From Artefacts to Anomalies: Papers inspired by the contribution of Arnold Aspinall

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Inheriting the Earth: Prehistoric soil management in North Atlantic Britain

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This paper is dedicated to Arnold Aspinall whose enthusiasm for archaeology and fatherly support to so many of us has advanced not only our careers, but also the discipline of archaeology and the integration of archaeological sciences.

The archaeology of Northern Isles has long been a focus of archaeological research for the University of Bradford. Arnold, with his new geophysical techniques, was present on what may be regarded as the first wave of the 'New Archaeology': integrating aspects of geographical, biological and scientific techniques in Colin Renfrew's investigations into Neolithic Orkney. As Head of the Department of Archaeological Sciences, it was his support of the investigations at Tofts Ness (1984-88), which allowed the beginning of a research programme that has continued over the last twenty years and forms the base for this joint paper.

This paper examines the use of anthropogenic soils in supporting intensive barley cultivation from a number of sites demonstrating continuity of agricultural practice from the Neolithic to the Iron Age together with the social dynamics that such a practice generates. This paper is split in two; the first section examines the evidence for the intensive management of these soils through three departmental projects, which provide evidence from the Neolithic, Bronze Age and Iron Age. The second part examines the importance of these soils as an inherited resource and then briefly looks at new work examining areas where these resources are not available.

Created Arable soils of the Neolithic and Early Bronze Age

Tofts Ness is located on the north east peninsula of the island of Sanday, Orkney (Figure 1). The archaeological investigations at Tofts Ness provided the opportunity to examine the relationship of a prehistoric settlement mound (dating to the Neolithic to Early Iron Age) with its contemporary landscape, later buried by windblown sand. In terms of geographical situation, the low-lying Tofts Ness peninsula presents an exposed setting and may be regarded as being marginal when compared with other settlement locations on the same island. The excavation programme was evaluative, taking place ahead of scheduling and was funded by a research grant from The Society of Antiquities in 1984 and by Historic Scotland between 1985-8.

Because of the overlying cover of windblown sand, Tofts Ness had remarkable archaeological potential, allowing the possibility of being able to examine the interface of a prehistoric settlement mound with its surrounding landscape.

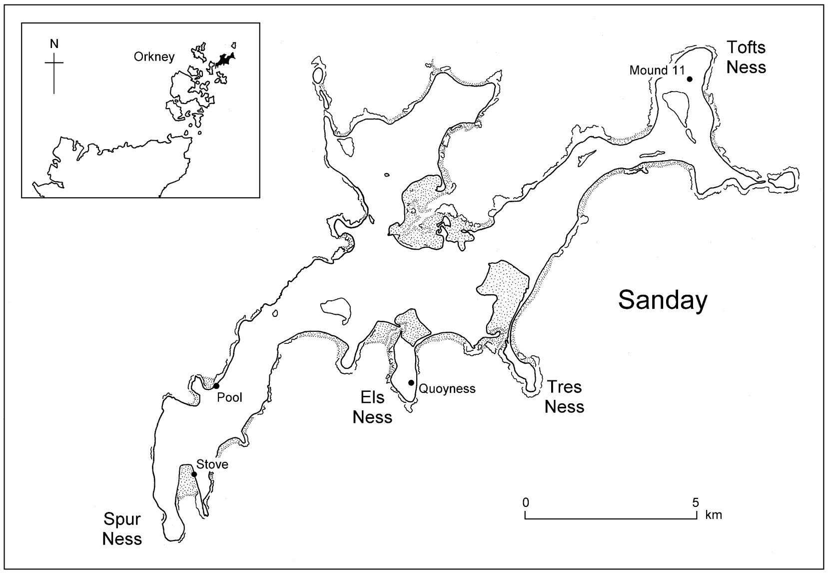

Figure 1: Location of Mound 11 on the Tofts Ness Peninsula, Sanday, Orkney.

The potential survival of buried soil horizons at Tofts Ness was seen as an important opportunity to provide information about the utilisation, management and agricultural potential of these soils. The surviving contours of the mound (Figure 2) suggested that the mound represented two foci of settlement; a bulbous primary mound to the south (containing excavation areas G and H) and a smaller and clearly secondary focus, to the north (area C) that revealed elements of dry stone walling indicative of a roundhouse structural form.

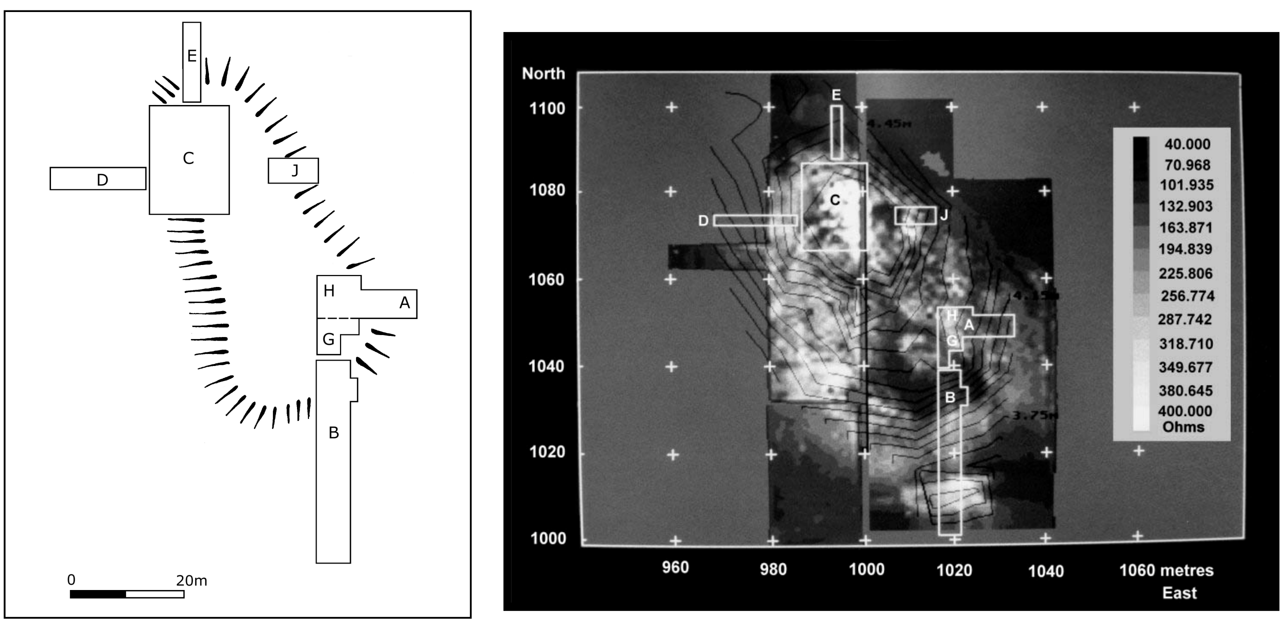

Figure 2 Mound 11, showing the location of the excavation Areas and height contours superimposed on the earth resistance survey data.

This excavation strategy was intended to examine both the primary mound and this secondary element and also the relationship between these two foci of settlement with the surrounding area.

Excavation of the stratigraphic sequence for the primary mound provided a chronology dating from the late fourth millennium to the mid second millennium BC. A Neolithic building (Structure 1) formed part of the primary sequence in areas A, G & H and was separated by an extensive deposition of midden from an Early Bronze Age building in area B. The secondary mound stratigraphic sequence to the northwest spanned a period from the late Bronze Age to Early Iron Age in date. The partially exposed roundhouse (contained within area C) was seen on excavation to be late in this sequence and was found to date to the mid-part of the first millennium BC. Beyond both the primary mound and secondary mound a number of buried soil sequences were identified and excavated in areas A, B, D, E, & J. A number of these soils in areas A, B, and J were clearly amended and had been subject to ard cultivation (Plate 1).

Plate 1: Neolithic and Bronze Age soil, sealed by an ard cultivated sand based soil dating to the Early Iron age, sealed by Iron Age midden. (S.J. Dockrill)

A research-led approach to the examination of these buried soils enabled the integration of a number of techniques including magnetic susceptibility measurement, total phosphate chemistry, carbon isotope measurement, soil micromorphological analysis, particle size analysis, molluscan analysis, the study of carbonized botanical remains and the analysis of soil sterols were used to produce an integrated study of the ‘infield’ as an economic resource (Dockrill 1993; Dockrill et al 1994; Dockrill & Simpson 1994; Simpson et al 1998 and Guttmann et al 2004).

More recent research on these early soils by Erica Guttmann has also allowed a reinvestigation of the Neolithic middens to the east of the Neolithic house (Structure 1) at Tofts Ness (Guttmann et al 2004). The fine particle size and enhanced phosphate values of both this Neolithic midden spread and the underlying cultivated soil suggested that the midden was cultivated (Guttmann et al 2004, 61). The midden extends to no more than an area of probably less than $20m^2$ to the east, however its spread to the south and west has not been quantified. It is possible to say that this evidence is suggestive of an intensive cultivated area more in keeping with garden cultivation, a model supported by the macrobotanical assemblage.

In 2004 clearer evidence of midden cultivation was recorded at the multi-period site of Jarlshof. Situated at the southern tip of Shetland (Figure 3) Jarlshof is of central and continuing importance in the archaeological understanding of late Neolithic to late Norse settlement in the North Atlantic. It was, however, excavated in the earlier half of the 20th century (Hamilton 1956, 6-7) and had neither scientific dating of its chronological sequence nor any usable palaeoeconomic or environmental data.

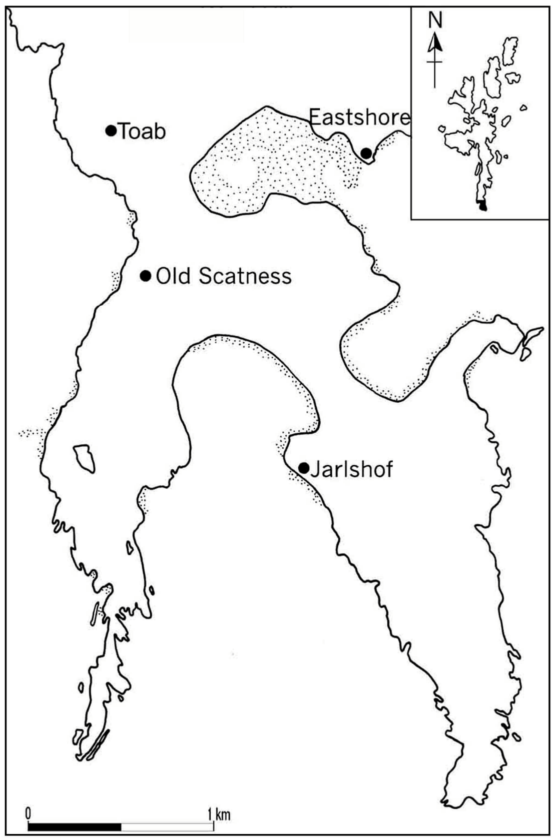

Figure 3: Location map of Jarlshof, Shetland

The extreme north east corner of the site was excavated by Childe in 1937 and revealed the earliest occupational evidence for the site and a sequence of midden and sand depositions spanning the period from this early activity to the medieval period (Childe, 1938 and Hamilton, 1956, 8-17).

The new Jarlshof research programme was designed to inform on both the economy of the settlement and the absolute chronology (based on the integrated use of AMS radiocarbon dating and optically stimulated luminescence) of the sequence observed by Childe. These sequences were examined in three areas (Figure 4). Trench 1 was located on a flat terraced lawn above the earliest elements of the site (possibly dating to the late Neolithic). Trench 2 was located on the adjacent higher terrace to the west, next to walls associated with the Norse structural sequence (north of Hamilton's

House 2) and a third small area, trench 3, which was opened to the north-west in the hope of retrieving environmental and dating evidence which proved to be missing from trench 2.

Trench 1 was located on the first terrace, northwest of the displayed remains representing the features within Childe's early sequences (Childe 1938, 351-356). The terrace appears to have been formed by the removal of material ('Viking layers', and *Midden I*) during either Childe's or Miss Laidler's excavations of these features (Hamilton 1956, 8-10, Fig.3). The stratigraphic sequence revealed in Trench 1 can be summarised as: topsoil, a grey sand, midden, (equating to Childe's *Midden II*), and a white wind blown calcareous sand, which separated this upper midden from a more extensive lower midden (equating to Childe's *Midden III*). Both midden deposits contained artefacts and bone and showed clear signs of ard cultivation (Plate 2). Below this, a series of mineral sand deposits and buried turf lines sealed a black humic silt which covered bedrock.

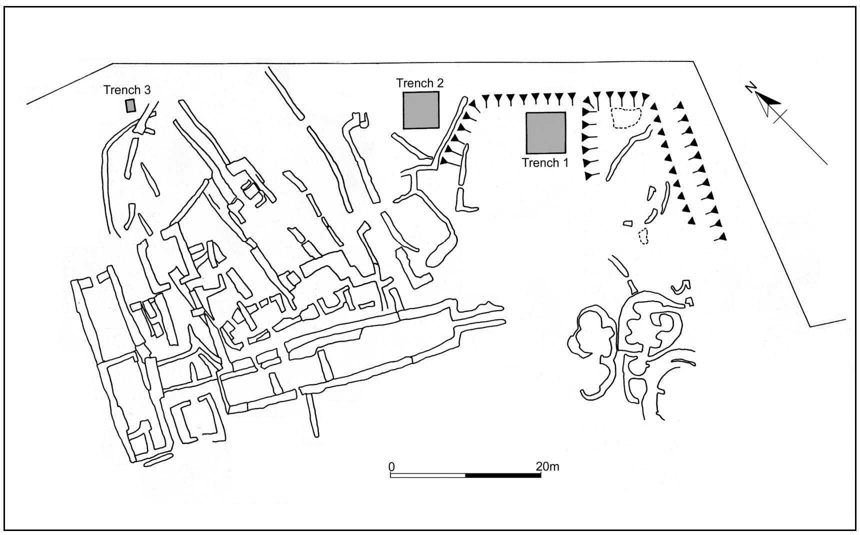

Figure 4: Location of the 2004 trenches

Trench 2 was located on the second terrace in order to provide a link between the prehistoric middens in trench 1 and the Medieval and Viking midden and possible Iron Age soils identified by Childe as overlying the deposits in the north-east corner of the site (Childe, 1938, 349). Trench 2 was also excavated to natural (Figure 2.6) revealing in the lower part substantially the same stratigraphic sequence as that observed in trench 1.

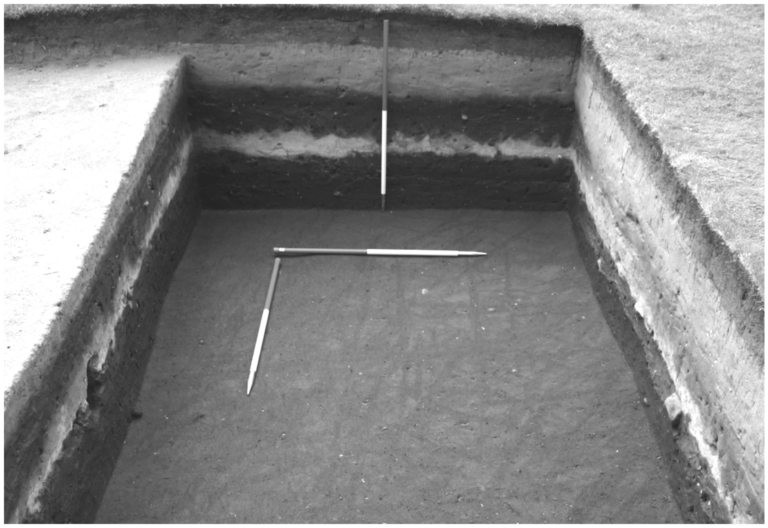

Plate 2: Ard marks within the primary midden sequence of Trench 1. (S.J. Dockrill)

The early midden sequences identified by Childe in his 1937 excavations (M.IIA & B, M.III) were adjacent to structural features such as hearths, stone settings and wall elements and were separated by sand blow events. The nature of the midden adjacent to the settlement appears from the descriptions of Childe and the re-interpretation by Hamilton as one of deposition and accumulation (Hamilton 1956, 8-17). No traces of ard cultivation were recorded by either archaeologist and the pottery appears to be less abraded than that recovered in 2004. The midden sequences in both modern Trench 1 and Trench 2 are separated by a sand-blow event and seem likely to represent Childe's Midden II and Midden III. A coherent picture for the development of the anthropogenic soils can be seen within trench 1. AMS radiocarbon dating of barley grains indicates that these soils were developed within the Neolithic/Early Bronze Age period.

Sample code	Context	Trench	Uncalibrated age (BP)	Calibrated age range (95% confidence)	Estimated age	$\delta^{13}C$ (‰)
GU-12914	011	1	3260±35	1620-1440BC	BA	-25.2
GU-12915	017	1	3370±35	1750-1600BC (87.2%); 1590-1530BC (8.2%)	Neolithic/BA	-24.3
GU-12916	019	1	3455±35	1880-1680BC	Neolithic/BA	-25.4

The cultivation of the midden in trench 1 and trench 2 is significant as this material is clearly domestic midden containing bone, carbonised plant material, and artefacts. The repeated sets of ardmarks and the abraded nature of the pottery indicate that this zone was used repeatedly over time. This excavation clearly confirms the cultivation practice suggested above for Tofts Ness.

This zone is perhaps best described as being a cultivated midden rather than a cultivated soil representing a small heavily manured infield. The plump barley grains and weeds of fertile ground from samples taken from these midden contexts clearly illustrate the success of this strategy.

Created Arable Soils of the Late Bronze Age and Early to Middle Iron Age

Tofts Ness

Evidence from the Late Bronze Age buried soils associated with Mound 11 and Mound 8 at Tofts Ness indicates a development in soil management. The manuring strategy at this time sees the application of podsolic turf from heath land (some of which is burnt). This turf may have been used within a complex cycle, first having been used as animal bedding before being composted and used as a manure (Dockrill, et al ,1994; Bond 1995;.and Simpson et al 1998, 743-4). The mineral components from these podsolic soils stripped from the heathland gradually increase the thickness of the soil profile. Cattle manure does not feature as a manure additive, being a valuable fuel resource. Ash and carbonised seaweed appears to have been applied to the soil. The evidence for seaweed is seen in both botanical samples and by the presence of burnt marine molluscs (Dockrill et al 1994, 115-72). Organic geochemical study of these soils indicates the addition of grassy turves (Bull et al 1999, 535-56). Faecal material, although not a major element, appears from sterol structures to be present (Simpson et al 1998, 743).

A radical change occured at Tofts Ness in the middle of the first millennium BC due to massive movements of sand burying the Late Bronze soils (Plate 1). This fundamentally changed the main mineral component of the soil matrix, which became calcite sand. Early Iron Age land management strategies continued with a similar intensity of soil enhancement by the application of a mixture of materials to the soil. This included the application of significant quantities of decomposing organic materials indicated by the enhanced number of excremental pedofeatures modified by microbial activity (Dockrill & Simpson 1994, 89). This material would help mitigate against the two main threats presented by the sand based soils: that of drying and in turn susceptibility to wind erosion.

Old Scatness, Shetland

The excavations of another multi-period settlement mound at Old Scatness, South Shetland some 1.5km north west of Jarlshof (Figure 3) has produced evidence for the continuity of these soil management practices into the middle and later Iron Age (Simpson et al 1998b). The site contains a ditch defended Iron Age village surrounding a Broch.

Investigation of the contemporary field system revealed a series of soils covering an extensive area around the site that had been created over a mineral sand.

A number of complete profiles of these soils to the east and two sequences to the southwest of the site have been excavated. Area L (southeast of the site) was typical (Plate 3) revealing an overall stratigraphic sequence of some 1.5m metres. The lower metre represented soils of the Iron Age. At least five different soils and two sets of ard marks were visible within this profile. This sequence was excavated by hand and the soil from each stratigraphic context was sieved using a 5mm mesh, which yielded evidence of artefacts (mainly abraded pottery).

The primary soil in this sequence, created directly on the sand, was a distinctive red ash-based soil. This soil had been subjected to ard cultivation and was found to predate the construction of the broch, having a mid first millennium BC date. This deposit was distinguished by both its fine particle size and its high total phosphate values (691-1516mg P/100g) mirroring the ash middens found on site (Guttmann et al, 2004, 59).

Plate 3: The prehistoric ardmarks and soil sequence below the post medieval sand (top) at Old Scatness (Area L).

In the Middle Iron age ash midden was no longer applied to the surrounding infield but was stored within the settlement site. At this point, rich organics predominate in the list of added material and include animal manures and domestic waste such as flooring material (Guttmann et al 2003, 28). Clear visual evidence of organic flooring had been found in several of the structures from various phases of the site. This change occurs with the construction and first use of the broch and a significant build up of the soil (Dockrill et al forthcoming)

Discussion

This research at the early levels at both Tofts Ness and Jarlshof indicates that the cultivation of midden spreads and the midden amendment of cultivated soils enabled the successful production of barley even in the marginal locality of Tofts Ness. The enhancement of the soil matrix over time by fresh midden and manure would have protected the resulting soils from excessive drying and wind erosion as well as replacing the important nutrients needed for such intensive cultivation year on year. Manuring of the infield together with intensive weeding would maximise the yield return of barley (Dockrill 1993, 161 & Dockrill 2002,156).

Exploitation of a mixed broad spectrum economy (terrestrial and marine) evidenced by data from both Jarlshof and at the early deposits at Tofts Ness can be seen as providing an economic buffer in times of hardship. This same strategy can be seen within the Early and Middle Iron Age deposits at Tofts Ness and at Old Scatness.

A model has been suggested by Dockrill elsewhere that the intensive management of infield soils provides the potential for a barley surplus in good years; storage of this surplus would have acted as a safeguard against poor years (Dockrill 2002 155-161). The economic stability generated by this model provides the catalyst for site viability and continuity. It can be argued that the continuity and success of these and other sites is due this intensive form of cultivation and to the broad spectrum economy of which it is part (Bond 1998 and Bond 2003). Within this context we are perhaps beginning to see that the maintained infield is an important resource generated by those working these 'garden' patches which develop into heavily manured infields and become the inherited resource of the generations that follow. It is not surprising then to find Jarlshof and Old Scatness as centres of Viking settlement as these islands of inherited agricultural resource would have been highly attractive to the new settlers (Bond 2003).

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