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The Calanais Fields Project: excavation of a prehistoric sub-peat field system at Calanais, Isle of Lewis, 1999–2000

Melanie Johnson, Catherine Flitcroft and Lucy Verrill

With contributions by
Mhairi Hastie, Anthony Newton, Adrian Tams and Graeme Warren

This paper is dedicated to the memory of Stephen Owen (1979–2017),
who brought so much joy to the excavations.

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ABSTRACT

Excavations at Calanais, Isle of Lewis in 1999 and 2000, through the University of Edinburgh, revealed fragments of a prehistoric field system buried beneath blanket peat. Stone structures including buildings, walls, clearance cairns and heaps and cobbled surfaces were identified and excavated. Environmental analyses indicate that these features, associated with a buried soil, represent prehistoric farming activity, and radiocarbon determinations indicate that they are likely to be no later than Late Bronze Age/Early Iron Age in origin. This excavation is important as it is one of very few recent prehistoric excavations in the Hebrides on the blacklands instead of machair, in addition to showing evidence for an agricultural landscape in close proximity to a major ritual monument (Calanais Standing Stones).

1. INTRODUCTION

The Calanais Fields Project was conceived as a research and training project through the archaeology department of the University of Edinburgh, with excavations undertaken in 1999 and 2000 on land at Calanais, Isle of Lewis (NGR: NB 2125 3265; Illus 1). The site lay to the south-west of the Calanais Standing Stones (Site no.: NB23SW 1; Canmore ID 4156), on a triangular peninsula extending into Loch Ceann Hulabhig, a sea loch to the south of East Loch Roag: the land formed part of the former holdings of the University of Edinburgh, was used as rough grazing at the time of the excavations, and had been used for peat cutting in the past (Illus 2). The study area measured approximately 400m by 400m at *c* 10m AOD and comprised an area of deep peat attaining depths of up to 3m.

In January 1998: a watching brief (Coles et al 1998; Canmore ID 140912) was conducted during the excavation of a trench for an underground cable by Scottish Hydro-Electric in an area of previously undisturbed blanket peat immediately adjacent to Calanais Farm (Illus 1). The remains of at least three stone features were recorded, associated with a potentially prehistoric ground surface beneath *c* 1.4m of peat. These features were interpreted as walls, and limited excavation was carried out within the confines of the cable trench. The apparently good preservation of these features and their associated buried soil provided an ideal opportunity to further explore their extent and attempt to characterise/date them. Additionally, the close proximity to the Calanais Standing Stones complex provided a chance to examine the use of the landscape around a well-known and prominent monument. The Calanais Fields Project was established for that purpose and two seasons of excavation were carried out with undergraduate students.

From the outset it was intended that both the walls found during the watching brief and the areas they enclosed should be examined in an effort to determine their function. It was thought that excavation could reveal structures associated with agricultural activity, providing complementary information on the nature of occupation and economy. The overall objective was a better understanding of the settlement, subsistence and domestic landscape to contrast with the already well-explored ritual setting of the Calanais Stones.

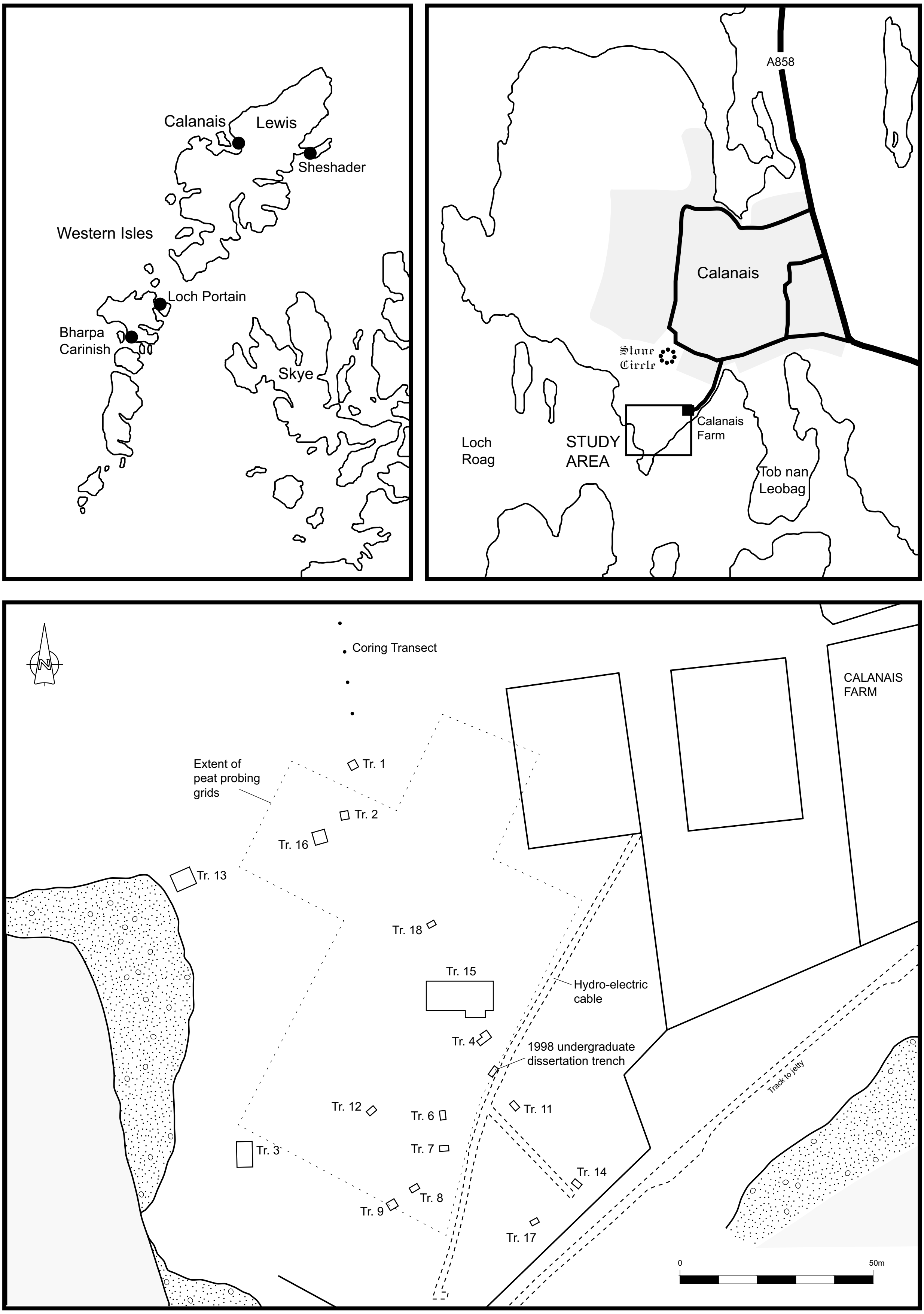
Fieldwork in 1999 was designed to evaluate, through trial trenching and a system of testing with a 2m steel peat probe, the nature, extent and potential of the archaeological features buried beneath the peat. It soon became clear that there was a complex and well-preserved field system and associated structures beneath the peat. The second season, in 2000, further explored the areas of interest partially uncovered in 1999 (Canmore ID 140912).

1.1 Post-excavation reporting

The fieldwork and post-excavation analysis was undertaken while the authors were postgraduate students at the University of Edinburgh and a draft publication report was produced in the years immediately following. After graduation, the authors moved on to other studies and full-time jobs, some of which were outside archaeology. As a result, the publication of this work was delayed.

The archaeological background and the specialist reports contained herein have not been revised since the original analyses and draft reporting were undertaken in the early 2000s, while some light revision of the discussion has occurred. A section on further reading is provided, highlighting relevant articles which have come to publication since this paper was first drafted.

Unpublished aspects of the analyses are contained within the archive.



Illus 1 Location map and trench plan

Illus 2 General view of Calanais Fields study area

2. ARCHAEOLOGICAL BACKGROUND

Evidence for the earlier prehistory of Lewis consists largely of ritual and burial monuments, especially the well-known concentration of standing stone sites around Calanais (Armit 1996; Ashmore 2016). While the Calanais Stones are important structures, the settlement record of the period is poorly understood; in part this is a reflection of the environmental record in the region during the period following Neolithic settlement, as the extensive growth of blanket peat during prehistory and thereafter makes it difficult to discover and identify earlier features. Conversely, it is this growth of peat that has given us detailed records of environmental change and human activity and has resulted in the preservation of relatively intact prehistoric landscape features at Calanais.

Sub-peat features of probable prehistoric date had previously been noted in peat cuttings and natural erosion, often in a very disturbed condition, in the Calanais area (Coles & Burgess 1994). In nearly all cases, these wall fragments were badly disturbed by the processes of peat cutting or natural erosion which had brought them to light. At Tob nan Leobag (NGR: NB 218 326), a low-lying peninsula projecting into upper Loch Roag immediately south of the Calanais Standing Stones, work on a series of field walls and possible enclosures exposed by peat cutting was able to demonstrate that they dated to the Late Bronze Age (Cowie 1979; Cowie 1980; Bohncke 1988; Canmore ID 4162). Traces of similar sub-peat 'field walls' were also recorded beside Loch Roag (NGR: NB 142 248) (Bohncke 1988). It was anticipated that the features identified at Calanais during the cable trench watching brief (Coles et al 1998) would provide further examples of prehistoric activity in the area, sealed beneath undisturbed peat.

3. EXCAVATION RESULTS

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3.1 Working methods

Eighteen trenches were excavated during the course of the project; these ranged from trial trenches measuring 1m by 2m to larger excavation areas around identified features. The locations of the trenches were determined mainly as a result of systematic probing of the peat, using a 2m peat probe, by transects on a grid system, used to identify and trace sub-peat stone features. Some trenches were also randomly placed across the study area to target apparently 'blank' areas enclosed by the field walls, and other trenches targeted features which were visible on the surface.

Several trenches warranted further excavation due to the features revealed within them; Trenches 3, 4, 5, 9, 10, 13 and 16 (and Trench 15, formed when Trenches 5 and 10 were combined and extended) are described in detail below. Minor features identified, which are not described below, include a scatter of stones with no discernible structure in Trench 11; a possible continuation within Trench 18 of the cobbles seen in Trench 15; and a possible wall and spread of stones relating to peat cutting activities in Trench 2. The remaining trenches contained no features and simply recorded the peat depths and palaeosol characteristics. Some artefacts were recovered from some of these trenches, in particular a piece of pitchstone from Trench 12 and a flint flake from Trench 18.

The sampling strategy involved four main elements:

- Bulk soil samples for wet-sieving and routine smaller soil samples for laboratory tests were taken from each deposit beneath the peat.
- The palaeosol associated with the sub-peat features was sampled for phosphates on a grid system.
- Monoliths for pollen analysis were taken from Trenches 14 and 15.
- Soil micromorphological samples were taken from several key positions in Trenches 15 and 17.

The trench positions are shown on Illus 1 and features are described below. The stone structures in Trench 15 were not removed and remain in situ.

3.2 Mineral soils

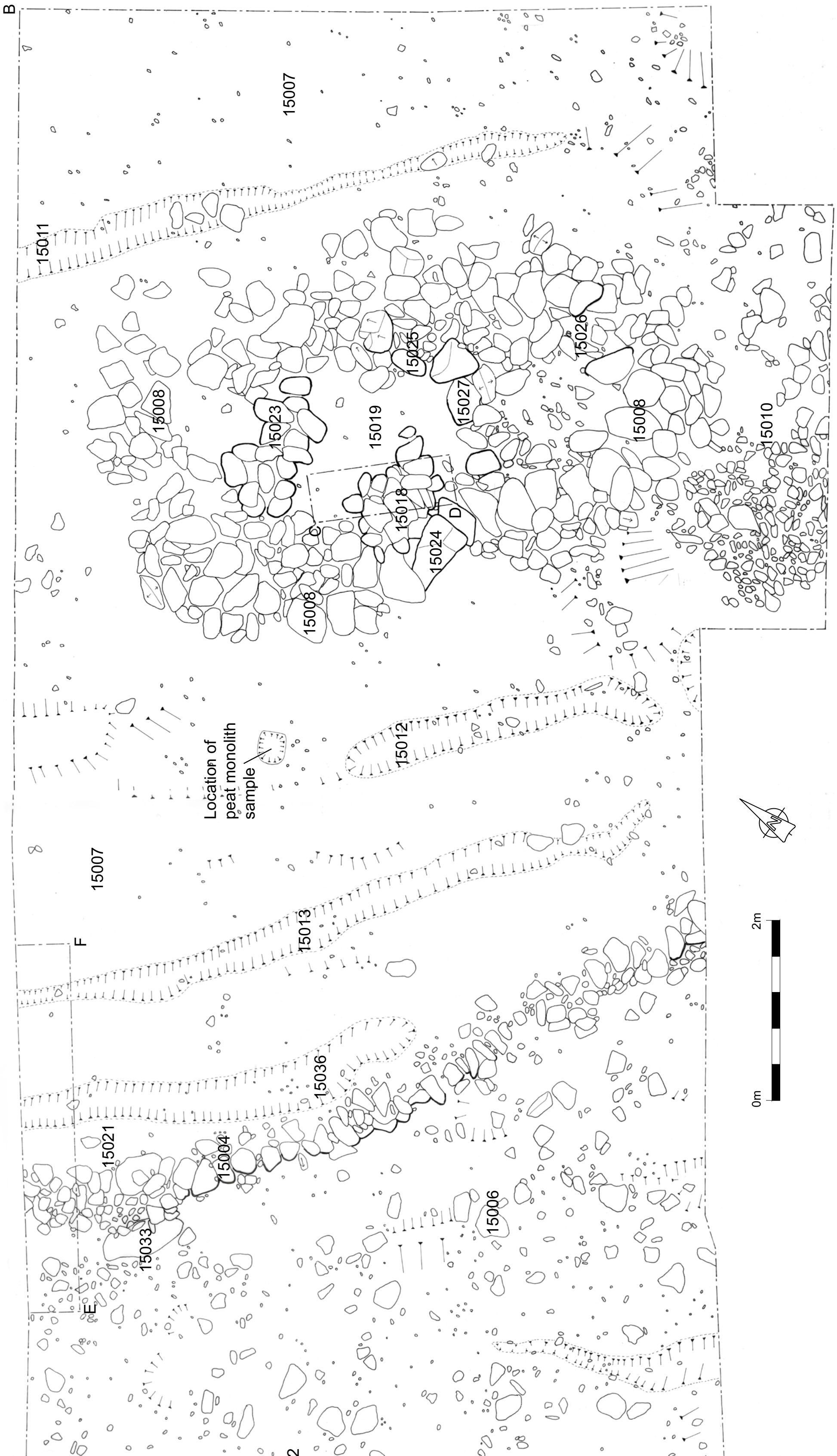
A mineral soil was discovered beneath undisturbed peat in every trench with an overlying growth of peat. This soil measured between 0.02m and 0.15m thick, and consisted of a dark brown, compact sandy silt, with grit inclusions, occasional charcoal flecks and some root matter throughout. This soil is interpreted as a palaeosol, representing the land surface prior to peat initiation, and its presence in every trench indicated extensive preservation of this surface. In several trenches an earlier soil was found beneath this palaeosol, lying directly on top of glacial till. This soil comprised a medium/light brown, compact, silty sand, with occasional root matter throughout and occasional charcoal flecks. This soil had characteristics of a brown earth (Curtis et al 1976: 49) and was interpreted as an earlier palaeosol. These palaeosols were typical of thin, poorly developed soils which form on weather-resistant acid bedrock such as Lewisian Gneiss and were thus consistent with other observations on the island's soils (Hudson 1991: 19).

To provide an indication of how far the buried land surface survived beneath the peat within the study area, a coring transect was established, running roughly NNW away from the main area of excavation (Illus 1). The transect began on a large peat bank to the north of the study area and continued for a distance of *c* 120m. Cores were recovered every 8m along this line using a 1m length Eijelkamp corer. Each core was described, drawn and a sample of the palaeosol was taken for soil tests. A similar sequence of peat growth was recorded along the transect and the palaeosol was present in all cases. Peat depth varied from 0.4m to 1.97m, and the palaeosol was between 0.07m and 0.29m thick and appeared to have been unaffected by peat cutting.

A range of prehistoric structures were found beneath the peat through the prospection methodology, all lying on this palaeosol. These are categorised and described below.

3.3 Sub-peat structure, field wall and cobbling (Trench 15)

The focus of the excavations was on Trench 15 (Illus 3). The final trench measured 17m by 9m overall, expanding from two previous trial trenches



Illus 3 Plan of Trench 15

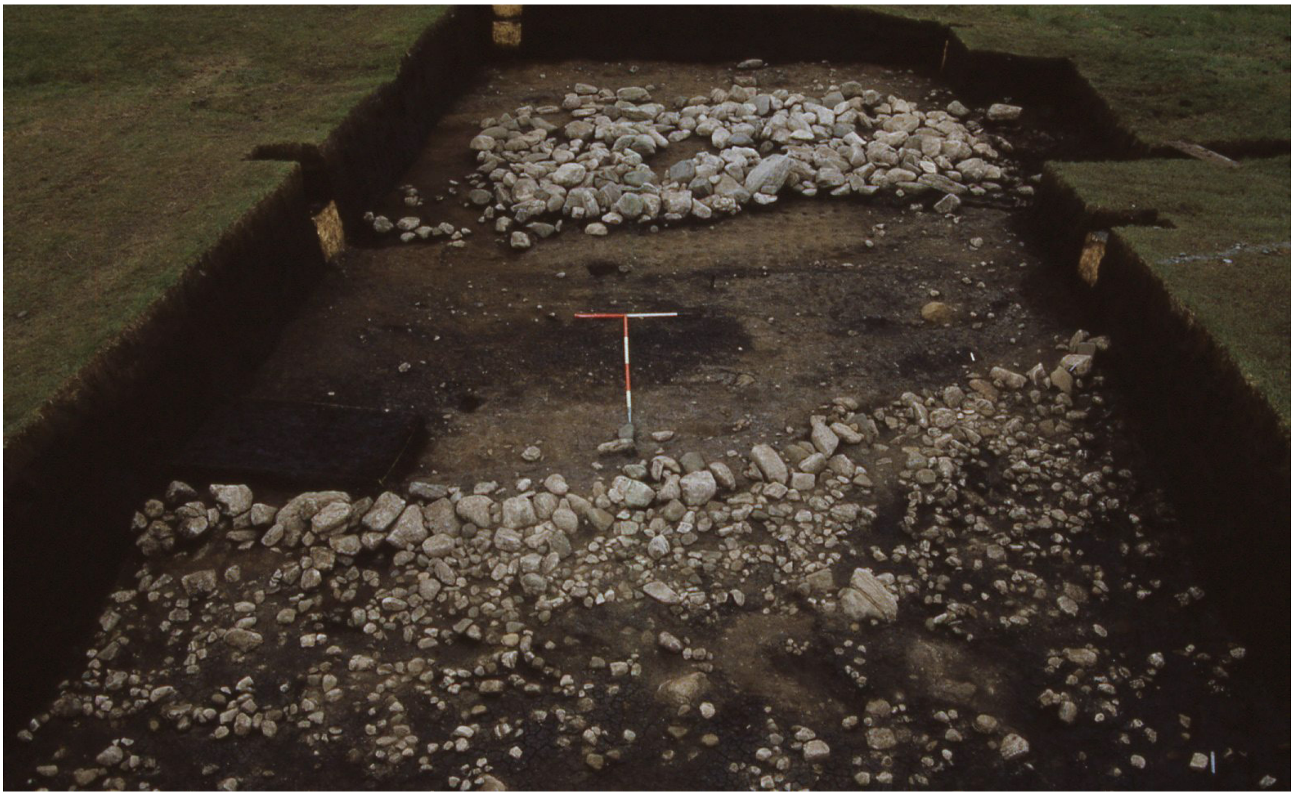
(Trenches 5 and 10), with peat reaching a maximum depth of 1.8m.

A suite of prehistoric stone features were uncovered in this trench. These features were: a sub-rectangular structure (Context 15008) with an internal division at the eastern side of the trench; a single-faced wall (C15004) running roughly east/west and revetted against a bank of palaeosol; and to the west of this wall, an area of cobbling (C15005, C15006) which had two phases of use (Illus 4). Two deposits of palaeosol were found; within the upper palaeosol, two sets of cultivation furrows were recorded.

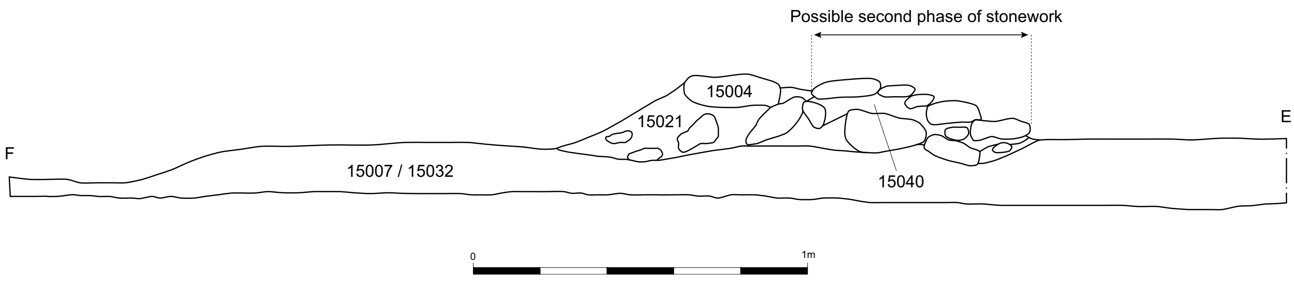
Five phases of construction have been identified within this trench. Some sequential arrangement of these phases is possible but Phases 2 and 3, as well as Phases 4 and 5, may be contemporary.

3.3.1 Phase 1

The earliest features were vestigial structural remains (C15033) found to the west of the wall (C15004) and sealed beneath the cobbling of Phase 3 (C15006). These appeared to sit within a thin (0.05m) layer of palaeosol (C15034), believed to represent the earliest agricultural soil uncovered in Trench 15.



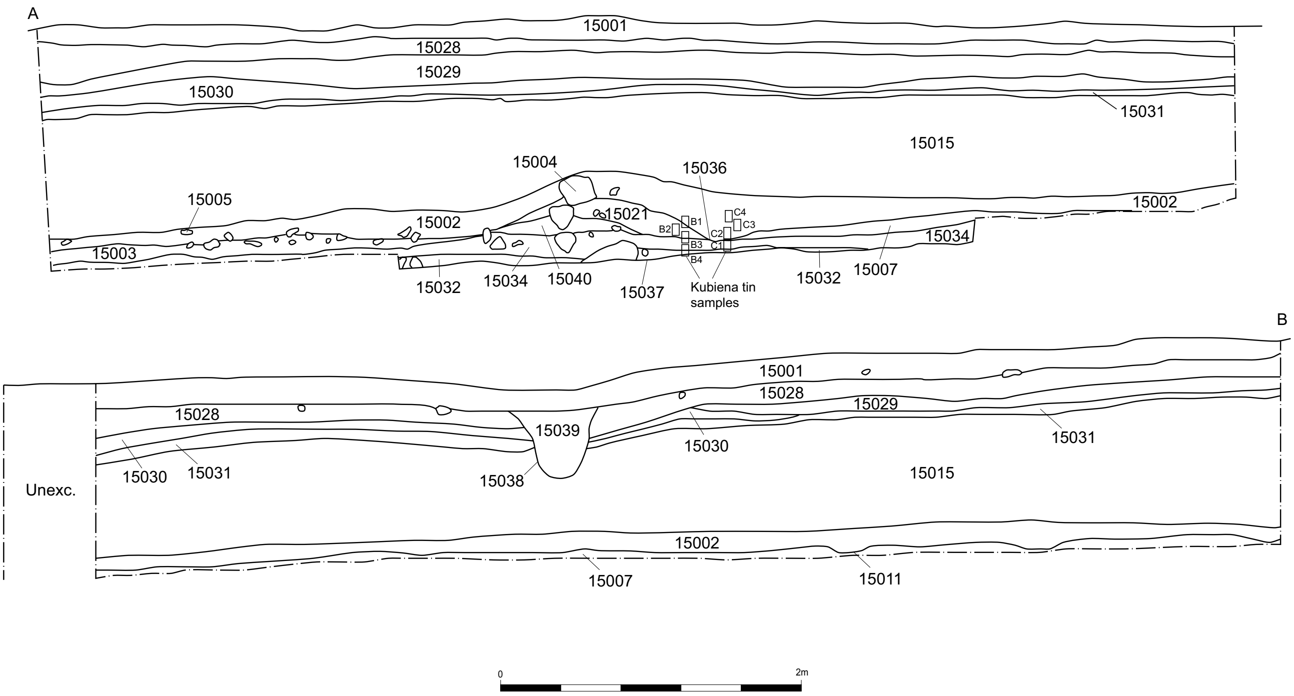
Illus 4 Trench 15 from the west



Illus 5 Trench 15, north-facing section

Illus 6 Trench 15, boundary wall and west end of trench, from the north

Illus 7 Trench 15, detail of boundary wall from the north-west



Illus 8 Trench 15, south-facing section

3.3.2 Phase 2

This phase is characterised by a wall (C15004) running east/west (Illus 3, 5, 6). It was possibly used to demarcate areas of either arable or pastoral land, or to separate the domestic from agricultural activity. The accumulation of material either side of this wall, particularly to the east, indicates the longevity of this feature as a functioning entity (Illus 7). This boundary wall demarcates an area of well-developed agricultural soil (C15019, C15003, C15007), which formed a more fertile, less waterlogged area in the centre of the trench, and has prevented the soil from eroding. Associated with this feature is a bank of soil against the back of the wall (C15021) and a ditch probably inserted to improve drainage (C15036) (Illus 3, Illus 8). Possible secondary stonework was noted in section (Illus 5).

This phase may also be associated with a system of cultivation furrows (C15011, C15012, C15013) because the surface of the palaeosol (C15003) in the centre of the trench displayed traces of such features, which were particularly noticeable when the overlying peat was removed (Illus 3, 9, 10).

Illus 9 Trench 15, Furrow 15011 from the north

Illus 10 Trench 15, Furrows 15012 and 15013 in centre of trench from the north

Illus 11 Trench 15, cobbling between Structure 15008 and trench edge, from the east

Illus 12 Trench 15, Structure 15008 from the north

Illus 13 Trench 15, general view of Structure 15008 from the north

These furrows measured about 0.5m wide by 0.15m deep, were aligned roughly north-west/south-east and parallel to each other. The two in the centre of the trench (C15012 and C15013) lay about 1m apart. Similarly, the presence of cereals, confirmed through pollen analysis of the palaeosol (see below) supports the presence of arable land.

3.3.2 Phase 3

The laying of a cobbled surface (C15006) to the west of the boundary wall marks a change (Illus 3). This is the first phase of cobbling to the west of the field wall, and the stones may have been laid to consolidate the ground surface. This feature lay within the palaeosol (C15003), which was covered with preliminary peat growth (C15002). A patch of cobbling (C15010) within the palaeosol to the south of the building may also belong to this phase (Illus 11).

3.3.3 Phase 4

Phase 4 is characterised by the construction of a structure (C15008) (Illus 12), which itself has at least two phases of activity. Located in the east of the trench, the walls of this structure were constructed of substantial boulders, which may have supported an organic superstructure, perhaps turf (Illus 3, Illus 13).

Phase 4a sees the building in its original form, sub-rectangular with an internal division resulting in two compartments linked by an internal doorway (C15027). The structure measured 7m by 4m overall; the northern compartment measured approximately 2m by 1.8m internally while the southern compartment measured about 1.5m by 1.5m internally (Illus 14). Two possible entrances into the larger, northern compartment were located to the east (C15025) and west (15024) respectively (Illus 15), and one possible entrance was identified in the southern cell facing south-east (C15026) (Illus 16).

A phase of reconstruction, Phase 4b, saw the northern compartment shortened by a secondary cross-wall (C15023) (Illus 17) and the western entrance blocked (C15018). A section measuring 1.6m by 0.6m was excavated within the northern cell in front of what was the west-facing entrance (Illus 18). The palaeosol here (C15019) overlay a brown

Illus 14 Trench 15 from the east

Illus 15 Trench 15, blocking of the western entrance of Structure 15008, from the west

Illus 16 Trench 15, southern cell of structure from the south-east

earth (15020), itself set over glacial till (C15037). A series of soil monoliths were taken here for soil micromorphological analysis (see below; Illus 19).

The function of this building is unclear and very few artefacts were found associated with it, comprising only two flint chips and a small number of quartz flakes (see below); there were no internal stratified deposits or features such as a hearth. There was also no evidence to indicate whether this structure was roofed or not. Its small size may indicate it functioned as a bothy or shelter.

3.3.4 Phase 5

A second phase of cobbling (C15005) was laid down to the west of the Phase 2 field wall (C15004), perhaps as a consequence of increased wetness and paludification[1] of the ground surface (Illus 20). This appeared to be sitting within a thin layer of compact peat (C15015) above a gritty interface layer (C15002) (Illus 8). The stratification indicates that farming activity or stock control may have continued after the peat had begun to grow and an attempt to continue use of the area in a wet and infertile environment was made, if only for a brief period. A possible continuation of this cobbled surface was excavated in Trench 18.

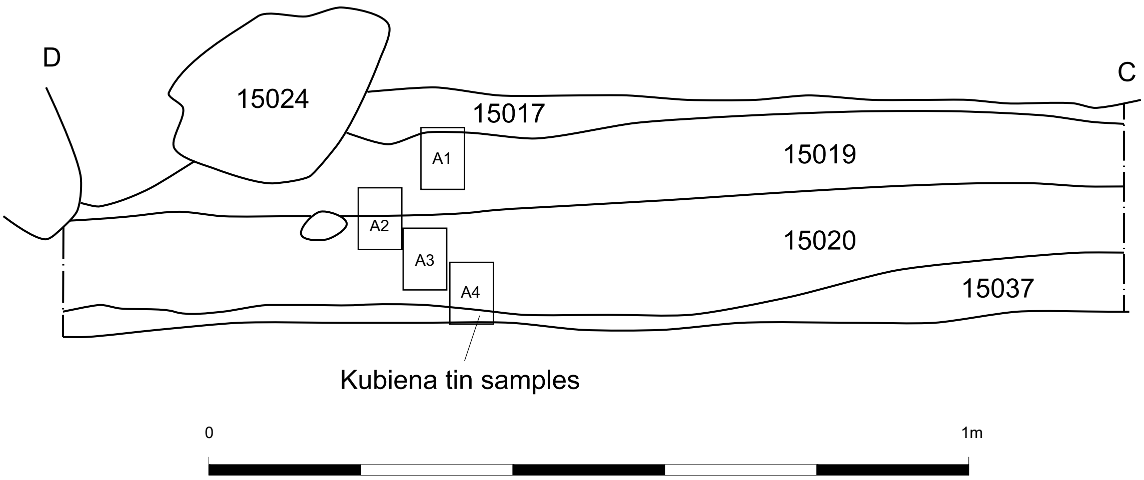
3.4 Sub-peat field wall (Trench 4)

A stone wall was excavated, lying on the same alignment as a wall found during the watching brief (Inglis 1999). This wall (C4003) measured 1.5m wide by 3m long and was constructed on top of the palaeosol (Illus 21). It was built of large sub-angular gneiss boulders measuring up to 0.65m across, with a little tumbled stone lying to the east (Illus 22). Its presence is particularly significant in light of the features present in Trench 15, just 5m to the north. It is possible that this represents a linear field wall aligned NNW/SSE, whose northern end

1 Paludification is the process by which blanket bog encroaches onto formerly dry land through the accumulation of organic matter, increased soil moisture and sphagnum moss colonisation. This can be caused by climatic change, geomorphological change, and by the natural advancement of peatland.

Illus 17 Trench 15, main cell of structure from the north

Illus 18 Trench 15, slot within structure



Illus 19 Trench 15, east-facing section of slot within structure

Illus 20 Trench 15, boundary wall and cobbled surface from the north-west

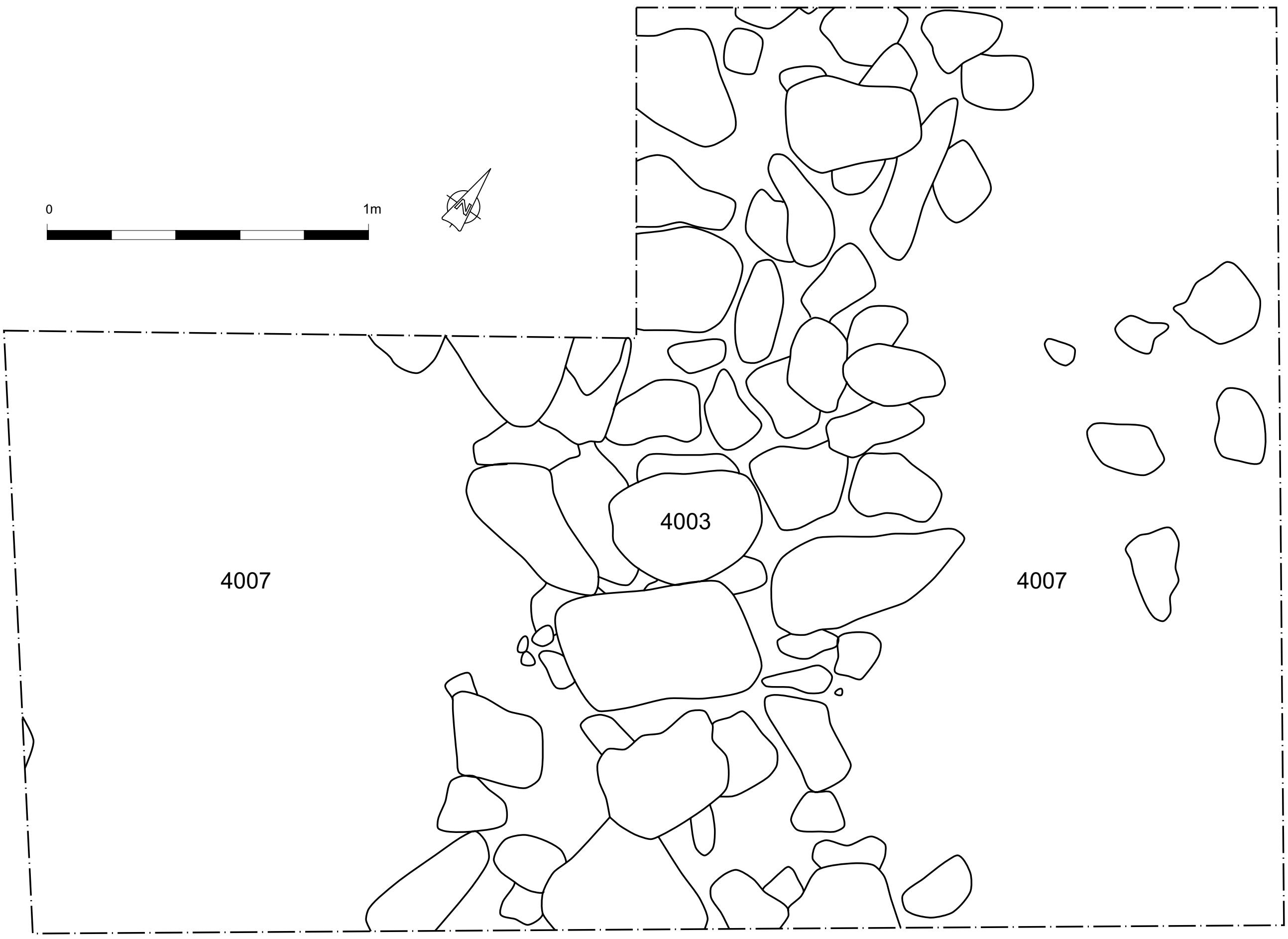
could be seen in the section edge of Trench 15; the line could be followed by probing between the trenches.

3.5 Sub-peat clearance cairns and heaps (Trenches 2, 9 and 16)

A circular spread of small stones (C9010), measuring about 1m in diameter, was discovered beneath 1.15m of peat in Trench 9 (Illus 23). These stones were heaped up towards the centre and became more scattered towards the edges (Illus 24). This feature is interpreted as a clearance cairn.

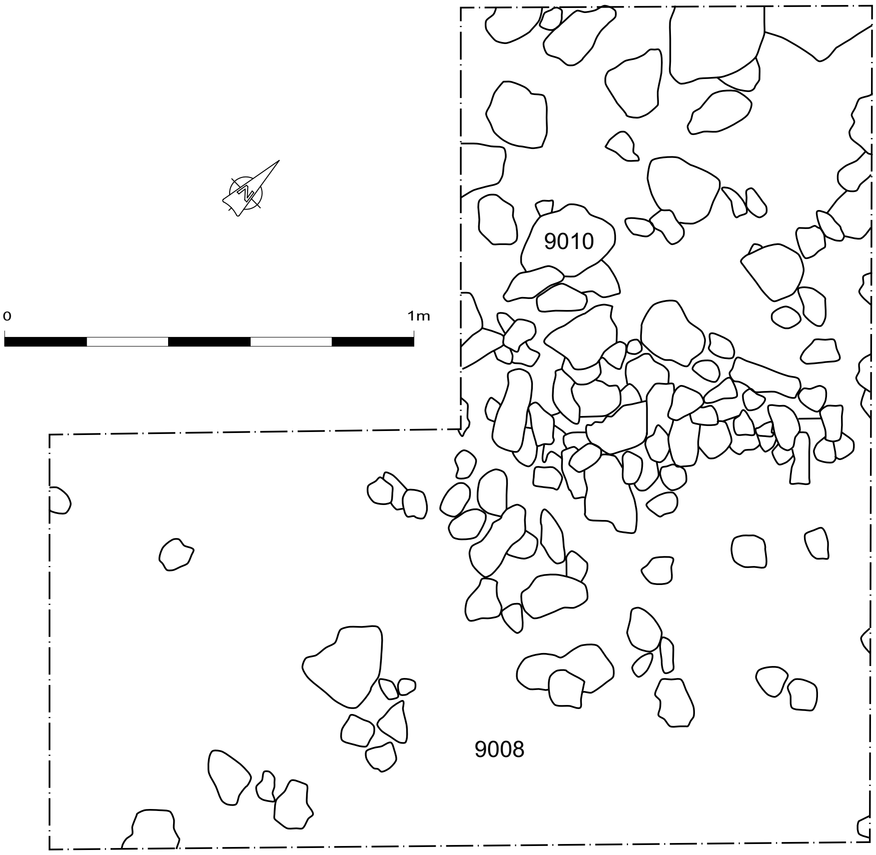
A linear heap of stones (C16009) was excavated in Trench 16, aligned roughly north/south, and piled to a height of about 0.4m at the north of the trench, tailing off towards the south (Illus 25, 26). It had a clear boundary on its north-western side and a much more diffuse one towards the south. It was initially assumed that an earlier field wall had been obscured by later clearance stones piled up against it. However, upon excavation, no wall faces could be discerned and the stone heap was irregular in construction. This feature is interpreted as a linear clearance heap, demarcated on its northern side, perhaps suggesting that clearance activity occurred from the south. It is unlikely that peat cutting has removed portions of this feature and created a false edge because the feature runs obliquely across the peat cutting. This feature possibly continued further to the east in Trench 2, where a stone spread running north-east/south-west was identified, with edge-set stones marking the south face (Illus 27).

Below this stone feature was a thin layer of well-humified peat, beneath which was a spread of small sub-angular/sub-rounded stones (C16010) lying on top of the palaeosol (Illus 28). These stones perhaps indicate that a clearance heap had already begun to accumulate and was augmented by further clearance over a period of time. A small sub-oval pit (C16011) was found cutting into the palaeosol beneath these stones. It measured 0.24m across by 0.2m deep and contained a homogeneous dark brown silt.



Illus 21 Trench 4 plan

Illus 22 Trench 4 from the south



Illus 23 Trench 9 plan

Illus 24 Trench 9 from the north-east

Illus 25 Trench 16 plan

Illus 26 Trench 16 from the west

Illus 27 Trench 2 from the west

Illus 28 Trench 16 from the south following removal of upper stones

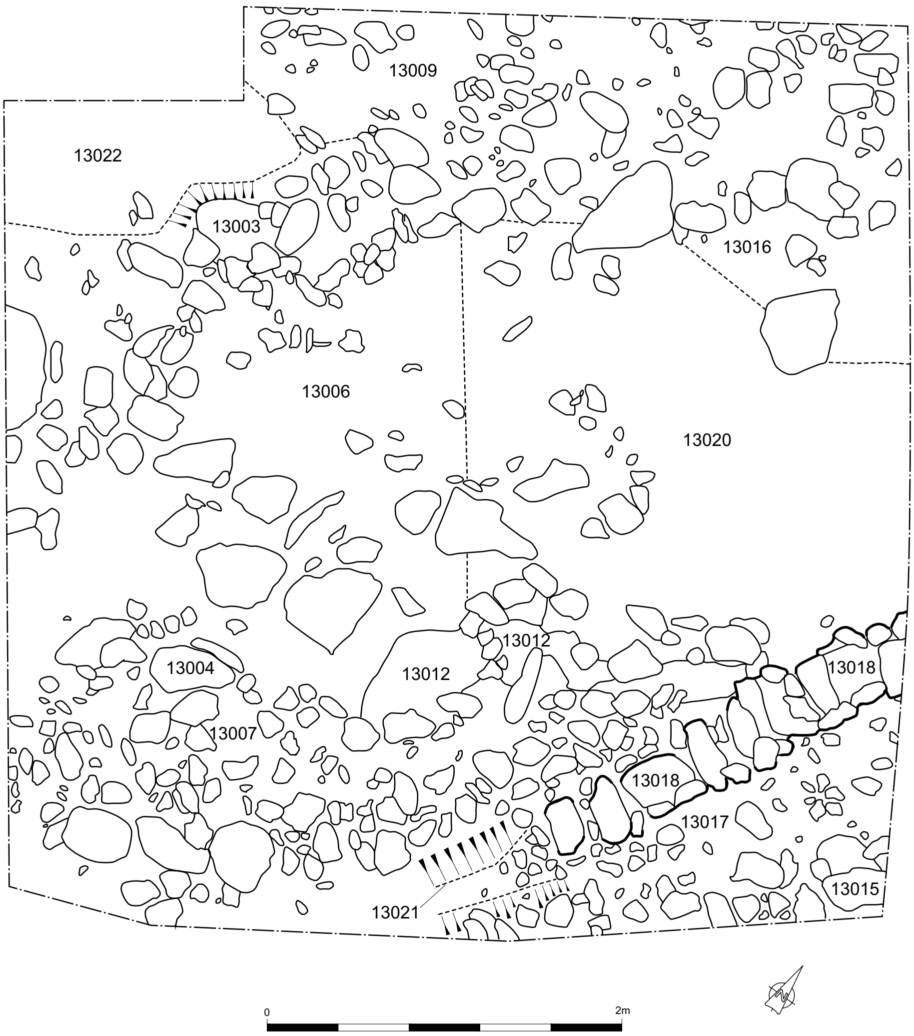
3.6 Oval structure of unknown date (Trench 13)

The footings of an oval building were found on the coastal edge sealed beneath a layer of gritty colluvium (Illus 29). It measured 2.5m by 4.5m internally and was aligned north-east/south-west (Illus 30). The walls of this structure were poorly built with no distinct coursing and had a gritty matrix, possibly forming a soil wall core, so is likely to have supported a peat/turf superstructure (Illus 31); indeed, on the south side the wall was constructed of peat blocks, their shape still readily discernible, placed on top of a stone foundation. There was no evidence of an entrance and there were no internal features within this building.

A thin organic soil covered the interior of the building and has been interpreted as an earlier floor layer. A possible secondary turf floor or platform (C13011), constructed after the original floor went out of use and the building began to fill with colluvium, was found in the eastern side of the building. It measured 0.8m wide by 3m long by 0.3m thick. This deposit lay on top of a compact peaty layer which perhaps resulted from a foundation layer made of peat blocks. It could also indicate that the platform itself was turf-built, and what is seen is the peaty topsoil adhering to the underside of turfs cut from peat.

To the east of the structure, a length of stone wall appeared to continue beneath a peat bank. This wall could be traced by probing for a short distance heading east, but here the peat rapidly increased in depth to 3m. Between the oval structure and this ancillary wall was a thick dump of mixed material (C13014) containing patches of clay, peat and peat ash. Upon its removal, a slab-capped drain was revealed (C13018) (Illus 32). This measured 2.3m in length, aligned north-east/south-west, and continued into the section to the north. This feature could not be excavated in full because of time constraints, and so its underlying structure and contents remain unknown. This drain appears to lie outside the excavated building and may therefore be draining water away from the structure or be evidence for a second building as yet not revealed.

Illus 29 Trench 13, general view of structure from the east



Illus 30 Trench 13 plan

Illus 31 Trench 13, structure from the south

Illus 32 Trench 13, drain seen from the west

3.7 Post-medieval structure and redeposited early prehistoric finds (Trench 3)

A trench was excavated adjacent to a large bedrock knoll in the west of the study area. The latest phase of activity in this area was represented by a small semi-circular building. It had a double-faced stone wall with a soil core and was assigned a medieval or later date on the basis of its morphology and the recovery of Craggan Ware sherds from within it; it was interpreted as a bothy or hut. The building measured 4m by 3.2m overall, and a large orthostat had been used to form the north side of the entrance on the east. A spread of peat ash was interpreted as a hearth, and two possible postholes were cut into the floor deposits.

Beneath this building, and across an area of outcropping bedrock around the area the building had occupied, was a series of deposits filling the hollows within the bedrock (Illus 33), some of which contained flint, pottery and plant macrofossils. These deposits were difficult to interpret, but it is possible that some accumulated naturally, while others may have been deliberately laid to level the uneven bedrock surface prior to constructing the building. A few of the artefacts found have been dated to the Late Neolithic or Bronze Age, suggesting that the hollows within the bedrock acted as catchments for material during prehistoric activity in this area.

Illus 33 Trench 3 from the north, bedrock exposed

4. ENVIRONMENTAL ANALYSES

4.1 Palynology

Catherine Flitcroft and Lucy Verrill

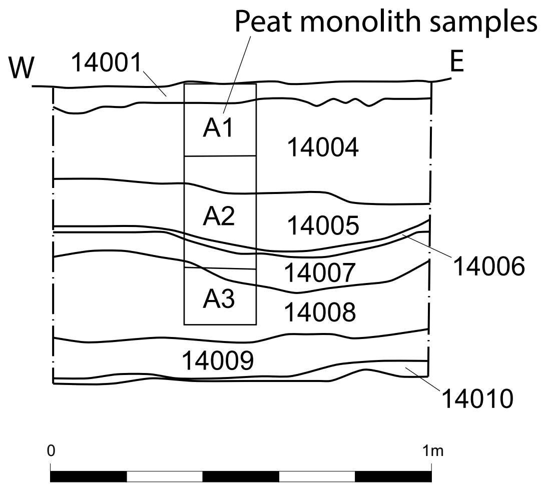
Two peat monoliths were removed, from Trench 14 (Illus 34, Illus 35) and Trench 5 (which later became incorporated within Trench 15; position indicated on Illus 3, Illus 36), and a sequence of Kubiena tins were used to sample the relict soil profile in Trench 15 (Illus 8 – samples C1–4).

4.1.1 Methodology

Sub-samples of one cubic centimetre from the Trench 15 (CLF-15) and Trench 14 (CLF-14) peat column monoliths, and from the soil profile in Trench 15 (CLF-SP), were processed for pollen analysis using standard techniques (Moore et al 1991). Identification used the pollen key in Moore et al (1991) and reference material. For CLF-14 and CLF-15 counts, a total land pollen count (TLP: total identified pollen excluding spores and aquatics) of 500 was aimed for; where this was not possible a minimum count of 300 was obtained. For CLF-SP counts, preservation was generally poorer and a minimum TLP count of 300 per level was obtained. Pollen diagrams were constructed using *Tilia* and *TGView*.

4.1.2 Radiocarbon dates

AMS radiocarbon dates of six bulk peat samples were taken from the peat monoliths in Trenches 14 and 15 in order to provide dates for the pollen



Illus 34 Trench 14 south-facing section

Illus 35 Trench 14 peat monolith position

Illus 36 Trench 15 peat monolith position

sequences. The humin fraction only was dated. These were assayed at the Oxford Radiocarbon Accelerator Unit in 2001 and the dates have been recently recalibrated using OxCal 4.4.2. Results are shown in Table 1 and Illus 37.

Samples OxA-10091 and OxA-10120 were taken from the lowest level of peat growth in each monolith, at the interface between the palaeosol and the first identified natural peat growth. The dates indicate that peat growth in this area began in the first millennium BC and was not simultaneous across the area, since peat inception began earlier at the base of the slope in Trench 14 (Oxa-10120, 750–380 cal BC) than further upslope in Trench

Table 1 Radiocarbon dates. Calibrated using OxCal v.4.4.2. IntCal13 atmospheric curve (Reimer et al 2020)

Lab code	Trench	Depth within peat column	^{14}C age (years BP)	Calibrated date range at 95% probability	δ^{13}C (‰)
OxA-10089	15	200–210mm	234 ± 34	1520–1560 cal AD 1630–1690 cal AD 1730–1810 cal AD 1930–1950 cal AD	–27.9
OxA-10090	15	590–600mm	1628 ± 37	360–550 cal AD	–27.2
OxA-10091	15	1040–1050mm	2222 ± 37	390–170 cal BC	–28.7
OxA-10118	14	200–210mm	1370 ± 40	600–780 cal AD	–26.4
OxA-10119	14	340–350mm	1805 ± 45	120–370 cal AD	–28.2
OxA-10120	14	520–530mm	2380 ± 40	750–380 cal BC	–29.9

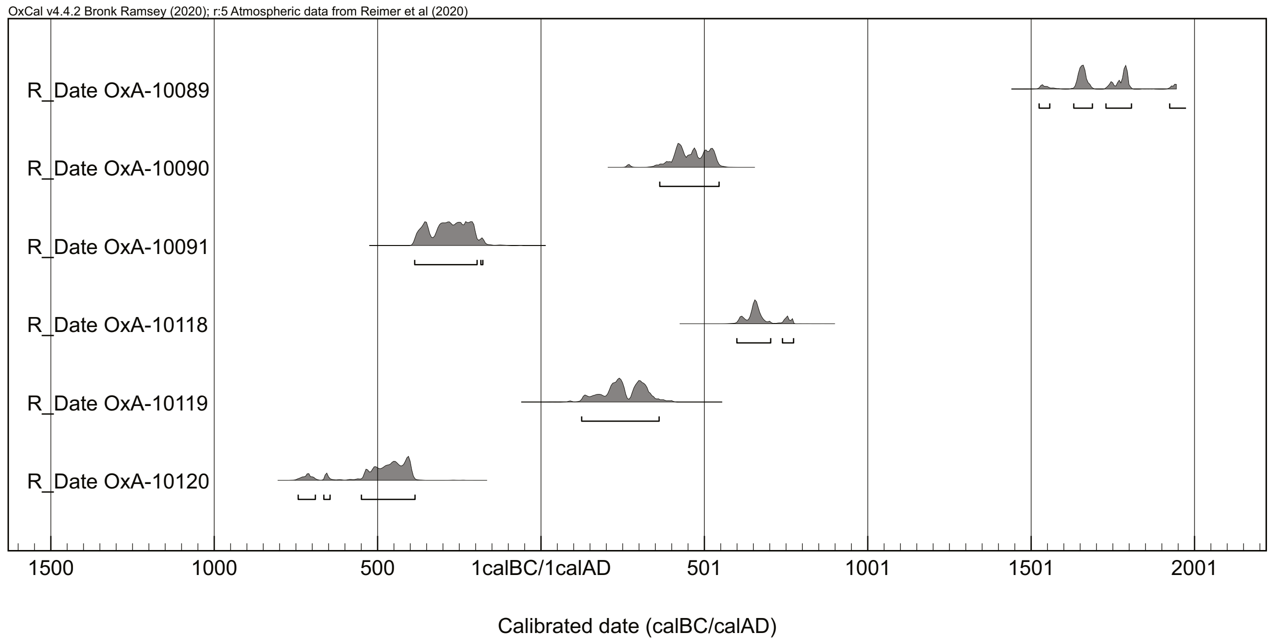
15 (OxA-10091, 390–170 cal BC). The uppermost dates (OxA-10089, OxA-10118) were taken from immediately beneath the modern turf and roots, while the centre dates (OxA-10090, OxA-10119) provided additional control for the pollen sequence. These dates provide a *terminus ante quem* for the activity at Calanais Fields and suggest that the structures excavated and described above may be Late Bronze Age/Early Iron Age or earlier in date.

4.1.3 Results

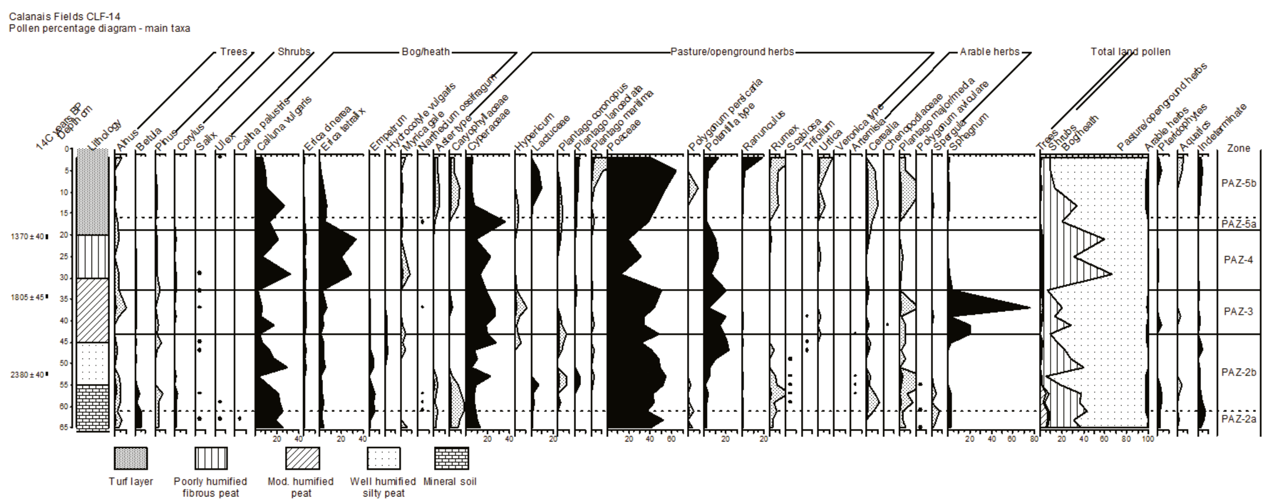
Percentage pollen diagrams showing selected taxa are presented in Illus 38–40. Shaded curves show ×10 exaggeration and a dot denotes presence. Five pollen assemblage zones (prefixed 'PAZ') were identified.

Pollen stratigraphy interpretation

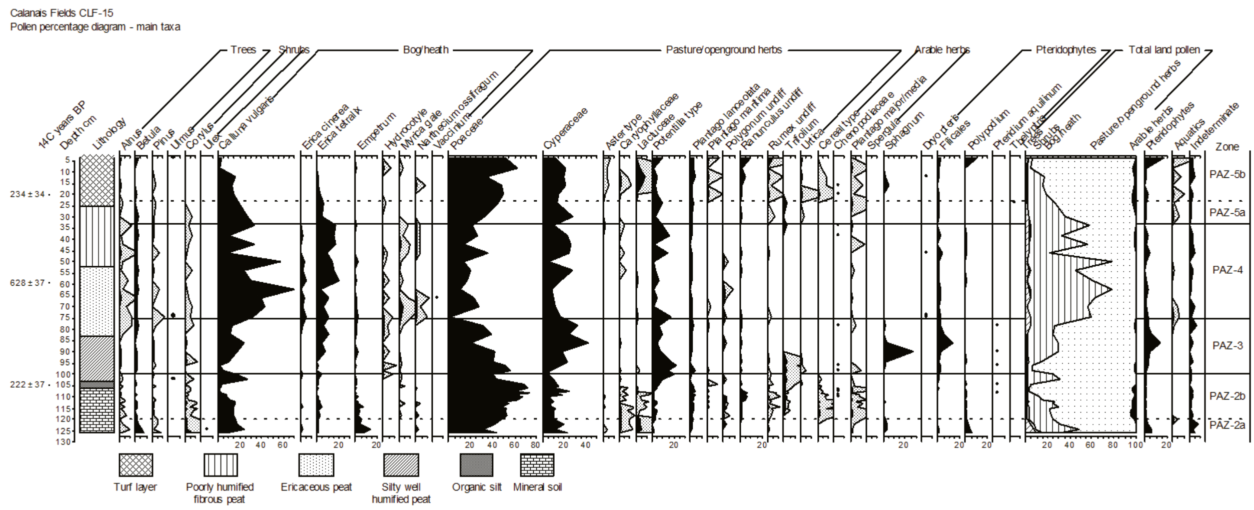
The sequence is interpreted as opening in the Late Bronze Age, pre-600 BC, based on extrapolation from



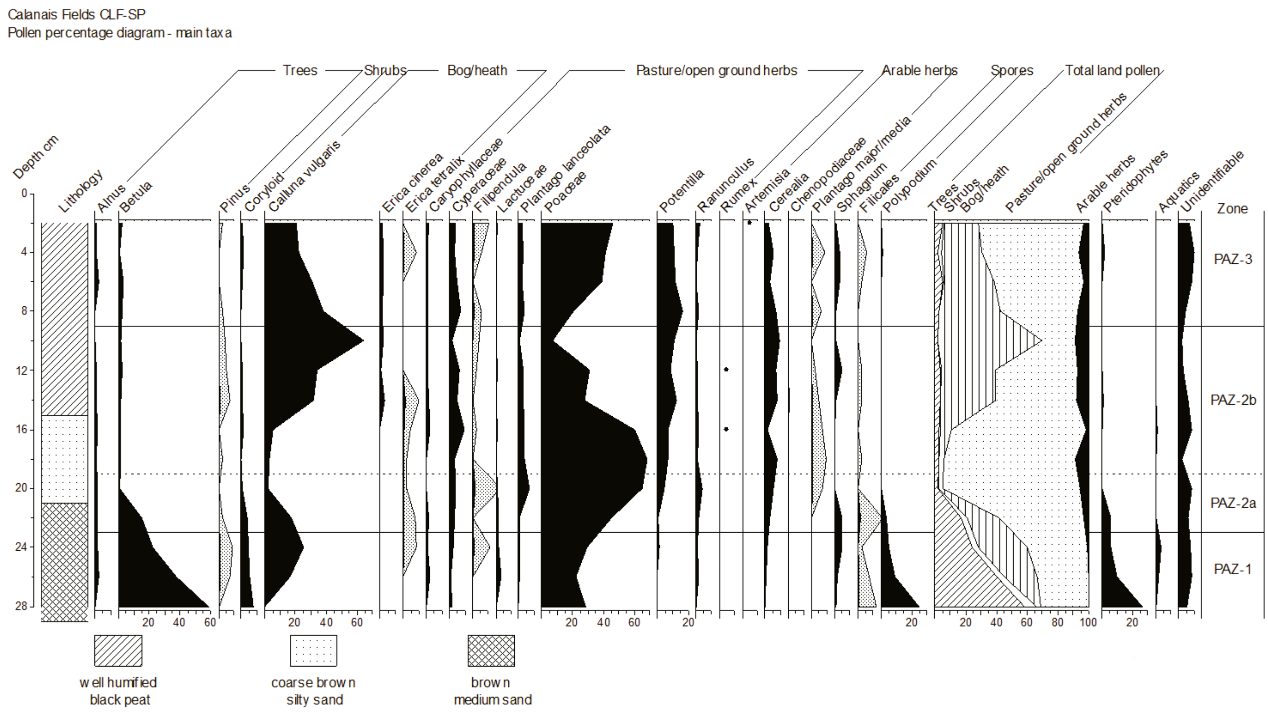
Illus 37 Radiocarbon dates



Illus 38 Pollen percentage diagram CLF-14



Illus 39 Pollen percentage diagram CLF-15



Illus 40 Pollen percentage diagram CLF-SP

radiocarbon-dated basal peat. The fall in tree pollen corresponds well to the early part of subzone CaN-3c at Tob nan Leobag where a phase of agricultural activity was recorded (Bohncke 1988: 456).

A mixed arable and pastoral agricultural regime is evident. Cereal-type pollen grains were identified in the PAZ-2 assemblages. Both *Hordeum*-type and *Avena-Triticum*-type sensu Andersen (1979) were identified but are not distinguished in the diagrams. While pollen from some wild grasses is included in the *Hordeum*-type group (Andersen 1979), the frequency of cereal-type pollen grains in the profiles and the presence of *Avena-Triticum*-type grains support an interpretation of cereal cultivation. The particular cultivars cannot be confidently inferred from pollen data.

Peat initiation commenced earlier in Trench 14 (downslope) than in Trench 15, which accounts for the earlier decline in cereal-type pollen in CLF-14 than in CLF-15. Cereal-type pollen and associated weeds decline in CLF-15 at the soil–peat interface (106cm), and cereals disappear entirely at 101cm, just before the PAZ2b/3 boundary. Cereal-type pollen continues to be recorded in PAZ-3 in the CLF-SP profile. This is probably due to the disturbed nature of the context. Infilling of the ditch feature (C15036) by peaty material (C15002) may have redistributed sediment from elsewhere within the site.

By *c* 200 BC agricultural activity in the locality had ceased. This coincided with a marked peak in *Sphagnum* (bog moss) representation and the appearance of *Hydrocotyle vulgaris* (marsh pennywort), both of which are typical of the wetter areas within blanket bog. This apparent phase of increased bog growth is seen in both CLF-14 and CLF-15. There is a *Sphagnum* peak at *c* 2000 BP in the Tob nan Leobag profile and increases in wet-loving species in all profiles (Bohncke 1988: 457–8). Together with the evidence from Calanais Fields, a picture develops of increased wetness leading to the acceleration of local blanket bog growth and the expansion of wet moorland. Arable indicators and occasional cereal pollen grains continue to be recorded in PAZ-3 at CLF-14. It is possible that agriculture continued in the locality, but not in the immediate vicinity of the field system; perhaps in areas remaining free of blanket peat. Asynchronous growth of blanket peat across the field system and indeed elsewhere in the Calanais area (see eg Bohncke 1988) may have necessitated phases of moving or expanding of the field systems into previously uncultivated areas.

By *c* AD 200 the period of increased local wetness ceased, and major expansions in pollen taxa such as *Calluna vulgaris* (ling), *Erica tetralix* (cross-leaved heather) and *Myrica gale* (bog myrtle) indicate the replacement of grassland by heath. This situation is reversed by the PAZ 4/5 boundary at around AD 900, at which a renewal of agricultural activity is apparent. Poaceae (grasses) increase and pastoral weeds such as *Rumex* spp. (docks), *Plantago* spp. (plantains) and *Urtica* (nettles) reappear. This resumption of agriculture can be correlated with the early Norse occupation of the islands. By around AD 1000 cereal cultivation resumed, with cereal-type pollen including both *Hordeum*-type and *Avena-Triticum*-type recorded.

Continued mixed agriculture is evident in the upper subzone. Medieval and later occupation of the Calanais township is documented and the pottery and archaeobotanical assemblages from Trench 3 show that this part of the site was utilised in late medieval/post-medieval times (see Sections 4.4 and 5.1 below). There are remains of undated blackhouse-type structures visible within the area under consideration; subsistence arable agriculture associated with the habitation of these domiciles is evident in PAZ-5b. By the top of both profiles, grassland and pastoral taxa are the dominant vegetation types, with reduced bog and heath vegetation.

4.2 Soil tests

Catherine Flitcroft

Samples for phosphate and loss on ignition (LOI) tests were taken across the palaeosol in a grid system in Trenches 4, 6, 7, 8, 9, 11 and 15; and through selected sections in Trenches 14 and 15. The intention was to analyse the lateral variation of the palaeosol across the site, and in Trench 15 assess spatial variation across the trench's various structures and either side of the field boundary wall. Samples were also taken from within structure C15008 and from around a series of furrows cut into the palaeosol (C15013, C15012, C15011). The samples were collected following removal of the overlying peat.

4.2.1 Methodology

Phosphate analysis
Air-dried samples were analysed for total phosphate concentration using ignition-hydrochloric phosphate digestion followed by the one-step vanadomolybdate extraction method (Gurney 1985; Hamond 1983: 62–4). Absorption was measured after 10 minutes using a spectrophotometer at 470nm transmission (Jackson 1958: 153). Results are expressed as milligrams of phosphorus per 100 grams of soil (Sieveking et al 1973).

Loss on ignition
Organic content was estimated by measuring LOI after five hours at 550° C.

4.2.2 Results

Background phosphate concentrations
Control samples showed that peat deposits at Calanais Fields have a background mean of 250mgP/100g and the mean background levels in basal mineral soils are 480mgP/100g.

Trench 15 grid samples: phosphate concentrations
Phases 1–4
Overall, the results show higher phosphate levels to the west of field boundary wall C15004, where there is a cluster of high concentrations in the central area of C15003. To the east of wall C15004 there were fewer concentrations of high phosphate levels, with only a small area of enhancement recorded on the slope of a possible furrow (extension of feature C15012). Similarly, only one high concentration was recorded from within the structure, adjacent to and slightly beneath feature C15018, a secondary wall blocking the earlier entrance of structure C15008. Higher concentrations from grid positions adjacent to the trench edge correspond with the position of a step into the trench and are likely to represent contamination from trampling.

The high phosphate concentrations in the palaeosol C15003 to the west of wall C15004 are in marked contrast to those encountered in the rest of the site. This suggests the earliest cobbling in the palaeosol to the west of the trench marks a phase of pastoral activity and that the function of this area differed from that elsewhere. These results support the idea that the cobbles were laid down to consolidate the area and to facilitate the movement of animals.

The rate at which phosphates are dispersed across the site and through the soil depends upon the rate of mixing and may be affected by processes such as ploughing and erosion, resulting in uneven distribution. Several higher concentrations occurred to the east of wall C15004, particularly from within the ditch feature and also the ditch behind wall C15004 (C15014 and C15021), highlighting the accumulation of phosphate-rich soil layers here as material was built up behind the wall during Phase 3. These features are stratigraphically related to the agricultural soil and phosphate-rich palaeosol to the west of the wall, supporting the interpretation of intensive human activity. Elsewhere across the site, the remnants of cultivation furrows (to the east of the field wall), may have masked high phosphate concentrations through the redistribution of soil layers. Their presence implies this area may have predominantly been used for arable cultivation, rather than for the grazing of animals. Similarly, the low levels of phosphate from within the structure suggest that this was not a shelter for livestock but had some other purpose, such as storage or a shelter for humans. The results, together with the low number of artefacts recovered from Trench 15, suggest that the structure was kept clean and quantities of waste material were prevented from accumulating.

The phosphate levels which are interpreted as enhanced above the background mean of 480mgP/100g, generally fall into the range of 500–1000 mgP/100g. Such levels can be compared with those from Bronze Age agricultural soils at Old Scatness, Shetland, where total phosphorus values range from 711–1515mgP/100g (Simpson et al 1998a: 116). The limited use of domestic refuse and peat ash as amendment materials is suggested by thin-section micromorphology (ibid). Iron Age-cultivated soils at the same site contained higher total phosphate values (1224–1783mgP/100g), with the addition of animal manure to the amendment strategies evident (ibid). Phosphate levels at Calanais Fields are comparable to, though lower than, the Bronze Age soils at Old Scatness. This, with the micromorphological results, suggests that there was no significant addition of domestic refuse or manure to the soils at Calanais Fields.

Phase 5
Context 15015, the dark brown sandy silt separated from the palaeosol C15003 by the gritty interface C15002, exhibits low phosphate concentrations. This suggests either a change in function of the cobbling over time or less intensive pastoral agriculture. However, phosphate retention can depend on the sediment in question. Mineralisation and inorganic fixation of organic phosphates occurs as organic matter decomposes in soils. Higher phosphate concentrations would therefore be expected in more minerogenic soils (Crowther 1997). Continued physical weathering will affect the distribution of phosphates within the soil profile

and small lenses of variable phosphate content may occur (Hamond 1983). Similarly, the lack of mineral material within peat, the presence of only a few, nutrient-poor, plant species on the surface of the peat bog and the highly acidic nature of the peat body means that few phosphates are released and they are highly soluble, giving low phosphate levels throughout the peat (Hamond 1983). In this phase characterised by peaty soil, phosphate concentrations may have been reduced due to the above factors.

Trenches 4, 6–9 and 11 grid samples: phosphate concentrations

Grid samples of the palaeosol taken from each of these trenches exhibited low phosphate concentrations of between 90mgP/100g and 261mgP/100g, suggesting that human activity had not centred on these areas. These smaller trenches, to the south and downslope of Trench 15, are in an area of deeper peat where the acidic nature of the soil had considerably lowered the natural phosphate concentrations and no evidence for human activity was uncovered. The organic content of these grid samples also shows little variation and predominantly reflects the minerogenic nature of the palaeosol.

Trench 14 section: phosphate concentrations and organic content

Phosphate levels were analysed at 10mm resolution through the west-facing section (0.88m depth) to highlight any anthropogenic activity that was mirrored in the features found further up the hill. Results indicate a peak in phosphate levels at 23–4cm, which correlates well with the fill of a cut (C14003) that was exposed in the section. This feature appeared to be natural in origin and the corresponding lower organic content values suggest it reflects the inwash and accumulation of more minerogenic material. There is another peak in phosphate levels at 61–2cm (540mgP/100g), corresponding with the levels measured in the palaeosol in Trench 15. At 56cm, organic content in Trench 14 drops considerably prior to the rise in phosphate levels. Phosphate content then continues to rise to exceptionally high levels at 75–6cm (1,212mgP/100g), with organic content remaining low. These basal levels are higher than those seen in Trench 15 but reflect soil samples from beneath the palaeosol. These deposits may represent a mixture of soil from further upslope, some in-situ palaeosol and the accumulation of colluvium (C14009).

This soil, formed on eroded slopes, represents the initial pedogenesis in the area, with very high background phosphate levels. Phosphate levels in the glacial till are slightly reduced. The organic content values through this section also suggest that the main period of peat growth occurred between 15cm and 56cm and during this time there was little or no anthropogenic disturbance. These conclusions correspond well with the palynological record as this period of undisturbed peat growth commences at the upper boundary of the ancient agricultural occupation phase (PAZ-2) and ceases early in the most recent phase of occupation (PAZ-5b).

Trench 15 section: phosphate concentrations and organic content

Samples were also taken at 1cm intervals through the south-facing section of Trench 15. Unlike Trench 14, there are several defined peaks in phosphate levels (28–9cm, 62–3cm, 76–7cm and 88–9cm). They are not high enough to suggest anthropogenic activity, but are interpreted to indicate periods when the blanket peat surface dried out, growth slowed and more minerogenic material accumulated. Phosphate levels, however, do increase towards the base of the profile in the palaeosol (rising to 903.6mgP/100g), recording agricultural activity associated with the palaeosol and the higher phosphate levels in the brown earth. Again, the increased phosphate signals above 30cm correspond to the agricultural activity apparent in the palynological record.

The pattern demonstrated with the phosphate levels can similarly be reflected in the organic content curve from the same profile. The slight peaks in phosphate are mirrored with small drops in the organic content of the profile as a result of the bog surface drying out and an accumulation of sands/silts on the surface. At the peat/palaeosol interface (106–7cm), organic content drops considerably and phosphate levels again rise.

4.3 Soil micromorphology

Adrian Tams

4.3.1 Methodology

Samples for soil micromorphological analysis were taken from Trenches 15 and 17 (Illus 41) to aid in the interpretation of land use and of the formation processes of the palaeosol and overlying peat. Samples were also taken from inside Structure 15008 (Illus 19), to investigate what the building had been used for.

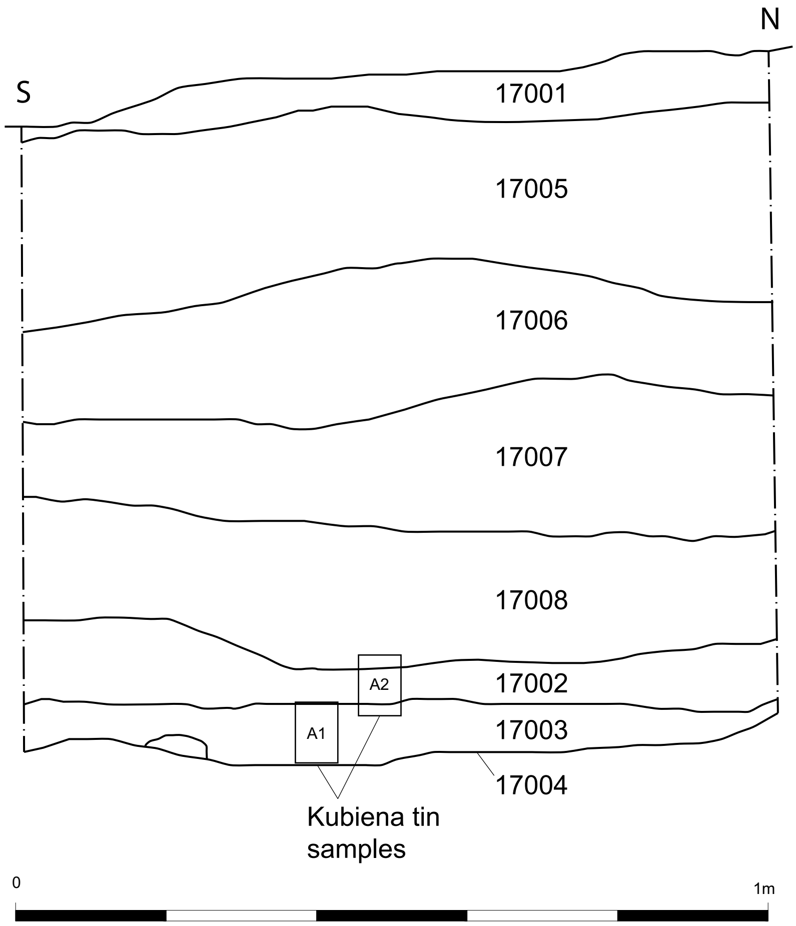
The thin-sections were produced following the standard methods of acetone drying, resin impregnation and thin-sectioning (Fitzpatrick 1984; Fitzpatrick 1993). The thin-section was first analysed over a light box without magnification, and then under a transmitting light microscope using a range of light sources (plane polarised and crossed polarised) at a range of magnifications. Thin-section descriptions conform to the internationally accepted terminology by Bullock et al (1985), and components and features within the sediments were semi-quantified with the aid of frequency charts in that source.

4.3.2 Results

Trench 15: Samples A1–A4 (Illus 19)

These samples were collected from a section through the northern cell of the structure within Trench 15, with Contexts 15017, 15019, 15020 and 15037 being represented in the thin-sections.

The aim was to determine whether there was any sign of anthropogenic activity within the structure or a possible indication of the use of the structure. The presence of charcoal fragments through most of the thin-sections is the sole micromorphological indication of human activity; the other chief micromorphological signals of human activity,



Illus 41 Trench 17 east-facing section

bone fragments, were not found as they will have decomposed due to the acidic nature of the peat deposits. The charcoal fragments were evident in varying frequencies, from 10% in A1, A2 and A3, decreasing to 2.5% in A4.

Section A4 is largely composed of the sub-peat palaeosol. The low frequency of charcoal fragments in the palaeosol is largely a consequence of the low infiltration capacity of the peat, the extended timescale required for this to occur, and also because of the dominant clay matrix and low pore content of the glacial till.

Evidence for trampling within the material was sought. The massive microstructure of the samples (with few or no cracks and voids within the organic matrix) is not suggestive of trampling, which is typically indicated by frequent linear horizontal and vertical cracks and voids. There was no microstratification within the material, which occurs as a result of trampling and is typified by thin lenses occurring throughout the main bulk of the material, indicating local compaction of a surface. The deposits are therefore interpreted as in-situ peat accumulations.

Trench 15: samples B1–B4 (Illus 8)

These samples were collected from the east side of wall C15004, through deposits accumulated behind the wall, with Contexts 15002, 15021 15034 and 15032 being represented in the thin-sections. The aim was to understand the phasing of agricultural activity and the nature of soil accumulation.

The upper two thin-sections (B1 and B2) are representative of natural peat accumulations, revealing no anthropogenic inclusions or signs of modification by anthropogenic activities.

Sample B3 contained 5% charcoal fragments, interpreted as anthropogenic inclusions. These fragments were well embedded within the dense organic matrix and will thus have been incorporated into the peat at the time of its accumulation. There is no other indication of the peat having undergone anthropogenic alteration.

Sample B4 largely comprised a brown earth with a high organic content and displaying a dense, dark brown colouration, contrasting in colour with the overlying peat deposits. This soil appears to have been well mixed with peat deposits after its accumulation. The mineral fraction shows strong evidence for anaerobic conditions leading to gleying. The minerals are very coarse-grained, with pebble-sized grains dominant, and are unsorted in nature. The sample is also very well mixed with a random arrangement of the grains. It is possible that these grains were purposely added to this highly organic soil to increase its porosity and thereby its drainage potential. Evidence for clay particles in this deposit is perhaps a result of mixing by later ploughing activity (also evidenced by the presence of furrows).

This sample also has a low peat content, possibly added artificially. The peat added is likely to have been well-humified as there is little evidence for any plant remains with visible cellular structure present, aside from coarse root fragments.

In summary, it is clear that sample B4 is representative of an attempt at soil improvement with the addition and mixing of a coarse-grained glacial till to the brown earth. It is possible that a till, low in clay but with a high mineral content, was specifically chosen to enhance the drainage potential of the brown earth and peat soil.

Trench 17: samples A1 and A2 (Illus 41)

These samples were collected in order to provide a comparison with Trench 15, to investigate whether the possible inclusion of glacial till into the peat was a cross-site phenomenon. However, the micromorphological analysis of these two samples confirms that this was not the case.

All of the micromorphological characteristics present are comparable with the peat samples taken from Trench 15. There is no high incidence of coarse mineral grains, no clay patches/signs of anaerobism, nor any apparent mixing of the sediments.

It is therefore concluded that these samples represent natural peat accumulations with no anthropogenic input into the formation of the deposit.

4.4 Carbonised plant remains

Mhairi Hastie

The plant fractions were scanned to assess the quantity and quality of the palaeoenvironmental remains. It was established that, apart from wood charcoal, which was present in most samples, only a small number of samples contained other carbonised plant remains. The samples identified as containing carbonised plant material during initial assessment were fully sorted and all cereal grain and other plant material was removed for identification. Identifications were made with reference to the modern comparative collection of Headland Archaeology Ltd and seed atlases (Berggren 1969; Berggren 1981). Plant nomenclature utilised in the text follows Stace (1997) and Zohary & Hopf (2000).

4.4.1 Results

The recovery of carbonised plant material from the bulk soil samples was low. The majority of samples contained wood charcoal, but this was present only in low concentrations. Carbonised cereal grains and other plant material such as the seeds of wild taxa were recovered, the majority of which came from contexts excavated in Trench 3 (Table 2).

Cereal grains and weed seeds were recovered from a range of contexts in Trench 3. The cereal grains recovered consisted primarily of oat (*Avena* sp.), with lesser quantities of hulled barley (*Hordeum vulgare*). Occasional seeds from wild species were also present, including dock (*Rumex* sp.), knotgrass (*Polygonum* spp.), ribwort (*Plantago lanceolata*), grass family (Poaceae indet.) and one possible caryopsis of heath grass (cf *Danthonia decumbens*). In addition, small quantities of hazelnut shell were recovered from the majority of samples and carbonised rhizomes were present in C3014.

Low concentrations of carbonised rhizomes and hazelnut shell were recovered from palaeosol deposits excavated in Trenches 8, 9 and 15.

4.4.2 Discussion

All cereal grains and weed seeds were recovered from deposits associated with a stone-built structure (Trench 3). The cereal grain recovered from these deposits was predominantly oat, with lesser quantities of hulled barley. This predominance of oat throughout the samples and the oat/barley combination is characteristic of cereal grain assemblages from other medieval or later sites for this region. The weed seed assemblages consist of wild taxa commonly associated with grasslands. Their presence together with the cereal grain suggests that these wild taxa were growing with the cereals and thus brought to the site with the harvested crop.

In northern temperate regions it was common practice to dry cereal grain to aid both the removal of awns and the grinding process. In the absence of any obvious conflagration deposits associated with the structure, the likely source of the charred material is from the domestic hearth around which cereal grain could have been dried or prepared for cooking. The presence of burnt material within many unassociated contexts indicates the reworking and redepositing of cereal grain, and the preservation of the carbonised material is probably a reflection of their having been protected from trampling and similar activities.

A deposit of peat ash (C3017) also contained small quantities of oat and barley grain. This ash deposit is believed to be the remains of a hearth. The presence of both oat and barley within this deposit suggests a medieval or later date for the hearth structure and indicates that it may be associated with the structure. The quantity of hazelnut shell was low and could either represent domestic debris discarded onto the fire or material collected with firewood. The presence of carbonised rhizomes, albeit in low concentrations, suggests the possible use of turf for fuel.

Table 2 Composition of carbonised plant remains. Key: + = rare, ++ = occasional, +++ = common and ++++ = abundant

		Context no.	3002	3003	3005	3010	3006	3011	3030	3017
		Trench	3	3	3	3	3	3	3	3
Wild taxa										
Corylus avellana L.										
Gramineae (medium)	nut shell	hazel	+	+	+	+	+		+	+
Rumex sp.	caryopsis	medium-grained grass						1		
Polygonum spp.	nutlet	dock				1	1	1		
Plantago lanceolata L.	nutlet	knotgrass				2				
Cf *Danthonia decumbens* (L.) DC.	seed	ribwort				1				
	caryopsis	heath grass			1					
Cereals										
Hordeum indet.										
Cf *Hordeum* indet.	caryopsis	barley			2	1				1
Hordeum vulgare L. (hulled)	caryopsis	barley							2	
Hordeum vulgare L. (hulled – straight)	caryopsis	hulled barley	2	4			9		1	
Hordeum vulgare L. (hulled – twisted)	caryopsis	hulled barley						1		
Hordeum indet.										
	rachis	barley					1			
Avena indet.										
Cf *Avena* indet.	caryopsis	oat	9		3	6	6	3		2
Avena indet.	caryopsis	oat						1		
	floret	oat								
Cereal indet.	caryopsis	cereal indet.			1					

5. ARTEFACTS

5.1 Pottery

Melanie Johnson

A small assemblage of 64 sherds of handmade, coarse pottery was found, weighing 450g in total. A full catalogue can be found in the site archive.

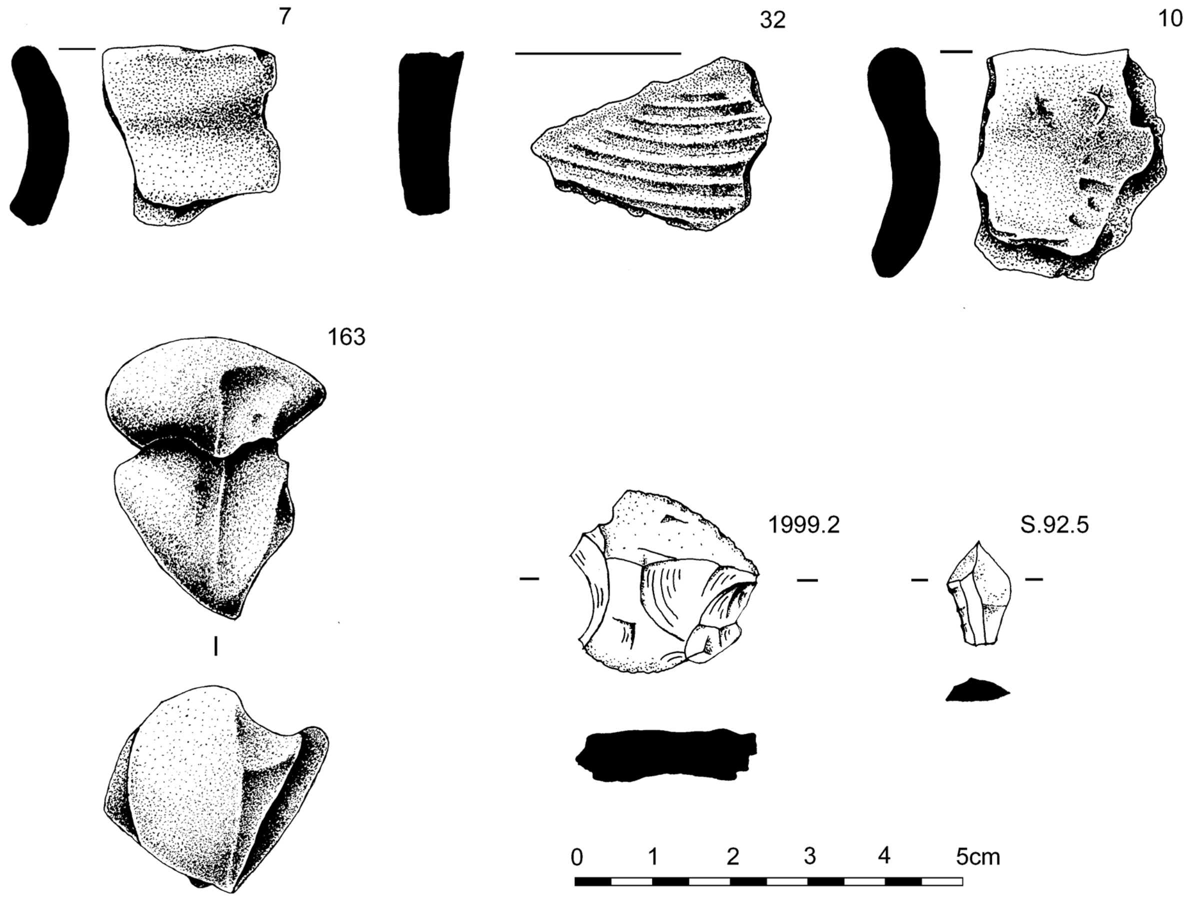
Fifty-six sherds were found in Trench 3. The majority of these were small, plain body sherds but four flat base sherds, seven rim sherds and three decorated sherds were found. The rim sherds represent five different vessels and are flaring or simple rounded upright rims (Illus 42, nos 7 and 10). They are all likely to be Craggan Ware, of late- or post-medieval date, corroborating the interpretation of this structure as a possible bothy. One decorated sherd comprised a possible rim or carination decorated with parallel curved incised lines, the surface of the carination also decorated with incised lines (Illus 42, no. 32); this is likely to be Neolithic in date. Two other sherds were decorated with oval stab impressions and may be Bronze Age in date, indicating the mixed nature of this assemblage.

Eight sherds were found in Trench 13. These sherds were all small, plain body sherds. Most of the sherds were recovered from contexts which post-date the structure, although one sherd was recovered from the wall core. The small size, degree of abrasion and undiagnostic nature of these sherds render it very difficult to make any interpretations of date or function.

5.2 Chipped stone

Graeme Warren

A total of 169 worked or probably worked pieces were macroscopically classified according to standard analytical principles (Finlayson et al 2000). A full report and catalogue can be found in the site archive.



Illus 42 Finds

Worked material was recovered from ten trenches, mainly in small numbers but with a much larger scatter from Trench 3. The assemblages are broadly similar in terms of technology and raw materials and, apart from Trench 3, the numbers are too small to allow meaningful analysis.

5.2.1 Raw materials

Four raw materials are present: flint, quartz, banded shale and pitchstone (Table 3). The flint was likely to have been available in small amounts as pebbles on local beaches. The cortex (present on 50% of the flint) is heavily battered, and the pebbles rounded. The flint has been greatly affected by post-depositional staining and patination, while some is burnt, but most of the flint was grey when fresh.

The quartz utilised in the assemblage takes two forms – a grey/white opaque quartz which is sometimes powdery and sometimes more crystalline; the latter includes occasional micaceous inclusions. It is of variable quality, but some pieces appear to be particularly friable. Quartz of this form is available widely in Lewis in secondary and primary deposits, and large quantities of this material are found as natural pieces within soil samples from the site. Twenty-two of the quartz artefacts (41% of the total) are of high-quality, clear quartz crystals: a durable and robust material. This is also likely to have been available locally, although the exact source is unknown.

There are three chips and a chunk of a metamorphosed sedimentary deposit, identified as baked or banded shale. This material, which is also known from Neolithic/Bronze Age assemblages from the nearby kerbed cairn at Olcote (Warren 2005) is presumably comparable to the mylonite identified by Ballin (Ballin 2016) at the main Calanais ritual complex: all the materials are characterised by thin horizons of grey or blue and by notable weathering. These are poorly understood materials: mylonite for example was identified by Simpson (1976) at Northton but later described as banded mudstone from Skye (Wickham-Jones 1986: 7). Outcrops of shales to the north of the site are known, although further work is required on this raw material in order to clarify patterns of exploitation.

Two artefacts of pitchstone are in the assemblage. One is a crude pitchstone, olive-green in colouration, with large quartz inclusions. The other is a much higher-quality, dark grey material – visually much more like classic Arran pitchstone. The presence of pitchstone in the assemblage is of some interest as, although Arran pitchstone is found on prehistoric sites throughout northern Britain and Ireland, it was previously unknown on the Isle of Lewis and this find, over 180 miles from its source, is an important addition to our knowledge of the distribution of this material. Although pitchstone is used from the Mesolithic through to the Bronze Age, the widespread exchange appears to be especially characteristic of the Neolithic (see Warren 2001 for discussion). In many instances pitchstone forms only a very small aspect of assemblages and its exchange is best interpreted in terms of the results of some kind of symbolic meaning and association.

5.2.2 Review of assemblages

Most finds (82% of the total) came from Trench 3. Three contexts were particularly rich: topsoil; the putative floor of the structure; and a deposit within a bedrock hollow. Other contexts produced material in low quantities.

Table 3 Number of finds by trench

	3	4	5	9	10	12	13	15	16	18	Total
Banded shale	4										4
Flint	97	2		5		3		2		1	110
Pitchstone	1					1					2
Quartz: def	27		2	1	1		2	3	1		37
Quartz: prob	10		2	2		1	1				16
Total	139	2	4	8	1	5	3	5	1	1	169

There is one retouched and one possibly retouched flint from Trench 3. *S 92.5* is a small and unusual patinated backed piece (Illus 42). Short blunting retouch is visible on two sides of the blank, but it is difficult to interpret the overall form of the artefact as the apparent break visible in the drawing does not actually appear to be a break. It is probably best interpreted simply as a backed piece and is not chronologically distinctive. *1999.18* is a distal fragment of a secondary flake with an unusual area of irregular flake scarring, seemingly initiated from the dorsal surface. The scarring is not morphologically distinctive and is slightly differentiated from the flake surface by greater chemical alteration of the latter. This rather undistinguished flake may be an irregular retouched artefact of some kind but the scarring may also have resulted from damage.

The assemblage from Trench 3 demonstrates the use of bipolar and platform techniques to utilise local flints and quartzes and produce small flakes (Table 4). Banded shales and pitchstone were also used, although the small quantities do not allow any classification of the technology employed in their manufacture. The retouched pieces offer little indication of the age of the assemblage. Local parallels include the flint, quartz and mylonite assemblage from the main Calanais ritual complex (Ballin 2016) and the assemblage from the Olcote kerb cairn (Warren 2005). Both assemblages include Bronze Age and Neolithic elements, and demonstrate a mixture of platform and bipolar technologies. The Calanais Fields assemblage therefore has good local parallels suggesting a Neolithic or Bronze Age date. Looking further afield, flint and quartz industries utilising bipolar and platform techniques are recorded on Barra in late Neolithic/Bronze Age contexts (Wickham-Jones 1995). Quartz is found on many sites, for example Northton and Rosinish (Shepherd 1976: Simpson 1976; see Saville & Ballin 2001 for discussion). The presence of pitchstone may be evidence of an earlier date for the assemblage – possibly Neolithic rather than Bronze Age – although such a conclusion can only be tentative.

The assemblages from the other trenches (Trenches 9, 12, 13, 15, 16, 18) are all too small to allow meaningful analysis, and include examples of flint and quartz flakes, cores, chunks and bashed lumps. An irregular flake of pitchstone was recovered from the palaeosol in Trench 12. A scraper (*1999.2*) manufactured on a bipolar flake, with both convex and concave working edges (Illus 42) was one of two flakes found in Trench 4. Trench 15, the core of the excavated prehistoric features, contained two flint chips and a regular quartz flake found in the palaeosol within the oval structure, a further crystal quartz flake in the palaeosol, and six further quartz pieces were found within the peat. It is striking that so few chipped stones were found in the largest area exposed. Generally comparable in type to the larger collection from Trench 3, they give further evidence of the use of local raw materials and bipolar technologies. Most of the finds are from palaeosols, or sometimes within peat deposits, and much of the material may be disturbed or secondary.

Table 4 Composition of assemblage from Trench 3

	Flint	Quartz definite	Quartz probable	Banded shale	Pitchstone	Total
Bashed lump		1				1
Bipolar core	4	3				7
Blade	2	1			1	4
Chip	20			3		23
Chunk	15	2	5	1		23
Core		1	1			2
Flake irreg	40	10	4			54
Flake reg	16	9				25
Total	97	27	10	4	1	139

5.2.3 Conclusions

The small lithic assemblage offers another example of an increasingly well-documented Neolithic/ Bronze Age lithic tradition in the Calanais region which utilises a mixture of bipolar and platform techniques to work locally available flint, quartz and banded shale/mylonite. The assemblage is generally dispersed, and only found in significant numbers in Trench 3. The presence of pitchstone at Calanais Fields is of interest, and may imply that a Neolithic date is appropriate for aspects of the assemblage. It is possible that at least some of the less diagnostic lithics may be later in date.

5.3 Pumice

Anthony Newton

Six pieces of brown pumice, one of which has probably been worked (Illus 42), were found in Trench 3 and are typical of the pumice found in the Western Isles. There are at least 11 sites in Lewis where pumice has been documented and a total of 48 sites (over 780 pieces) in the Western Isles (Newton 1999). Except for a single site, all the sites in Lewis are found along the western coast of the island, although these excavations have produced the only recorded pumice find in the Calanais area. All of the sites in Lewis where pumice has been found are Bronze Age or younger.

The pumice found at Calanais Fields is dacitic in composition and is physically similar to other pumice found in the Western Isles and the rest of Scotland. It was erupted from one of a series of eruptions of the Katla volcanic system, southern Iceland (Newton 1999); the eruptions which produced the type of pumice found at Calanais Fields occurred between *c* 6600 ^{14}C years BP and *c* 1626 ^{14}C years BP. It is difficult, however, to correlate a pumice piece to an individual eruption even after undertaking geochemical analyses and so pumice can be difficult to date, but can still be useful

The pumice would have provided a useful abrasive to the people who lived at Calanais. Other sites have produced pumice which shows signs of having been used for sharpening objects such as antler, bone and wood and it was probably also used to prepare hides. Due to its low density there is also evidence that pumice was used as a fishing float.

6. DISCUSSION

6.1 The Calanais Fields in their local context

Very little is understood about the organisation and practice of agriculture during the later prehistoric period in the Hebrides. Evidence of prehistoric agricultural landscapes and for farming techniques is ephemeral and, arguably, ambiguous. The results of the Calanais Fields Project are therefore of some importance. The excavations are also significant in demonstrating that substantial and well-preserved prehistoric features can survive, unseen, beneath blanket peat, indicating that archaeological research in such areas, although superficially appearing to be uninviting, does in fact have the potential to reveal aspects of the islands' prehistory which are missing at the more visible monuments and, so far, in the more intensively explored machair.

The Calanais Fields Project has identified a fragment of what is in all likelihood a more extensive buried prehistoric agricultural landscape preserved beneath peat, and features found include structures, walls, clearance heaps and clearance cairns.

The excavation was concentrated upon Trench 15, where significant archaeological features were uncovered, in particular a sub-rectangular structure associated with a field wall and an area of cobbling. Several phases of activity were identified, including modifications to this building. The activities undertaken here appear to be associated with farming, as indicated by the environmental evidence and the lack of domestic features and artefacts. The presence of vestigial remains of cultivation furrows demonstrates the practice of arable agriculture, and this is supported by the presence of cereals in the pollen diagrams. Additionally, the field wall and cobbled surface indicate the division of land for different purposes, which may include the stocking of animals; high phosphate concentrations to the west of Feature 15004 support this idea. Similarly, the appearance of *Plantago lanceolata* (ribwort plantain), *Rumex* (docks) and *Trifolium* (clover) are indicators of pastoral activity. This reflects stock-keeping in the locality, as soil pollen is assumed to predominantly derive from very local sources (Andersen 1986) and high phosphate concentrations to the west of Wall 15004 support this idea. This pastoral activity is thought to be more widespread across the Calanais area due to similarities with other local pollen diagrams (eg Tob nan Leobag, Bohncke 1988).

The primary layer of cobbles within peat at the west end of the trench appears to correspond archaeologically to the beginning of peat growth in this area. This episode is also evident in the pollen records, where the boundary between the palaeosol and early blanket peat, dated to 390–170 cal BC (OxA-10091), correlates well with pollen zone PAZ-2b. A rapid rise in pasture and open ground species along with cereal-type pollen and associated weed species mark the early indicators of agricultural activity mirrored in Phase 2 of Trench 15 and pollen zone CaN-3c at Tob nan Leobag (Bohncke 1988: 456). Blanket peat initiation is correlated, with bog and heath species becoming more prominent (a peak in *Sphagnum* and rise in *Calluna vulgaris*), indicating wetter and more waterlogged conditions. A decline in cereals however, is not evident and farming would appear to have continued at the beginning of true blanket peat development, where inevitably the ground would have become more saturated and harder to farm. It was perhaps at this stage that the secondary cobbled surface was created to the west of the field wall in Trench 15 (C15004) in order to consolidate a poorly draining agricultural soil and combat the development of blanket peat. The evidence from thin-section soil micromorphological analysis that gravel or till was added to increase the drainage capability of the increasingly paludified soil at this part of the site is an indication of adaptation to increasing pedological marginality for agriculture.

Very few artefacts were found within Trench 15, apart from several pieces of flint and quartz, which unfortunately do not help in either dating the features or determining their function. The scarcity of finds from the palaeosol across all of the trenches suggests that domestic refuse was not regularly used as a means of middening the fields, although it does not preclude the use of other forms of fertiliser. However, thin-section soil micromorphology did not record any manuring strategies such as addition of animal dung, bone or burnt material as fertiliser. This is in contrast with similar studies from the Northern Isles, where the technique has been used to illustrate land management strategies of Late Bronze Age date, including the addition of domestic wastes, ash and burnt turfs (Simpson et al 1998a; Simpson et al 1998b). This is supported by the phosphate concentrations, as these do not produce consistently high concentrations across the site.

Radiocarbon-dated samples from the lowest level of peat growth, at the interface between the palaeosol and the first identified natural peat growth, indicate that peat growth began here in the first millennium BC and did not occur at the same time across the project area. Peat inception began earlier at the base of the slope in Trench 14, at 750–380 cal BC, while further upslope in Trench 15, where the principal archaeological features were located, peat inception dated to 390–170 cal BC. These dates provide a *terminus ante quem* for the activity at Calanais Fields and suggest that the structures excavated in Trench 15 are at least likely to be earlier than the Early Iron Age, and may be Late Bronze Age in date.

The excavation, therefore, indicates that the area around the Calanais Standing Stones was used for agricultural activity in prehistory, which may have extended over a much wider area to incorporate the features found at Tob nan Leobag (Cowie 1979; Cowie 1980), and indeed Bronze Age activity is also known at the Calanais Standing Stones (Ashmore 2016), with ploughing and ard marks noted during the second millennium BC. At the stone circle, peat growth is recorded as starting 920–400 cal BC (Phase 15) (Ashmore 2016: 981); although the earlier part of this range extends earlier than peat initiation at Calanais Fields, it does overlap with the date for peat initiation from Trench 14.

Cultivation appeared then, to have been taking place close to the standing stones in the second and first millennia BC which, along with the cultivation evidence from Calanais Fields, suggests that the stone circle was not separated from the agricultural/domestic sphere at this time but sat within it, with agriculture coexisting alongside further ritual alterations and additions to the monument in the second millennium. In the first millennium BC, the monument sees no further alteration, although it would have continued to be visible to the local population, and ploughing is recorded alongside evidence for cereal cultivation in the immediate locality.

Trench 3 proved to be more enigmatic. A later bothy of likely post-medieval date lay on top of a series of deposits containing artefacts. The assemblage is mixed but overall a Neolithic or Bronze Age date for at least parts of the pottery and lithic assemblages can be suggested. The finds assemblage from Trench 3 also produced the only examples of pumice found from the site and one of only two pieces of pitchstone. These deposits may represent a working area, lying in the lee of a bedrock outcrop to provide shelter. The presence of pitchstone is a valuable addition to the distribution of this material, as it has not previously been found on Lewis.

Although there is evidence for Neolithic occupation in the vicinity, as evidenced by the finds from Trench 3 and by the activity at Calanais Standing Stones, any palynological evidence of Neolithic agricultural activity has been masked by pollen deterioration and soil reworking. Re-occupation, or long sequences of use, of field systems may result in masking of early activity and boundary construction. Mid-second millennium BC partial realignment of the Belderg field system contemporary with, and just 7km distant from, the Céide Fields in North Mayo, illustrates the often complex occupation histories of agricultural sites. A longer occupation sequence than is indicated by the *terminus ante quem* provided by the radiocarbon dates for construction at Calanais Fields is suggested by the presence of Neolithic and Bronze Age artefacts and the proximity to, and possible association with, the boundaries at Tob nan Leobag, where an occupation and agricultural sequence beginning in the Neolithic has been interpreted (Bohncke & Cowie nd). Later Bronze Age activity outwith Calanais Fields is also known at the stone circle (chambered tomb, ard marks, stone and turf structure) and at Tob nan Leobag.

Initial peat formation (itself perhaps accelerated by climatic change) in the early first millennium BC necessitated certain responses with respect to agricultural activities and techniques. The practice of cereal growth was abandoned simultaneously across the Calanais Fields area *c* 200 cal BC even though peat growth is asynchronous (as seen in the dates of Trenches 14 and 15), suggesting that climatic conditions may have been a driving force behind the cessation of cereal production. This abandonment does coincide with the regional shift to wetness noted in the Talla Moss humification records (Chambers et al 1997). There may have been a change at this time in the organisation of land holding, perhaps with a corresponding acceptance of the marginality of the land leading to an emphasis on pastoralism. It is interesting that at around the same period there are changes seen in the settlement record of the Outer Hebrides, with the construction of large circular structures, known as Complex Atlantic Roundhouses (CARs; see Armit 1996 for a general summary). The impetus behind the construction of these buildings has never been satisfactorily established, and the results at Calanais may support an admittedly environmentally deterministic hypothesis that worsening climatic conditions and the spread of blanket peat resulted in stresses being placed upon the farming system, which may have led to the abandonment of cereal production in certain areas; the construction of CARs may have been a response to these conditions.

The gradual burial of the soil by blanket bog brings into question the issue of anthropogenic influences and impacts upon pedological and vegetational successions. Whether human activity in prehistory has caused or retarded blanket mire spread has been much debated (eg Moore 1988; Moore 1993; O'Connell 1990). The coincidence of abandonment of agricultural activity with the spread of blanket bog is often a further factor to be considered, with the ultimate question being whether blanket bog spread caused land abandonment, or vice versa. In western Ireland, O'Connell (1990: 68) has suggested that long-term prevention of tree/shrub regeneration may have been a more important factor than primary woodland clearance in blanket bog spread.

A period then ensued of blanket bog development with little or no arable activity, although it is possible that animal stocking continued. Although blanket peat spread continued (and is still ongoing), climatic amelioration in the final centuries of the first millennium AD allowed the resumption of agriculture, and by this time a new cultivar, oat, was grown which was adapted to the poorer soil conditions. At *c* AD 900, the pollen (CLF-15) records a renewal of agricultural activity and by *c* AD 1000 cereal cultivation resumes, perhaps with the development of a medieval township at Calanais.

6.2 The Calanais Fields in their wider context

Other evidence for later prehistoric agricultural landscapes in the Hebrides is limited, making the Calanais Fields evidence significant. Such insubstantial features as have been recognised include the sub-peat wall at Sheshader near Stornoway, Isle of Lewis (Newell 1988): a short length of field wall built upon a thin layer of peat was associated with palynological indicators of pastoral and arable agriculture (including cereal-type pollen), and construction was dated to *c* 2900 BP (ibid.). At Loch Portain, North Uist, there is another example of a sub-peat stone bank, dated to the earlier part of the first millennium cal BC, which was interpreted as a clearance feature, though apparently not associated with arable or intensive pastoral agriculture (Mills et al 1994). Another sub-peat stone enclosure feature occurs on North Uist at the multi-period site at Bharpa Carinish (Crone 1993). Here, some two millennia after the abandonment of a Neolithic settlement, peat samples taken from directly underneath field banks forming an enclosure were dated to the Late Bronze Age, and later Iron Age modification of the banks was also apparent. Again, palynological analysis furnished no evidence for arable or intensive pastoral agriculture (ibid.). Ard marks and spade-dug furrows were recorded at Kilellan Farm, Islay in Trench L2: Phase 3.2 (Ritchie 2005: 37–38), and this layer was dated to the Late Bronze Age/Early Iron Age. Earlier examples of plough marks, dating to the Early Bronze Age, have been recorded at the Udal, North Uist (Ballin Smith 2018: 41), at Rosinish, Benbecula (Shepherd 1976), at Sligeanach, South Uist (Parker Pearson 2012: 219–21) and at Cladh Hallan, South Uist (Parker Pearson et al 2004: 51).

Among the earliest discovered field systems of Atlantic Europe are those of western Ireland, in particular the concentration of sites in North Mayo. The best-known and most extensively investigated is the relatively large, co-axially organised Céide Fields, which was abandoned and partially buried by blanket peat by 4500 cal BP (Caulfield 1978; Caulfield 1983; Caulfield et al 1998; Molloy & O'Connell 1995). Other early field systems include the less substantial system at Scord of Brouster, Shetland, where the construction of associated houses is dated to the mid-third millennium cal

BC (Whittle et al 1986); and the field boundaries on Arran, where one boundary was discovered to have a *terminus ante quem* of the late Neolithic/Early Bronze Age (Barber 1997: 80–3). Early Bronze Age cultivation is recorded at Rosinish, Benbecula, where an agricultural and domestic landscape was buried by machair (Shepherd & Tuckwell 1977: 108). Here, however, the agricultural evidence consists of ard marks, and the only possible field boundary uncovered is not of stone (ibid.). These systems on the Atlantic fringe are the earliest so far discovered in north-west Europe, preceding the more widely distributed fields which appear in the later Bronze and Iron Ages (Johnston 2000: 47). There seems to be a distinct period of field system construction in the mid-second millennium BC, encompassing such examples as the Dartmoor Reaves (see Fleming 1978; Fleming 1988) as well as field systems from more geographically distant regions of the European Atlantic fringe, such as Scandinavia and the Netherlands (Johnston 2000: 50). The Calanais Fields may well be a late manifestation or continuation of this phenomenon.

Johnston (2000) provides a significant reevaluation of the study of the field systems of the Atlantic fringe, moving away from previous attempts to classify field systems based on their form and morphology (eg Bowen 1961; Feacham 1973; Fowler 1981) towards a social analysis of the pan-regional phenomenon of increasing land enclosure in later prehistoric Atlantic Europe. Arguing that differentiation of so-called intentionally and unintentionally created boundary systems (eg 'co-axial systems' versus 'cairnfields') is too simplistic and largely unhelpful to the study of field systems, he postulates that field development signifies the changing relationships between people and the land (Johnston 2000: 48–9). The implication is that the phenomenon of field system construction has significance extending beyond the development and intensification of prehistoric agricultural regimes.

To approach this pan-regional trend of land enclosure in the Late Bronze Age by suggesting it implies an Atlantic 'identity', where boundaries were an important aspect of the lives of the people who inhabited these landscapes (Johnston 2000: 48), may invite the question of the importance of long-distance contacts to the geographical spread of this trend. However, Johnston goes on to argue that the range and variety of field and boundary systems display regional or local peculiarities and traditions rather than relating to a unified tradition (ibid: 53). In addition, there is no clear link between the early fields of the west and the north of the Atlantic European region, and fields appear in areas which were not associated with the Atlantic Bronze Age traditions until later in the sequence (ibid, see also Bradley 1997: 30).

It is important to note that reoccupation, or long sequences of use, of field systems may result in the masking of early activity. Mid-second millennium BC partial realignment of the Belderg field system contemporary with, and just 7km distant from, the Céide Fields in North Mayo, illustrates the often complex occupation sequences of agricultural sites, and the later prehistoric drystone roundhouses in the Hebrides may mask, or in some instances represent the final development of, a much longer pre-existing occupational sequence, as few have absolute dating evidence for construction and original use (eg Harding & Armit 1990; Gilmour & Cook 1998; Gilmour 2000: 157). A longer occupation sequence at Calanais Fields is suggested by the palynological indications of cereal cultivation, the vestigial earlier structural remains, the presence of Neolithic and Bronze Age artefacts, and the proximity to the boundary structures at Tob nan Leobag, where a sequence beginning in the Neolithic has been interpreted (Bohncke & Cowie nd).

7. CONCLUSION

The results of the Calanais Fields Project are of particular significance in two principal areas. Firstly, it is the most extensively investigated fragment of sub-peat prehistoric field system in the Hebrides, which has produced evidence of a variety of stone-built features including field walls, clearance cairns and heaps, cobbled surfaces and structures. The detailed examination of the local environmental context at Calanais has incorporated pollen analysis, phosphate analysis, soil micromorphology and archaeobotanical remains to provide a detailed picture of the use and changing nature of these features and of the agricultural system in the first millennium BC.

Secondly, the sequence of occupation at Calanais Fields is potentially of great importance to the study of marginality in prehistoric settlement and agriculture. The site offers an insight into responses of human societies to climatic and environmental changes. The field system at Calanais may be seen as a local development arising from specific social/cultural conditions, echoing a wider phenomenon of increased land enclosure and boundary formation which was an inherent part of life in the Atlantic fringes of Britain and north-west Europe during the Late Bronze Age.

This excavation is also one of very few excavations demonstrating prehistoric cultivation in the Hebrides on the blacklands instead of the machair, in addition to showing evidence for an agricultural landscape in close proximity to the major ritual monument of the Calanais Standing Stones.

8. ARCHIVE

The records for this excavation will be deposited with the National Record of the Historic Environment. Finds from the excavation have been deposited with Museum nan Eilean, Stornoway.

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