west, was a further surface-like deposit, (**945**) composed of compacted black coal rich sand, also containing small assemblages of animal and fish bone, shell, and thirteen iron objects. The layer was traced in section as a continuous deposit for 8m west of Trench 9 before it became disturbed and fragmented. A very similar deposit (**965**) recorded in the western half of the coastal section is likely to be the same as (**945**).

Plate 7:
Aerial view of paved stone floor of the building [919] looking east. The material of the paving is bituminous shale. The area of large cobbling can be seen on the left side of the room next to the north wall. An unexcavated section of the later limekiln can be seen in the far corner of the room.

Plate 8:
View of paved stone flooring [919] looking west. The north wall of the building is on the right. The remains of the south wall on the left. Blown sand deposits (923) and (944) that fill the building are visible in the far section. The scatter of nails upon a darker sandy layer (933) is visible as the dark horizon midway up the section.

Plate 9:
Organic rich deposit (920) within the building, looking east.

5.1.2. The coastal section (except for deposits (916) and (945) deposits in the coastal section were recorded in section only)

Layers (**916**) and (**945**) form part of a sequence of interleaving westwardly thickening deposits mainly comprising burnt shale, coal, sandstone, cinder, ash and sand, recorded in a continuous coastal section between Trench 9 (excavated in 2010) and Trench 3 (excavated in 2007). The deposits provide the stratigraphic link between the buildings recorded in each trench (Figure 6; Plate 12).

In the western 10m of the coastal section, the sequence of deposits attained a thickness of 1.4m, and comprised a series of dumps of material, primarily composed of burnt shale, coal, clay and ash (**983**, **974**, **982**, **972**, **966**), with occasional lenses of coal and clay rich sand (**968**, **977**). At the base of the sequence, overlying natural beach sand, deposit (**983**) contained the most concentrated inclusions of clearly industrial waste material including boulder sized concretions of clinker and burnt sandstone in a burnt shale, cinder and ash matrix. The only deposit in the coastal sequence that was not made up of the remnants of burnt fuel or blown sand was a small dump (1.6m wide, 0. 14m thick) of fragments of friable yellow sandstone (**973**), identical to the stone used for the door jambs in south wall [**904**]. A 0.3m deep, 0.6m wide, vertical sided flat bottomed cut, [**970**] filled with coal flecked sand (**971**) was located at the junction of the thick dumps of industrial midden-like deposits to the west and the thinner laterally extensive deposits to the east extending to Trench 9.

The earliest of the laterally extensive deposits that form continuous layers between Trench 9 and Trench 3 was (**969**), a 4cm-18cm thick, hard, blueish-grey clay rich sand, becoming much sandier and looser eastwards. East of cut [**970**], this layer overlay natural sand; west of cut [**970**] the layer overlay the thicker sequence of dumped industrial midden deposits.

Surface (**916**) directly overlies layer (**969**), except for a thin lens of intervening windblown sand (**967**) that occurs only in the western part of the coastal section.

Surface (**916**) was cut by a 0.5m deep, 1.0m wide concave sided, flat bottomed feature [**979**] filled with dark red burnt clay and fuel ash (**978**). There followed an extensive accumulation of windblown sand (**963**), before the deposition of a further hard, blueish-grey clay rich sand (**964**), that became progressively sandier and incorporated more burnt material eastwards. This layer was very similar to (**969**) described above, and also underlay the upper surface–like deposit of compacted black coal rich sand (**945**/**965**).

Plate 10:
View of section in front of eastern doorway in south wall [904] to show the relationship of external surfaces (916) (lower) and (945) (upper) with the building. Looking west.

Plate 11:
View from Trench 9 westwards towards Trench 3 showing the general arrangement of deposits exposed in the coastal section. Surface (916) is in the foreground and can be traced as the dark band dipping gently downwards beneath the uppermost coal rich layer approximately one third of the way along the section.

Plate 12:
The thickest part of the deposits in the coastal section located behind the remains of wall [3002] on the beach. It is possible burnt fuel from the building initially accumulated against the back wall of this possible pan house. South wall [904] in Trench 9 is just visible in the top right hand corner of the picture.

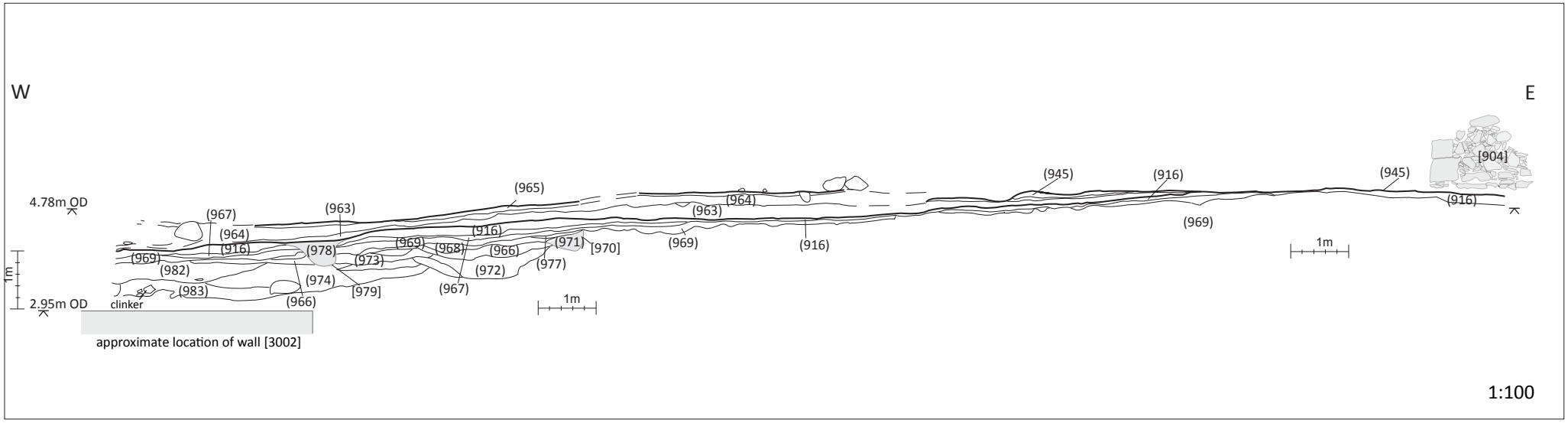

Figure 6. South facing section across sequence of industrial midden-like deposits exposed in the eroding face of the dune west of Trench 9. Layers [916] and [945/965] appear to form continuous surfaces that link the two buildings at either end of the sequence.

PHASE 2

5.1.3. Deposits associated with demolition and abandonment of the building

Inside the building, overlying layer (**920**) was a highly variable, plastic to loose, mottled grey/yellowish brown/dark brown deposit (**949**, **950**/**953**) composed of clay, sand mortar and containing boulder sized tumble. The deposit occurred as a 1.6m wide spread, against the inside face of north wall [**902**] and as 3m x 1m spread in the southwest corner of the site abutting wall [**904**]. It was thickest against the walls, and absent from the centre of the room.

The composition and distribution of these deposits are typical of demolition, probably originating from the collapse, or deliberate demolition, of the upper courses of the walls. The clay content would indicate that there was a clay component in the bonding of the upper courses of the building, although this was not seen in the surviving upstanding masonry.

A single iron object (nail) and two tiny triangular offcuts of plate glass were recovered from (**953**). Analysis of the glass revealed that it was high lime, low alkali glass (HLLA), almost certainly dating to before 1700 and so possibly contemporary with the early 17th century building.

At the eastern end of the room, a looser mixed deposit (**921**/**951**), of dark brown/yellowish brown/yellow and black sand containing mortar, clay lenses and lumps, boulder and pebble sized tumble, peaty lenses and broken paving flagstones, coincided with an area of disturbance in the paved floor (**919**). The composition of (**921**/**951**), comprising re-deposited materials from underlying deposits (peaty lenses, shale flagstones) as well as from nearby masonry (tumble, mortar, clay) points to an episode of disturbance following the disuse of the building. The disturbed area coincides with the position of the later limekiln, and it is possible the disturbance relates to its construction.

Demolition deposits were covered by a 0.3m – 0.6m thick layer of loose, pale yellowish brown windblown sand (**923**), banded with numerous very fine coal flecked horizons. Above this, extending over the western half of interior of the building at an elevation of between 5.13m – 5.47m OD, was a very thin layer of slightly compacted, dark brown sand (**933**). Forty iron objects, predominantly nails and diamond shaped objects were recovered from the surface of this layer, although no pattern was discernible (Plate 9075).

There followed an accumulation of a further 0.3m – 0.5m of very loose, pale yellowish brown sand (**944**), banded with fine coal-flecked horizons and containing rare very small fragments of quartzite and mortar.

PHASE 3

5.1.4. The lime kiln

Sometime after the abandonment of the building, and following accumulation of windblown sand (**923**, **944**), the north east corner of the ruinous walls of the old salt works building were modified, and a new wall built, to construct a limekiln (Figures 7;8, Plate 13).

The new wall [**905**] formed the west side of the limekiln bowl. The surviving 2.2m long, 1.4m high north-south section was constructed of beach boulders of various lithologies with occasional re-used white sandstone blocks from the earlier building (Plate 14). The size of the masonry ranged from 0.4m x 0.4m to 0.6m x 0.6m for the facing stones and 0.2m x 0.2m for the rubble core. No bonding material was present within the wall, although the stones were bedded in places into sand rich soily layers, which may have originally been turves. Possible evidence of a turf stack (**935**/**926**) was recorded outside the west wall of the kiln bowl. The west external face of the wall was roughly patched in places with a crumbly buff coloured mortar (**912**), but this did not form a bonding material within the wall and was probably applied during the use of the kiln. The wall measured 1.50m wide at the base, tapering to 0.84m wide at top (Plate 15). The east (inside) face of the wall was faced with medium sized angular blocks of limestone and sandstone, bonded with clay, to form the concave inside bowl of the western half of the limekiln. The facing stones are heat reddened, crazed and cracked in places.

At the same time as the new wall was constructed, the eastern end of existing north wall [**902**] and east wall [**903**] were modified ([**985**] and [**986**]), to create the north and east sides of the kiln bowl. A 0.6m high, 0.5m wide flue hole was inserted into the north wall by demolishing part of the wall, inserting a sandstone lintel, and rebuilding the upper courses with re-used masonry in a clay bonding. As with [**905**], the internal face of the kiln bowl was lined with angular medium-sized fragments of limestone and sandstone, typically 0.2 - 0.3m in diameter bonded with clay to create a gently concave kiln bowl. The stone lining was severely heat damaged causing *in situ* cracking, reddening and vitrification of the surface of the sandstone fragments. Vitrification was particularly pronounced in the immediate vicinity of the flue (Plate 16).

The kiln bowl had an internal diameter of 1.80m at the base and 2.90m at the top and survived to a height of 1.30m. The whole of the southern side of the kiln has been destroyed through erosion; however, it is highly likely that the draw hole would have been located in the south wall.

The bowl still contained a large quantity of burnt lime and associated deposits (Plate 17). Extending across the base and partially up the sides of the burning chamber was a 0.1m thick layer of cemented burnt orange/cream/grey blue/beige lime (**924**), with occasional inclusions of coal, sand, clay and pure lime fragments. In one area, the lime had a soft butter-like consistency. The remainder of the bowl was filled with a mass of lime rich material, appearing to be in three distinct states. The main deposit (**911/a**) was composed of a cemented white lime mass. At the centre of the chamber, however, there was an area of unburnt and partially burnt light grey limestone chips (**911**/**b**), identical to a deposit of limestone chips (**910**) recorded outside the western wall of the kiln. In the upper western part of the chamber was a mass of crumbly light brown lumps of lime with a yellow coating (**911/c**). These three distinct deposits were individually sampled. Throughout the whole deposit, there were lenses and patches of black disintegrated coal-like material (**938**), and in one or two places, the lime had a putty or butter-like consistency. Towards the top of the chamber, the lime had fractured horizontally, and a yellow, sometimes orangey yellow coating lined the fracture planes.

The deposit of dull grey, 3mm - 80mm in size, angular limestone chips (**910**) recorded on the outside of the kiln was thickest in the corner formed at the junction of wall [**905**] with [**902**]. Some of the deposit was removed during machining, but it was observed extending, and becoming patchy, towards the western limit of excavation. Occasional rounded beach cobbles of the same stone with chatter marked cortex and clear percussion marks show that the source of the limestone chippings were beach cobbles, broken up with a hammer or mallet on site. These are still present on the rock platform in the immediate vicinity of the site and are almost certainly Oxfordian Stage Ardassie Limestone that outcrops on the north side of the Brora estuary.

To the north of the limekiln, the probable contemporary ground surface (**906**, **907**) was composed of moderately compacted coal dust rich black sand containing burnt and unburnt limestone, sandstone, vitrified sandstone, cinder, mortar and clay.

Demolition deposit (**909**), an area of tumbled stone in loose dark brown soily sand, originating from the collapse or demolition of limekiln wall [**905**], was the latest cultural deposit recorded in Trench 9.

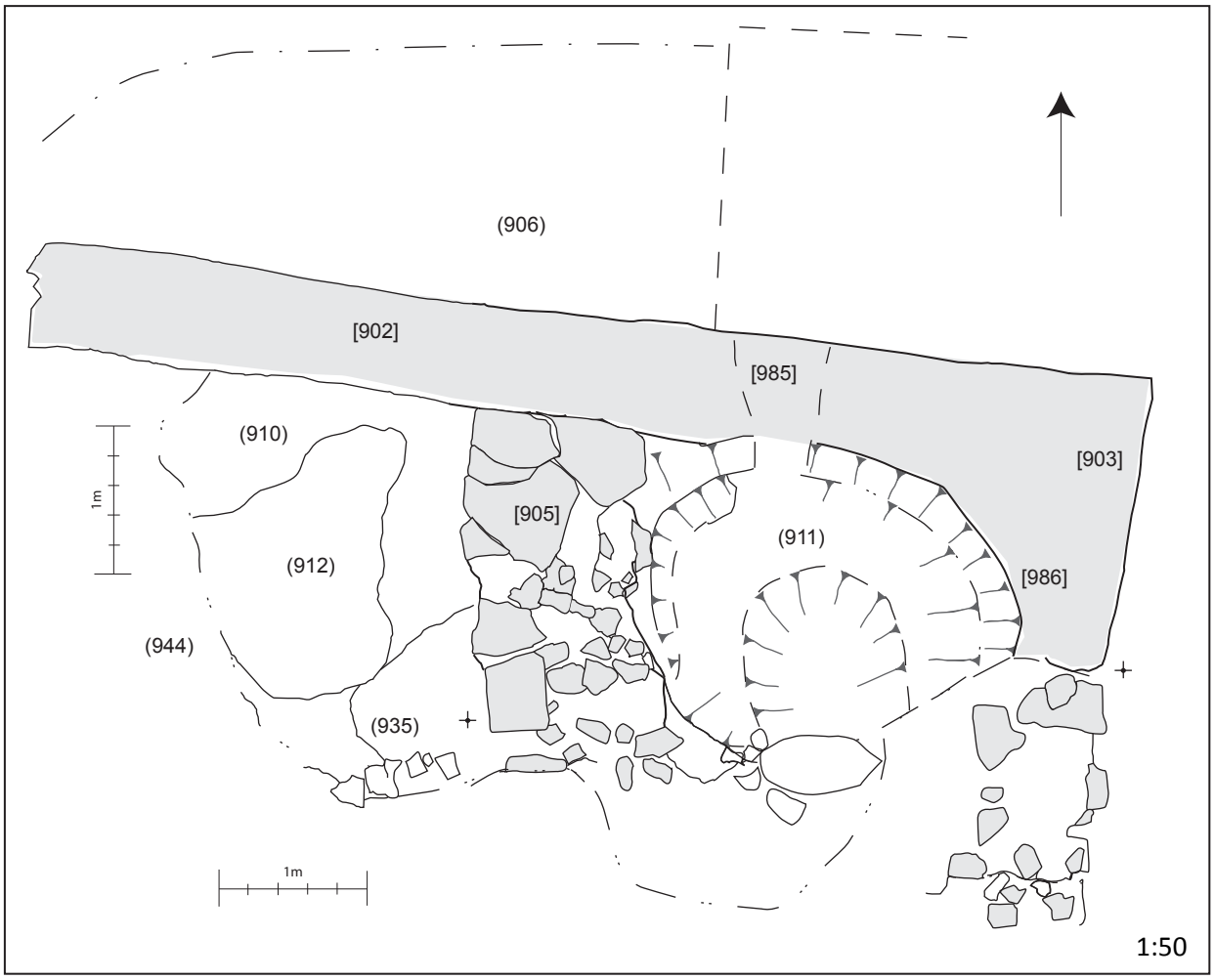

Figure 7. PHASE 3: Features and deposits associated with the limekiln

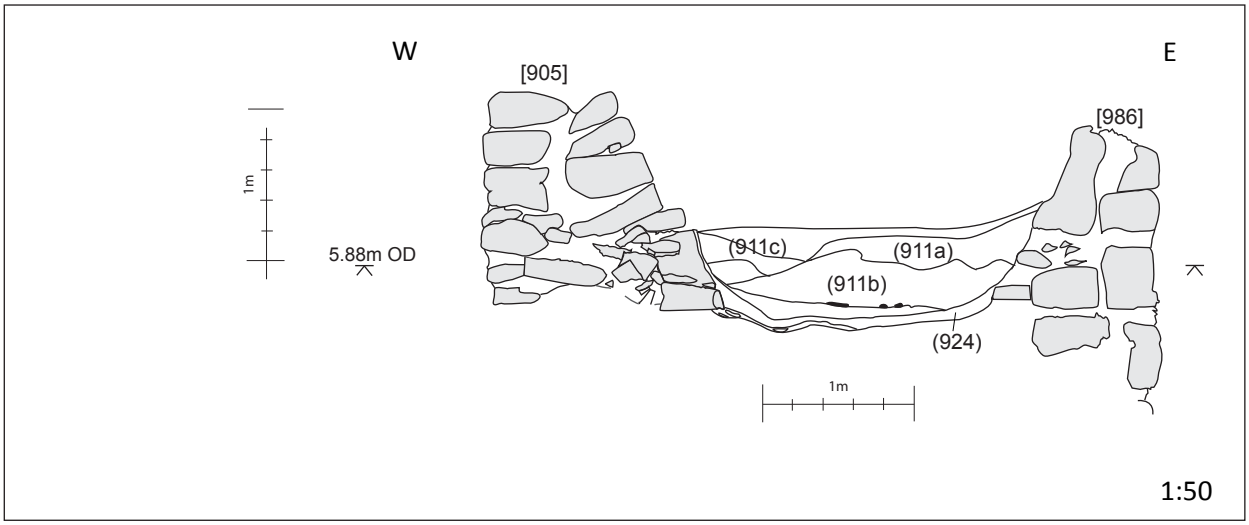

Figure 8. Section across the kiln bowl

Plate 13:
Pre-excavation aerial view of limekiln inserted into ruinous east end of salt works building. Looking east.

Plate 14:
Newly constructed west wall of limekiln, [905], clearly abutting existing wall of the former salt works building. Looking east.

Plate 15:
Section across limekiln wall [905] to show distinctive shape of the wall to create the bowl. The flue is visible on the right.

Plate 16:
Vitrified sandstone above the flue of the limekiln.

Plate 17:
Section across the limekiln inserted into the northeast corner of the salt works building, showing the modification of the existing east wall [903] to create the bowl; the contents of the kiln; and the heat affected sand below.

A short note on Trenches 8 and the re-excavation of the hearth in Trench 4 is given below. The results will be fully considered in the final reporting of the 18th century salt works.

5.2. Trench 8

The small trench opened up at the edge of the sand dune cliff 10m east of Trench 4 revealed the almost completely robbed out remains of the base of an east-west oriented wall, cut [**809],** fill (**810**), and an adjacent compacted black coal dust rich sand (**805**) (Plate 18) containing fragments of mortar and burnt coal. Four fragments of 18th century bottle glass, 2 fragments of 18th century window glass, a sherd of white salt glazed stoneware and 14 fragments of animal bone were recovered from the deposit.

These deposits represent the robbed out north or back wall and fragment of surviving exterior ground surface of the easternmost of a pair of buildings depicted by Kirk in 1772 (see Hooper *et al.,* 2009, Figure 12 page 31). The inside face of the robbed out wall lay only 0.7m from the coast edge, and no interior deposits survived. The exterior surface was very similar in composition and finds to exterior surfaces (**4208**) and (**4234**) recorded in 2008 and 2009 in Trench 4. When plotted onto Kirk's plan, the current coast edge truncates all but the northwest corner of this eastern building. The fragment of the building revealed within Trench 8 confirms that this is correct and the building is now almost gone. The remnants that do survive are extremely ephemeral, but very similar to those recorded in Trench 4.

5.3. Trench 4

The re-excavation of the furnace in Trench 4, initially recorded in 2008, revealed a complex series of changes, additions and probable repairs or re-builds of the structure (Plates 19-23). At least two main phases of the structure are apparent. These comprise:

1. the remains of the back of a chimney and hearth base contemporary with the original thick slabs of the floor in this area, and with the dividing wall of the building;
2. the insertion of a clay bonded E shaped stone structure just in front of the chimney area, laid directly upon the stone floor slabs.

The earlier chimney back and hearth base were of mortared brick and stone. In places the mortar of the hearth base appeared to be contiguous with mortar of the chimney breast structure providing evidence these elements were constructed at the same time. The mortar was also identical to that used in the walls of the building and of that found between the thick slabs of the floor in this area.

At some point, the hearth was completely re-modelled by the addition of the clay bonded E shaped structure.

In addition to the identification of these two main phases, the excavation revealed evidence of a number of modifications that have not yet been fully resolved. Whatley (1987) reports that the most common building job in a salt pan was the replacement of the panhouse hearth. In 1710, this cost only 1/10th of the cost of the much more major job of stripping down and repairing the pans ('*beiting*') which was carried out approximately every 2 years. It is possible to imagine, therefore, that even in a pan house operating for less than 10 years, the hearth may have been replaced or repaired frequently and this would account for the complex surviving archaeological evidence.

Plate 18:
Trench 8 looking south towards the beach. The robbed out remains of the base of wall (809/810) is visible as the line of rubble and sand extending across the Trench in the background. Compacted black exterior surface (805) is in the centre of the picture.

Plate 19:
Hearth structure in Trench 4 at an early stage in the excavation. The E shaped masonry structure, bonded with greenish clay is clearly seen built against, but slightly misaligned with, the original chimney breast foundation walls.

Plate 20:
Hearth structure in Trench 4 showing the mortar bonded hearth base and chimney back. The E shaped structure is a later addition and is out of phase with the brick within the chimney breast walls.

Plate 21:
Hearth, Trench 4 with part of the later structure removed so the relationship of the original hearth base and floor slabs is visible. The slabs are also mortared. The space between the chimney breast walls are filled with unmortared brick, the function or origin of which is not yet understood.

Plate 22:
Hearth, Trench 4 during excavation of deposits underlying the original hearth base. These deposits underly the slabs, but not the structure of the chimney breast.

Plate 23:
Hearth, Trench 4 following removal of the later E shaped structure - the imprint of which can still be seen upon the slabs. The deposits within the chimney breast have been completely excavated to clean sand. There is slight evidence of scorching of the sand in the centre.

6. RESULTS: Discussion

6.1. Trench 9

PHASE 1

6.1.1. The building in Trench 9

The difference in elevation of approximately 1m between the contemporary ground surface (**908**) behind the building, (5.7m - 5.9m OD), compared with the finished floor levels inside the building (5.24m OD - 4.98m OD) and the highly compacted surface (**916**) in front of the building (4.9m – 4.97m OD) provides evidence that the building was constructed upon a shallow terrace cut into the seaward side slope of a low sand dune. Further confirmation is provided by the distribution of the harling of the external face of north wall [**902**], which begins from a height of approximately 0.8m from the foundation course. This shows that the first 0.8m behind the back wall was immediately backfilled after construction, in effect, the base of the back wall being terraced into the sand dune.

The survival of well-preserved sections of harling at the base of the walls also provide evidence that the external and internal faces of the walls of the building were originally coated with a continuous weather proofing covering of lime mortar, probably obscuring much of the wall masonry, except for perhaps the quoins and the centre of the largest masonry facing blocks. Not a single fragment of slate or pantile (although the building is probably too early to be pantiled) was recovered during the excavation, so it highly likely the roof was made of organic material such as heather, turf or wooden shingles.

The shape and dimensions of each of the three cut features below the paved floor of the east room strongly suggest they are structural. This is almost certainly the case with [**952**] and [**957**] as the frequency and arrangement of broken paving stone fragments within the fill suggests these could be the remains of the packing materials for the post. Furthermore, the surrounding shale paving slabs almost perfectly respect the edges of both cuts, suggesting the presence of an upstanding post or structure around which the paving was laid.

The shape of cut [**962**] also suggests it is structural, although there was no evidence of packing material. The cut was backfilled with re-deposited sand, before beach boulders and large cobbles were laid down to complete the stone floor of the building. This is the only place in the floor where boulders have been used. The small area of boulders may be evidence of the infilling of the area following the cessation of activity connected with underlying feature [**962**]; a later repair; or an area where greater strength was needed, for example to support heavy equipment.

Together, the finds recovered from these three features account for the majority of all finds recovered from deposits associated with the building in Trench 9. These include the majority of the *c.* 500 whole fish brought to the site, probably as food, as well as 44 iron objects (mainly nails), clinker, and from (**961**) (the final fill of [**962**]), several lumps of smithing slag. The fills of each feature also contained remnants of the raw materials used in the construction of the building such as sandstone chippings, fragments of mortar and lumps of clean yellow clay. The composition of the inclusions and finds within the three features shows they were back filled during the construction phase of the building. The recovery of smithing slag provides evidence of on-site smithing during the construction phase.

Thus far, therefore, the majority of cultural material, including food waste, recovered in Trench 9 has been found in deposits associated with the construction of the building, not with its use. It also appears that the material has been deliberately cleared up and placed into features which would be eventually sealed beneath the paved floor of the building.

The bituminous shale paving slabs that made up most of the floor proved to be extremely friable during excavation, and it is unlikely they could have borne much use without incurring damage. Further analysis of the peaty deposit (**920**) that covered the paving slabs will hopefully identify the origin of this material, and help clarify whether there was an organic layer (heather?, bracken?) that protected the floor surface. It is also possible, however, that (**920**) is the remains of organic roofing material. If the floor was not protected, there cannot have been much traffic associated with its use; for example if it functioned as a store. However, it is also possible that it was never or barely used. Sutherland Estate documents that record that when John the 12th Earl of Sutherland died in 1616 '*he left his house overburdened with debt'* and that this was due in part *'by enterprising some works - salt pans at Brora, which, at his great cost, were just finished and brought to perfection when he died. His death interrupted their working*.' Two years later the sale of 'the *iron of the saltpannis of Broray*' suggests that salt making in Brora had ceased.

Overall, the remains excavated and recorded in Trench 9 reveal a building of a scale and quality rare and remarkable for the turn of the 17th century in this part of the Highlands. Remarkable too is the fact that it was not a high status residence or ecclesiastical building, but an industrial work place. The surviving evidence shows that all materials used in the construction were sourced locally. The builders ate large quantities of fish, drank from, and broke a green glazed jug and at the end of the construction period, cleared away their rubbish in pits or postholes beneath the floor. One of the workers was a smith who made the iron fixtures for the building on site. A mason carved his mark into the door jambs. The presence of rare pre 18th century window glass provides evidence that glass could have been used either in the building or in its furnishings. The high quality of the build, the choice of carved stone masonry for the building's openings and the presence of specialist craftsmen reflect the investment and direct involvement of the Sutherland Estate in this early, short-lived industrial venture.

6.1.2. The coastal section

The architecture of the deposits exposed in the coastal section suggests the deliberate deposition of dumps and spreads of industrial waste material, predominantly burnt fuel, in preparation of a made surface linking the building in Trench 9 with the building now below the high water mark represented by wall [**3002**]) excavated in Trench 3 in 2007 (Figure 6). The form and thickness of the deposits in the western part of the section relative to the thin laterally extensive spreads in the vicinity of the building in Trench 9, indicates the material originated from activity carried out within the building on the beach represented by wall [**3002**], and that initially this material was dumped to fill a natural hollow in the sand. The first of the highly compacted surfaces, (**916**), was separated from the second compacted surface (**965**/**945**) by an extensive layer of windblown sand, (**963**). This is possible evidence of a period of inactivity at the saltpans, although it could represent a storm event after which the surface was renewed. The existence, early on in the sequence, of a lens of the friable yellow Brora sandstone (**973**), identical to the stone used for the door jambs in south wall [**904**] introduces the possibility that the initial accumulation of the midden deposits could have taken place during the construction of the building in Trench 9.

The complete exposure and recording of the coastal section is an important step forward in the understanding of the eroding remains of wall [**3002**], systematically recorded at the shoreline of this

part of the Back Beach at Brora by Jacquie Aitken and the Clyne Heritage Society since the late 1990's, and occasionally noted prior to this. It has provided, for the first time, clear evidence that this building belongs to the 16th-17th century period of salt pan activity; '*the Old Salt House'*, and was contemporary with the building in Trench 9 excavated in 2010. The quantity and depth of accumulation of the industrial waste material adjacent to wall [**3002**] together with its geographical situation on the beach, indicates that it was this building that was most likely to have been the pan house of the old salt works. The corresponding lack of evidence of structures or materials associated with the process of salt panning within the building in Trench 9, suggests this building, or at least the eastern room of it, had a different function – possibly a store, for salt, for coal, or for both.

PHASE 2

6.1.3. Demolition and abandonment of the building

The surviving height of the walls to 2m in places shows that the building was not comprehensively dismantled or demolished, although any portable fixtures such as doors, windows, internal structures, and all equipment was presumably removed. There is a reference to the *£666-13s 4d* (presumably pound Scots) *got from the sale of the iron of the saltpannis of Broray* in 1618.

The distribution of well-preserved harling within 0.3-0.5m wide band at the base of the walls provides evidence that the building was inundated with sand up to this level relatively quickly. Above this the mortar is much more fragmented and friable, almost certainly as a result of a period of exposure and weathering.

It is also at approximately 0.5m above the paved floor level that an episode of stability, within the accumulation of blown sand, is hinted at by a stained horizon scattered with forty iron nails and other iron objects. These may be the result of deliberate removal from, or *in situ* decay of a wooden structure, such as planking from a boat.

PHASE 3

6.1.4. The lime kiln

At some point in its history, the ruins of the eastern end of the 16th/17th century salt works building were modified to create a lime kiln. The surviving remains comprised the base of a single bowl-shaped burning chamber, 1.6m high and nearly 3m wide at the top. A flue at the base of the northern side of the bowl would have allowed air flow to the interior of the chamber. The draw hole, through which the lime was extracted, must have been located in the now destroyed, south wall, although it is possible that, instead of a draw hole, part of the front wall was demolished after each firing to extract the contents of the kiln. There was no evidence of a ledge or grate to separate the fire from the limestone charge so it is likely that the limestone and coal were simply layered directly upon a fire lit at the base of the bowl. This is indicative of an intermittent or periodic kiln that was loaded, fired, cooled and emptied, to meet specific demands for lime, rather than continuously run.

Unusually, a quantity of the charge from the final firing of the kiln remained within the burning chamber. The burning of limestone or chalk in a kiln transforms the raw material in its insoluble and solid calcium carbonate state, into calcium oxide or quicklime in a process called *calcining*. Quicklime reacts with water to produce a fine powder of calcium hydroxide or slaked lime, which then slowly

reacts further with carbon dioxide to revert back to insoluble calcium carbonate. It is this property of gradual hardening during the reverting process that makes quick lime so ideal as a component in mortars and cements. Until the 19th century, another very common use for the products of limekilns was as a soil improver in agriculture. Lumps of quicklime were transported from the kiln to the fields and dispersed in small heaps and left to slake over time, breaking down into a fine powder which was ploughed into the soil.

It is not known for what purpose the lime produced in this kiln was used. Neither is it known why the bowl was not fully emptied of its charge after the final firing - despite a considerable investment of time and raw material to produce it. The various states in which the contents were found give some insight into the firing and burial conditions of the chamber. The cemented white lime mass has fully reverted to carbonate, although the occasional patches of creamy material with a putty-like consistency indicate that in small areas of the bowl, lime has been preserved in the hydrated or slaked state. The mass of unburnt and partially burnt limestone chips at the centre of the deposit indicate temperatures varied throughout the bowl. In the centre, temperatures did not reach the 900-1100˚ C necessary for long enough to fully calcine the limestone to quicklime.

No dating evidence was recovered from deposits associated with the limekiln. However, it does not appear on detailed estate maps produced from the mid-18th century onwards, so it is highly likely it pre-dates these.

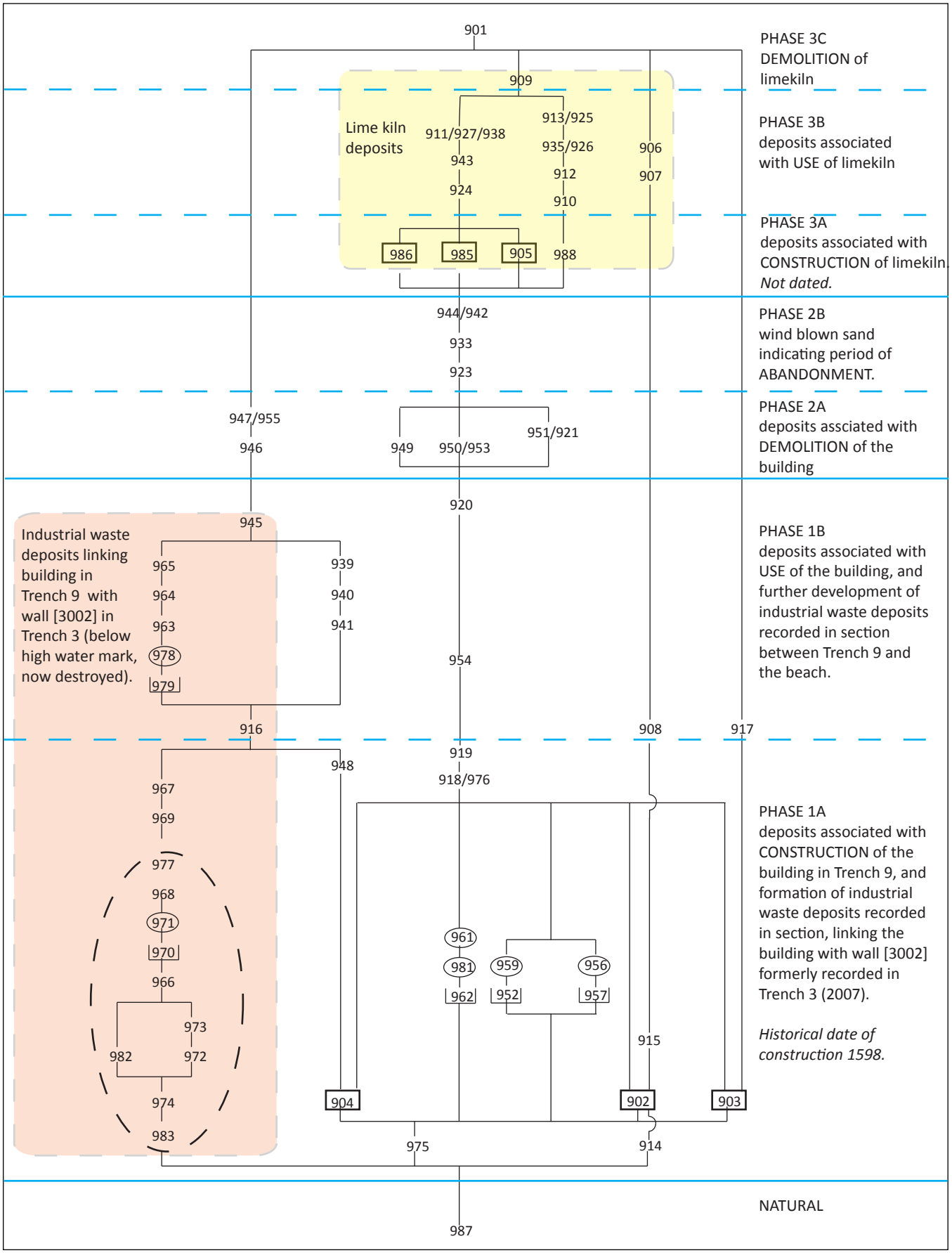

Figure 9. Harris matrix, Trench 9

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8. APPENDICES

APPENDIX 8.1. Summary of contexts

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
901		Initial cleaning layer number for finds				
902	STRUCTURE	Wall. Oriented E-W. Exposed surviving length 7.5m, height 1.9m, thickness 0.7m. Constructed mainly from fine-grained, hard, greyish white sandstone blocks, with less common occurrence of quartzite, ORS, conglomerate, granite, Moine schist and red flag-like sandstone. Size of masonry blocks generally 15cm-50cm. These are surrounded by smaller angular packing stones. Wall construction is of two parallel skins of facing bocks infilled with a generously mortared rubble core. Finish is random uncoursed rough face, with stressed quoins. See **984** for description of mortar bonding and harl. The wall foundation comprised unmortared very large unworked beach boulders, presumably laid into a foundation trench, although the cut was not visible. All masonry derived from beach boulders of local and glacially derived lithologies.	North wall of building in Trench 9			
903	STRUCTURE	Wall. Oriented N-S. Exposed surviving length 3.6m, height 2.0m, thickness 0.7-0.8m See **902** for description.	East gable end wall of building in Trench 9			
904	STRUCTURE	Wall. Oriented E-W. Exposed surviving length 8.7m, height 1.0m, thickness 0.7m. For description of wall construction and materials see **902**. Two door openings are present 3.4m and 5.2m from the southwest corner of the wall. Each doorway had quarried Sputie stone jambs with chamfered corners. A mason's mark of a bisected upside down triangle, c. 6cm wide was carved onto the outside face of the western jamb of each door at ground level. Threshold/sill stone **948** in eastern doorway, none in western.	South wall of building in Trench 9			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
905	STRUCTURE	Wall. Oriented N-S. Exposed surviving length, 2.20 N-S, 1.40m high, 1.50m wide at base, tapering to 0.84m wide at top. The west (outside) face of the wall is vertical, with no attempt at facing. The east (inside) face of the wall has been faced to taper upwards in a slightly concave form. This forms the inside bowl of the western half of the limekiln. The inside face is heat reddened and the surface of the stone crazed and cracked in places. Heat reddening penetrates into the interior of the wall. The wall is constructed from beach boulders with occasional re-used blocks from earlier salt pan building. Lithologies include sandstone, quartzite and occasional ORS. Sizes of blocks ranges from 0.4m x 0.4m - 0.6m x 0.6m for facing blocks and 0.2m x 0.2m for rubble core. Blocks are bonded with sand rich soily layers - presumably turves. The outside face is roughly patched in places with mortar, but this does not form a bonding material within the wall - it has probably been applied during the use of the structure. The southern part of the wall and limekiln bowl has been destroyed by coastal erosion.	West wall of limekiln bowl. Inserted into ruinous salt pan building, following inundation by approximately 0.8m of windblown sand 923 and **944**. See also [**985]** and **[986].**			
906	DEPOSIT [exterior]	Moderately compacted black sand with significant coal dust and organic content, containing moderate quantities of burnt and unburnt chipped stone, occasional burnt and unburnt mortar fragments and occasional burnt and unburnt clay. Variable thickness up to 12cm. Forms continuous layer on north and east outside of building, staining external faces of walls **[902]** and **[903].** Layer follows slope of the ground surface, being relatively level behind the building and sloping downwards from north to south towards the beach.	Trampled exterior ground surface north of wall **[902].** Contains vitrified sandstone and limestone pieces as well as frequent coal and burnt fuel and clinker fragments. This strongly suggests it is the exterior ground level contemporary with the limekiln phase of the building in trench 9.		9095, 9096, 9097, 9107	
907	DEPOSIT [exterior]	Loose, mottled yellow sand with coal stained lenses. 10cm-20cm thick.	Disturbed dune sand below more trampled horizon 906**,** although these are effectively the same deposit. Probably associated with limekiln phase of building in Trench 9.		9004, 9005, 9094	

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
908	DEPOSIT [exterior]	Slightly compacted dark brown sand, approx. 5cm thick. Uneven surface. Layer composed of numerous interleaving lenses separated by very thin clean sand. Occurs outside north wall **[902].**	Former tussocky vegetated ground surface, probably contemporary with construction and use of building in Trench 9. The levels show that the external ground surface to the north of the building was approx. 1m higher than the internal working floor, and that the ground surface sloped downwards from north to south outside the eastern end of the building. This suggests that the building was constructed on a terrace cut into the face of a sand dune, and that the lower 1m of the back wall buried in sand immediately after construction.	917?	9097, 9099	
909	DEPOSIT [interior]	Boulder and large cobble size stone in a loose dark brown soily sand matrix. Mainly removed by machine.	Tumble. Limited surviving area of demolition or collapse of structure [905].			
910	DEPOSIT	Mid grey calcareous stone (probably Oxfordian Stage Ardassie Limestone) angular chips, 3mm - 80mm in size within a loose greyish brown sandy matrix. Present on western side of N-S wall/structure [905]. The deposit is thickest where it abuts structure [905] and the inside face of north wall [902]. Its western limit has been removed by machining, but the stone chips were observed extending across the interior of the building, although survival became patchy towards the western LOE. Occasional rounded beach cobbles of stone with chatter marked cortex and clear percussion marks show that the source of the limestone chippings were beach cobbles. These are still present on the rock platform in the immediate vicinity of the site.	Remnants of the limestone charge for possible limekiln? Storage area for limestone charge or preparation area where limestone broken into smaller fragments.			50

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
911	DEPOSIT	(a) Cemented white lime mass, filling remains of limekiln bowl. (b) At the centre of the deposit is a mass of unburnt and partially burnt light grey limestone chips, identical to **910.** (c) In the upper western part of the deposit is a mass of crumbly light brown lumps of lime with a yellow coating. These three distinct deposits were individually sampled. The whole deposit is 0.5m thick and 2.20m E-W. In one or two places, the lime had a putty or butter-like consistency. Within the whole lime mass there are lenses and patches of black disintegrated coal-like material **938,** probably fuel. In the upper part of the mass, the lime has fractured horizontally, and a yellow, sometimes orangey yellow coating lines fracture planes. There are also patches of burnt orange staining at the base of the bowl.	The remains of the final firing of kiln. The cemented white lime mass has presumably reverted to carbonate, although the occasional patches of lime with a putty-like consistency indicate that in small areas of the kiln bowl, lime has been preserved in the hydrated or slaked state. The mass of unburnt and partially burnt limestone chips at the centre of the deposit indicate temperatures varied throughout the bowl. At the centre in the base of the bowl, temperatures did not reach 900-1100 ˚ C for long enough to fully calcine the limestone to quicklime. There is no evidence of a ledge or grate to separate the fire from the limestone charge so it is likely that the limestone and coal were simply layered directly upon a fire lit at the base of the bowl. This is indicative of an intermittent or periodic kiln that was loaded, fired, cooled and emptied, probably to meet specific demands for lime, rather than continuously run. The presence of a significant quantity of lime remaining within the bowl suggests it was not fully emptied after the final firing - despite a considerable investment of time and raw material to produce it. It is not	927, 938		51, 52, 53, 54, 55, 57

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
			known why.			
912	DEPOSIT	Compacted layer of buff coloured mortar, crumbly when excavated, extending west from N-S structure [905] and contiguous with the mortar bonding the structure. Western limit removed by machine but not observed as a continuous layer across interior of building and so probably confined to the area adjacent to the west side of [905]	Probably associated with repair/patching of wall [905]. Suggests limekiln was used more than once.			
913	DEPOSIT	Cemented in places, fragments upon excavation, crumbly surface. Pale brown and white mortar with moderate quantities of limestone chips and occasional coal frags. 0.25m thick, occurs in west side of wall **[905]** as an approximately 0.6m x 0.6m lump. Southern edge truncated by dune edge.	Similar to large chunk of consolidated lime mortar along southern LOE in front of limekiln. Rake out material?			
914	DEPOSIT (exterior)	Loose, pale yellow, coal flecked, fine sand containing occasional sandstone chippings and lumps and spills of mortar. Occurs on north side of wall **[902]**	External construction horizon associated with construction of wall **[902].**	975		
915	DEPOSIT [exterior]	10cm - 30cm wide skirt of cemented mortar and sand adhering to external face of north wall [902]. Discontinuous. Generally occurs between *c.* 0.8m - 1m above base of wall foundation. Occurs as lenses within layer **914**.	Mortar deposits associated with the construction and harling of north wall **[902]**.	984		

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
916	DEPOSIT [exterior]	Highly compacted, pink/purple/black/dark red/ black layer composed of primarily burnt shale/coal/clay and clinker in a sandy matrix. Extends from south side (i.e. outside) of surviving fragment of south wall **[904]** as a continuous layer recorded in section westwards, over 30m to previously recorded 'long wall' [3002], Trench 3, Site 4, on the beach. The layer thickens westwards from approx. 6cm thick in Trench 9 to approx. 16cm thick at the location of [3002]. The altitude of the surface of the layer declines gently from approx. 5m OD at the west doorway of wall **[904]** in Trench 9 to approx. 4m OD at [3002].	Deliberately made external surface linking the building in Trench 9 with the 'long walled' [3002] building (now gone) of Trench 3, Site 4, approx. 25m to the west (excavated 2007). It is part of a sequence of interleaving westwardly thickening industrial midden deposits, the origin of which is very likely to come from activities carried out within the building (now gone) of Trench 3, Site 4. The architecture of these deposits suggests deliberate spreads or dumps of industrial midden material (primarily burnt fuel and clay) to form a hard surface linking the two buildings. Layer **916** is the primary surface. A secondary compacted coal road type layer **965** is separated from **916** by a layer of windblown sand, **963** and further industrial midden rich layer **964.** This could indicate a short period of inactivity at the saltpans.		9003, 9084, 9085, 9093, 9116, 9117, 9118	
917	DEPOSIT [exterior]	Compact, black coal dust, clay sand. Large patch of burnt clay. Adjacent to and abutting east [gable] wall [903]. Northern limit of deposit removed by machine, and by 2007 test pit, but was observed as extending to form a continuous layer with **[908?**] present to the north of the building. This relationship can be seen as a black stain on the external face of wall [902], [903]. Eastern and southern extent of the layer lost to erosion.	Exterior ground surface contemporary with the use of the primary building in Trench 9.	908?	9082, 9103, 9104	
918	DEPOSIT [interior]	See **976**	Bedding for internal paved stone floor 919 of building in Trench 9.	976		

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
919	DEPOSIT (interior)	Paved stone floor comprising mainly large angular laminated bituminous shale slabs, between 0.5m -1.5m (longest edge) One area against north wall 902 of approx. 1.5m x 1.5m, made up only of beach boulders , 0.3m-0.5m diameter, of varying lithologies. Slabs are bedded onto clean beach sand **976**, and packed with beach cobbles. The floor is disturbed and partially absent at the eastern end of the room. The slabs respect cuts for postholes **952** and **957**, although the boulder area seals cut **962**.	Floor of east room in building in trench 9. The boulder area is possibly a repair? Or an area where greater strength was needed to support heavy equipment? The shale paving stones are extremely friable. A few days trampling by members of the excavation team caused significant damage, yet they appeared to be in good condition when first exposed. Either, there was no heavy traffic, or even moderate traffic, associated with the use of this room, or it was never used/barely used.			
920	DEPOSIT [interior]	Variable layer of loose to compacted dark brown, black and sometimes greyish soil-like and peat-like deposit 3cm-14cm thick. The deposit extends as a continuous layer directly overlying paved floor **919**, inside the room of the building, except where it has been disturbed at the east end. Contains low quantities of a range of finds: shell, fishbone, bone, pot, wood, fe objs & clinker. Deposit not present outside of the building.	High organic content and peaty texture indicate origin as a thick layer of vegetation material, e.g. heather or turf. It is relatively clean, although does contain very low quantities of a range of finds. Possible roofing material? Or flooring material laid upon the flagstone surface? The deposit lies directly upon flagstones 919 with no intervening sand lenses, therefore likely to be contemporary with the building, or immediately post abandonment.		9047, 9052, 9068, 9074, 9110, 9111	60

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
921	DEPOSIT [interior]	Loose, dark brown/yellowish brown/yellow/black sand containing occasional mortar, clay lenses and lumps, boulder and pebble sized tumble, peaty lenses and broken shale flagstones. Occurs at east end of room in building in Trench 9, covering an area of 3.4m x x2.2m. Underlying layer **920** and paved stone floor **919** disturbed in this area.	Composition of this deposit comprises re-deposited materials from underlying deposits (peaty lenses, shale paving stones) as well as from possible nearby masonry (tumble, mortar, clay). There is no evidence of a clear cut. This deposit, together with 951, represents an episode of disturbance almost certainly following dis-use of the building. It may not be coincidental that the disturbed area coincides with the position of the later limekiln. It is possible the disturbance relates to the construction of the kiln.	951		
922	VOID	VOID	VOID			
923	DEPOSIT	Loose, pale yellowish brown sand. Banded with numerous very fine coal flecked horizons.	Windblown sand. Banding and very fine drifts of coal flecks indicate incremental accumulation. Overlies demolition deposits, represents initial period of abandonment.		900, 9002	
924	DEPOSIT	Cemented burnt orange/cream/grey blue/beige lime. Some creamy areas have a soft butter-like consistency. Occasional inclusions of coal, sand, clay and lime mortar frags. Extends across the base and partially up the sides of the limekiln. Maximum 10cm thickness, 1.8 m in diameter.	Kiln base. Probably the result of kiln use rather than a deliberately laid base.			56
925	DEPOSIT	Cemented, fragments upon excavation. Pale brown and white mortar lumps within white lime matrix. Moderate quantities of angular limestone chips, occasional coal frags. 0.25m thick, 0.8m wide, recorded in section only in limekiln area. Possibly in front of the kiln, although not clear.	Rake out material or area of limekiln? Similar deposit **913,** on west side of wall [905] could indicated location of draw hole of the kiln in the SW corner.	913		
926	DEPOSIT	See **935**	See **935**	935		
927	DEPOSIT	See **911**	See **911**	911, 938		
928	DEPOSIT	Wash of burnt material from limekiln in eroding section. Not i*n situ* material.	Wash of burnt material from limekiln in eroding section.			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
			Not i*n situ* material.			
929	VOID	VOID	VOID			
930	VOID	VOID	VOID			
931	VOID	VOID	VOID			
932	VOID	VOID	VOID			
933	DEPOSIT	Slightly compacted, loose on excavation, dark brown sand. Some organic content. <5cm thick, extends over western half of interior of building in Trench 9, sloping downwards from north to south. 40 Fe objs, predominantly nails and diamond shaped objects recovered on the surface of this layer. No pattern immediately discernible.	Organic content of deposit suggests a former vegetated surface, or, decomposed organic material, e.g. wood (seaweed?). Fe objs may be the result of deliberate removal or *in situ* fixings from a decayed wooden structure. The layer represents an episode of stability within the time period during which the ruinous building was being inundated with sand.		9006-9050, 9109	9081
934	VOID	VOID	VOID			
935	DEPOSIT	Friable, loose upon excavation, black sand with organic content, also coal dust.6cm thick, and occurs west of wall [905] for approx. 1m, truncated by dune edge to south. Layer composed of interleaving lenses of organic rich sand, separated by thin layer so clean sand and occasionally mortary spreads.	Possibly the remains of turves, or a tussocky former ground surface. Wall [905] is likely to have been bonded with turves, so the first interpretation more likely. Probably same as similar deposit **926,** recorded in section 008, and located in the area immediately south of the limekiln.	926		
936	VOID	VOID	VOID			
937	VOID	VOID	VOID			
938	DEPOSIT	Black fine particled deposits interleaving lime mass in some parts of the kiln bowl. Fused in places. See **911.**	Coal-like. Remains of kiln fuel?	911, 927		58
939	DEPOSIT [exterior]	Compact, loose upon excavation, mottled dark brown/black sand containing flecks of coal and mortar, lens on surface of flagstone **[940].**	Trample upon flagstone in front of easternmost doorway in south wall **[904].**			
940	STRUCTURE [exterior]	Single angular shale paving stone, 0.9m wide, 0.58m wide.	Single paving stone placed immediately outside easternmost doorway in south wall [904]. Presumably positioned in area of greatest wear in front of door. Section			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
			shows hollowing of sand below slab (due to wear).			
941	DEPOSIT [exterior]	Compacted, loose upon excavation, light brown sand containing frequent rounded gravel and pebbles. <4cm thick, below and extends to the south of flagstone **[940].** Truncated by dune edge to south. Contains fish bone, bone and shell.	Bedding material for flagstone [940]. Presence of material beyond flagstone to the south indicates there may have been another slab. Now eroded.		9100, 9101, 9102	
942	DEPOSIT	See **944**	Heat altered/coloured upper part of windblown sand **944.**	944		
943	DEPOSIT	Loose, purple sand lens, 10cm thick, 1.20m E-W at base of limekiln bowl.	Lens of burnt sand within base of limekiln bowl.			
944	DEPOSIT	Loose, pale yellowish brown sand. Banded and containing very fine coal flecked horizons. Contains rare quartzite and mortar fragments.	Windblown sand. Banding and very fine drifts of coal flecks indicate incremental accumulation. Upper part of deposit beneath limekiln burnt pink/orange/grey.	942		
945	DEPOSIT [exterior]	Slightly compacted black coaly sand, < 10cm thick. Uneven surface. Survives south of south wall **[904]** in same area as **916.**	Exterior trampled and layer, possibly associated with use of building. Possibly same as **965.**	965?	9069, 9072, 9122, 9123, 9124	
946	DEPOSIT	Loose, white/grey/pale yellow mortar and angular stone deposit, up to 60cm thick. Visible in section within and in immediate vicinity of doorways in south wall **[904].**	Demolition.			
947	DEPOSIT	Variable deposit of angular stone in clay rich and mortar rich matrix, yellowish grey, compact/plastic/loose in places. Up to 40cm thick, visible in section within and in immediate vicinity of doorways in south wall **[904].**	Demolition. See **955.**			
948	STRUCTURE [exterior]	Sub-rectangular, hard white sandstone block, 0.85m wide, 20cm deep, 20cm thick. Smooth rounded front edge. Positioned between chamfered door jambs of easternmost opening in south wall **[904].**	Threshold stone/sill of easternmost doorway in south wall **[904].**			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
949	DEPOSIT [interior]	Plastic, loose in places, mottled grey/yellowish brown/dark brown, clay, sand & mortar containing boulder sized tumble. Occurs in SW corner of room in Trench 9, abutting wall **[904].** Area in plan, 3m x x1m but extends into western LOE. Uneven surface and variable thickness from 20cm, thickening southwards towards wall.	Demolition deposit surviving against wall **[904],** and very probably originating from collapse, or deliberate demolition of its upper courses. High clay content would indicate that there was a clay component in the bonding of the upper courses of the building, although this was not seen in the surviving masonry. Deposit same event as **950** in northern half of room, (and possibly 921) although not contiguous with it.	950		
950	DEPOSIT [interior]	Plastic, loose in places, mottled grey/yellowish brown/dark brown, clay, sand & mortar containing boulder sized tumble. Extends along inside of wall **[902]** spreading up to 1.6m southwards. Area in plan, 3m x x1m but extends into western LOE. Uneven surface and variable thickness from 20cm.	See **949**. Also incorporates 953, as this deposit was recorded twice. **953** retained as finds were recorded for it.	953, 949	9073	
951	CUT ?? [interior]	Irregular area of disturbance to layers **920** and flagstones **919**. Area of missing slabs approx. 1,6m x 1.10m at eastern end of room in building in Trench 9. No cut apparent continuing below flagstones.	Area of disturbance rather than a true cut. See **921** for further comment.	921		
952	CUT [interior]	Vertical sided 0.7-0.9m diameter, not bottomed, but at least 0.4m deep. Half excavated in section only.	Cut for posthole. The edges respect the edge of the surrounding paving stones suggesting the posthole is contemporary with use of the building. Also contemporary with posthole **957** 1.5m to the NE.			
953	DEPOSIT [interior]	see **950**	See **950**. Two tiny triangular off-cuts of pre 18th century plate glass recovered from this deposit.	950	9048, 9049	
954	DEPOSIT [interior]	30cm x 50cm x 4cm thick lens of compacted, pale grey, mottled with pink in places deposit comprising crushed shell, pebble, lime & shale.	Raw material for making mortar for harling material **984**??			61
955	DEPOSIT [exterior]	see **947**	Demolition. see **947**			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
956	FILL	Loose to friable, dark brown and black sand, containing frequent large pieces of broken shale paving stone, moderate amounts of burnt coal/shale. Single fill of cut **957**. Contains 1 pot sherd, fishbone, fe objs, clinker & mussel shell.	Single fill of posthole **957**. Frequency and arrangement of flagstone pieces within fill suggests these could be the remains of the packing materials for the post.		9075, 9083, 9147, 9148	65, 66 (sieved)
957	CUT [interior]	Sub-circular cut, vertical sided and flat bottomed, 0.6m in diameter, 0.6m in depth. Filled with **956.**	Cut for posthole. The edges perfectly respect the edge of the surrounding paving stones suggesting the posthole is contemporary with use of the building. Also contemporary with posthole **952** 1.5m to the SW.			
958	VOID	VOID	VOID			
959	FILL	Compacted blackish brown sand containing lenses of clean yellowish sand and moderate amounts of larges broken paving stone pieces. Contains 5 fe objs.	Single fill of posthole **952**. Arrangement of flagstone pieces indicates packing.		9077	
960	VOID	VOID	VOID			
961	FILL	Loose, dark yellowish brown sand, stained black in places with coal. Maximum thickness 0.2m, extending over an area 1.4m x 1.6m beneath cobbled area of paved stone floor **919**. Contains occasional lumps of clean yellow clay, sandstone chips (burnt and unburnt), fragments of shale flagstone and numerous fe objs, slag-like material and fishbone.	Secondary fill of cut **962**. Contents of deposit include building materials and smithing slag. Evidence of on-site smithing during construction phase of building in Trench 9?		9088, 9089, 9119, 9120, 9121	67 (sieved)
962	CUT [interior]	Sub-circular cut, vertical sided and flat bottomed, 1.10m in diameter, 0.6m in depth. Backfilled with sand **(981)** and **(961).**	Feature associated with construction of building in Trench 9. Shape of cut suggests it is structural (e.g. upright post, part of scaffolding? Pulley?), although, no evidence of structure survives, and the cut has been backfilled with sand, before large beach cobbles have been laid on top of it to complete the stone floor of the building. This is the only place where cobbles have been used in floor construction, elsewhere; it is of shale paving slabs. It is possible the cut			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
			remained open during an initial phase of use of the building; sealed by different flooring materials at a later date than the laying of the main flagstone floor **919.** Or, the function associated with the cut continued to the final stage of construction and it was backfilled and sealed beneath the floor, just prior to the completion of the building.			
963	DEPOSIT [exterior]	Loose, very light greyish well-sorted coal flecked sand. Maximum thickness 0.3m, thickening eastwards. Extends along section 16.8m E-W, recorded in section only. Contains 1metal object, 9079.	Windblown sand. Continuous and extensive deposit upon surface 916. Could indicate a period of inactivity at the salt pans as sand allowed to inundate external compacted surface.		9079	
964	DEPOSIT [exterior]	Hard, bluish grey clay sand, coal flecked with occasional sandstone chips, becoming much sandier and mixed with reddish burnt deposits (shale, etc.) in east of the section. Maximum thickness, 0. 3m, extends 19m E-W along section. Recorded in section only.	Possible a foundation layer for overlying compacted fuel ash/clinker surface **945/965**, the second and last of the compacted surfaces that link the building in Trench 9 with wall [3002], Trench 3. It is possible that the laying of the clay upon an accumulation of windblown sand, **963,** reflects a period of renewed activity of the salt pans.			
965	DEPOSIT [exterior]	Compacted black, becoming more reddish and burnt orange brown eastwards, sand and fuel ash containing frequent clinker, coal, shale frags. 0.3m thick, extending 17m E-W, recorded in section only.	Compacted surface composed of burnt fuel residues and coal. Probably same as **945.** Uppermost of highly compacted deliberately laid surfaces that link the building in Trench 9 with wall [3002], Trench 3.			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
966	DEPOSIT [exterior]	Compact, dark reddish/orange brown sandy clay, containing moderate quantities of burnt sandstone, clinker, coal/shale. 0.2m thick, 5.40m EW, recorded in section only.	Layer of fuel ash, part of industrial midden sequence that link the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			
967	DEPOSIT [exterior]	Loose, pale brown sand, with occasional coal flecks and small angular sandstone chips. 6cm thick extends 9m E-W. Recorded in section only.	Thin layer of wind-blown sand within industrial midden sequence that links the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			
968	DEPOSIT [exterior]	Soft mid brown coal flecked sand containing clay lumps. Recorded in section only.	Part of industrial midden-like deposits linking the building in Trench 9 with wall [3002], Trench 3, recorded 2007.			
969	DEPOSIT [exterior]	Hard, blueish grey clay sand, coal flecked with occasional sandstone chips, becoming much sandier and looser in eastern part of section. 4cm-18cm thick, extending at least 13m E-W, probably truncated by erosion to the east. Recorded in section only.	Bottom most of the laterally extensive layers linking the building in Trench 9 with wall [3002], Trench 3. East of cut **970,** the layer overlies natural sand; west of cut **970** the layer overlies a series of dumped industrial midden deposits. Layer could be a foundation for overlying compacted fuel ash/clinker surface **916.** It is similar in composition to **964,** which also underlies a later compacted fuel ash/clinker surface **945/965.**			
970	CUT [exterior]	Steep sided, flat bottomed cut, 0.3m deep, 0.6 m wide (E-W). Seen in section only.	Unidentified, clearly defined cut, located at the boundary of thick dumps of industrial midden-like deposits to west and thinner laterally extensive midden deposits to east extending between building in Trench 9 and wall [3002], Trench 3, recorded 2007.			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
971	FILL	Soft mid brown coal flecked sand containing clay lumps. Fill of cut **970.** Recorded in section only.	Backfill of cut **970.**			
972	DEPOSIT [exterior]	Friable-loose flaky, dark brown/grey/orange/reddish, and black deposit of fuel ash, containing moderate frags of burnt sandstone. 0.4m thick, 2.00m wide, seen in section only. Concave shape of deposit like that of a fill within a bowl-shaped cut, but equally likely to be a dump within a hollow in the sand	Dump of fuel ash at base of industrial midden sequence that link the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			
973	DEPOSIT [exterior]	Loose, pale brownish yellow lens composed of Sputie sandstone frags. 0.14m thick, 1.6m E-W, recorded in section only.	Lens of material in sequence of predominantly industrial midden-like deposits that link the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007. The soft Sputie sandstone is used only for carved stone door jambs in Trench 9 building, being too soft for general building stone. This introduces the possibility that the midden deposits could have accumulated during construction of the Trench 9 building.			
974	DEPOSIT [exterior]	Loose to friable, dark grey deposit principally composed of burnt shale/coal/ash with moderate quantities of clinker and burnt sandstone frags. 3.80m wide (E-W), 0.1-0.5m cm thick, seen in section only.	Deposit at base of industrial midden sequence that link the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			
975	DEPOSIT (interior)	Loose, pale greyish yellow, coal flecked, fine sand containing occasional sandstone chippings and lumps and spills of mortar, beach boulders, clean yellow clay lumps, burnt shale/coal, slag and clinker-like material and metal objects. Extends as uneven deposit across interior of building in Trench 9, 20cm - 30cm thick.	Construction horizon on building in Trench 9. Contains building raw materials, presence of coal dust burnt material typical of trample.	914	9086, 9127, 9128	
976	DEPOSIT (interior)	Loose, clean yellow beach sand, 10-20cm thick, extends as a continuous layer throughout interior of building in Trench 9 below paved stone floor **919.**	Bedding for internal paved stone floor 919 of building in Trench 9.	918		
977	DEPOSIT [exterior]	Soft, dark grey coal rich clayey sand lens, 6cm thick, 0.8m E-W. Recorded in section only.	Lens within predominantly industrial midden-like deposits that link the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
978	FILL	Friable dark reddish brown clayey sand, containing burnt shale, coal, clinker, ash. Single fill of cut 979, recorded in section only.	Backfill of cut **979.** Composed of fuel ash.			
979	CUT [exterior]	Concave sided, flat bottomed cut, 0.5m deep, 01.0 m wide (E-W). Seen in section only.	Unidentified, clearly defined cut, within sequence of industrial midden-like deposits between building in Trench 9 and wall [3002], Trench 3, recorded 2007. Cuts earliest identifiable 'surface' **916.**			
980	VOID	VOID	VOID			
981	FILL	Loose, mottled pale yellowish brown and darker brown sand, containing rare fragments of mortar, sandstone chips and clay. 50cm thick, primary fill of cut **962.** Contains occasional fishbone, shell, and fe objs (x 2).	Primary fill of cut **962**. Re-deposited natural sand, incorporating occasional cultural material.		9087, 9125, 9126	
982	DEPOSIT [exterior]	Friable-loose/flaky, mid-grey shale, coal and ash. 0.4m thick, 2.60m wide, seen in section only.	Dump of fuel ash near base of industrial midden sequence that lines the building in Trench 9 and wall [3002] previously recorded in Trench 3 in 2007.			
983	DEPOSIT [exterior]	Multi-coloured dark orange/red, pink purple, black deposit of boulder sized lumps of clinker and burnt sandstone in a burnt shale/cinder/ash/coal and sand matrix.	Primary dump of industrial midden material at base of sequence of deposits that link Trench 9 and Trench 3 (excavated in 2007). It's location in the immediate vicinity of the wall in Trench 3 [3002] indicates the deposit originates from activities carried out within this building. The form of the deposit indicates it fills a hollow in the sand.		9145	
984	DEPOSIT	Lime mortar. Weakly cemented, (friable when weathered) white lime mortar, speckled with yellow and orangey brown coarse sand/fine grit and shell fragments. Also see **915**.	Lime mortar bonding and harling of the interior and exterior of walls **902**, **903**, **904**.	915	9108	68

CONTEXT NO.	CONTEXT TYPE	DESCRIPTION	INTERPRETATION	SAME AS	FINDS	SAMPLES
985	STRUCTURE	Remodelling of eastern end of wall [902] to create flue hole for limekiln and modify internal face to create kiln bowl. Flue hole 0.6m high, 0.5m wide created by demolishing part of wall, inserting a sandstone lintel, and rebuilding the wall with re-used masonry in a clay bonding. The interior of the wall has been lined with angular medium-sized fragments of limestone and sandstone, typically 0.2 - 0.3m in diameter bonded with clay. The internal stone lining is severely heat damaged causing in situ cracking, reddening and vitrification of the surface of the sandstone fragments. Vitrification is particularly pronounced in the immediate vicinity of the flue.	Modification of the eastern end of north wall [902] for later limekiln, including insertion of flue and creation of bowl-shaped burning chamber. See also **[905]** and **[986]**			
986	STRUCTURE	Remodelling of east gable end wall [903] to create kiln bowl. A 0.7m x 0.5m quartzite block has been used to create the east side of the kiln bowl. The top of the wall has been re-built using re-used masonry in clay, soily and rubbly bonding material. As in **985,** the interior of the wall has been lined with angular medium-sized fragments of limestone and sandstone, typically 0.2m - 0.3m in diameter bonded with clay. Most are heat reddened and cracked. Heat reddening penetrates to the interior of the wall.	Modification of east wall [903] for to create burning chamber of lime kiln. See also **[905]** and **[985].** Surviving height of kiln bowl = 1.3m, internal diameter of bowl at base = 1.80m, internal diameter of surviving top of bowl = 2.9m. The draw hole for the kiln must have been located in the front (south) wall which doesn't survive. Or, the front wall was taken down to extract the burnt lime.			
987	DEPOSIT	Clean yellow windblown sand. Faint striations dipping down from north to south, cease approximately 60cm from back wall **[902]** are visible in section.	NATURAL sand dune into which salt pan building constructed. Striations indicate natural slope of dune face towards beach.			
988	DEPOSIT	Cemented, pale yellowish and white lime mortar with limestone chips and occasional coal frags. 6cm thick, 0.6m wide, extends as a spread of material along base of external face of wall **[905].**	Spread of cemented lime mortar at base of limekiln wall. Associated with limekiln construction?	910		

APPENDIX 8.2. Register of drawings

DRAWING NO.	DRAWING TYPE	NO. OF SHEETS	DESCRIPTION	SINGLE/ MULTI-CONTEXT	CONTEXTS	SCALE
1	PLAN	2	Pre-ex deposits associated with limekiln.	MULTI	902, 903, 905, 909, 910, 911, 935, 944	1:20
2	PLAN	2	Exterior deposit north of building, probably associated with use of limekiln	SINGLE	906	1:20
3	SECTION	1	3 sections across exterior deposits north of building.		906, 907, 908, 914, 915	1:20
4	PLAN	2	Exterior deposits south of building. South wall, doorway and threshold stone.	MULTI	904, 916, 939, 940, 941	1:20
5	PLAN	1	Mortary deposit, associated with limekiln, on west side of limekiln wall.	SINGLE	912	1:20
6	SECTION	1	South facing section across Trench 9 deposits, west.		904, 916, 918, 919, 920, 923, 933, 936, 937, 944	1:20
7	SECTION	1	South facing section across Trench 9 deposits, centre.		913, 918, 919, 920, 923, 933, 935, 944	1:20
8	SECTION	1	South facing section across Trench 9 deposits, east.		918/976, 919, 920, 921, 922, 923, 924, 925/913, 926/935, 927/911, 928, 932	1:20
9	PLAN	1	Exterior deposit north of building, probably former ground surface associated with construction and use of building.	SINGLE	908	1:20
10	PLAN	1	Lime deposit 911 within kiln.	SINGLE	911	1:20
11	SECTION	1	South facing section showing deposits associated with limekiln outside the western limekiln wall.		905, 910, 912, 935, 944	1:20
12	ELEVATION	2	North facing elevation of external face of north wall 902, also showing later modifications associated with construction of limekiln.		902, 915, 985	1:20

DRAWING NO.	DRAWING TYPE	NO. OF SHEETS	DESCRIPTION	SINGLE/ MULTI-CONTEXT	CONTEXTS	SCALE
13	ELEVATION	1	South facing elevation of eastern doorway in south wall 904.		904, 916, 939, 940, 941, 947	1:20
14	ELEVATION	1	West facing elevation of exterior face of west kiln wall 905.		905, 944	1:20
15	SECTION	1	South facing section across limekiln, showing structure and internal deposits.		903, 905, 911, 923, 924, 942, 943, 944, 986	1:20
16	PLAN	1				1:20
17	PLAN	1				1:20
18	PLAN	1	Limekiln structure.	MULTI	905, 985	1:20
19	PLAN	1	Exterior deposits south of wall 904 associated with use of the building.	SINGLE	916	1:20
20	X	0				1:20
21	PLAN	1	Scatter of nails etc. on layer 933.	SINGLE	933	1:20
22	ELEVATION	1	East facing elevation of external face of east (gable end) wall 903.		903, 986	1:20
23	ELEVATION	1	South facing elevation of eastern doorway and threshold stone in south wall 904.		904, 945, 947, 948	1:20
24	ELEVATION	1	South facing cross section through west kiln wall 905.		905	1:20
25	SECTION	1	East facing section across deposits accumulated against the outside face of south wall 904.		916, 941, 945, 946, 947	1:20
26	PLAN	2	Deposits inside the building associated with partial demolition/collapse of upper courses of walls.	MULTI	921, 949, 950	1:20
27	SECTION	1	East facing section across Trench 9 deposits. Includes section of posthole 952.		919, 920, 923, 933, 944, 949, 950, 952, 959	1:20
28	PLAN	2	Organic rich black layer 920 inside building. Location of small finds also plotted.	SINGLE	920	1:20
29	PLAN	1	Exterior deposits south of wall 904, beyond western LOE of Trench 9, associated with use of the building.	MULTI	916, 945	1:20
30	PLAN	2	Interior flagstone floor 919.	SINGLE	919	1:20
31	PLAN	1	Postholes 952, 957 inside building.	MULTI	952, 957	1:20
32	SECTION	5				1:20
33	ELEVATION	1	South facing elevation of external face of south wall 904.		904	1:20

DRAWING NO.	DRAWING TYPE	NO. OF SHEETS	DESCRIPTION	SINGLE/ MULTI-CONTEXT	CONTEXTS	SCALE
34	ELEVATION	1	South facing elevation of inside face of north wall 902.		902	1:20
35	SECTION	1	Sections of postholes 957, 962 inside building.		957, 962	1:20
36	PLAN	2	Plan of postholes 952, 957, 962, and stone alignment within construction deposit 975 inside building.	MULTI	952, 957, 962, 975	1:20
37	PLAN	1	Surviving remains of wall [3002]	SINGLE	3004	1:20
38	PLAN	2	East wall 903 and exterior deposits on its outside associated with use of the building.	MULTI	903, 917	1:20

APPENDIX 8.3. Register of finds

Finds No.	Trench No.	Context No.	Material	No. of pieces
9001	9	923	fe	1
9002	9	923	fe	1
9003	9	916	pottery	1
9004	9	907	pb	4
9005	9	907	fe	1
9006	9	933	fe	1
9007	9	933	fe	2
9008	9	933	fe	1
9009	9	933	fe	1
9010	9	933	fe	1
9011	9	933	fe	1
9012	9	933	fe	1
9013	9	933	fe	1
9014	9	933	fe	1
9015	9	933	fe	1
9016	9	933	fe	1
9017	9	933	fe	1
9018	9	933	fe	1
9019	9	933	fe	1
9020	9	933	fe	1
9021	9	933	fe	1
9022	9	933	fe	1
9023	9	933	fe	1
9024	9	933	fe	1
9025	9	933	fe	1
9026	9	933	fe	1
9027	9	933	fe	1
9028	9	933	fe	1
9029	9	933	fe	1
9030	9	933	fe	1
9031	9	933	fe	1
9032	9	933	fe	3
9033	9	933	fe	1
9034	9	933	fe	1
9035	9	933	fe	1
9036	9	933	fe	3
9037	9	933	fe	1
9038	9	933	fe	1
9039	9	933	fe	1
9040	9	933	fe	1
9041	9	933	fe	1
9042	9	933	fe	1
9043	9	933	fe	1
9044	9	933	fe	1
9045	9	933	fe	1
9046	9	933	fe	1
9047	9	920	pottery	4
9048	9	953	glass	1

Finds No.	Trench No.	Context No.	Material	No. of pieces
9049	9	953	glass	1
9050	9	933	fe	3
9051	9	920	wood	1
9052	9	920	fe	1
9053	9	920	fe	1
9054	9	920	fe	1
9056	9	920	wood	1
9057	9	920	wood	1
9058	9	920	fe	1
9059	9	920	fe	2
9060	9	920	fe	1
9061	9	920	fe	1
9062	9	920	fe	1
9063	9	920	fe	1
9064	9	920	wood	1
9066	9	920	fe	2
9067	9	920	clinker-like	1
9068	9	920	fe	1
9069	9	945	fe	13
9072	9	945	clinker-like	1
9073	9	950	fe	1
9074	9	920	fe	1
9075	9	956	pottery	2
9077	9	959	fe	5
9079	9	963	fe	1
9080	9	940	wood	1
9081	9	933	fe	3
9082	9	917	fe	2
9083	9	956	fe	19
9084	9	916	fe	3
9085	9	916	clinker-like	1
9086	9	975	clinker-like	many
9087	9	981	fe	2
9088	9	961	fe	18
9089	9	961	slag-like	many
9090	9	961	coal	many
9091	9	921	clinker-like	1
9092	9	901	clinker-like	6
9093	9	916	slag-like	1
9094	9	907	slag-like	1
9095	9	906	stone	4
9096	9	906	slag-like	3
9097	9	908	stone	3
9098	9	unstrat	pb	1
9099	9	908	bone	1
9100	9	941	bone	2
9101	9	941	fishbone	7
9102	9	941	shell	4
9103	9	917	bone	2
9104	9	917	shell	24

Finds No.	Trench No.	Context No.	Material	No. of pieces
9105	9	939	shell	2
9106	9	939	fishbone	1
9107	9	906	bone	1
9108	9	980	bone	1
9109	9	933	shell	6
9110	9	920	fishbone	35
9111	9	920	bone	13
9112	9	920	shell	69
9113	9	921	shell	15
9114	9	921	fishbone	2
9115	9	956	fishbone	many
9116	9	916	shell	29
9117	9	916	fishbone	18
9118	9	916	bone	32
9119	9	961	shell	9
9120	9	961	bone	3
9121	9	961	fishbone	>200
9122	9	945	bone	19
9123	9	945	fishbone	33
9124	9	945	shell	25
9125	9	981	fishbone	many
9126	9	981	shell	6
9127	9	975	shell	5
9128	9	975	fishbone	1
9129	8	805	bone	35
9130	8	805	fishbone	4
9131	8	805	shell	4
9132	8	805	CBM	10
9133	8	801	glass	6
9134	8	805	pottery	1
9135	8	805	glass	6
9136	8	805	clinker-like	9
9137	8	805	fe	3
9138	4	401	fe	1
9139	4	401	slag-like	1
9140	4		fe	1
9141	4		fe	1
9142	4		fe	2
9143	4		slag-like	11
9144	4		coal	
9145	9	983	clinker-like	2
9146	4		fabric	1
9147	9	956	clinker-like	15
9148	9	956	shell	30

APPENDIX 8.4. Extract from glass report

Robin Murdoch

Catalogue

Context number 953; Finds number 9048

Window Glass, two very small shards, clear, no obvious tinge, pale yellow-buff L – MD, 0.7mm thick. Both have two possible cut edges at less than 90 degrees to each other indicating possible Lozenges. Analysis shows that this glass is HLLA (High lime, low alkali) and is a probable import. Late 16th/17th century.

Discussion

Window glass was recovered from 13 small finds all exhibiting significant denaturing. Most would fit in with a mid 18th century date, the exception being the two small shards from **953(2010).** It was possible to have one of these shards analysed and it transpired that it was HLLA (High lime, low alkali glass) and almost certainly dates to before 1700 and could indeed be contemporary with the earliest salt-making
activity around 1600. My sincere thanks to David Dungworth of English Heritage for carrying out this analysis. (see additional notes)

Additional notes

Window Glass
Because of the lack of manufacturing detail, window glass can often be difficult to date. However, it is possible to make some assessment based on denaturing. Glass made from different chemical constituents tend to denature in different ways. This is particularly true with regards to the fluxing alkali used to lower the temperature at which the silica will vitrify.

These alkalis fall into two camps, predominantly soda (sodium compounds) or predominantly potash (potassium compounds). Although in most cases a small amount of the other is present. Recent and ongoing research by English Heritage has enabled a rough date by chemical content typology to be developed, at least for English window glass.

One of the findings from this research was that kelp was the source of the fluxing alkali from about 1700-1830. Kelp-sourced alkali is rich in both Sodium and Potassium and also contains significant Strontium. Earlier English window glass tended to be high lime low alkali. **(pers comm., D Dungworth, English Heritage)**

It would not be unreasonable to assume a similar situation with Scottish glass although dating could differ slightly. James Ord, one of the early Scottish glassmakers, sought the sole rights to burn and prepare kelp in 1621**(Turnbull 2001, 9)**. This might suggest that kelp came into the glass-making equation in Scotland much earlier than England but much more research would need to be carried out to confirm this.

APPENDIX 8.5. Note on ceramic finds recovered from Trench 9

George R. Haggarty

Scottish post medieval oxidised wares (SPMOW) & Scottish post medieval reduced wares (SPMRW).

Context number	Find number	Comments
920	9047	Six conjoining SPMOW body shards with slight traces of a lead glaze on both its interior and exterior. Imposable to say with any certainty what type of vessel but may have been a bowl?
916	9003	One tiny SPMOW body shard with an exterior lead glaze
956	9075	Two conjoining body shards from the shoulder of a SPMRW jug lead glazed on its exterior

APPENDIX 8.6 Animal catalogue, Trench 9

Catherine Smith, Alder Archaeology

FIND NO.	CONTEXT NO.	BRIEF STRATIGRAPHIC INFO	Phase'	Class	Species	Bone	L/R	prox	dist	Age	Part	Quantity	Butchery	Gnawed	Comment
9107	906	external ground surface/limekiln	3	mammal	IM						fragment	1			abraded
9099	908	external ground surface/salt pan	1	mammal	Cattle	metatarsal	L		df	adult	distal	1	probably ch ML		abraded; 'rootlet' damage
9103	917	"	1	mammal	Cattle	Ph2			pf	adult	entire	1			
9103	917	"	1	mammal	LU	vertebra					centrum	1		GD	
9118	916	"	1	mammal	Sheep/goat	radius	R		pf	I/A		1			KC, hacks
9118	916	"	1	mammal	horse	mandible	L				ramus, condyle	1	?chopped	GD	
9118	916	"	1	mammal	horse	mandible	L & R				symphysis	1	thin KC aboral; ?chopped		butchery
9118	916	"	1	mammal	horse	tooth					lower incisor	1			in wear
9118	916	"	1	mammal	SU	rib					shaft	1			
9118	916	"	1	mammal	SU	rib					shaft	1			
9118	916	"	1	mammal	IM	LBSF					shaft	7			
9118	916	"	1	mammal	IM							10			
9118	916	"	1	mammal	IM							1		GD	
9118	916	"	1	bird	Curlew	femur	L			adult	proximal	1			
9118	916	"	1	bird	indet sp						shaft	1			
9118	916	"	1	fish	fish						fragments	6	abraded		
9111	920	internal floor deposit/salt pan	1	mammal	cattle	tooth					fragment	1			chopped across crown
9111	920	"	1	mammal	Sheep/goat	skull	L				nasal	1			
9111	920	"	1	mammal	Sheep/goat	tooth					incisor	2			

FIND NO.	CONTEXT NO.	BRIEF STRATIGRAPHIC INFO	Phase'	Class	Species	Bone	L/R	prox	dist	Age	Part	Quantity	Butchery	Gnawed	Comment
9111	920	"	1	mammal	Sheep/goat	Ph 1					entire	1		?GR	
9111	920	"	1	mammal	Sheep/goat	Ph 1					proximal	1		?GR	
9111	920	"	1	mammal	LU	Rib					shaft	1		?GD	
9111	920	"	1	mammal	IM							4		GD	
9111	920	"	1	bird	Razorbill	femur	L			adult	entire	1			
9100	941	external ground surface/salt pan	1	mammal	LU							1			
9100	941	"	1	bird	Fowl	radius	L				dist	1	small size		
9112	945	"	1	mammal	Cattle	tooth					upper molar	1	chopped		
9112	945	"	1	mammal	Cattle	metatarsal	L/R				shaft	1	chopped DV/ML	GD	
9112	945	"	1	mammal	Sheep/goat	innominate	R				ischium	1		?GD	
9112	945	"	1	mammal	horse	mandible	L				PM4	1	in wear		
9112	945	"	1	mammal	LU	rib					shaft	1			
9112	945	"	1	mammal	SU	rib					shaft	1	chopped ML; KC		
9112	945	"	1	mammal	IM						fragments	5			
9112	945	"	1	mammal	IM						fragment	1		GD	
9112	945	"	1	bird	Fowl	Carpo-metacarpus	L			adult	entire	1			
9112	945	"	1	bird	Fowl	femur	R			adult	entire	1			
9112	945	"	1	bird	Fowl	tibio-tarsus	L			adult	distal	1	KC dist condyle		2 conjoining fragments
9112	945	"	1	bird	cf Fowl	tibio-tarsus	R				shaft	1			
9112	945	"	1	mammal	Mole	femur	R			adult	entire	1			
9108	980	same as 984, wall render	1	mammal	IM						fragment	1			abraded
9120	961	pit fill below salt pan floor	1	mammal	SU	vertebra					dorsal	1			
9120	961	"	1	mammal	IM	LBSF						1			

APPENDIX 8.7. The fish bones recovered from Trench 9, 2010

Ruby Ceron-Carrasco

Table 1: Fish remains recovered in Trench 9, 2010, using number of individual species present (NISP)

Fish species	**Trench 9**
Cod	44
Haddock	378
Saithe	29
Gadidae	35
Dab	1
Halibut	6
Plaice	
Pleuronectidae	2
Elasmobranchii	
Skate	26
Herring	5
Salmonidae	
Total NISP	**526**

Table 2: Catalogue of the fish remains from Trench 9 recovered in 2010

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
961	**9121**	S	clei	1	Haddock	L	3	3	6	70%	medial
			fron	3	Gadidae	S	4	4	8	50%	
			pcver	1	Cod	L	3	4	7	70%	
			preop	1	Gadidae	L	4	4	8	50%	medial/3 pieces
			fron	4	Gadidae	S	4	4	8	60%	
			preop	3	Haddock	S	4	4	8	60%	proximal
			hyom	3	Gadidae	S	4	4	8	60%	
			epi	1	Gadidae	S	4	4	8	60%	
			cerath	5	Haddock	S	3	4	7	70%	
			cerah/epi	3	Cod	S	3	4	7	70%	fused
			art/l	3	Haddock	S	4	4	7	60%	
			postt	2	Haddock	S	3	4	7	70%	proximal
			vomer	2	Haddock	S	3	4	7	70%	proximal
			postt	2	Cod	S	3	4	7	70%	proximal
			den/l	1	Haddock	S	3	4	7	70%	proximal

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			premx/l	2	Haddock	S	3	4	7	70%	proximal
			premx/r	2	Haddock	S	3	4	7	70%	proximal
			max/l	1	Cod	S	3	4	7	60%	proximal
			quad/l	1	Cod	S	3	4	7	70%	proximal
			quad/r	1	Cod	S	3	4	7	70%	proximal
			pteryt	3	Cod	S	3	4	7	60%	
			den/l	2	Haddock	S	4	4	8	60%	proximal
			den/r	2	Haddock	S	4	4	8	60%	proximal
			basiocc	1	Gadidae	S	4	4	8	60%	
			pcver	10	Cod	S	3	4	7	70%	
			cver	4	Cod	S	3	4	7	70%	
			pcver	1	Cod	S	4	4	8	70%	burnt/white
			clei	3	Dab	Juvenile	4	4	8	70%	
			paras	3	Dab	Juvenile	3	4	7	70%	
			hyom	2	Dab	Juvenile	4	4	8	60%	
			oper	2	Dab	Juvenile	4	4	8	60%	

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			pteryt	1	Pleuronectidae	Juvenile	3	4	7	60%	
			cver	17	Haddock	M	3	4	7	70%	
			cver	3	Haddock	S	3	4	7	70%	
			cver	3	Haddock	S	4	4	8	60%	fused
			pcver	11	Haddock	M	3	4	7	70%	
			pcver	5	Haddock	S	3	4	7	70%	
			bran	10	Unidentifiable	Unknown	3	4	7	60%	
			finr	5	Unidentifiable	Unknown	4	4	8	60%	
			fragments	100	Unidentifiable	Unknown	4	4	8	10%	
916	**9117**	S	pcver	1	Cod	L	4	4	8	50%	traces of burning
			pcver	1	Gadidae	L	4	4	8	30%	traces of burning
			clei	3	Haddock	M	3	4	7	50%	medial
			paras	1	Gadidae	M	4	4	8	60%	
			premx/l	1	Haddock	S	4	4	8	60%	proximal
			cver	1	Dab	Adult	4	4	8	70%	

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			fragments	9	Unidentifiable	Unknown	4	5	9	5%	
945	**9123**	S	max/l	1	Halibut	juvenile	3	4	7	70%	proximal
			den/l	1	Halibut	juvenile	3	4	7	70%	proximal
			preop	1	Halibut	juvenile	3	4	7	70%	proximal
			oper	1	Halibut	juvenile	3	4	7	70%	proximal
			cerat/epih	1	Halibut	juvenile	3	4	7	70%	fused
			art/l	1	Halibut	juvenile	3	4	7	70%	proximal
			vomer	1	Halibut	juvenile	3	4	7	60%	proximal
			max/r	1	Halibut	juvenile	3	4	7	70%	proximal
			quad	1	Halibut?	juvenile	4	4	8	60%	proximal
			epio	1	halibut?	juvenile	3	4	7	70%	
			clei	1	Haddock	S	3	4	7	50%	medial
			art/l	1	Cod	L	3	4	7	40%	proximal
			fragments	20	Unidentifiable	Unknown	4	4	8	5%	
920	**9110**	S	clei	1	Haddock	S	4	4	8	70%	proximal

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			clei	3	Haddock	s	4	4	8	60%	medial
			cerath	1	Haddock	s	4	4	8	70%	
			cerath	2	cod	s	4	4	8	70%	
			pcver	5	cod	s	3	4	7	70%	
			paras	3	Gadidae	s	4	4	8	60%	
			preop	1	Gadidae	s	4	4	8	60%	medial
			phar	1	Haddock	s	3	4	7	70%	
			fragments	15	Unidentifiable	Unknown	4	5	9	5%	some partially burnt
921	**9114**	S	finr	2	Flatfish	Adult	3	4	7	70%	
941	**9101**	S	basiocc	1	Gadidae	S	4	4	8	60%	
			fragments	5	Unidentifiable	Unknown	4	4	8	5%	
975	**9128**	S	fragment	1	Unidentifiable	Unknown	4	4	8	5%	
939	**9106**	S	clei	1	Dab	Adult	3	4	7	70%	proximal

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
956	**9115**	S	den/r	1	Haddock	L	4	4	8	70%	proximal
			den/r	1	Haddock	L	4	4	8	70%	medial
			art/r	1	Haddock	L	3	4	7	70%	proximal
			art/l	1	Haddock	L	3	4	7	70%	proximal
			quad/l	1	Haddock	L	3	4	7	70%	proximal
			vom	1	Haddock	M	4	4	8	60%	proximal
			den/l	1	Haddock	L	4	4	8	30%	proximal
			hyom	3	Gadidae	L	4	4	8	70%	
			preop	1	Gadidae	L	4	4	8	60%	medial
			paras	1	Gadidae	M	3	4	7	50%	
			bucklers	26	Skate	Adult	3	4	7	70%	
			oto	11	Haddock	S	3	4	7	70%	
			oto	6	Haddock	S	3	4	7	40%	
			fragments	100	Unidentifiable	Unknown	4	5	9	10%	
			phar	24	Haddock	S	4	4	8	70%	
			den/r	1	Haddock	S	4	4	8	70%	proximal

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			den/l	1	Haddock	S	4	4	8	70%	proximal
			max/r	2	Haddock	S	4	4	8	70%	proximal
			max/l	2	Haddock	S	4	4	8	70%	proximal
			pcver	78	Haddock	S	3	4	7	70%	
			cver	89	Haddock	S	3	4	7	70%	
			pcver	55	Haddock	M	3	4	7	70%	
			cver	37	Haddock	M	3	4	7	70%	
			pcver	5	Cod	M	4	4	8	60%	
			cver	3	Cod	M	4	4	8	60%	
			cver	12	Saithe	VS	3	4	7	70%	
			pcver	10	Saithe	VS	3	4	7	70%	
			pcver	3	Haddock	m	4	4	8	60%	burnt/white
			cver	12	Cod	s	4	4	8	70%	
			pcver	13	Cod	s	4	4	8	60%	
			pcver	2	Cod	s	4	4	8	60%	burnt/white
			clei	2	Haddock	m	3	4	7	50%	medial

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			cerath	1	Gadidae	m	4	4	8	60%	
			epio	1	Gadidae	l	3	4	7	70%	
			quad/l	1	Haddock	s	3	4	7	70%	proximal
			cerath	5	Gadidae	s	4	4	8	60%	
			pteryt	3	Gadidae	s	4	4	60		
			clei	2	Haddock	m	3	4	7	50%	medial
			clei	7	Haddock	s	3	4	7	50%	medial
			fron	1	Gadidae	s	3	4	7	70%	
			cerath/epih	1	Haddock	s	3	4	7	70%	fused
			basiocc	3	Gadidae	s	3	4	70	60%	
			vom	2	Haddock	s	3	4	7	60%	proximal
			premx/r	2	Haddock	s	3	4	7	70%	proximal
			epih	2	Gadidae	l	4	4	8	60%	
			preop	2	Gadidae	s	4	4	8	50%	proximal
			postt	2	Haddock	s	3	4	7	70%	proximal
			premx/l	2	Haddock	s	3	4	7	70%	proximal

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			art/r	1	Haddock	s	3	4	7	70%	proximal
			preop	1	Gadidae	s	4	4	8	70%	medial
			epibr	1	Gadidae	l	3	4	7	70%	
			oper	1	Gadidae	s	4	4	8	50%	medial
			epih	4	Gadidae	s	3	4	7	70%	
			cerath	1	Haddock	m	3	4	7	70%	
			art/l	1	Haddock	s	3	4	7	70%	proximal
			ceratbr	150	Gadidae	s	4	4	8	60%	
			fragments	100	Unidentifiable	Unknown	4	4	8	10%	
			finr	50	Unidentifiable	Unknown	4	4	8	30%	
			cver	6	Halibut	Adult	4	4	8	60%	
981	**9125**		oto	1	Haddock	M	3	3	6	70%	
			cver	5	Herring	Adult	3	4	7	70%	
			den/r	1	Saithe	S	4	4	8	60%	
			phar	1	Saithe	S	3	4	7	70%	
			pcver	5	Saithe	S	3	4	7	60%	

Context	Sample	Recovery method	Element	Number	Species	Size	Erosion	Texture	Condition	Element % completeness	Comments
			phar	1	Haddock	S	3	4	7	60%	
			basiocc	1	Gadidae	S	3	4	7	70%	
			finr	50	Unidentifiable	Unknown	3	4	7	50%	

Key to element identification:
Neurocranium: Olfatory region: vom=vomer. Orbital region: fro=frontal. Otic region: epio=epiotic, postt=posttemporal, supra=supraoccipital. Basiocranial region: basiocc=basioccipital, paras=parasphenoid.

Branchiocranium: Oromandibular region: art=articular, den=dentary, max=maxilla, pal=palatine, premx=premaxilla, quad=quadrate. Hyoid region: bran=branchiostegals, ceratoh=ceratohyal, epih=epihyal, hyom=hyomandibular, oper=opercular, preop=preopercular. Branchial region: ceratobr=ceratobranchial, epibr=epibranchial.

Vertebral column: pcver=precaudal vertebra (abdominal vertebra), cver=caudal vertebra.

Median fins: spines=acanthrotrich and pterygiophore, finr=soft fin rays (lepidotrich).

Appendicular skeleton: clei=cleithrum, supra=supraoccipital.

Others: oto=otolith.

Keys:
Side of paired elements:
l=left, r=right

Key to Gadidae size categories:
VS= Very Small < 15-cm total length
S=Small 15-30 cm total length
M=Medium 30-60 cm total length
L= Large 60-120-ccm TL

Key to recovery method:
S=Sieved
H/C=Hand-collected