A Study of West Coast Circular Structures Through Landscape Survey, Site Survey and Excavation:

Environmental Analysis

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A Study of West Coast Circular Structures Through Landscape Survey, Site Survey and Excavation: Environmental Analysis

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Prepared by: Jackaline Robertson

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Author:	**Date:**
Approved by:	**Date:**
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Enquiries to: AOC Archaeology Group
Edgefield Industrial Estate
Edgefield Road
Loanhead
EH20 9SY

Tel. 0131 440 3593
Fax. 0131 440 3422
e-mail. edinburgh@aocarchaeology.com

www.aocarchaeology.com

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Abstract

Eleven bulk samples were collected from six sites in western Scotland form a series of round houses/hut circles/enclosures and submitted for environmental processing. These samples derived from occupation, hearth and pit features.

The environmental evidence was dominated by charcoal, retrieved both by hand and from the bulk samples. This material was analysed to identify evidence of occupational activity within features, ascertain what wood species were used for fuel and the composition of the woodland growing in the surrounding landscapes.

Factual data

Eleven bulk samples were submitted for environmental processing from six sites at Loch Raa, Achnahaird, Rue, Srathain, Auchtercairn 1 and Auchtercairn 2. The environmental assemblage recovered from these sites was comprised of carbonised wood of which 125 fragments larger than 4mm were identified to species. Charcoal fragments smaller than 4mm were not analysed. The wood species identified were alder (*Alnus glutinosa*), birch (*Betula* sp.), hazel (*Corylus avellana* L.) and pine (*Pinaceae* sp.). The charcoal assemblage contained two roundwood fragments and a single piece of bark, but there were no worked wood offcuts. The charcoal derived from a range of features such as hearths, occupation horizons and pits.

The only other environmental material recovered was five poorly preserved bone fragments from a single bulk sample taken from Rhue, Ullapool. The fragments did not exceed 10mm and none could be identified to either element or species.

Modern contamination was extensive in all samples and consisted of peat, roots, twigs, bracken fronds, heather leaves/stems, moss, seeds, insect eggs, insect remains, earth worm capsules and fibres. The close proximity of these features to the surface and the thickness of the covering vegetation may have affected the archaeological security of these contexts. The problem of modern root invasion within archaeological features was noted during excavation, but it was believed that the overall security of the small finds and charcoal has not suffered extensive re-working and is therefore reliable.

Methodology

The eleven bulk samples were processed in their entirety in laboratory conditions using a floatation method designed to retrieve environmental remains (cf. Kenward *et al*. 1980). The type of sediment was variable and depended on which area it came from. The samples described as occupation layers were mostly silty sediments and the burnt layers were ashy, none of which required any pre-treatment. The samples from Srathain were extremely compact and had to be soaked in warm water for 24 hours prior to processing. No charred or waterlogged macroplants were recovered.

The recovery of charcoal from Scottish sites tends to be limited and this ultimately affects how far the evidence can be interpreted and how it is used. In the absence of any other environmental material such as carbonised macro plant remains this has placed greater importance on the charcoal evidence in assisting with understanding the development of these sites and the surrounding landscapes. To ensure as much information as possible was obtained from this relatively small charcoal assemblage the conclusions presented in the discussion can only be described as interpretive assumptions. The interpretation of the charcoal evidence is therefore arbitrary and its main role will be to provide radiocarbon dates and be used to help identify fuel sources and the nature of the nearby landscape.

Results

Results are recorded in Tables 1, 2 and 3

The overall assemblage was dominated by birch which accounted for 57%, followed by alder 38%, hazel 3%, and pine 2%. The charcoal assemblage included large fragments along with two smaller pieces of roundwood and a single bark fragment. There was no evidence of worked wood within the assemblage, nor was there any evidence for the shaping or working of structural wood on any of these six sites. The charcoal assemblage was concentred in the enclosure at Auchtercairn 2 with 89 fragments identified from this site.

Discussion

ACHILTIBUIE AREA

Loch Raa Hut Circle, Achiltibuie

This hut circle was described as a domestic habitation and 11.4g of charcoal were recovered from trench 1 and 2. The charcoal appears to have originated from fuel debris associated with the hearths and the species were alder, birch and hazel which included two roundwood fragments. The presence of mixed wood species and roundwood is a strong indicator of fuel debris rather than in situ structural burning.

A single fragment from hearth [1.2] was poorly preserved and could not be identified to species. The morphological distortion affecting this charcoal fragment was distinctive in that the damage was either attributable to the burning process or to the nature of the wood itself. It is possible this wood was deliberately charred at an extremely high temperature for a specific purpose. Alternatively the wood could have been either partly decayed prior to charring or may represent another part of the tree such as a root or branch.

Achnahaird Hut Circle, Achiltibuie

This walled structure had undergone a period of abandonment before being reoccupied and a small assemblage of 0.8g of charcoal was recovered. A single fragment of alder was present in context [2.2] described as the collapse of the round house wall out with the structure. This single fragment is off little interpretive value. A further 4 unidentifiable fragments of charcoal were in context [2.3] in the abandonment phase. The preservation of these fragments was similar to the other unidentifiable charcoal fragment from the hut circle in Loch Raa.

ULLAPOOL AREA

Rhue Hut Circle, Ullapool

A small assemblage of 0.3g of birch were recovered by hand from contexts [1.3] and [2.3] located within the stone walled domestic structure and from along the extended entrance. This material probably derived from fuel debris which was subsequently trampled and re worked into the occupation horizons' within the hut circle. Four fragments of poorly preserved bone all of which were smaller than 10mm were recovered and none could be identified further. The bone fragments if contemporary with the hut circle are probably representative of food refuse discarded on the floor. Two fibres were also recovered which were clearly modern and were probably introduced accidently during excavation.

Srathain Hut Circle, Ullapool

These platform structures cut into the hill slope are not believed to represent domestic habitation or activities. This was confirmed by the near absence of any finds from the two bulk samples submitted for processing as only a single fragment of birch charcoal was retrieved from context [1.2]. These two bulk samples were described as a greasy/compact sediment and they proved the most difficult to process.

GAIRLOCH AREA

Auchtercairn 1 Hut Circle, Gairloch

This was described as a massive circular enclosure and 6g of birch fragments were collected from trench 1 which contained evidence of three levels of activity and intensive burning in the centre of the site. This site is not believed to have functioned as a domestic habitation and the charcoal recovered is likely to represent fuel debris.

Auchtercairn 2 Hut Circle, Gairloch

The original earth banked round-house was later replaced with a stone walled structure which included the later construction of a hearth within the building. The charcoal assemblage was concentrated in this hut circle with 48.8g of alder, birch, hazel, pine and a single bark fragment spread through out trenches 1 and 4. This charcoal was probably fuel debris which has subsequently become trampled and re-deposited within the occupation layers. If this charcoal relates to activities associated with the later hearth then this was after the stone built house was abandoned and was no longer primarily used as a domestic habitat.

Conclusion

The charcoal assemblage recovered from these six sites are all representative of mixed fuel debris as there is no evidence of any in situ structural burning.

The absence of any charred macroplants and burnt bone is surprising for those sites described as domestic structures. It is possible the occupants of the domestic buildings and sites regularly cleaned both the floors and hearths with the accumulative refuse disposed out with the living areas. Alternatively the presence of extensive modern contamination especially in the form of plant roots may have inadvertently led to the removal of smaller environmental finds. The recovery of small bone fragments from Rhue, Ullapool is inconclusive as this same site also contained modern fibers and it is unclear if these bone fragments are also intrusive.

The recovery of unidentifiable charcoal from both Loch Raa Hut Circle and Achnahaird Hut Circle situated in Achiltibuie suggests that either this region was deliberately burning things at an extremely high temperature or that they had to use decayed wood or other parts of the tree for fuel.

The composition of wood species found at these sites, alder, birch, hazel and pine, probably reflects the composition of woodland in the surrounding landscape. Birch and alder were the most common species present, reflecting their dominance in the landscape. Many of these sites appear to have been situated close

to a water source and the damp ground conditions would have readily supported both birch and alder woodland, hence its dominance within the charcoal assemblage. The hazel species would have been components of this scrubby woodland. The small number of pine fragments within the assemblage is not unusual as due to the high resin content of this species it reduces to ash more readily than other wood species, as a consequence it is typically underrepresented within the archaeological record.

The charcoal assemblage from Loch Raa, Achnahaird, Rue, Srathain, Auchtercairn 1 and Auchtercairn 2 are representative of mixed fuel remains where birch and alder have clearly been favored. The charcoal assemblages from these six sites are typical of other finds recovered from similar sites in Scotland.

References

A Study of West Coast Circular Structures Through Landscape Survey, Site Survey and Excavation:

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Section 2: Appendix 1

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Table 1. Flot finds

Area	Site	Sample	Context	Trench	Feature	Sample Vol (l)	Flot (ml)	% sorted	Charcoal
Achiltibuie	Loch Raa	LR 05	1.3	1	Hearth	1.5	25	100	<4mm
Achiltibuie	Loch Raa	LR 07	1.5	1	Occ H	3.5	200	100	Yes
Gairloch	Auchtercairn 1	G1. 2	1.3	1	Ash	3	150	100	Yes
Gairloch	Auchtercairn 1	G1.5	1.4	1	Pit	1	30	100	<4mm
Gairloch	Auchtercairn 2	Acht 1.3	110	1	Occ H	1	110	100	Yes
Gairloch	Auchtercairn 2	Acht 1.4	1.11	1	Occ H	2	130	100	Yes
Gairloch	Auchtercairn 2	Acht 4.4	4.3	4	Occ H	1	250	100	Yes
Ullapool	Rhue	R 03	1.3	1	Occ H	3	65	100	<4mm
Ullapool	Rhue	R 04	1.4	1	Occ H	3	25	100	No
Ullapool	Srathain 1	S1.1	1.2	1	Occ H	1	110	100	Yes
Ullapool	Srathain 1	S1.5	2.3	2	Occ H	0.5	30	100	<4mm

Table 2. Retent finds

Area	Site	Sample	Context	Trench	Feature	Sample Vol (l)	Retent Vol (l)	% Sorted	Charcoal	Bone (g)	Fibre (g)
Achiltibuie	Loch Raa	LR 05	1.3	1	Hearth	1.5	0.08	100	<4mm		
Achiltibuie	Loch Raa	LR 07	1.5	1	Occ H	3.5	0.1	100	<4mm		
Gairloch	Auchtercairn 1	G1. 2	1.3	1	Ash	3	0.2	100	<4mm		
Gairloch	Auchtercairn 1	G1.5	1.4	1	Pit	1	0.2	100	<4mm		
Gairloch	Auchtercairn 2	Acht 1.3	1.11	1	Occ H	1	0.3	100	Yes		
Gairloch	Auchtercairn 2	Acht 1.4	1.11	1	Occ H	2	0.3	100	<4mm		
Gairloch	Auchtercairn 2	Acht 4.4	4.3	4	Occ H	1	0.05	100	<4mm		
Ullapool	Rhue	R 03	1.3	1	Occ H	3	1.2	100	<4mm	5 (0.03g)	1 (N/A)
Ullapool	Rhue	R 04	1.4	1	Occ H	3	1.1	100	<4mm		1 (N/A)
Ullapool	Srathain 1	S1.1	1.2	1	Occ H	1	0.2	100	<4mm		
Ullapool	Srathain 1	S1.5	2.3	2	Occ H	0.5	0.05	100	<4mm		

Key: Occ H=Occupation horizon, <4mm= smaller than 4mm not collected, weight given in grams in bracket, N/A too small too weigh

Table 3. Charcoal species

Area	Site	Sample	Context	Trench	Feature	Recovery	Latin name	Common name	No	RW	Total Weight (g)
Achiltibuie	Loch Raa	LR 2	1.2	1	Hearth	HD	Indet	Indet	1		6.1
Achiltibuie	Loch Raa	LR 6	1.3	1	Hearth	HD	*Alnus glutinosa*	Alder	1		
Achiltibuie	Loch Raa	LR 6	1.3	1	Hearth	HD	*Corylus avellana*	Hazel	1		0.2
Achiltibuie	Loch Raa	LR 7	1.5	1	Pit	B/S	*Betula sp*	Birch	6		
Achiltibuie	Loch Raa	LR 7	1.5	1	Pit	B/S	*Corylus avellana*	Hazel	1	Yes	2.1
Achiltibuie	Achnahaird	F 05	2.2	2	Wall outside structure	HD	*Alnus glutinosa*	Alder	1		0.08
Achiltibuie	Achnahaird	F 28	2.3	2	Abandonment phase	HD	Indet	Indet	4		0.8
Achiltibuie	Loch Raa	F LR 15	2.4	2	R/H Occ h	HD	*Alnus glutinosa*	Alder	1	Yes	0.8
Achiltibuie	Loch Raa	F LR 15	2.4	2	R/H Occ h	HD	*Betula* sp	Birch	3		2.2
Gairloch	Auchtercairn 1	1.2	1.3	1		RT	*Betula sp*	Birch	5		3.3
Gairloch	Auchtercairn 1	1.3	1.3	1	Ashy soil	HD	*Betula* sp	Birch	5		1.4
Gairloch	Auchtercairn 1	1.7	1.4	1	Ashy soil	HD	*Betula* sp	Birch	1		1.3
Gairloch	Auchtercairn 2	Acht 1.5	1.10	1	Occ H	HD	*Alnus glutinosa*	Alder	5		
Gairloch	Auchtercairn 2	Acht 1.5	1.10	1	Occ H	HD	*Betula* sp	Birch	3		
Gairloch	Auchtercairn 2	Acht 1.5	1.10	1	Occ H	HD	*Corylus avellana*	Hazel	1		
Gairloch	Auchtercairn 2	Acht 1.5	1.10	1	Occ H	HD	*Pinaceae* sp	Pine	1		2
Gairloch	Auchtercairn 2	Acht 1.3	1.11		Occ H	B/S	*Betula sp*	Birch	11		6.9
Gairloch	Auchtercairn 2	Acht 1.4	1.11	1	Occ H	B/S	*Betula sp*	Birch	3		5.5
Gairloch	Auchtercairn 2	Acht 1.6	1.11	1	Occ H	HD	*Alnus glutinosa*	Alder	1		
Gairloch	Auchtercairn 2	Acht 1.6	1.11	1	Occ H	HD	Indet	Bark	1		
Gairloch	Auchtercairn 2	Acht 1.6	1.11	1	Occ H	HD	*Betula sp*	Birch	23		

Gairloch	Auchtercairn 2	Acht 1.6	1.11	1	Occ H	HD	*Corylus avellana*	Hazel	1	13.4
Gairloch	Auchtercairn 2	Acht 4.4	4.3	4	Occ H	B/S	*Alnus glutinosa*	Alder	19	6.6
Gairloch	Auchtercairn 2	Acht 4.5	4.3	4	Occ H	HD	*Alnus glutinosa*	Alder	17	
Gairloch	Auchtercairn 2	Acht 4.5	4.3	4	Occ H	HD	*Betula sp*	Birch	2	
Gairloch	Auchtercairn 2	Acht 4.5	4.3	4	Occ H	HD	*Pinaceae* sp	Pine	1	14.4
Ullapool	Srathain 1	S1.1	1.2	1		B/S	*Betula sp*	Birch	1	0.6
Ullapool	Rue	F 05	1.3	1	Hearth	HD	*Betula* sp	Birch	2	0.1
Ullapool	Rue	F 04	2.3	2	Hearth	HD	*Betula* sp	Birch	3	0.2

Key: Occ H= Occupation horizon, HD=Hand recovered, B/S= Bulk sample, total weight of charcoal sample given in grams









AOC Archaeology Group, Edgefield Industrial Estate, Edgefield Road, Loanhead EH20 9SY

tel: 0131 440 3593 | **fax:** 0131 440 3422 | **e-mail:** edinburgh@aocarchaeology.com

Wedig Project; Micromorphology Analysis Report

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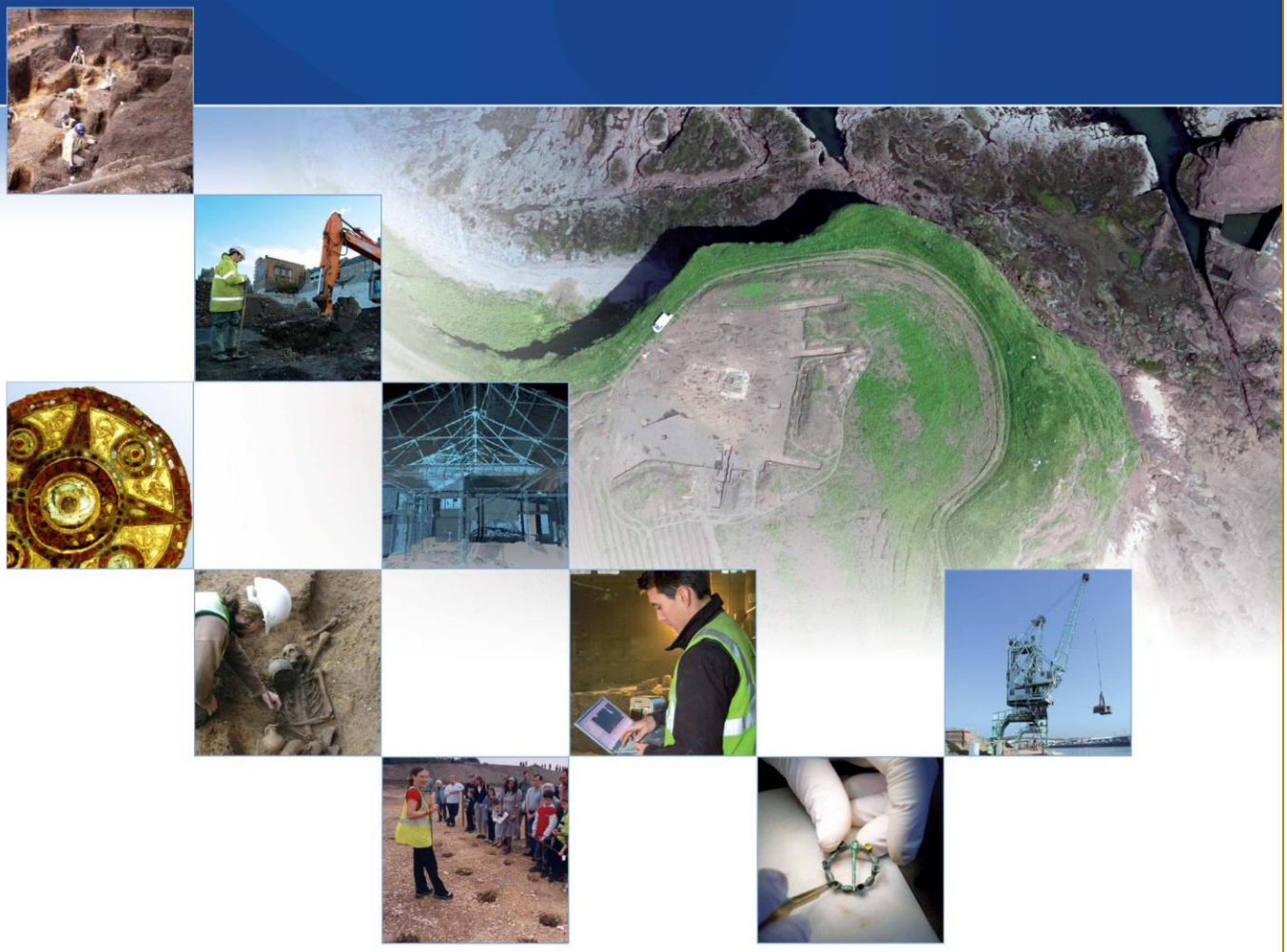

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Prepared by: Lynne Roy

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Author: Lynne Roy	**Date: 19th September 2014**
Approved by:	**Date:**
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Enquiries to: AOC Archaeology Group
Edgefield Industrial Estate
Edgefield Road
Loanhead
EH20 9SY

Tel. 0131 440 3593
Fax. 0131 440 3422
e-mail. edinburgh@aocarchaeology.com

www.aocarchaeology.com

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Introduction

This report presents the results of micromorphological analysis of nine kubiena samples collected as part of the Wedig community archaeological project. The project aimed to allow a better understanding of circular structures in Wester Ross, through the survey, excavation and sampling at the sites of circular structures across Wester Ross (Wildgoose and Welti, 2012). Eight of the samples analysed were removed during the 2012 excavation season from across five sites; Loch Raa, Achnahaird, Rhue, Strathain and Achtercairn 2. The ninth sample was removed from Achtercairn 3 during a later phase of excavation in 2014. A tenth sample removed from Achtercairn 1 (Wedig 3) was not analysed due to difficulties encountered during processing.

The solid geology beneath the two sites at Achiltibuie (Loch Raa and Achnahaird) comprises reddish feldspathic sandstones and grits of the Torridonian strata. These rocks give rise to a drift geology that is characteristically reddish or pinkish with stony and loamy sand textures. Soils at both sites are peaty gleys or peaty podsols, often strongly gleyed above an iron pan and have either friable or an indurated B horizon immediately below the pan. Soils at Strathain are also derived from Torridonian strata but are more commonly developed on glacial till or colluvium; they are peaty gleys or peaty podzols (Futty and Towers 1982, 556-7).

The solid geology at Rhue comprises pebbly and gravelly sandstones of the Applecross Formation overlain by a superficial geology of glacial sands and gravel with common colluvial deposits. Soils are of the Torridon Association and consist of peaty gleys and peat with some peaty podzols and peaty rankers (Futty and Towers 1982, 115).

The soils at Achtercairn are developed on drifts derived from the Lewisian metasediments and hornblende-schists of the Loch Maree Group. Drifts are mainly brown or dark brown, stony and with loamy sand or sandy loam. Soils are of the Lochinver Association and are peaty gleys, peat and peaty rankers with some peaty podsols (Futty and Towers, 91-94).

Micromorphology has become an increasingly important analytical tool in understanding site formation processes (Simpson and Barret 1996) and the use of space (Matthews *et al.* 1997), which can be difficult to resolve at the macro scale. The occupation deposits and buried land surfaces excavated at each of the circular structures present an opportunity to differentiate between areas of occupation and abandonment and also allow these to be set in context with pedogenetic processes to which each site has been subject, both during and after its occupation.

Aims and objectives

The aims of the soil micromorphological analysis are summarised in the Data Structure Report (Wildgoose and Welti, 2012) and are to provide a more refined interpretation of the soil profile. For the purpose of the analysis of the nine samples that form the focus of this report the aims include:

i) The process of deposition
ii) The character of the material deposited
iii) Identification of occupation areas
ii) Identification and characterisation of hearth structures
iv) Identification of post-depositional processes.

Micromorphological analysis of Achtercairn 3 was undertaken with the additional aim of identifying any multiple events or activities within the micro layers (Welti, 2014 *pers comm.).*

Methodology

The samples were prepared for analysis using the methods of Murphy (1986) at the University of Stirling in the Department of Environmental Sciences. The thin sections have been described using the terminology of Bullock *et al* (1985) and Stoops (2003). The coarse/fine limit of 10µm is used for both the mineral and organic components.

Micromorphology is an analytical technique by which soils and sediments are made into thin transparent glass mounted slides (usually 30µm thick) which can be examined using a petrographic microscope. Interpretation of microstratigraphic sequences in thin section is based on internal and comparative analysis of the type, frequency, morphology and structural relationships of depositional components and boundaries in each sequence and their spatial, temporal and sociocultural contexts within settlements. Analysis of micromorphological soil features can identify elements relating to human activity which may not be identifiable during excavation and also allow these to be set in context with both the natural pedogenic and disturbance related processes to which an archaeological site is subject, both during and after its occupation.

When estimating abundance of fabric constituent the following terms (after Stops 2003; 49) have been used:

Abundance	**Area %**
Very dominant	>70
Dominant	50-70
Frequent	30-50
Common	15-30
Few	5-15
Very few	<5

Results

The results are summarised below in Table 1. A full description of the results is located in Appendix 1.

Loch Raa (Wedig 1)

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Sample	Context	Coarse Mineral						Fine Mineral		Coarse Organic			Amorphous Fine Organic			Pedofeatures					Microstructure	Coarse Material arrangement	C/F related distribution
		Rock frags	Chlorite	Muscovite	Biotite	Feldspar	Quartz	Groundmass b-fabric	Colour PPL	Charred	organ residues (decomposed)	Plant tissues (fresh)	Yellow	Reddish brown	Black	Excremental	Impure/limpid clay coatings	Silty clay coatings/infill	accumulations Fe/Mn	Fe/Mn nodules			
T1 LR 1	1.3	tr			+		++++	Yellowish brown Heterogeneous Speckled b-fabric		++	+	tr	++	+++	++	t			ttt	ttt	Complex. Massive with rare channel voids	Randomly oriented some clustering of coarse minerals. Poorly sorted (frequently sand sized)	Close porphyric
T1 LR 2	1.3	+	tr		++		++++	Very dark brown Heterogeneous Weakly speckled b-fabric		++	++	+	tr	+++	+++	tttt	t	t	tt	ttt	Complex. Intergrain microaggregate	Randomly oriented and arranged. Unsorted	Single spaced smooth enaulic
T1 LR 3	1.3/1.2	tr			+	+	++++	Yellowish to reddish brown Heterogeneous Undifferentiated		+	+	+	++	+++	+	tttt		t	tt	ttt	Complex. Massive with rare channel and chamber.	Randomly oriented and arranged. Unsorted	Open porphyric
T1 LR 4	1.2	++			++	++	++++	Yellowish brown Heterogeneous Speckled b-fabric		+++	+	++	+++	++	++	tttt			tttt	ttt	Complex. Massive with few channel voids	Randomly oriented. Some clustering of coarse mineral and organic matter. Unsorted	Open porphyric
T3 LR 1	3.3				+	+	+++	Yellowish to reddish brown Heterogeneous Undifferentiated b-fabric		++	tr	+++	++	+++	+++	tt	tt	ttt	tttt	tttt	Complex. Channel and chamber	Random and poorly sorted	Close porphyric
T3 LR 2	3.2				+	+++	++++	Yellowish to reddish brown Heterogeneous Undifferentiated b-fabric		++	+++	++	++	+++	+	tt	tt	ttt	ttt	ttt	Complex. Channel and chamber	Random unsorted. Rare clustering of coarse organics towards top of layer	Close fine enaulic

Achnahaird (Wedig 4)

Sample	Context	Coarse Mineral							Fine Mineral		Coarse Organic			Amorphous Fine Organic			Pedofeatures					Microstructure	Coarse Material arrangement	C/F related distribution
		Rock frags	Chlorite	Muscovite	Biotite	Feldspar	Quartz		Colour PPL	Groundmass b-fabric	Charred	organ residues (decomposed)	Plant tissues (fresh)	Yellow	Reddish brown	Black	Excremental	Impure/limpid clay coatings	Silty clay coatings/infill	accumulations Fe/Mn	Fe/Mn nodules			
ACH T1.1	1.3	+		+	+	+	++++		Dark brown to black. Homogenous Undifferentiated b-fabric		t	+	++		+++	++++	t			tt		Massive	Random and unsorted	Chitonic
ACH T1.2	1.2	+		+	+	+	++++		Dark reddish brown to black Heterogeneous Undifferentiated b-fabric		+++	+	++	+	+++	++++	tr		t	tttt	ttt	Massive	Random and poorly sorted (exception black layer horizontal band see Appendix 1)	Close porphyric
ACH T1.3	1.2	++		+	++	++	++++		Yellowish to reddish brown Heterogeneous Undifferentiated b-fabric		+++	++	+++	++	++++	++	tr					Complex. Weakly developed moderate sub-angular structure with few large channels	Random orientation. Clustering/banding of coarse material. Moderately sorted (mainly medium sand sized)	Open porphyric
ACH T2.1	2.7					+	++++		Yellowish brown Slight birefringence			T	+	+	+++	+++	tttt	t	ttt	tttt	ttt	Complex. Massive to bridged grain in places	Randomly arranged and oriented. Moderately sorted (mainly medium sand sized)	Gefuric
ACH T2.2	2.6	+	+	+	++	++	++++		Dark yellowish brown to black Heterogeneous Slightly speckled b-fabric		++	T		T	+++	+++	tttt			t	tr	Massive with few vughs. Excremental vermiform in places	Randomly arranged and oriented. Poorly sorted	Close porphyric
ACH T2.3	2.3					+	++++		Dark yellowish brown to black Heterogeneous Slightly speckled b-fabric		t		t		+++	++	tttt		tr			Massive with rare channels	Random and unsorted	Close porphyric

Sample	Context	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
		Quartz Feldspar Biotite Muscovite Chlorite Rock frags	Colour PPL Groundmass b-fabric	Plant tissues (fresh) Plant tissues (decomposed) organ residues Charred	Black Reddish brown Yellow	Fe/Mn nodules Fe/Mn accumulations Silty clay coatings/infill Impure/limpid clay coatings Excremental			
ACH T3.1 Fabric 1	3.5	t +++ ++++	Brown with patches of yellowish brown to reddish brown fabric Heterogeneous Undifferentiated b-fabric	tr ++ +	+ + ++	tt tt t tt	Complex. Channel and chamber with patches of weakly developed sub-angular blocky. Patches of crumb/granular structure in more porous areas	Random orientation. Common clustering of part decomposed/fragmented blackened organic material. Poorly sorted	Close porphyric
ACH T3.1 Fabric 2	3.5	t +++ ++++	Brown to reddish brown. Heterogeneous Undifferentiated b-fabric	++ +++ +	+++ +++ +++	tt tt t tttt	Channel and chamber with patches of granular to crumb structure	Randomly oriented and distributed. Poorly sorted	Close porphyric
ACH T3.2	3.4	t +++ ++++	Dark yellowish brown to dark reddish brown. Heterogeneous Undifferentiated b-fabric	+ ++ + +++	++ +++ +++	tt t tttt	Complex channel and chamber to granular/crumb in more porous areas.	Randomly oriented. Some clustering of medium to coarse sand (possibly earthworm lines)	Porphyric
ACH T3.3	3.3	+ +++ ++++	Yellowish brown Heterogeneous Undifferentiated b-fabric	t ++ t	++ ++ ++	ttt tt tttt	Complex Channel and chamber to granular crumb in more porous areas.	Randomly oriented. Decomposing plant materials occasionally clustered and commonly associated with granular/crumb microstructure	Close porphyric.

Rhue (Wedig 2)

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Sample	Context	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
		Quartz Feldspar Biotite Muscovite Chlorite Rock frags	Colour PPL Groundmass b-fabric	Plant tissues (fresh) Plant tissues (decomposed) organ residues Charred	Black Reddish brown Yellow	Fe/Mn nodules Fe/Mn accumulations Silty clay coatings/infill Impure/limpid clay coatings Excremental			
RHUE 1 1	1.3	t	Light yellowish brown to orange brown heterogeneous Undifferentiated b-fabric	+++ ++++ ++ +++	+ + ++++	t tttt T	Complex. Weakly developed sub angular blocky, few platy or lenticular structure with few polyconcave voids	Frequent parallel orientation of elongate plant tissue. Banding of elongated plant tissue and charcoal	Porphyric (ranging from close to open)
RHUE 1 2	1.2	t	Orange to reddish brown. Heterogeneous Undifferentiated b-fabric	+++ +++ ++ +	+++ +++ ++++	ttt tttt tt tttt	Complex weakly developed sub angular with few channels. Few patches of granular structure esp. towards top where more porous.	Common parallel orientation of fibrous plant tissue but more frequently randomly oriented. Randomly distributed	Porphyric

Strathain (Wedig 5)

Sample	Context	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
		Quartz Feldspar Biotite Muscovite Chlorite Rock frags	Colour PPL Groundmass b-fabric	Plant tissues (fresh) Plant tissues (decomposed) organ residues Charredl	Black Reddish brown Yellow	Fe/Mn nodules Fe/Mn accumulations Silty clay coatings/infill Impure/limpid clay coatings Excremental			
RHUE 2 1	1.2/1.3?	++++ +++ +++	Yellowish brown Patchy and heterogeneous Undifferentiated b-fabric	+++ +++ t +++	+++ + +++	ttt ttt +++	Complex. Channel and chamber with occasional granular patches.	Randomly oriented some clustering of plant tissues and phytoliths	Porphyric (ranging from close to open)
RHUE 2 2	1.2	++++ + ++ +++ + +	Very dark reddish brown to black Homogenous Undifferentiated b-fabric	+ + + ++	++++ ++ +++	t ttt t tttt ttt	Channel and chamber	Randomly oriented and arranged. Unsorted	Porphyric
RHUE 2 3	1.2	++++ + +	Light yellowish to very dark brown Heterogeneous Undifferentiated	++ ++++ + +	+ ++++ +++	tttt tttt tt tttt	Complex. Medium separated sub angular. Channel and chamber and granular	Randomly oriented and arranged. Unsorted	Porphyric

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Achtercairn 2 (Wedig 6)

Sample	Context	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
		Quartz Feldspar Biotite Muscovite Chlorite Rock frags	Colour PPL Groundmass b-fabric	Plant tissues (fresh) Plant tissues (decomposed) organ residues Charred	Black Reddish brown Yellow	Fe/Mn nodules Fe/Mn accumulations Clay coatings/infill Impure/silty clay coatings Excremental			
GAIR 2 1	1.11	++++ +++ ++ +++ +++	Dark greyish brown to reddish yellow brown Heterogeneous Speckled b-fabric	t ++ + ++ ++	++ +++ +++	ttt t tttt t	Complex. Massive to very weakly developed sub angular blocky. Few channel voids	Randomly oriented and distributed. Unsorted	Close porphyric
GAIR 2 2	1.11	++++ ++ +++ ++ +++ ++	Yellow to greyish Heterogeneous Speckled b-fabric	t +++ + ++	+ ++ +++	ttt tt tttt tttt	Complex. Massive with few channels and chambers. Very few granular structure (commonly within channels)	Randomly oriented. Frequently randomly distributed but few clusters of charred, organic and ash material. Poorly sorted	Close porphyric
GAIR 2 3	1.6	++++ +++ ++ + + +	Orangish yellow Homogeneous Undifferentiated	+ +++ t +	+ + ++++	ttt tt tttt t t	Complex. Weakly to moderately separated sub angular blocky. Common channels and chambers and rare granular (left hand of layer above large void)	Randomly oriented. Few clusters/ very weak bands of coarse minerals) Coarse mineral predominantly medium to coarse sand sized. Phytoliths and single cells are silt sized	Open porphyric

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Achtercairn 3

Sample	Context	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
		Quartz Feldspar Biotite Hornblende Muscovite Chlorite Rock frags	Colour PPL Groundmass b-fabric	Plant tissues (fresh) Plant tissues (decomposed) organ residues Charred	Black Reddish brown Yellow	Fe/Mn nodules Fe/Mn accumulations Clay coatings/infill Textural Excremental			
ACHT 3 1	5.3	+++ ++ ++ +++ +++ ++ +++	Yellow to orange brown with some dark brown patches Heterogeneous Speckled b-fabric	t ++ + +++	+ +++ +++	Ttt ttt tttt	Complex. Vughy to crumb in places with frequent channels and chambers	Randomly oriented and distributed. Rare clustering of charred material. Unsorted	Close porphyric
ACHT 3 2	5.3	++ ++ ++ +++ +++ ++ ++++	Yellow Heterogeneous Undifferentiated b-fabric	t ++ + ++	++ ++ ++	ttt tt tt	Complex. Weakly sub-angular blocky with common channels and chambers.	Randomly oriented. Dominantly randomly distributed but few clusters of charred, material. Unsorted	Close porphyric
ACHT 3 3	5.3	++ ++ ++ +++ +++ ++ ++++	Dark reddish brown to orange brown. Heterogeneous Undifferentiated b-fabric	+ ++ + +++	+++ +++ +++	ttt tt ttt ttt	Complex. Channel and chamber with vughs. Crumb to granular like in places where excremental features dominate	Randomly oriented and distributed. Unsorted	Close porphyric
ACHT 3 4	5.3/5.2	++ +++ ++ ++ +++ +++ +++	Yellowish brown to dark brown. Heterogeneous Speckled b-fabric	T ++ ++ ++	++ +++ +++	t t ttt tttt	Complex. Channel and chamber with patches of crumb microstrcuture.	Randomly oriented and distributed. Unsorted	Close porphyric
ACHT 3 5	5.2	+ ++ + ++ ++ + ++++	Reddish brown Heterogeneous Speckled b-fabric	+++ +++	+++ +++ +++	Ttt Tttt tt	Complex. Massive with few channels and chambers	Randomly oriented and distributed. Poorly sorted (frequent fine to medium sized quartz)	Close porphyric

Interpretation and Discussion

Interpretation of the results is presented below by site, sample and layer number and from the base up, followed by a brief discussion.

The mineral and rock fragment suite present throughout the five samples from Achiltibuie (Loch Raa and Achnahaird) is typical for the area being dominated by quartz with few feldspars and very few other minerals (see Appendix 1 for full description). The sample from Strathain is similarly derived from Torridonian strata (Futty and Tower 1982, 115). Rock fragments where present and identifiable are often sandstone and of sedimentary origin. Mineral fragments are largely absent from the Rhue sample and restricted to rare quartz. The two samples removed from Achtercairn display a more diverse mineral composition than the others studied and this reflects the underlying drift geology which is derived from the Loch Maree Group (Futty and Towers 1982, 91-94). No erratics introduced by human occupation were observed in any of the samples.

Loch Raa: Sample LRT1

This sample was taken over the boundaries of contexts 1.2 and 1.3, a sequence of hearth deposits. When viewed at macro scale no boundaries are visible. However when viewed microscopically this samples comprises four distinct layers with zones of layer 3 appearing within layer 2. It is assumed that the upper (L4) and lower layers (L1) can be assigned to context 1.2 and 1.3 respectively but owing to the diffuse nature of the boundaries between the layers and the description of both contexts as 'patchy' (Wildgoose and Welti 2012) a context number cannot be certainly assigned to the two central layers. Both contexts 1.2 and 1.3 are interpreted as occupation horizons associated with a hearth feature.

Layer 1 (Context 1.3)

The lower part of context 1.3 (layer 1) is a compact dense (porosity 1-2%) sandy silt. The coarse to fine ratio (c/f ratio) is 40/60 with a high proportion of fine ash material as indicated by the speckled birefringence fabric (b-fabric). The matrix is predominantly yellowish brown in plane polarised light (PPL) and black brown in cross polarised light (XPL). Frequent black angular flecks (possibly micro charcoal) throughout the matrix give the layer a speckled heterogeneous appearance. Noted pedofeatures include occasional iron (Fe) and manganese (Mn) blackened rounded anorthic nodules indicative of some water saturation and incipient podsolisation (See Lindbo et al 2010) but the layer appears to otherwise have been subject to very limited post-depositional disturbance.

Amorphous reddish brown to black organic matter (possibly charred) dominates the organic matter, while larger fragments of charcoal with visible pores are few rising to frequent in the top left of the layer. The survival of charcoal indicates that this hearth deposit was subject to relatively low temperatures but the absence of cellular plant tissue material is indicative of temperatures high enough to combust the larger plant tissue fragments leaving only reddish and yellowish fine charred material. The larger charcoal fragments are angular indicating limited physical weathering or physical movement i.e. they are probably *in situ* and appear to be embedded within the fine ash groundmass. Experimental research into the micromophological properties of hearths undertaken by Miller et al (2008) showed embedding of coarse burned material to be a property of trampled hearths and indeed the compacted nature of this layer is also consistent with a trampled hearth.

The clear to sharp boundary between layer 1 and the overlying layer 2 is undulating and varies from clear (<60µm) to sharp in places indicative of a relatively abrupt change in use

Layer 2

Layer 2 is an unsorted fine sand with a complex intergrain microaggregate microstructure; occasionally crumb like in places with rugose porous excremental aggregates. The extensive post-depositional bioturbation experienced by this layer is indicated by the many excremental pedofeatures most frequently faecal pellets, (the by-product of small arthropods (Dawod and Fitzpatrick, 1992)) and is also reflected in the complexity of the microstructure and in the enaulic related distribution (See Stoops 2003, 42). This evidence for significant biological working contrasts with the layer 1 and is indicative that the boundary between layers 1 and 2 represents a change in the type and intensity of use of space. For layer 2 to have been so extensively reworked it is likely that it was exposed and/or located in neglected domestic space.

Iron and manganese accumulations and nodules are many and may be indicative of significant redox conditions (Lindbo et al 2010) caused by chemical weather and water saturation of the profile. It should be noted however, that iron and manganese formation is commonly observed within buried archaeological soils as an artefact of burial beneath structures as evidenced by the experimental earthwork at Overton Down (Macphail and Cruise, 1996) and Hazleton, Gloucestershire (Macphail 1990) and thus these features may in at least part result from burial beneath the hearth (layers 3 and 4) sediment.

The matrix is heterogeneous and speckled. It is very dark brown to black in PPL owing to a dominance of dark brown and blackened amorphous fine organic material with a very weakly speckled b-fabric indicative of fine ash within the matrix. Charcoal material is often fragmented and denuded indicative of trampling and/or of post-depositional physical weathering. The contents of layer 2, although reworked are thus indicative of general occupation debris incorporating some hearth waste as evidenced by the presence of charcoal and fine ash.

Layer 3

Layer 3 has a clear boundary with the underlying layer and by contrast is a much finer, moderately sorted silt deposit dominated by compacted amorphous reddish brown organic material mixed with fine ashy material. The presence of fine ash, burned bone fragment and possible burned peat fragments as well as charcoal fragments is indicative of the incorporation of domestic hearth waste. Excremental features and Fe/Mn nodules and accumulations are many, indicating significant biological and chemical weathering. Patches of layer 3 like material are present within layer 2 providing further indication of significant physical and biological mixing. The presence of woody organ residues and highly birefringent tissue residues towards the top of the layer is also indicative of mixing by modern root material.

Layer 3 thus bears several similarities to layer 2 and appears to represent general occupation and hearth debris which has been subject to significant post-depositional pedoturbation.

Layer 4 (Context 1.2)

Layer 4 has much in common with the compact material found in layer 1 and is consistent with trampled hearth material. It has a largely massive microstructure; it is very compact and dominated by fine ash material. Unlike the underlying layers, layer 4 has does not appear to have been subject to significant reworking by soil biota and excremental features are rare. The influence of other post-depositional processes specifically water action and compression during burial is evidenced by many Fe/Mn aggregates and nodules. Rock fragments are few but notable given their relative absence in underlying layers. There is some clustering of coarse mineral and charred matter which may have been caused by sweeping of hearth waste, a feature noted by Miller at al (2008) during their experimental work on micromorphological signatures of hearth features.

Discussion

The series of deposits represented in the Loch Raa sample thus present a mix of compacted hearth debris and reworked organic and charred sediments which have been much altered due to post-depositional pedoturbation. This complex layering of reworked and apparently unaltered material could be interpreted as representing changes of use within the hearth sequence and would be consistent with temporary abandonment of a hearth area (perhaps in favour of another nearby) leaving layers 2 and 3 in exposed or neglected domestic space perhaps as an area for dumping of hearth and organic waste which would have provided food for soil biota allowing them to remix the charred organic material. The compact hearth debris presented in layer 4 could thus tentatively be interpreted as representative of a change in the intensity use of this area perhaps back into use as a hearth.

Loch Raa: Sample LRT3

This sample was removed across two buried soil contexts located within the soil trench outwith (north of) the area of occupation. The context boundary is not visible within the sample when viewed at macro scale but is distinguishable microscopically although diffuse.

Layer 1 (Context 3.3)

Context 3.3 is a moderately sorted silt dominated by amorphous reddish brown organic matter. The layer has a complex channel and chamber microstructure with a porosity of up to 5%. Large channel voids dissect the layer and the presence of some bright orange woody organ residues within or in close association is indicative of post-depositional disturbance by root action. Excremental pedofeatures are rare and are concentrated in a single large channel void with an incomplete infilling of rounded excremental fabric each up to 400µm in diameter probably derived from earthworm channelling (see Kooistra and Pullman, 2010). Fe pedofeatures range from weakly impregnated, irregularly shaped, orthic impregnations of the groundmass in the form of nodules and hypo-coatings, to strongly impregnated anorthic nodules, pans and hypocoatings. There are also many channel voids with coatings or infillings of amorphous yellow clay indicative of translocation of fine organic material through the soil profile (Kuhn et al 2010). Anthropogenic indicators are limited to few charcoal fragments probably blown in from the nearby hut circle.

Layer 2 (Context 3.2)

Context 3.2 bears some similarities to context 3.2 and is similarly dominated by amorphous reddish brown organic matter. Fe pedofeatures are occasional and indicative of podsolisation although they tend to be more weakly impregnated and less frequent than those in the layer below, perhaps reflecting the higher position of context 3.2 in the soil profile (Fe pedofeatures tend to increase with depth (See Wilson et al 2013)). The enaulic related distribution, frequent channels and chambers associated with highly birefringent woody organ residues are indicative of a high degree of post-depositional mixing. Excremental features are rare and the post-depositional disturbance appears to have been caused mainly by root activity. Organic material is commonly blackened, frequently blackened towards the top of the slide where planar voids and fissures are indicative of shrink swell processes thus suggesting that layer 2 has been subject to changing hydrological regimes.

Discussion

Contexts 3.2 and 3.3 are thus typical of the peaty podsols found in this area (see above and Futty and Towers 1982). As discussed by Limbrey (1975; 137-41) the formation of humic-iron pans at the base of the profile coupled with high rainfall can cause saturation and the formation of acidic peats higher in the profile a process that appears to have occurred here. Unlike the archaeological examples from the Loch Raa hut circles, the buried soils appear to have undergone relatively little post-depositional mixing by soil biota but have experienced significant mixing by root activity as well as being subject to post depositional distortion by leaching and water saturation.

The question of when the podsolisation of these buried soils occurred is of some interest to the study of the wider landscape of Loch Raa and specifically to the settlement of the Loch Raa hut circle. Generally the impact of humans on the upland soil system is associated with accelerating soil development towards podsolisation, gleying and peat formation all of which have been evidenced in the buried soils from Loch Raa and thus could tentatively be interpreted as a signature of anthropogenic activity. However, podsolisation may already have been underway by the time of the settlement. For example at Kilphedir in the Strath of Kildonan, Sutherland, the floor of an excavated hut circle was found to have been established on a soil transitional between a podsol and podsol with an iron pan (Fairhurst et al, 1974) and iron pedofeatures noted within the Loch Raa samples are also indicative of incipient podsol formation. However, iron pan formation is often found directly below occupational surfaces (see above) as the subsoil becomes compacted and drainage is inhibited, representing the 'reactive' zone of occupation surfaces (Simpson et al 1998) thus any interpretation of the 'natural' soil on which any occupation surface was formed must be treated with great caution.

Achnahaird – Sample ACH T1

This sample was removed from within the Achnahaird hut circle close to a hearth feature and over the boundary of context 1.2 a hypothesised occupation horizon and 1.3 interpreted as representative of abandonment. When examined microscopically this sample comprised three distinct layers; layer 1 representing context 1.3 and layers 2 and 3 forming part of context 1.2.

Layer 1 (Context 1.3)

Layer 1 comprises moderately sorted sand dominated by medium sized sand grains. There are no anthropogenic indicators and pedofeatures are limited to Fe stained organic matter and rare coalesced aggregates of probable excremental origin. There are few plant tissue remains and organ residues, often highly birefringent and associated with channel voids indicating that they are associated with post-depositional mixing by root material. The layer has a chitonic related distribution with fine Fe stained material surrounding the quartz grains. Chitonic distributions are typical of sandy spodic horizons (Stoops 2003, 42). The moderate sorting of the mineral material, its sub-rounded nature and, the absence of rock fragments may indicate that this deposit is at least in part windblown perhaps sealing the occupation horizon following it's abandonment. It has evidently undergone some limited post-depositional remixing as evidenced by iron staining, fine amorphous black material and, modern roots and rare excremental features.

Layer 2 (Context 1.2)

Layer 2 forms the lower part of context 1.2 and comprises compact poorly sorted sand with a massive microstructure and chitonic related distribution. This layer has developed on the windblown sand below and has a high proportion of coarse mineral material derived from the underlying layer. The fine fraction is dominated by very dark brown to black amorphous iron stained organic material. The composition of layer 2 is thus consistent with general occupation and the compacted dominantly heterogeneous nature of the groundmass is typical of floor deposits (see Goldberg and Macphail 2010, Milek 2012). The low concentrations of charcoal and charred organics coupled with the survival of plant tissue fragments suggest against a hearth deposit rather it appears to represent general occupation. The exception to this is a black lens 1-3mm thick aligned parallel to the top of the slide and located close to the top of layer. It is dominated by amorphous black material with common cellular charcoal as well as few plant tissues and organ residues. Preservation of cellular charcoal alongside fibrous plant tissues again suggest against burning *in situ* but the concentration of material coupled with its horizontal alignment is perhaps indicative of sweeping of hearth waste. Two part denuded bone fragments are located just below this lens and provide further possible evidence for domestic hearth waste.

The layer is commonly dissected by pseudomorphic voids indicating some mixing in of material from above. There are few bright orange tissue fragments in the layer as well as very few bright orange rounded organ fragments indicative of modern root action. Excremental pedofeatures are rare and post-depositional mixing has been limited.

Layer 3 (Context 1.2)

Layer 3 has a clear boundary with the underlying layer 2 and is a compact poorly sorted silt as reflected in the porphyric occasionally close porphyric related distribution. The coarse organic component is mixed including cellular charcoal, frequent single plant cells and few plant tissues. The fine material is dominated by reddish brown amorphous material with ash patches. Phytoliths are common and are indicative of grass ash. Pedofeatures are limited to rare anorthic Fe/Mn nodules. The absence of excremental features and preservation of well preserved plant tissues is indicative of relatively limited post-depositional mixing. The components of layer 2 are also consistent with compact floor material but the differences in structure may suggest a change in the balance of activities affecting this particular area. Clustering of coarse material may be indicative of some form of sweeping (Miler et al 2008) possibly of waste material.

Discussion

The micromorphological evidence from the sample from Achnahaird Trench1 is thus largely consistent with the field interpretation. Context 1.3 contains very few anthropogenic indicators and appears to represent a period of abandonment of the hut circle during which windblown sand encroached. Context 1.2 appears to represent general occupation incorporating a lens of charred hearth debris.

Achnahaird –ACH T2

This sample was removed from the boundary of three contexts (2.3), (2.6) and (2.7) which correspond to the layers identifiable microscopically. This sample has suffered some loss of sediment during processing.

Layer 1 (Context 2.7)

This layer was interpreted in the field as the natural sand dune upon which the hut circle was constructed. Micromorphological evidence is largely consistent with this interpretation being a poorly sorted medium sand, dominated by sub-rounded medium sized quartz grains consistent with a windblown sand deposit. The very few plant remains are fragmented or sub-rounded indicating that they have been subject to chemical or physical weathering. There are many spherical elliptical and coalesced excremental remains loosely packed and bridging the quartz grains giving the sediment a gefuric related distribution common to spodic horizons (Stoops 2003, 42). Iron and/or manganese accumulations and nodules indicate that the sediment has undergone podsolisation (Lindbo et al 2010) a process which may have been caused or accelerated by the subsequent construction of the hut circle (see Simpson et al 1998).

Layer 2 (Context 2.6)

This context represents the first phase of occupation developed upon the windblown sand. The layer is dominated by amorphous fine organic material which is responsible for the dark yellowish brown matrix colours. Plant tissues and organ residues are notably absent with the exception of a single woody root fragment. There are few cellular charcoal fragments and occasional patches of calcitic ash material indicative of human influence. The boundary between the two layers is diffuse and has probably been blurred by post-depositional mixing by soil biota, the activity of which is evidenced by the many loosely spherical aggregates and excrements. Indeed post-depositional mixing has created a much altered sediment with a complex microstructure varying from massive to vermiform to excremental in places. Despite this mixing the layer remains relatively compact with a dominantly porphyric related distribution.

Layer 3 (Context 2.3)

Context 2.3 was interpreted in the field as representative of the same abandonment represented by Context 1.3 (see ACH T1) and indeed the two layers show sufficient similarities micromorphologically to support this interpretation. The microstructure of 2.3 is also massive with local variation caused by the dominance of excremental material. Context 2.3 is a poorly sorted sand deposit in which the coarse mineral material dominates. The coarse mineral material is dominated by sub-angular to angular quartz and the physical weathering of grains noted in 1.3 appears to be absent. As with 1.3, the fine material of 2.3 is dominated by dark reddish brown amorphous organic material and the presence of many excremental features is indicative of significant post-depositional mixing by soil biota. Indeed this mixing is consistent with a sediment representing abandonment as it would have been exposed following deposition and open to mixing by biological and physical elements.

Discussion

Significant post-depositional mixing has thus altered and destroyed much of the sediment record within this sample but the sample has retained sufficient of its original structure to allow for differentiation between deposits and for the identification of a defined sequence of events from the initial sand dune surface through to occupation and a first phase of abandonment.

Achnahaird ACH T3

This sample was removed from a soil trench situated beneath lazy bed cultivation outwith the main occupation area. The whole sample has been subject to significant post-depositional pedoturbation as demonstrated by the observed channel and chamber and granular and crumb microstructures.

Layer 1 Context 3.5

Context 3.5 is a poorly sorted heterogeneous sand deposit. It has a complex microstructure which largely reflects differences in post-depositional mixing by soil biota with few to common channels and chambers and patches of granular structure in more porous areas towards the top of the layer. Plant tissue remains are very few, as are charred cellular fragments. Pedofeatures are dominated by excremental fabrics including infilled passage features with occasional Fe/Mn nodules and Fe impregnation indicative of incipient iron pan formation (see Lindbo et al 2010). Context 3.5 thus appears typical of a Bc transitional soil horizon with some Fe/Mn concretions. Organic and charred material is probably mixed in from above and the increase in coarse mineral content towards the base of the layer is further indicative of a transitional Bc horizon.

Layer 2 (Context3.4)

Context 3.4 is significantly more organic than the underlying layer with a much lower coarse mineral content. The layer is dominated by reddish brown amorphous organic material occasionally with cellular structure but more commonly heavily decomposed. The channel and chamber to granular microstructure attests to the extensive post-depositional pedoturbation and most pedofeatures are excremental in origin. The patches of granular structure are a mixture dominantly of enchytraeid and earthworm excrement (see Kooistra and Pullman, 2010). Essentially this layer has been almost entirely reworked by soil meso and microfauna and is an excremental fabric. Anthropogenic indicators are limited to few internally amorphous possible carbonised fragments.

Layer 3 (Context 3.3)

Context 3.3 displays a certain degree of similarity to context 3.5, having a much higher coarse mineral content than the intermittent layer and it is a moderately sorted sand deposit. As with context 3.5, context 3.4 has been subject to significant post-depositional disturbance and this is reflected in the channel and chamber rarely granular microstructure. However context 3.3 has not been as reworked as extensively as the intervening layer (Context 3.4) probably reflecting the reduction in organic matter content in this layer which would have resulted in a significant decrease in available food supply for micro and meso soil fauna. Organic matter is represented by modern roots and few internally amorphous reddish brown to black features. The majority of pedofeatures are of an excremental

nature, although occasional amorphous yellow clay coatings to mineral grains and hypocoatings to voids were noted.

Discussion

The sequence of sediment layers represented in this slide thus appears to represent the transition from a sandy Bc horizon to an organic rich buried soil horizon which has been buried by a reworked sand deposit. Sediments within Achnahaird trench three have been extensively reworked as evidenced by very diffuse boundaries between each layer and frequent excremental fabrics and there are no features that can be confidently interpreted as directly linked to former cultivation of the buried soil horizon. Research by Davidson (2002, 1252) (see also Davidson and Carter, 1998) has demonstrated that outwith archaeological contexts, micromorphological features diagnostic of cultivation are rarely preserved and that soil fauna are able to rework former cultivated soils within decades. Although context 3.4 is buried beneath context 3.3, it is likely that 3.3 represents the gradual accumulation of sediment and as such has not prevented the reworking of 3.4 by soil fauna. The higher organic matter content and higher degree of excremental pedofeatures within context 3.4 is indicative of greater bioturbation than in the underlying and overlying layers, perhaps reflecting the addition of manure which will have had a positive effect on burrowing animals leading to the production of more excremental pedofeatures.

Rhue – RHUE 1

This sample was removed from across the boundary of two contexts located within the hut circle in close proximity to a hearth slab. Context 1.2 was described as a rich brown gritty soil with no stones and Context 1.3 was described as a black to brown greasy soil with no stones. Context 1.3 was hypothesised as a possible occupation horizon (Wildgoose and Welti 2012).

Layer 1 (Context 1.3)

Context 1.3 is a dominantly organic deposit with <1% coarse organic mineral material. The context is dominated by highly humified organic residues that have not been burnt, so they are not fuel ash. The high degree of humification has left limited structural information with which to identify the plants originally present and the context is dominated by amorphous yellow clay. Recognisable remains include epidermal and vascular tissues derived from herbaceous materials which are commonly most resistant to decomposition (see Fitzpatrick 1993). The elongate plant material is frequently wavy in appearance and is frequently aligned parallel to the top of the slide giving the layer a lenticular or platy appearance. Charcoal is common and is distributed into weak horizontal bands. The charcoal and bark and wood material within Context 1.3 has a curled appearance indicating that it has been compressed and lost its structure (Schweingruber 1982, 202) The relatively compact nature of the sediment is reflected in the frequently porphyric, commonly close porphyric related distribution. The subangular blocky to platy microstrcuture, compacted ‘wavy’ plant tissue and bark and partially infilled polyconcave voids all contribute to the low proposity of the layer and are indicative of compaction and/or trampling typical of floor deposits within occupied structures (Milek 2012)

The near absence of rock fragments and coarse mineral material is unusual for a deposit located within an hypothesised occupation horizon as occupation zones and floors are typically heterogeneous and mixed (see Macphail et al 2004; Goldberg and Macphail 2010) and whilst common charcoal provides clear evidence for anthropogenic activity, it is not associated with ash or other anthropogenic material and could thus have been swept, trampled, blown or washed into the deposit from nearby.

Layer 2 (Context 1.2)

As with Context 1.3, 1.2 is dominantly organic with very few angular medium sand sized quartz. Whilst plant material is commonly horizontally aligned it is more frequently randomly oriented than in Context 1.2 and the banding lenticular structure observed in 1.3 is notably absent. The layer is dominated by amorphous yellow organic material with few elongate plant tissue fragments and rare cellular charcoal. There are rare woody organ residues and woody epidermal structures with high birefringence indicative of modern root action. Much of the organic matter is blackened to dark reddish brown and internally amorphous and this coupled with frequent black flecks in the matrix give the groundmass a darker colour when compared with the underlying layer. One localised area

towards the top of the layer contains possible vivianite, a compound which forms under reducing conditions when there is abundance of iron and phosphorous (Karkanas and Goldberg 2010, 535-6) which may be a result of abundance of phosphate rich dung and plant matter and is evidence for localised reducing conditions within the deposit. Channel voids occasionally contain excremental fabric. The porosity of the layer increases towards the top of the slide where rugous porous aggregates form a granular microstructure and are indicative of a higher degree of post-depositional disturbance than in the underlying layer.

Discussion

Contexts 1.3 and 1.2 thus comprise highly organic sediments subject to increasing post-depositional disturbance towards the top of the slide. The severe reworking of both layers by soil fauna is not surprising in such an organic deposit.

The function of contexts 1.2 and 1.3 within an occupation zone is intriguing. As discussed above, the near absence of coarse mineral material indicates that this is not a typical floor or occupation horizon. Stabling deposits from Early Medieval London Guildhall (Macphail and Goldberg 2006, 245) and Butser Ancient Farm (Macphail et al 2004) were found to be highly organic with fragments of layered plant material and excremental material not unlike the humified organic bands discussed above. Whilst the fecal spherulites which help to characterise such layers (Goldberg and Macphail 2010) are notably absent from Contexts 1.2 and 1.3, anthropological research into the micromorphology of known stabling deposits has shown that faecal spheruiltes are not always present (Milek 2012, 130). Indeed it is possible that the highly organic nature of the deposit inhibited the preservation of calcitic faecal spherulites. Research into stabling deposits by Milek (2012, 130-132) has also shown that whilst stabling deposits typically consist of readily identifiable herbaceous plant tissue and associated phytoliths embedded in amorphous organic matter, in deposits that have been reworked by soil fauna it is not possible to distinguish between plant tissues representing dung and those representing hay. It is possible therefore that the decomposed banded plant matter identified in contexts 1.3 and 1.2 represents the remnants of a banded stabling deposits where the finer boundaries have been blurred by post-depositional disturbance.

It is also possible that the compact plant matter represented in contexts 1.2 and 1.3 has been redeposited as a means of covering or resurfacing the floor a practice that is readily documented in anthropogenic (Milek 2012) and archaeological contexts (Courty 1992, Macphail and Goldberg 2010, Roy 2012), although the absence of a more heterogeneous occupation layer above to be compared with micromorphologically prevents any further testing of this theory.

A further possible interpretation lies with the possibility that this deposit is derived from the collapse or part collapse of a peat turf roof or wall into the structure following abandonment and has then subsequently undergone compaction and reworking by soil biota. Experimental research into collapsed turf by Macphail et al (2003) demonstrated preferential preservation of lignified material and charcoal and a predominantly porphyric related distributed both features identified within the samples from Rhue.

Strathain - RHUE 2

This sample was removed from within the platform and taken over a single context (1.2) which was hypothesised as a possible occupation horizon. When viewed microscopically this slide comprises three separate layers each of which is interpreted as part of context 1.2.

Layer 1 (Context 1.2)

Layer 1 is a very heterogeneous unsorted silt loam deposit characterised by the presence of large (gravel sized) sedimentary rock fragments and coarse sand sized minerals. The complex channel and chamber to granular microstructure and advanced decomposition of organic tissues is indicative of significant pos-depositional reworking. Anthropogenic indicators are limited to few to common cellular charcoal which increases in size and quantity towards the top of the layer. The diffuse nature of the boundary and increase in organic material towards the top of the layer are indicative that this layer represents a BC horizon or transitional zone between the lower coarse mixed material derived from the local natural through to a mixed anthropogenic deposit.

Layer 2 (Context 1.2)

Layer 2 is dominated by amorphous black material, with frequent reddish brown amorphous material which masks much of the groundmass and gives the layer a homogenous very dark brown to black appearance. It is possible that this amorphous black material is disaggregated amorphous charcoal and ash and representative of hearth debris which has subsequently been mixed with plant material and other occupation debris. However, the high degree of blackening and humification has left limited structural information with which to identify the plants originally present. Recognisable remains include elongated epidermal and vascular which are commonly most resistant to decomposition (Fitzpatrick 1993), indeed many of these tissues appear as elongate external cells or outer cases to empty or psedumorphic voids where the interior of the root or plant structure has been eaten by soil micro and mesofauna. The presence of few highly birefringent woody organ residues is indictaive of modern root action. As with the underlying layer, a complex channel and chamber microstructure attests to significant bioturbation and pedofeatures are dominated by many infilled passage features. The passage feature infillings are heterogeneous and similar in composition to the excremental fabric of the overlying layer 3.

Layer 3 (Context 1.3)

Layer 3 is an unsorted silt loam with a complex medium separated sub angular blocky microstructure with common accommodating planes and cracks and fissures. The compacted heterogeneous nature, fragmented nature of inclusions and microstructure are all consistent with a trampled deposit (See Macphail and Goldberg 2010). There are few charcoal fragments frequently fragmented and distributed throughout the matrix as well as small flecks of micro charcoal which contribute to the overall heterogeneity of the layer. The presence Fe/Mn nodules and accretions is indicative that this layer has also undergone oxidation and reduction and given the high organic matter content this is likely to have caused shrink swell forming the observed cracks and fissures.

As with the underlying layers of Context 1.2, layer 3 has also experienced significant bioturbation. This is evidenced by many channel features infilled with a yellowish brown silt excremental fabric. The presence of similar fabric pedofeatures with blurred boundaries with the groundmass is indicative of earlier passage features that have been reworked into the groundmass and there are rare patches of granular structure within more porous areas. Unlike in the layer above, where traces of epidermal structures are indicative that passage features were created by plant or root activity, the passage features in layer 3 are less defined and it is not always clear if they were created by a root or burrowing organism (see Fitzpatrick 1993).

Discussion

The three layers that comprise context 1.2 thus document the development of a very heterogeneous anthropogenic sediment which has been subject to numerous post-depositional processes from the probable trampling and compaction of the sediment during use of the structure through to the action of soil biota and plant activity and also changing hydrological regimes and acidification of the soil which have caused the formation of Fe/Mn pedofeatures.

Achtercairn 2 - GAIR 2

The Achtercairn sample was removed from across the boundaries of contexts 1.11 and 1.6 within the round house. When viewed microscopically this sample comprised three layers. Layers 1 and 2 corresponding to context 1.11 and layer 3 corresponding to Context 1.6.

Layer 1 (Context 1.11).

Layer 1 is a compact heterogeneous deposit comprising approximately 50% medium to coarse sand sized minerals. The mineral component is dominated by quartz but also comprises frequent chlorite and hornblende common biotites and few feldspars giving it a more diverse mineral range than most other samples studied as part of this project. The slightly speckled b-fabric and presence of fragmentary biogenic silica in the form of common elongate phytoliths associated with amorphous yellow to red organic matter are indicative of the presence of fine ash mixed into the martrix. Black angular flecks <50µm are distributed randomly throughout the matrix and probably represent micro charcoal. Identifiable plant tissues are rare and most coarse organic matter is fragmented and strongly decomposed (following Fitzpatrick 1993).

The massive to very weakly developed sub-angular structure reflects the compact nature of the deposit and highly fragmented nature of inclusions such as charcoal, plant tissues and rock fragments are consistent with a sediment that has been compacted and/or trampled (Milek 2012, 132; Macphail and Goldberg 2010). Amorphous fine yellow organic clay coatings/ partial infilling to voids occur in just over half of the few channel voids identified and are also consistent with a trampled deposit (see Fitzpatrick 1993). Rare woody organ residues attest to some modern root penetration. In contrast to most other sediments studied as part of this project, excremental features are rare and it is likely that the reduction in porosity caused by the compaction of the sediment would have made it more difficult for earthworms and other soil fauna to penetrate.

Layer 2 (Context 1.11)

As with the underlying layer, layer 2 is highly heterogeneous. The mineral component reflects that of the underlying layer but shows a slightly greater proportion of coarser material. As with the underlying layer, coarse organic matter is heavily decomposed and plant tissues are very few. The speckled b-fabric, common phytoliths and micro charcoal in the matrix are indicative of the presence of ash and fine charred material within the matrix. A weak band of charcoal and grey ash towards the top of the layer has a diffuse boundary with the surrounding groundmass but may represent remnants of hearth clear out or sweeping that has subsequently been mixed.

Fragmentary charcoal, rock fragments and plant tissue show similarities with the underlying layer and alongside many infilled planar and polyconcave voids are indicative of compaction by trampling (see above). In contrast to the underlying layer however, layer 2 has a complex massive to channel and chamber microstructure with very few patches of granular material increasing to few towards the top where porosity is greater. Layer 2 has thus been subject to significantly greater post-depositional disturbance than the underlying layer which probably reflects its location within the sediment profile and suggests that it was subject to greater exposure to biological, physical and chemical weathering following its deposition.

Layer 3 (Context 1.6)

Layer 3 is hypothesised as representative of abandonment (Wildgoose and Welti 2013). The boundary with the underlying layer is very diffuse and mixing between layers 2 and 3 is evidenced by the common patches of layer 2 type fabric distributed throughout the base of layer. Layer 3 is a compact poorly sorted orange/yellow clay which becomes increasingly homogenous in colour and composition towards the top of the slide. The coarse mineral fraction is significantly less than in the underlying layers and comprises less than 10% of the overall layer. Plant tissues and aggregated plant matter are rare and coarse organic matter is dominated by disaggregated plant cell material. Biogenic silica in the form of frequent equant, elongate and spiny phytoliths are frequent and evenly distributed throughout the layer. Anthropogenic aggregates are limited to very few angular part cellular charcoal and rare grey ashy material located towards the bottom of the layer.

The microstructure is complex and varies from weakly developed sub-angular blocky with common channels towards the base to channel and chamber with rare patches of granular structure. Towards the top of the layer is a cluster of channels infilled with very dark brown rounded excremental features and is indicative of mixing by soil fauna.

Discussion

The micromorphological evidence analysed in this slide is thus consistent with the hypothesised interpretation of a period of occupation followed by abandonment. Post-depositional reworking has blurred the boundaries between the contexts and limits interpretation regarding the function of the deposit. Nevertheless, Context 1.11 can be interpreted as a beaten/trampled material which represents the accumulation of general occupation debris whereas context 1.6 has been extensively reworked but is consistent with the interpretation of abandonment.

Achtercairn 3 – ACHT 3

This sample was removed from trench 5 which was excavated in March 2014 in an attempt to clarify the relationship between occupation phases within the structure. Sample ACHT 3 was removed from across the boundary of contexts 5.2 and 5.3. Context 5.3 was described as a black charcoal rich soil and 5.2 was described as a loose brown yellow crumbly soil containing small cobble stones, come charcoal pieces and numerous struck quartz flakes (Welti, 2014 *pers comm.)*. When viewed microscopically this sample is comprised of five layers separated by diffuse boundaries. Extensive biological reworking and the diffuse nature of boundaries makes it difficult to assign these layers confidently to a context but is assumed that layers 1-3 are part of context 5.3 and layer 5 is part of context 5.2

Layer 1 (Context 5.3).

Layer 1 is a porous heterogeneous deposit comprising approximately 50% medium to coarse sand sized minerals and common larger (5-10mm), metamorphic schist type, sub-rounded to sub-angular rock fragments. The mineral component comprises frequent quartz, chlorite and hornblende with common biotites and few feldspars. The b-fabric is slightly speckled; elongate and equant phytoliths are few. Black angular to sub-angular flecks 50-100µm are common and are distributed randomly throughout the matrix. Cellular charcoal is rare throughout the layer with the exception of a concentrated patch measuring c.7mm x 7mm towards the base of the slide where cellular charcoal and micro charcoal are common. In the centre of this area is a large (c.5 x 3mm) sub-angular blackened rock fragment surrounded by a partially reddened groundmass. It is possible that this rock fragment has been burned and blackened by heat which in turn has heated and reddened the surrounding sediment. Frequent sub-rounded to sub-angular internally amorphous black fragments (50-400µm) located in the groundmass surrounding the rock fragment may also be charred material.

Identifiable plant tissues are rare within this layer and restricted to irregular fibrous brown to reddish brown fragments with traces of elongate cells. Most coarse organic matter is fragmented and strongly decomposed (following Fitzpatrick 1993) and is largely represented by irregular internally amorphous patches of organic rich material.

The channel and chamber to crumb microstructure reflects the large number of organo-mineral excrements present and the extensive post-depositional bioturbation experienced by this layer is also indicated by the many excremental pedofeatures most frequently faecal pellets, (the by-product of small arthropods (Dawod and Fitzpatrick, 1992). Pedofeatures are largely excremental in origin with occasional fe/mn nodules also present. Layer 1 thus likely represents the general remains of occupation much altered and reworked by biological activity.

Layer 2 (Context 5.3).

Layer 2 has a diffuse boundary with the underlying layer and is distinguished from it by a slight change in porosity, mineral composition and microstructure. This layer is an unsorted fine sand with a complex weakly sub-angular blocky structure with few channels and chambers; occasionally crumb like in places with rugose porous excremental aggregates (although it is less porous than the underlying layer 1). The coarse mineral fraction accounts for approximately 60% of the layer and is dominantly comprised of medium to coarse sand sized minerals with fewer rock fragments than in the underlying layer. Quartz dominates the mineral fraction with frequent biotite, and hornblende with few chlorite and feldspars also present.

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The matrix is heterogeneous and speckled. It is yellow to dark brown in PPL owing to the frequency of yellow amorphous fine organic material within the matrix. There are few cellular charcoal fragments throughout the matrix. At the top of the layer is a cluster of burned material dominated by black amorphous fine material as well as internally amorphous black fragments (100-400µm). Coarse organic matter is largely comprised of irregular reddish brown stained areas. There are rare woody bright orange to red well preserved organ and tissue residues indicative of modern root penetration. Occasional impregnative dark brown pedofeatures with higher organic content are possibly heavily decomposed organic matter. Excremental pedofeatures are fewer than in the layer above reflecting a lesser degree of soil fauna activity within this layer.

The contents of layer 2 like those of layer 1, although reworked are thus indicative of general occupation debris incorporating some hearth waste as evidenced by the presence of charcoal.

Layer 3 (Context 5.3).

As with the underlying layer, layer 3 is highly heterogeneous. This layer is dark reddish to orange brown in PPL reflecting higher proportions of amorphous reddish brown organic matter in the matrix than present in the underlying layer. The mineral component reflects that of the underlying layer but displays a lesser proportion (40%) of coarse material. As with the underlying layer, coarse organic matter is heavily decomposed and plant tissues, organ residues and single cells are also very few. Although highly decomposed the coarse organic matter content of this layer is higher than in the underlying layers. The speckled b-fabric, common phytoliths and micro charcoal in the matrix are indicative of the presence of ash and fine charred material and also contribute to darker matrix colours than observed in the underlying layers.

Layer 3 has a porosity of c.15% and has a complex channel and chamber and crumb microstructure which reflects the large number of organo-mineral excrements present. This crumb structure coupled with the many excremental pedofeatures identified is indicative that layer 3 has been subject to significantly greater post-depositional disturbance than the underlying layer. Pedofeatures comprise occasional fe/mn nodules and accumulations, occasional irregular impregnative features are of probable organic origin. In the centre of the layer contained within a large channel void is a compact orange textural pedofeature measuring approximately 5,000µm. The feature is a well sorted silt with a massive microstructure with medium sand sized quartz inclusions and silt sized black punctuations (see also layer 5 below). Rare smaller patches (<1000µm) of this fabric are distributed randomly throughout the layer.

Layer 4 (Context 5.3/5.2?).

Layer 4 displays a certain degree of similarity to layer 2, having a higher coarse mineral content than the intermittent layer and containing less reddish brown amorphous fine organic material. The mineralcomposition of this layer reflects that of layer 2.

As with all of the underlying layers, layer 4 has been subject to significant post-depositional disturbance and this is reflected in the channel and chamber to crumb microstructure. Coarse organic material includes common single cells (20-50µm), few plant tissue residues and disaggregated cell clusters as well as few bright orange woody fragments of probable modern origin. Few internally amorphous reddish brown to black features are probably decomposed organic matter. There are frequent internally amorphous sub-angular to sub-rounded black fragments which along with few sub-angular charcoal fragments (100-400µm) make up the charred organic component.

The majority of pedofeatures are of an excremental nature, although traces of amorphous yellow clay coatings to mineral grains and hypocoatings to voids were also noted. Many textural pedofeatures in the form of fragments of layer 5 are present, occasionally located within the larger channel voids but often located within the general matrix. These pedofeatures frequently but not always have sharp to clear boundaries with the surrounding groundmass suggesting perhaps that they have been trampled in from the layer above rather than reworked by soil fauna. In some places the fragments have been partially reworked into the groundmass and the boundaries are more diffuse.

Layer 5 (Context 5.2).

As discussed above, fragments of layer 5 types fragment are mixed into layer 4 and also present in layer 3. In contrast to the other layers analysed in this slide, layer 5 is a compact deposit with low porosity and a massive microstructure.

Evidence for bioturbation includes few channels and chambers, rare excremental pedofeatures and traces of modern roots. Layer 5 is a poorly sorted silt deposit with a coarse mineral component dominated by sand sized quartz inclusions. Identifiable plant tissues are rare and most coarse organic matter is fragmented and strongly decomposed (following Fitzpatrick 1993) and comprises common reddish brown rounded internally amorphous features (possibly burned soil clasts) and common single cells and disaggregated groups of cells. Cellular charcoal is absent but there are common large internally amorphous black fragments (100-200µm) and frequent black punctuations <20µm.). Observed pedofeatures include many infilled passage features and occasional fe/mn nodules.

The massive microstructure, anthropogenic inclusions in the form of possible burned soil and charred material are consistent with a domestic floor deposit (see Golderg and Macphail 2010,264). Layer 5 also displays similarities to layer 1 (Context 1.11) of Achertcairn 2 which is also interpreted as compact floor deposit (see above).

Discussion

Micormophological analysis of contexts 5.2 and 5.3 has allowed for the identification of five discrete layers. All layers contain evidence for anthropogenic activity in the form of varying proportions of charred material including a possible heat blackened rock fragment in layer 1. Given their location within a roundhouse structure, these layers probably represent the gradual accumulation of occupation deposits. Layer 5 at the top of the sequence has a massive microstructure and is interpreted as a probable domestic floor surface bearing similarities to the floor surface observed in the thin section from Achtercairn 2 (see above).

Extensive biological reworking has produced a channel and chamber to crumb microstructure in all four remaining layers. The boundaries between the layers are diffuse and the mixing of the sediments by soil fauna and to a lesser extent soil flora has prevented the identification of the aimed for difference in use and activities across the sequence. The degree of biological reworking also differs throughout the layers and indeed is responsible for many of the observable characteristics and features of the sediments. Factors that determine soil fauna activity include food sources, moisture, pH, temperature and soil disturbance and in some instances are able to point to disturbance and or changing environmental conditions (see Kooistra and Pullamn, 2010). At Achtercairn 3 however the relatively high soil fauna activity across the four bottom layers prevents identification of such subtle changes. Nevertheless the observed slight differences in proportions of coarse mineral material, organic component and anthropogenic inclusions such as charred material could tentatively be used to infer changes in intensity and/or type of use within the structure over time.

Conclusion

By analysing and characterising the matrix of these deposits and comparing their results with the other excavated circular structures and with wider micromorphological and anthropological studies it has been possible to identify a range of anthropogenic and pedogenic site formation processes. At Loch Raa hut circle, limited post-depositional disturbance has allowed for identification of possible changes of use of space through the sequence. Although

subject to significant pedoturbation, analysis of samples from Achnahaird has allowed for the possible differentiation of occupation and abandonment deposits.

Samples removed from the interiors of the hut circle at Achtercairn 2 although too biologically reworked to infer use of space, displayed a composition, heterogeneity and porosity consistent with compacted/trampled occupation horizons. The sample from Achtercairn 3 has also been subject to significant mixing by soil biota which has characterised and formed many of the noted microfabric types and pedofeatures observed. It has not been possible to identify the aimed for difference in use and activities occurring within this sequence but the identification of five discrete layers hints at changes in intensity of occupation which at the very least has affected organic matter content and the degree of post-depositional reworking. The final layer in the sequence comprises the remains of a probable compact floor surface.

Although not thought to be an occupied hut circle (Wildgoose and Welti 2012), the sample from Strathain produced evidence consistent with an anthropogenic deposit including a dense layer of amorphous black material which could be representative of hearth debris. As with the two Achtercairn deposits, the sediments at Strathain are too reworked to infer specific use.

The sample removed from Rhue, whilst also reworked retained fine laminations of organic matter and a near absence of mineral material raising a number of possibilities regarding interpretation ranging from a possible stabling deposit to the remains of a turf roof or wall collapse. Whilst the results of the micromorphological analysis at Rhue are inconclusive, they highlight the importance of micromorphology as a technique for identifying micro-scale structural properties that are not visible at the macro-scale and the implications this can have for the understanding of site formation processes.

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Appendix

Loch Raa

T1 LR Layer 1 (Context 1.3?)

C/F ratio:
40:60
Thickness:
1-25mm
Particle size and sorting:
Moderately sorted. Clay 15%, silt 55%, very fine sand 10%, fine sand 15%, medium sand 5%.
Coarse mineral:
Coarse mineral fraction comprises 35% of layer (c 70% of overall coarse fraction). Rock fragments are limited to two sub-angular sedimentary examples. Minerals and aggregates are dominantly sub-angular and commonly c200µm. Dominated by fine sand sized quartz, very few feldspars including microcline.
Rare elongate phytoliths.
Coarse organic:
Common sub-rounded to sub-angular reddish brown clasts average 200µm with amorphous/organic stained interiors. Rare rounded woody organ residue (e.g. one noted at bottom right of layer, probably woody modern root fragment c600µm. In close proximity to this is an elongate yellow tissue fragment c.100µm in length but with scarce remaining cell structure. Rare clusters of reddish brown cells c10µm in aggregated groups of up to 30 cells.
Few charcoal fragments average 150µm. Charcoal distribution is uneven and charcoal is more common towards top and left of layer where charcoal occurrence is frequent.
Coarse material arrangement:
Randomly oriented. Rare clustering of sub-angular sand sized mineral grains. Poorly sorted (frequently sand sized 100-200µm).
Fine organic:
Frequent fine yellow organic amorphous material gives matrix background colour with aggregates of fine amorphous reddish brown and black material contributing to a speckled appearance.
Groundmass:
Heterogeneous. Yellowish brown PPL, reddish brown, XPL. Speckled b-fabric caused by the presence/dominance of ash in the fine material.
Pedofeatures:
Occasional Fe impregnated organic matter and anorthic and orthic Fe/Mn nodules. Rare rounded excremental features.
Microstructure:
Complex massive structure with rare channel voids. Porosity 1-2%
C/F related distribution:
Close porphyric.
Boundary:
The boundary with the overlying layer is clear (<60µm) to sharp in places.

T1 LR Layer 2 (Context 1.3?)

C/F ratio:
60:40
Thickness:
20-60mm
Particle size and sorting:
Unsorted. Clay 15%, silt 30%, very fine sand 25%, fine sand 10%, medium sand 5%, coarse sand 5%.
Coarse mineral:
Coarse mineral fraction comprises 20% of layer (c 50% of overall coarse fraction). Very few sub-angular to sub-rounded rock fragments up to 2500µm variable mineral composition but of probable igneous origin. A single

fragment dominated by microcline is located in the centre of the layer and has been broken at one end and tapers towards the other showing possible anthropogenic influence. Mineral aggregates are mainly sand sized sub-rounded to sub-angular aggregates of quartz and feldspars. Mineral components is dominated by quartz with few feldspar and rare chlorite and ?hornblende.
Few phytoliths.

Coarse organic:

Approximately 30% of the whole layer is composed of very dark brown to black sub-rounded clasts which dominate the coarse organic component. They have no visible internal structure and are black in XPL.
Few bright orange rounded organ fragments avg 400µm (probably root fragments) distributed randomly through layer. Very few part decomposed bright orange elongate tissue fragments up to 3000µm in length. Rare reddish brown tissue fragments including two large fragments in centre of layer both c. 2000-3000µm diameter.
Few charcoal fragments 200-2000µm often part denuded but with cellular structure visible.

Coarse material arrangement:

Randomly oriented and arranged. Unsorted.

Fine organic:

Frequent amorphous dark brown/ reddish brown to black material dispersed through matrix.

Groundmass:

Heterogeneous. Very dark brown to black PPL, black, XPL. Undifferentiated b-fabric.

Pedofeatures:

Many Fe impregnated organic matter and occasional anorthic and orthic Fe/Mn nodules. Rare clay coatings and hypocoatings and rare part infillings to voids-amorphous yellow clay. Many spherical, elliptical and coalesced arthropod, mite and earthworm excrements.

Microstructure:

Complex intergrain microaggregate – rugose porous aggregates not always accommodating one another almost crumb like in places. Porosity 15% but up to 30% in places.

C/F related distribution:

Single spaced fine smooth enaulic

Boundary:

Undulating clear boundary above and below.

T1 LR Layer 3 (Context 1.3/1.2?)

Note: this layer occurs as a layer proper above layer 2 and below layer 4 but also as large patches (several mm across) and smaller patches throughout layer 2.

C/F ratio:

40:60

Thickness:

10-35mm

Particle size and sorting:

Moderately sorted. Clay 15%, silt 50%, very fine sand 20%, medium sand 15%.

Coarse mineral:

Coarse mineral fraction comprises 15% of layer (c 60% of overall coarse fraction). Rock fragments are rare disaggregated or sub-rounded quartz and feldspar ?sandstone fragments. Minerals and aggregates are dominantly quartz mixed with very few feldspars including microcline, plagioclase and very few biotite and possible olivine.
No phytoliths noted
Patch of calcitic ash c150µm in centre of layer proper.

Coarse organic:

Very few charcoal fragments average size 400µm with greater frequency towards upper layer. Frequent angular black flecks throughout the matrix up to 100µm possibly charred but no cellular structure. Few reddish brown rounded material 10-100µm. Very few elongate orange tissue fragments increasing in frequency towards top of layer. Rare rounded woody organ fragments rising to few towards the top of the layer.

At left edge of upper layer is a partly fragmented black aggregate c2000x3500µm. The interior is a mixture of black and bright red material intermixed with quartz and may be burned peat/fuel fragment.

Coarse material arrangement:

Randomly arranged and oriented. Unsorted.

Fine organic:

The layer is dominated by compacted amorphous reddish brown organic matter. Common fine yellow organic amorphous material

Groundmass:

Heterogeneous. Yellowish to reddish brown PPL, black, XPL. Undifferentiated b-fabric.

Pedofeatures:

Common Fe impregnated organic matter and anorthic and orthic Fe/Mn nodules sand sized avg 100µm. Few planar voids infilled with amorphous yellow clay. In lower zone (within layer 2) pseudomorph or channel from above is part infilled with layer 2 fabric. In layer proper a single large pseudomorph part infilled with decomposing plant material. Many spherical, ellipsoid and coalesced excremental features.

Microstructure:

Complex. Massive with rare channel and chamber. Porosity 1-5%

C/F related distribution:

Open porphyric

Boundary:

Clear <60µm.

T1 LR Layer 4 (Context 1.2?)

C/F ratio:

50:50

Thickness:

1-3mm

Particle size and sorting:

Moderately sorted. Clay 15%, silt 55%, very fine sand 10%, fine sand 15%, medium sand 5%.

Coarse mineral:

Coarse mineral fraction comprises 35% of layer (c 70% of overall coarse fraction).Few rock fragments of probable sedimentary origin. Minerals and aggregates are dominantly sub-angular. Mineral component is dominated by fine sand sized quartz, with few feldspars (very few microcline and ?orthopyroxene), few biotite.

Very few phytoliths.

Very few sub-rounded patches of highly birefringent calcitic material (possibly ash).

Coarse organic:

Common orange sub-rounded aggregates avg 80µm. Few single reddish brown cells and aggregates cells groups.

Rare reddish brown patches sub-rounded and composed of disaggregated cellular material distributed in clusters.

Common to frequent (in top left hand corner) charcoal fragments 200-1000µm.

Single possible charred bone fragment 600x1000µm

Single large (4000µm) root channel with part decomposed orange plant tissue, adjacent to another long 2000µm and organ fragments.

Coarse material arrangement:

Randomly oriented. Some clustering of coarse mineral and organic material. Unsorted

Fine organic:

Frequent fine yellow organic amorphous material gives matrix background colour with aggregates of fine amorphous reddish brown and black material contributing to a speckled appearance.

Groundmass:

Heterogeneous. Yellowish brown PPL, black, XPL. Speckled b-fabric possibly indicative of calcitic ash in matrix.

Pedofeatures:

Many Fe impregnated organic matter and many anorthic and orthic Fe/Mn nodules. Occasional rounded coalesced excremental fabrics.

Microstructure:
Complex massive structure with few channel voids. Porosity 1-2%.
C/F related distribution:
Open porphyric.
Boundary:
Diffuse.

T3 LR Layer 1 (Context 3.3)

C/F ratio:
40:60
Thickness:
22-28mm
Particle size and sorting:
Moderately sorted. Clay 20%, silt 60%, very fine sand 20%.
Coarse mineral:
Coarse mineral fraction comprises 10% of layer (c 35% of overall coarse fraction). Rock fragments are notably absent with the exception of rare disaggregated metamorphic quartz and feldspar fragment. Minerals and aggregates are dominantly sub-angular and commonly c200µm.
Rare elongate phytoliths associated with organic material and more common towards base of slide.
Common quartz. Very few biotite and feldspars.
Coarse organic:
The layer is dominated by amorphous reddish brown organic matter. Common single rounded reddish brown cells 5-10µm, few in aggregated groups. Very few sub-rounded dark brown clasts (average 200x600µm). A cluster of blackened sub-rounded fragments is located at the bottom of the slide. Cellular structure is partially visible and may be disaggregated charcoal although more likely to be Fe impregnated organic matter. Frequent angular black flecks throughout the matrix up to 100µm possibly charred but no cellular structure. Common reddish brown rounded material 10-100µm. Few reddish brown elongate material (no cellular structure) 50-500µm.
Coarse material arrangement:
Random and poorly sorted (frequently sand sized 100-200µm).
Fine organic:
Frequent amorphous dark brown/ reddish brown to black material dispersed through matrix. Common fine yellow organic amorphous material
Groundmass:
Heterogeneous. Yellowish to reddish brown PPL, black, XPL. Undifferentiated b-fabric.
Pedofeatures:
Many Fe impregnated organic matter and many anorthic and orthic Fe/Mn nodules. Common pseudomorphic voids, approximately 50% of which either have coatings, hypocoatings or are part infilled with amorphous many yellow clay. Rare excremental features mainly contained within a single large channel void containing an incomplete infilling rounded excremental fabric up to 400µm.
Microstructure:
Complex channel and chamber. Porosity up to 5%
C/F related distribution:
Close porphyric but variable and locally concave gefuric around excremental features)
Boundary:
The boundary with the overlying layer is diffuse (>60µm), uneven and not discernible with the naked eye. This layer is distinguished from the overlying layer by slight differences in hue and coarse component.

T3 LR 1 Layer 2 (Context 3.2):

C/F ratio:
50:50

Thickness:
30-40mm
Particle size and sorting:
Poorly sorted. Clay 20%, silt 50%, very fine sand 25%, fine sand 5%.
Coarse mineral:
10% of overall layer (20% of coarse fraction). Dominated by sub-angular quartz (85%) with undulose extinction (quartz arenite). Frequent singular to sub angular with high order interference colours). Approximately 10% feldspars (plagioclase and microcline). Very few biotite. Patch of sub-rounded aggregates located in top centre right of layer comprised of quartz, mica and plagioclase feldspars.
Rare phytoliths.
Coarse organic:
Dominated by homogenous dark reddish brown PPL isotropic XPL material with some internal sub-rounded dark reddish brown clasts visible internally. In the top right hand of the layer is a patch of cellular black to very dark brown organic material possibly charred but more likely to be Fe impregnated. A single part disaggregated charcoal fragment c.1000µm is located at the top centre of the layer. Single large fragment c3500µm is also located at the top centre of the layer. Frequent black flecks 10-50µm throughout the matrix. Few disaggregated blackened cellular plant material up to 2000µm.
Common circular root channels with birefringent woody organ residues indicative of modern root disturbance.
Coarse material arrangement:
Randomly distributed and unsorted, rare clustering of coarse minerals and coarse organics towards tops of layer.
Fine organic:
Common amorphous yellow, Frequent amorphous reddish brown. Blackened material/punctuations give groundmass speckled appearance.
Groundmass:
Heterogeneous 10YR 5/6 yellowish brown to dark reddish brown PPL isotropic XPL. Undifferentiated to weakly speckled b-fabric
Pedofeatures:
Occasional blackened Fe/Mn nodules both anorthic and orthic (variable fromc400µ-4000µm. Occasional pseudomoprhic voids some 20% have many coatings or hypocoatings of amorphous yellow clay. C50% have no infilling. commonly with clay coatings. Rare spherical excremental
Towards top left of slide below large planar voids is a patch of fabric dominated by planar voids and fissured aligned at 40° in line with the large void. The groundmass of this material is dominated by blackened organic material (possibly compressed or subject to different hydrological regime below void). Located below an iron pan.
Microstructure:
Complex channel and chamber microstructure. Porosity locally variable but average c.15-20%
Related distribution:
Close fine enaulic.
Boundary:
Diffuse with Layer 1. See above.

ACH1 T1 Layer 1 (Context 1.3)

C/F ratio:
80:20
Thickness:
22-30mm
Particle size and sorting:
Moderately to well sorted. Clay 5%, silt 20%, very fine sand 10%, fine sand 5%, medium sand 60%.
Coarse mineral:
Coarse mineral fraction comprises 60% of layer (c 95% of overall coarse fraction). Rock fragments are notably absent. Mineral component is dominated by medium sand sized quartz, with rare chlorite and biotite.
Coarse organic:

Very few plant remains, comprising rare rounded orange organ fragments avg 400µm. Very few disaggregated tissue fragments sub-rounded to elongate 200-1000µm, bright orange in colour and part mixed into groundmass.
Single large irregular reddish brown to black fragment c.2000x2000µm closely associated with bright orange plant material located in centre of layer.

Coarse material arrangement:

Randomly oriented and arranged. Poorly sorted.

Fine organic:

Dominated by dark brown to black amorphous material with no birefringence.

Groundmass:

Heterogeneous. Yellowish brown PPL, black, XPL. Speckled b-fabric possibly indicative of calcitic ash in matrix.

Pedofeatures:

Many Fe impregnated organic matter. Rare coalesced aggregated of brown sub-rounded material of probable excremental origin.

Microstructure:

Massive. Porosity 1-2%

C/F related distribution:

Chitonic.

Boundary:

Diffuse.

ACH1 T1 Layer 2 (Context 1.2)

C/F ratio:

65:35

Thickness:

30-34mm

Particle size and sorting:

Poorly sorted. Clay 10%, silt 35%, very fine sand 10%, fine sand 5%, medium sand 40%.

Coarse mineral:

Coarse mineral fraction comprises 50% of layer (c 95% of overall coarse fraction). Rock fragments are notably absent. Mineral component is dominated by medium sand sized quartz, with rare chlorite and biotite.
Two part denuded bone fragments located just below the black lens at the top centre of the layer. The first measures 100x500µm and the second measures 250x500µm.

Coarse organic:

Few plant remains, comprising very few rounded orange organ fragments avg 400µm. Very few disaggregated tissue fragments sub-rounded to elongate.
At top left of the layer is a black lens 1-3mm thick aligned horizontally parallel with the top of the slide. It is clearly visible with the naked eye and is dominated by amorphous black material. Within the lens disaggregated cellular charcoal is common and is avg 500µm. The lens is commonly dissected by pseudomorphic voids indicating some mixing in of material from above. There are few bright orange tissue fragments in the layer as well as very few bright orange rounded organ fragments.
Patches of blackened organic material are common throughout the layer including two large patches both up 1cm diameter and associated with pseudomorphic voids.

Coarse material arrangement:

Randomly oriented and arranged. Poorly sorted.

Fine organic:

Dominated by dark brown to black amorphous material with no birefringence.

Groundmass:

Heterogeneous. Yellowish brown PPL, black, XPL. Speckled b-fabric possibly indicative of calcitic ash in matrix.

Pedofeatures:

Many Fe impregnated organic matter. Occasional Fe/Mn nodules. Occasional soil clasts. Rare channels infilled with amorphous yellow clay. Trace of brown coalesced possible excremental fabric.

Microstructure:
Massive. Porosity 1-2%
C/F related distribution:
Chitonic.
Boundary:
Diffuse with underlying layer. Clear (<60µm) above.

ACH1 T1 TR Layer 3 (Context 1.2)

C/F ratio:
40:60
Thickness:
7-17mm
Particle size and sorting:
Poorly sorted. Clay 20%, silt 50%, very fine sand 10%, medium sand 20%.
Coarse mineral:
Dominated by quartz with few feldspars (plagioclase, orthoclase, microcline). Few rock fragments probable sandstone fragments sub-rounded to sub-angular mostly medium to coarse sand sized. Minerals are clustered into patches and/or bands. No apparent preferred alignment, often close to voids but not exclusively so. Mineral material is firmly embedded within groundmass and does not appear within voids. Coarse mineral material also closely associated with charcoal clusters, suggesting a more general clustering of the coarser material.
Few phytoliths.
Rare patches of possible calcitic ash.
Coarse organic:
Common angular black flecks 10-50µm (possible fragmentary charcoal). Few cellular charcoal fragments 50-1000µm often part denuded.
Few pseudomorphic channel voids and chambers which contain fresh (orange) woody organ fragments of which there are few.
Frequent single reddish brown cells, common reddish brown elongate plant tissues quite heavily decomposed and with no cellular structure. Few rounded to sub-rounded irregular groups of round cells.
Rare elongate cellular tissue residues with some disappearance up to 4000µm.
At the top right side of the layer is a large (2000x4000µm) organ residue and groups of plant tissue with some disappearance.
Coarse material arrangement:
Coarse material is clustered and in places appears almost banded. No apparent preferred orientation or cause for clustering. Moderately sorted (mainly medium sand sized).
Fine organic:
Common amorphous yellow and reddish brown.
Groundmass:
Heterogeneous. Reddish brown at base gradually becoming yellower towards top (colour deepening towards base may be an artefact of slide preparation) PPL, black, XPL. Undifferentiated b-fabric.
Pedofeatures:
Rare rounded anorthic brown nodules (soil clasts from above?)
Microstructure:
Complex. Moderately sub-angular blocky with some large channel voids. Porosity up to 10% due to large channel voids but groundmass is very dense and compact and porosity locally <1%.
C/F related distribution:
Open porphyric
Boundary:
Clear <60µm.

ACH T2 Layer 1 (Context 2.7)

N.B frequent abrasive [powder and air bubbles in slide impairs interpretation of some areas.

C/F ratio:
70:30
Thickness:
11-25mm
Particle size and sorting:
Moderately sorted. Clay 5%, silt 20%, very fine sand 15%, medium sand 60%.
Coarse mineral:
Coarse mineral fraction comprises 60% of layer (c 95% of overall coarse fraction). Rock fragments are notably absent. Mineral component is dominated by medium sand sized quartz, with rare chlorite and biotite.
Coarse organic:
Frequent reddish brown rounded to sub rounded organic aggregates average 25µm with no internal structure ?excrement. Very few plant remains, comprising rare reddish to orange tissue residues 200-600µm. Grains are subrounded and weathered.
Coarse material arrangement:
Randomly oriented and arranged. Moderately sorted (mostly sand sized).
Fine organic:
Dominated by reddish brown to black amorphous material with no birefringence.
Groundmass:
Heterogeneous. Yellowish brown PPL, black, XPL. Undifferentiated b-fabric
Pedofeatures:
Many Fe/Mn accumulations. Many Fe/Mn nodules. Many spherical, elliptical and coalesced 10-100µm loosely packed and randomly distributed between quartz grains. Occasional amorphous yellow clay infillings of pore spaces possibly leached from nearby organics.
Microstructure:
Complex. Massive to bridged grain. Porosity 1-2%
C/F related distribution:
Gefuric.
Boundary:
Diffuse.

ACH1 T2 Layer 2 (Context 2.6)

C/F ratio:
60:40
Thickness:
35-50mm
Particle size and sorting:
Poorly sorted. Clay 10%, silt 30%, very fine sand 15%, fine sand 10%, medium sand 35%.
Coarse mineral:
Coarse mineral fraction comprises 55% of layer (c 70% of overall coarse fraction). Rock fragments are rare and of probable sedimentary origin. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with few feldspar and rare chlorite and biotite.
Coarse organic:
Few cellular charcoal fragments 200-800µm. One fresh organ residue. Plant tissues and organ residues are otherwise notably absent.
Frequent porous spherical aggregates (see also pedofeatures below) and individual ellipsoid and spherical clasts 10-200µm, coalesced in places.
Coarse material arrangement:
Randomly oriented and arranged. Poorly sorted.

Fine organic:
Dominated by dark brown to black amorphous material bridging quartz grains. Common reddish brown amorphous material. Density and quantity of fine bridging material varies through layer.
Groundmass:
Heterogeneous. Dark yellowish brown to black PPL, black, XPL. Patch of Speckled b-fabric in centre of layer possibly indicative of calcitic ash.
Pedofeatures:
Many spherical, elliptical and coalesced excrements.
Microstructure:
Complex, varying from massive to vermiform excremental fabric in places. Porosity highly variable and much of slide material missing
C/F related distribution:
Close porphyric.
Boundary:
Diffuse.

ACH1 T2 Layer 3 (Context 2.3)

C/F ratio:
70:30
Thickness:
13-21mm
Particle size and sorting:
Poorly sorted. Clay 15%, silt 25%, very fine sand 20%, medium sand 45%, coarse sand 5%.
Coarse mineral:
Coarse mineral fraction comprises 65% of layer (c 80% of overall coarse fraction). No rock fragments. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with few feldspar and rare chlorite and biotite.
Coarse organic:
Rare reddish brown to orange organ residues and plant tissues (fresh).
Common patches of coalescent irregular dark organic excrements individually c.30µm but patches up to 2000µm. In places the coalesced black/dark brown organic excremental material forms an enaulic coarse/fine distribution pattern with the quartz grains.
Coarse material arrangement:
Randomly oriented and arranged. Poorly sorted.
Fine organic:
Dominated by dark brown to black amorphous material bridging quartz grains. Common reddish brown amorphous material. Density and quantity of fine bridging material varies through layer.
Groundmass:
Heterogeneous. Yellowish brown to black PPL, black, XPL. Patch of Speckled b-fabric in centre of layer possibly indicative of calcitic ash patch.
Pedofeatures:
Many loosely packed porous spherical aggregates and organic excrements.
Trace of amorphous yellow coatings to channel voids.
Microstructure:
Massive with rare channels and patches of excremental fabric.
C/F related distribution:
Close porphyric.
Boundary:
Diffuse.

ACH2 T3 Layer 1.1 (Context 3.5)

This layer consists of two fabrics (1 and 2). Fabric 1 (below) is dominant but there are rare weakly to moderately impregnated patches of fabric 2 distributed randomly throughout the layer. A large patch of fabric 2 measuring 12mmx8mm is located in the lower left centre of the layer.

C/F ratio:
70:30
Thickness:
20-31mm
Particle size and sorting:
Poorly sorted sand. Clay 10%, silt 30%, very fine sand 20%, fine sand 20% medium sand 10%, coarse sand 10%.
Coarse mineral:
Coarse mineral fraction comprises 45-65% of layer (c 70% of overall coarse fraction). Rare coarse sand sized rock fragments of sedimentary origin. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with few to common (occasionally frequent) feldspars (microcline, plagioclase and orthoclase).
Trace phytoliths.
Coarse organic:
Few plant tissue fragments in varying stages of decomposition ranging from very light yellow to dark reddish brown. Commonly elongate up to 4000µm. Plant tissues appear to be decomposing *in situ* rather than modern fresh roots penetrating from above.
One possible burned peat fragment.
Very few blackened/carbonised cellular fragments and small flecks in matrix.
Coarse material arrangement:
Randomly oriented. Dominantly randomly arranges but occasional clustering of part broken down blackened material. Poorly sorted.
Fine organic:
Very few dark brown to black amorphous material bridging quartz grains. Few reddish brown amorphous material. Density and quantity of fine bridging material varies through layer.
Groundmass:
Heterogeneous. Brown with patches of yellowish brown to reddish brown PPL, black, XPL. Undifferentiated b-fabric.
Pedofeatures:
Occasional reddish/orange brown staining of fine material, probably fine organic matter moderately impregnated.
Rare fe/mn blackened nodules sub-rounded 10-200µm –strongly impregnated
Rare fabric passage pedofeatures – passage features resulting from soil mesofauna.
Occasional moderate to strongly impregnated fabric pedofeatures irregular reddened organic matter material mostly orthic but possibly some anorthic (impregnated organic matter from above?)
Trace yellow organic clay around plant tissue remains and voids
Microstructure:
Complex. Channel and chamber with patches of crumb granular structure in more porous areas. Also patches of weakly developed sub-angular blocky where porosity <2%.
C/F related distribution:
Close porphyric.
Boundary:
Diffuse.

Fabric 2
C/F ratio:
70:30
Thickness:
12X8mm (and in smaller patches throughout fabric 1)
Particle size and sorting:

Poorly sorted sand. Clay 10%, silt 30%, very fine sand 20%, fine sand 20% medium sand 10%, coarse sand 10%.

Coarse mineral:

Coarse mineral fraction comprises 20% of layer (c 25% of overall coarse fraction). Rare coarse sand sized rock fragments of sedimentary origin. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with few to common (occasionally frequent) feldspars (microcline, plagioclase and orthoclase).

Few phytoliths.

Coarse organic:

Common plant tissue fragments in varying stages of decomposition ranging from very light yellow to dark reddish brown. Commonly elongate up to 4000µm. Very few organ residues

Coarse material arrangement:

Randomly oriented and arranged. Poorly sorted.

Fine organic:

Frequent reddish brown to orange amorphous material. Common yellow and black amorphous.

Groundmass:

Heterogeneous. Brown to reddish brown PPL, black, XPL. Undifferentiated b-fabric.

Pedofeatures:

Occasional reddish/orange brown staining of fine material, probably fine organic matter moderately impregnated.

Microstructure:

Channel and chamber.

C/F related distribution:

Close porphyric.

Boundary:

Clear with fabric 1.

ACH2 T3 Layer 2 (Context 3.4)

C/F ratio:

60:40

Thickness:

13-25mm

Particle size and sorting:

Poorly sorted. Clay 10%, silt 45%, very fine sand 10%, fine sand 10%, medium sand 15%, coarse sand 5%.

Coarse mineral:

Coarse mineral fraction comprises 35% of layer (c 60% of overall coarse fraction). Rock fragments are rare and medium sand sized and of probable sedimentary origin. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with common feldspars.

Few phytoliths (elongate, spiky and equant)

Coarse organic:

Very few plant tissue fragments commonly elongate and up to 2000µm.

Few black possibly carbonised fragments. They are dense with no cellular structure which impedes identification commonly elongate with average length of c. 600µm. Frequent black angular flecks throughout matrix may be carbonised organic matter.

Few single brown cells c10µm and very few collections of aggregated cells (up to 30).

Two organ fragments part decomposed

One pseudomorphic void with tissue residue at edges and part infilled with microfauna excrement.

A single large area of dense blackened material measuring 14mmx1mm is located in the lower right part of the layer. It is horizontally aligned below a large channel void and appears to consist of black (?Carbonised?) organic matter with reddish brown staining around mineral grains and voids.

Coarse material arrangement:

Randomly oriented. Dominantly randomly arranged but some clustering of coarse mineral material into weak bands – possibly as a result of earthworm action. Poorly sorted.

Fine organic:

Frequent reddish brown amorphous. Common amorphous yellow clay.

Groundmass:

Heterogeneous. Dark yellowish brown to dark reddish brown PPL, black, XPL. Undifferentiated b-fabric

Pedofeatures:

Many spherical, elliptical and coalesced excrements. Rugous porous aggregates in places.

Occasional moderately impregnated fabric pedofeatures part broken down. Possibly reworked organic matter?

Rare fe/mn nodules

Microstructure:

Complex, varying from channel and chamber to excremental fabric in places. Granular crumb structure in more porous areas. Channel voids are large and up to 5mm in width.

C/F related distribution:

Porphyric.

Boundary:

Diffuse.

ACH2 T3 Layer 3 (Context 3.3)

C/F ratio:

75:25

Thickness:

25-31mm

Particle size and sorting:

Moderately sorted medium sand. Clay 10%, silt 25%, very fine sand 10%, medium sand 50% coarse sand 5%.

Coarse mineral:

Coarse mineral fraction comprises 60% of layer (c 80% of overall coarse fraction). Large rock fragments are notably absent. Rare medium sand sized and of probable sedimentary origin. Mineral component is dominated by medium sand sized sub-angular to angular quartz, with undulose extinction. Frequent feldspars (Microcline and Plagioclase).

Very few phytoliths (elongate)

Coarse organic:

Rare part decomposed orange organ fragments.

Few dark reddish brown to black heavily decomposed organic matter fragments/patches in places so decomposed that they have become moderately impregnated fabric pedofeatures with mineral embedded and mixed in (c200-400µm).

Very few elongate yellow plant tissue fragments (Small up to 200µm) embedded/arranged around sand grains.

Very few elongate large (1000-4000µm) reddish brown plant tissue fragments.

Coarse material arrangement:

Randomly oriented. Dominantly randomly arranged but some clustering of decomposing plant material which is commonly associated with granular/crumb structure i.e. has encouraged soil biota action. Unsorted.

Fine organic:

Frequent black amorphous. Few reddish brown amorphous. Few amorphous yellow/orange clay.

Groundmass:

Heterogeneous (but of more even colour than underlying layers). Yellowish brown PPL, black, XPL. Undifferentiated b-fabric

Pedofeatures:

Occasional fe/mn nodules

Many excremental features, spherical, elliptical

Occasional amorphous yellow to orange clay coatings to mineral grains and hypocoatings to voids

Microstructure:

Complex channel and chamber with granular crumb structure in more porous areas.

C/F related distribution:

Close porphyric.

Boundary:
Diffuse and undulating.

Rhue

RHUE 1 Layer 1 (Context 1.3)

C/F ratio:
40:60
Thickness:
40-45mm
Particle size and sorting:
Poorly sorted. Clay 35%, silt 40%, fine sand 10%, medium sand 10% coarse sand 5%.
Coarse mineral:
Rock fragments and mineral aggregates notably absent. Trace coarse sand sized angular quartz undulose extinction. Coarse mineral is <2% of layer
Common phytoliths (elongate equant and rounded).
Coarse organic:
Frequent to dominant elongate horizontally aligned wavy light yellowish plant tissue. Cellular structure frequent but rarely intact and associated cells distributed through matrix adjacent to fragments.
Common single reddish brown cells (30µm) and rounded clusters of up to 100 cells (3000µm).
Frequent disaggregated single elongate cells and groups of cells.
Common reddish brown elongate part disaggregated fibrous plant tissue fragments, commonly associated with phytoliths and single plant cells.
Few reddish brown woody organ residues very few of which have high birefringence (probably modern roots).
Few brown compressed wavy woody material –?possibly bark? 200-1000µm.
Common charred plant material, commonly elongate, frequently cellular and up to 4000µm (avg c.200-600µm).
Rare denuded charred bark
Frequent angular black flecks with amorphous interior 2-50µm located close to larger charred organics- probably micro charcoal.
Coarse material arrangement:
Elongate plant tissues and charred organics are frequently oriented parallel to the top of the slide giving a lenticular structure to the layer. Distribution of elongated plant tissues and charred organic matter is weakly to moderately banded and appears to be aligned roughly along same lines as polyconcave voids – compression/trampling?
Towards the base of the layer the plant material appears to be interleaved with darker more heterogeneous groundmass with slightly less elongate yellow plant tissue.
Dominantly unsorted although coarse charcoal seems to be sorted into fragments often c.200-600µm in size.
There is a band of frequent fragmented denuded charcoal towards the top of layer.
Fine organic:
Dominant to very dominant yellow amorphous clay.
Very few black amorphous.
Very few reddish brown amorphous.
Groundmass:
Heterogeneous. Light yellowish brown to orange brown PPL, black, XPL. (layer is more reddish to orange in colour towards base, where higher occurrence of amorphous black material). Undifferentiated b-fabric
Pedofeatures:
Many infillings/part infillings of planar and polyconcave voids with amorphous yellow organic clay
Rare textural excremental pedofeatures.
Very few pseudomorphic voids with part disappeared plant tissue material
Microstructure:
Complex weakly developed sub angular blocky microstructure with few lenticular or platy bands. Few polyconcave voids.
C/F related distribution:
Porphyric.

Boundary:
Diffuse.

RHUE 1 Layer 2 (Context 1.2)

C/F ratio:
50:50
Thickness:
22-25mm
Particle size and sorting:
Poorly sorted. Clay 25%, silt 50%, fine sand 10%, medium sand 10% coarse sand 5%.
Coarse mineral:
Rock fragments and mineral aggregated notably absent. Trace coarse sand sized angular quartz undulose extinction. Coarse mineral is <3% of layer
Single sub-angular blue fragment 100µm near base of slide-possibly vivianite formed from decomposition of bone in reducing conditions?
Common phytoliths (elongate, equant, spiky and rounded) rarely articulated.
Coarse organic:
Common elongate yellow plant tissue 2000-6000µm, frequently disaggregated and with associated cells mixed into groundmass.
Common reddish brown fibrous, frequently associated with reddish brown disaggregated cells and close to reddish brown amorphous material.
Common single reddish brown cells c30µm.
Common single elongate reddish brown cells c50µm
Few organ residues, very few of which are highly birefringent woody fragments – probably modern roots.
Rare elongate tissue fragments dissecting groundmass – post depositional floralturbation.
Frequent blackened organic matter.
At the top of the layer is a band of yellow to reddish brown elongate fibrous plant tissue aligned parallel with the top of the slide.
Rare cellular charcoal <1000µm, few black fragments angular with amorphous interior possibly charred.
Coarse material arrangement:
Elongate plant tissues and charred organics are frequently oriented parallel to the top of the slide but less so than in previous layer. Coarse material dominantly randomly oriented and randomly distributed
Fine organic:
Dominant yellow amorphous clay.
Common black amorphous.
Frequent reddish brown amorphous.
Groundmass:
Heterogeneous. Orange to reddish brown PPL, black, XPL. Undifferentiated b-fabric
Pedofeatures:
Many fe/mn blackened aggregates
Occasional fe/mn nodules
Common pseudomorphic voids with part disappeared plant tissue material – woody edges remain, plant material eaten by micro fauna as demonstrated by occasional excremental fabric within roots.
Occasional excremental textural pedofeatures rising to many towards top of the slide where microstructure granular and sediment more porous.
Rare coatings to voids and rare partial infillings with yellow amorphous clay, rising to occasional towards the top of the layer.
Microstructure:
Complex weakly developed sub angular blocky microstructure with few channels. Rare to common patches of granular structure, more common towards top of layer where porosity greater.
C/F related distribution:

Porphyric.
Boundary:
Diffuse.

Strathain 1

RHUE 2 Layer 1 (Context 1.3/1.2?)

C/F ratio:
40:60
Thickness:
10-31mm
Particle size and sorting:
Unsorted. Clay 20%, silt 40%, very fine sand 15%, medium sand 20% coarse sand 5%.
Coarse mineral:
Coarse mineral fraction comprises 35% of layer (c 80% of overall coarse fraction). Approximately 25% of the layer is comprised of four large micaceous sandstone fragments, average 10mmx10mm. Dominant grains in the smaller rock fragments are quartz with very few iron oxide staining around grains. Smaller rock fragments can be classed as quartz arenites.
Mineral component is dominated by sub-angular to angular quartz, with undulose extinction. Frequent platy muscovite (in matrix as well as in rock fragments). Muscovite randomly oriented in matrix but commonly oriented at 25° within larger rock fragments.
Common phytoliths (elongate with very few spiny).
Coarse organic:
Frequent light yellow part disaggregated plant tissues 10-200µm commonly associated with phytoliths.
Rare yellow very decomposed organ residues.
Common sub-angular to angular black fragments. Internal cracks and fissures but otherwise no structure, possibly charred?
Common cellular charcoal typically 100-600µm but occasionally up to 2000µm. Common small black flecks <10µm throughout matrix gives layer a speckled appearance. The quantity of charred material increases towards the top of the layer which has a darker colour and more frequent organic matter.
Coarse material arrangement:
Randomly oriented. Occasional clustering of decomposing plant material the top of the layer, plant tissues and phytoliths closely associated.
Unsorted.
Fine organic:
Frequent yellow amorphous Common black amorphous. Rare reddish brown amorphous.
Groundmass:
Heterogeneous. Yellowish brown to very dark brown PPL, black, XPL. Undifferentiated b-fabric
Pedofeatures:
Common small (20µm) blackened orthic nodules ?fe/mn nodules
Occasional rounded and rugous fabrics – probably excremental in origin.
Occasional staining and part infilling of voids with amorphous yellow clay
Microstructure:
Complex channel and chamber with occasional patches of granular structure (commonly granular towards the top of the layer).
C/F related distribution:
Porphyric.
Boundary:
Diffuse.

RHUE 2 Layer 2 (Context 1.2)

C/F ratio:
40:60
Thickness:
15-40mm
Particle size and sorting:
Unsorted. Clay 20%, silt 40%, very fine sand 10%, fine sand 10% medium sand 10% coarse sand 10%.
Coarse mineral:
Coarse mineral fraction comprises 35% of layer (c 70% of overall coarse fraction).
Very few micaceous sandstone and fine grained sandstone rock fragments. Generally much smaller than in the underlying layer averaging 250-1500µm. Excepting one large fragment dissected by the left hand edge of the slide and measuring 12x8mm.
Mineral component is dominated by sub-angular to angular quartz, with undulose extinction. Common platy muscovite. Few biotite, rare chlorite, rare feldspars.
Very few phytoliths (note this may be an artefact of visibility as dense black amorphous fine material masks most of layer; in areas where black material less dominant phytoliths are commonly visible).
Coarse organic:
Few bright orange to yellow part decomposed tissue fragments (no birefringence), Commonly elongate 500-2000µm.
Very few woody orange organ residues (highly birefringent)
Very few dark reddish brown to very dark brown/black tissue fragments merging with groundmass.
Rare patches of mashed up bright red and yellow plant tissues and organ residues associated with excremental fabrics (part digested by soil mesofauna?).
Few cellular charcoal, part embedded within black amorphous material with commonly diffuse edges.
Coarse material arrangement:
Randomly oriented and arranged.
Unsorted.
Fine organic:
Very dominant black amorphous mixed with mineral material (may be fine charred material but absence of structure and density makes identification difficult).
Common yellow amorphous.
Few reddish brown amorphous.
Groundmass:
Frequently homogenous (amorphous black) Few passage features infilled with yellowish brown fabric give overall more heterogeneous appearance. Very dark reddish brown to black PPL, black, XPL. Undifferentiated b-fabric
Pedofeatures:
Many infilled passage features, dominantly infilled with yellowish brown excremental fabric similar to layer 3 fabric.
Occasional amorphous yellow organic clay infillings/part infillings to passage features.
Occasional spherical features outwith passage features indicating mixing by soil microfauna as well as mesofauna.
Any fe/mn features masked by black amorphous material.
Microstructure:
Complex channel and chamber with channels and chambers accounting for 30% of layer
C/F related distribution:
Porphyric.
Boundary:
Diffuse.

RHUE 2 Layer 3 (Context 1.2)

C/F ratio:
35:65
Thickness:

12-26mm

Particle size and sorting:

Poorly sorted silt. Clay 20%, silt 50%, very fine sand 5%, fine sand 5% medium sand 15% coarse sand 5%.

Coarse mineral:

Coarse mineral fraction comprises 5% of layer (c 15% of overall coarse fraction).

Very few quartz sandstone concentrated towards base of layer. Additional rare coarse sand sized sandstone randomly distributed throughout matrix.

Mineral component is dominated by sub-angular to angular quartz, with undulose extinction. Very few platy muscovite.

Common phytoliths rising to frequent close to plant tissue remains.

Coarse organic:

Dominant fragmented reddish brown, yellow and black organic fragments average 25µm.

Frequent patches of reddish brown to yellow decomposing organic matter, cellular structure within is common but frequently disaggregated and part disappeared.

Common single reddish brown cells (c.25µm) and common aggregates of these cells in groups of up to 50.

Common patches of angular very dark reddish brown to black dense amorphous material up to 3000µm cracked and often have embedded charcoal fragments within. These fragments are similar to the overall fabric of layer 2 but without embedded quartz minerals.

Few cellular charcoal frequently disaggregated at edges.

Frequent small black flecks in matrix are possibly micro charcoal.

Few red to orange organ residues (20-1000µm) often with high birefringence (modern root fragments/bracken rhizomes) rising to common towards the top of the layer.

Coarse material arrangement:

Randomly oriented and arranged.

Unsorted.

Fine organic:

Dominant yellow amorphous

Frequent black amorphous

Few reddish brown amorphous

Groundmass:

Heterogeneous. Light yellowish brown to very dark brown PPL, black, XPL. Undifferentiated b-fabric

Pedofeatures:

Many excremental. Located at the boundary between layers 2 and 3 are c.30 rounded to sub-rounded mesofauna channels 200-1000µm.

Occasional infillings/part infillings of voids by amorphous yellow clay

Many fe/mn patches and concentrations around cracking shrinkage voids

Many black nodules fe/mn staining?

Many channels infilled with yellowish brown silt-backfilled by microfauna.

Many fe/mn impregnative pedofeatures.

Microstructure:

Complex medium separated sub-angular blocky with channel and chamber with common accommodating planes and intrapedal channels Common, cracks and fissures possibly shrinkage cracks due to drying? Rare patches of crumb to medium separated granular structure. Six large channel voids occupy c.25% of layer

C/F related distribution:

Porphyric.

Boundary:

Diffuse.

GAIR 2 Layer 1 (Context 1.11)

C/F ratio:

65:35

Thickness:
1-21mm
Particle size and sorting:
Unsorted. Clay 20%, silt 30%, very fine sand 10%, fine sand 10% medium sand 20% coarse sand 10%.
Coarse mineral:
Coarse mineral fraction comprises 50% of layer (c 65% of overall coarse fraction).
A single angular large (6x9mm) quartz arenite fragment is located at the base of the layer. Few other coarse sand sized rock fragments of sedimentary origin often partly disaggregated and starting to mix with groundmass.
Mineral component is dominated by sub-angular to sub-rounded quartz, with undulose extinction. Frequent chlorite, common biotite, few feldspars (microcline and plagioclase)
Common elongate phytoliths.
Coarse organic:
Few sub-rounded very dark reddish brown to black internally amorphous blackened organic matter large fragments (500-3000µm) commonly associated with smaller fragments mixed into groundmass.
Few oval brown part cellular plant structures with disappeared interior – probably cross-sections of woody roots (200-400µm).
Rare fibrous yellow elongate tissue fragments
Trace yellowish rounded organ residues
Rare orangey yellow organic accumulations internally amorphous but clear boundary with groundmass, heavily decomposed plant tissue.
Few large charcoal (1000-4000µm) cellular but frequently denuded and fragmented and not identifiable to species level. Few black angular flecks (<50µm) internally amorphous but probably charred.
Coarse material arrangement:
Randomly oriented and arranged.
Unsorted.
Fine organic:
Common yellow amorphous
Few black amorphous
Common reddish brown amorphous
Groundmass:
Heterogeneous. Dark greyish brown to reddish yellow brown PPL, black, XPL. Speckled b-fabric
Pedofeatures:
Many channel voids infilled or part infilled with amorphous yellow clay.
Occasional fe/mn nodules (50-100µm).
Rare patches fe/mn accumulations.
Very few pseudomorphic voids with traces of external epidermal structure and ‘disappeared’ insides.
Microstructure:
Complex massive to very weakly developed sub angular blocky microstructure with few channel voids.
C/F related distribution:
Close porphyric.
Boundary:
Diffuse.

GAIR 2 Layer 2 (Context 1.11)

C/F ratio:
60:40 – 70:30
Thickness:
15-35mm
Particle size and sorting:
Unsorted. Clay 15%, silt 30%, very fine sand 10%, fine sand 15% medium sand 20% coarse sand 10%.
Coarse mineral:

Coarse mineral fraction comprises 60% of layer (c 70% of overall coarse fraction).
Few other coarse sand sized rock fragments of sedimentary origin.
Mineral component is dominated by sub-angular to sub-rounded quartz, with undulose extinction. Common chlorite, frequent biotite, few feldspars (microcline and plagioclase), few muscovite.
Common (occasionally frequent) elongate, equant, spiny and rounded phytoliths.

Coarse organic:

Common reddish brown rounded cell aggregates >100 rounded cells average 100-600µm Frequent in top left corner of layer. Cell aggregates commonly dissected by channel voids indicating subject to post-depositional disturbance also commonly part 'disappeared' (eaten) in centre.
Very few elongate yellow to orange well decomposed tissue fragments (50-500µm).
Very few patches of reddish orange plant material part mixed with groundmass.
Rare reddish brown fibrous tissue, elongate but with no internal cellular structure. Frequently associated with other organic matter.
Plant material is black XPL (no birefringence indicating relatively well decomposed).
Common blackened organic matter
Few angular black fragments (50-600µm) no internal structure but angular fragmented nature indicative of charred material.

Coarse material arrangement:

Randomly oriented. Frequently randomly arranged but some clustering of charred material and organics especially towards the top of the layer. A weak band of charcoal rich ashy material is located at the top of the layer. It has a diffuse boundary with the surrounding groundmass and is distinguishable by higher ash and charcoal content alone.
Unsorted.

Fine organic:

Frequent yellow amorphous
Very few black amorphous
Few reddish brown amorphous

Groundmass:

Heterogeneous. Yellow to greyish brown PPL, black, XPL. Speckled b-fabric

Pedofeatures:

Very few pseudomorphic voids with epidermal structure part intact, elongate and rounded cross-sections of root material.
Occasional infilled channel voids cutting through groundmass and organic matter (post-depositional), often infilled with excremental material.
Many excremental features (mainly textural granular type with diffuse boundary with groundmass)
Many planar voids part infilled or coated with amorphous yellow organic clay.
Occasional to many fe/mn nodules
Occasional fe/mn impregnated features/accumulations.

Microstructure:

Complex massive with few channels and chambers very few patches of granular structure (within channels).

C/F related distribution:

Close porphyric.

Boundary:

Diffuse.

GAIR 2 Layer 3 (Context 1.6)

C/F ratio:

30:70

Thickness:

28-32mm

Particle size and sorting:

Poorly sorted. Clay 50%, silt 30%, fine sand 10% medium sand 5% coarse sand %%.

Coarse mineral:

Coarse mineral fraction comprises 10% of layer (c 30% of overall coarse fraction (excluding phytoliths)).

Very coarse sand sized rock fragments of sedimentary origin.

Mineral component is dominated by sub-angular to sub-rounded quartz, with undulose extinction. Common feldspars, few biotite, very few chlorite, very few muscovite.

Frequent (occasionally dominant) elongate, equant, spiny and rounded phytoliths. (very few are articulated)

Coarse organic:

Common single reddish brown rounded cells average 30µm

Common single reddish brown elongate cells average 15 x 50µm

Rare rounded reddish brown aggregates of cells up to 500µm

Rare elongate yellow and reddish brown tissue fragments 1 up to 2000µm

Rare birefringent (modern root) organ residues

Common sub rounded blackened organic matter – amorphous interior avg 30-500µm.

Very few angular part cellular charcoal fragments 20-600µm.

Coarse material arrangement:

Randomly oriented.

Few clusters/weak bands of coarse mineral material.

Clusters of coarse mineral material within patches of layer 2 type fabric.

Single plant cells and phytoliths (silt sized coarse fragments) have a very even distribution throughout the layer.

Fine organic:

Dominant yellow amorphous

Very few black amorphous

Very few reddish brown amorphous

Groundmass:

Dominantly homogenous Orangish yellow PPL, black, XPL. Undifferentiated b-fabric (exception is patches of layer 2 type fabric which are heterogeneous and have speckled b-Fabric)

Pedofeatures:

Rare pseudomorphic voids with epidermal structure part intact, rounded cross-sections of root material.

Occasional to many infilled channel voids infilled with amorphous yellow organic clay

Rare excremental features (mainly textural granular type with diffuse boundary with groundmass especially in top left of layers above planar void)

Rare channel voids with dusty silt coatings.

Occasional fe/mn nodules

Rare fe/mn impregnated features/accumulations.

Very few textural patches of layer 2 type material, diffuse (occasionally clear) boundary with groundmass

Microstructure:

Complex weakly to moderately developed sub angular blocky. Common channels and chambers dissecting groundmass. Rare patches of granular

C/F related distribution:

Open porphyric.

Boundary:

Diffuse.

ACHT 3 Layer 1 (Context 5.3)

C/F ratio:

70:30

Thickness:

9-20mm

Particle size and sorting:

Unsorted. Clay 10%, silt 25%, very fine sand 15%, fine sand 20% medium sand 5% coarse sand 20%.

Coarse mineral:
Coarse mineral fraction comprises 50% of layer (c 65-70% of overall coarse fraction).
Common metamorphic schist sub-rounded to sub-angular rock fragments 500µm – 1cm. Mineral aggregates and some of the smaller rock fragments are part disaggregated mixing into general groundmass – as sand sized particles.
A single angular fine grey fragment (200x600µm) probable flint – possible artificially struck?
Frequent quartz, hornblende and chlorite; common biotitie, few muscovite; few feldspars (plagioclase and orthoclase.
Few elongate and equant phytoliths.
Coarse organic:
Common very dark brown to black irregular to rounded nodules/clasts average c 200µm – blackened organic matter?
Very few reddish brown stained amorphous smooth patches c400µm formed around circular pseudomorphic? voids – probable of plant origin.
Few irregular fibrous brown to reddish brown fragments of probable plant matter with a clear boundary with groundmass. No discernible interior cell structure. Average c.4000µm
Common angular to sub-angular black flecks and oblong inclusions frequently 50-100µm but few up to 5000µm. They are internally amorphous but with dark reddish brown edges suggesting organic origin.
Common irregular patches of internally amorphous reddish brown organic material.
Rare reddish brown elongate plant tissue fragments and organ residues with epidermal and internal cell structure partially intact
With the exception of the clustered charred material described below, cellular charcoal is rare. Small black flecks and punctuations <10µm distributed throughout matrix may be micro-charcoal.
Left hand side of slide (6mm form the base) an area c 7mmx7mm has a greater proportion of charred material than the rest of the layer, The groundmass is the same as layer 1 and this area is distinguished by a higher concentration of cellular and amorphous charred black material. Cellular charcoal is common and frequently measures 600-1400µm. Frequent sub-rounded to angular black features (50-400µm) In the centre of this areas is a sub-angular rock fragment (5 x 3mm), mineral appears metamorphic in origin approximately half of the fragment is dense black material – heat blackened stone? The groundmass surrounding the fragment is of a redder colour than elsewhere in the layer and possibly heat reddened. Phytoliths are common in this area (few throughout layer).
Coarse material arrangement:
Randomly oriented and arranged. Clustering of charred materials at left hand side of slide (see above)
Unsorted.
Fine organic:
Common yellow amorphous
Few black amorphous
Common reddish brown amorphous
Groundmass:
Heterogeneous. Yellow or orange brown PPL, black, XPL. Speckled b-fabric
Pedofeatures:
Many rounded porous rugose aggregates of probable excremental origin. Rare rounded dark brown fecal pellets in channel voids.
Occasional fe/mn nodules (50-100µm)
Occasional dark brown (PPL) reddish brown (XPL) impregnative fabric clear to sharp boundary with groundmass and irregular outline. Most common at the base of the unit
Very few possible pseudomorphic voids with traces of external reddish brown structure.
Rare patches fe/mn accumulations.
Microstructure:
Complex. Vughy to crumb in places with many channels and chambers.
C/F related distribution:
Close porphyric.
Boundary:

Diffuse.

ACHT 3 Layer 2 (Context 5.3)

C/F ratio:
65:35
Thickness:
5-14mm
Particle size and sorting:
Unsorted. Clay 10%, silt 30%, fine sand 45% medium sand 10% coarse sand and gravel 5%.
Coarse mineral:
Coarse mineral fraction comprises 50% of layer (c 70-75% of overall coarse fraction).
Few metamorphic schist sub-rounded to sub-angular rock fragments 500µm – 5000µm.
Common medium sand sized angular mineral grains – dominantly quartz.
Dominant quartz. Frequent quartz, hornblende and chlorite. Common biotitie, few muscovite. Few feldspars (plagioclase and orthoclase.
Few to common (in places) elongate phytoliths.
Coarse organic:
Few dark red rounded patches of probable decomposed organic matter.
Few very dark brown to black irregular blackened organic matter patches.
Rare red birefringent organ fragments and cross sections of probable modern root material and bracken rhizomes.
Few cellular charcoal clustered at the centre top of the layer.
Few internally amorphous (probable charred) black fragments c.100-400µm average.
Few angular black flecks c.10-50µm scattered randomly through the matrix possibly micro charcoal.
Coarse material arrangement:
Randomly oriented and arranged. Clustering of charred materials at the centre top of the layer (see above)
Unsorted.
Fine organic:
Frequent yellow amorphous
Few black amorphous
Few reddish brown amorphous
Groundmass:
Heterogeneous. Yellow brown PPL, dark greyish brown, XPL. Undifferentiated b-fabric
Pedofeatures:
Occasional patches of moderately impregnated brown fabric with higher organic matter content than surrounding groundmass
Occasional rounded black internally amorphous nodules average 50-100µm fe/mn nodules.
Rare textural – brown patches, irregular welded aggregates – may be related to soil micro fauna.
Rare fine brown silt coatings to mineral aggregates.
Rare round/elliptical brown nodules in or near passage features 10-50µm
Rare pseudomorphic voids.
Microstructure:
Complex. Massive with many channels and chambers.
C/F related distribution:
Close porphyric.
Boundary:
Diffuse.

ACHT 3 Layer 3 (Context 5.3)

C/F ratio:
60:40
Thickness:

23-26mm

Particle size and sorting:

Unsorted. Clay 15%, silt 35%, fine sand 30%, medium sand 15% coarse sand and gravel 5%.

Coarse mineral:

Coarse mineral fraction comprises 40% of layer (c 60% of overall coarse fraction).

Few metamorphic schist sub-rounded to sub-angular rock coarse sand to gravel sized rock fragments. Mineral aggregates and some of the smaller rock fragments are part disaggregated mixing into general groundmass – as sand sized particles.

Large (1000x5000µm) angular flint fragment – possibly worked?

Frequent quartz, hornblende and chlorite. Common biotitie, few muscovite. Few feldspars (plagioclase and orthoclase.

Common elongate phytoliths.

Coarse organic:

Common black organic punctuations

Very few plant tissue fragments and organ residues within pseudomorphic voids.

Very few orange elongated tissue fragments and organ residues.

Rare round reddish brown clusters of c.30 cells c 400µm diameter.

Very few large angular charcoal fragments 200-2000µm.

At the boundary between layers 3 and 4 is a large (4,500 x 2,000µm) angular piece if cellular charcoal.

At the base of the layer is a patch of charred material 15 x 8 mm mixed in with the groundmass but dominantly (c.70%) black amorphous material. A single outlying cellular charcoal piece is associated with the amorphous black material.

Coarse material arrangement:

Randomly oriented and arranged. Clustering of charred materials at base of layer (see above)

Unsorted.

Fine organic:

Frequent yellow amorphous

Common black amorphous

Frequent reddish brown amorphous

Groundmass:

Heterogeneous. Dark reddish brown to orange brown PPL, black, XPL. Undifferentiated b-fabric

Pedofeatures:

Occasional pseudomorphic voids.

Occasional rounded black nodules – possible fe/mn features/blackened organic matter.

Many rounded aggregates make up groundmass – excremental fabric in places.

Occasional round faecal pellets within channel voids.

Occasional reddish brown irregular impregnative features possible very decomposed organic matter.

In the centre of the layer, an area c5000µm is comprised of dense orange groundmass – c,.70% silt with medium sand sized quartz inclusions and black punctuations. Diffuse to clear boundary with surrounding groundmass. It is possible that this textural pedofeature is a fragment of floor surface or building material mixed in from above. Rare smaller textural patches of this material up to 1000µm are distributed rarely and randomly through the layer.

Microstructure:

Complex. Channels and chamber with vughs to crumb like, granular in places where excremental fabric dominates.

C/F related distribution:

Close porphyric

Boundary:

Diffuse.

ACHT 3 Layer 4 (Context 5.3/5.2)

C/F ratio:

70:30

Thickness:
11-16mm
Particle size and sorting:
Unsorted. Clay 15%, silt 35%, fine sand 20%, medium sand 10% coarse sand and gravel 10%.
Coarse mineral:
Coarse mineral fraction comprises 50% of layer (c 70% of overall coarse fraction).
Few metamorphic schist sub-angular rock fragments; four large fragments measure 5-10mm but mostly have average measurement of 500-1000µm.
Frequent very fine to fine sand sized quartz. Common biotite, feldspar, chlorite. Few chlorite and muscovite.
Common elongate and equant phytoliths (rarely articulated).
Coarse organic:
Frequent internally amorphous sub-angular to sub-rounded black organic fragments and punctuations (20-100µm).
Common single cell residues (10-50µm).
Few plant tissue residues and disaggregated cells.
Few bright orange woody and fibrous tissue fragments and organ residues – birefringent possibly modern roots?
Few dark reddish brown rounded features with internal cells within an otherwise amorphous interior. Also, few reddish brown rounded areas with amorphous interior.
Few sub-angular cellular charcoal 100-400µm.
Very few bright red irregular fabrics with smooth amorphous interior containing few traces of elongate cells and frequent phytoliths- heavily decomposed plant tissue?
Coarse material arrangement:
Randomly oriented and arranged. Unsorted.
Fine organic:
Frequent yellow amorphous
Few black amorphous
Common reddish brown amorphous
Groundmass:
Heterogeneous. Yellowish brown to dark brown PPL, black, to very dark reddish brown XPL. Speckled b-fabric.
Pedofeatures:
Trace pseudomorphic voids.
Occasional rounded black nodules – possible fe/mn features/blackened organic matter.
Many rounded aggregates make groundmass – excremental in places.
Occasional reddish brown irregular impregnative features possible very decomposed organic matter.
Occasional patches of dense yellow fabric (layer 5 type) within channel voids and vughs. Groundmass significantly different from surrounding exhibiting massive microstructure, lower organic matter content and frequent sand sized quartz material similar to layer 5 and that observed in void space in layer 3.
Microstructure:
Complex. Frequent channels and chamber to crumb like, granular in places where excremental fabric dominates.
C/F related distribution:
Close porphyric
Boundary:
Variable – dominantly diffuse but occasional sharp boundary with layer 5 fabric in areas where faunalturbation lese extensive.

ACHT 3 Layer 5 (Context 5.2)

C/F ratio:
60:40
Thickness:
1-6mm
Particle size and sorting:
Poorly sorted silt. Clay 15%, silt 45%, fine sand 20%, medium sand 15% coarse sand and gravel 5%.

Coarse mineral:
Coarse mineral fraction comprises 50% of layer (c 80% of overall coarse fraction).
Very few sub-angular rock fragments up to 1000µm metamorphic in origin.
Dominant medium and fine sand sized quartz quartz. Few hornblende, biottie and chlorite.
Common elongate phytoliths.
Coarse organic:
Frequent black organic fragments and punctuations (<20µm)
Common sub-angular black fragments (100-200µm) internally amorphous
Common rounded internally amorphous reddish brown organic matter (100-300µm)
Common single cells and disaggregated cell material.
Coarse material arrangement:
Randomly oriented and arranged.
Poorly sorted (Frequent fine to medium sand sized quartz inclusions)
Fine organic:
Dominant yellow amorphous
Common black amorphous
Frequent reddish brown amorphous
Groundmass:
Homogenous. Reddish brown PPL, black, XPL. Speckled b-fabric
Pedofeatures:
Occasional rounded black nodules – possible fe/mn features/blackened organic matter.
Many passage features resulting from bioturbation by soil fauna. These appear as channels infilled with yellow excremental fabric (porous rugose aggregates)
Microstructure:
Massive with few channels and chambers.
C/F related distribution:
Close porphyric
Boundary:
Clear to sharp with layer 4 excepting some areas where excremental features apparent and boundary is diffuse.









AOC Archaeology Group, **Edgefield Industrial Estate, Edgefield Road, Loanhead EH20 9SY**

tel: **0131 440 3593** | fax: **0131 440 3422** | e-mail: **edinburgh@aocarchaeology.com**

21617

SF No.	Site	Context	trench	sample	Material	Condition	Colour
4.4.1	Auchtercairn 3	0	4	0	qz	0	white
4.4.2	Auchtercairn 3	0	4	0	qz	0	white
4.4.3	Auchtercairn 3	0	4	0	qz	0	white
4.4.4	Auchtercairn 3	0	4	0	qz	0	white
4.4.5	Auchtercairn 3	0	4	0	qz	0	white
4.4.6	Auchtercairn 3	0	4	0	qz	0	white
4.4.7	Auchtercairn 3	0	4	0	qz	0	white
4.4.8	Auchtercairn 3	0	4	0	qz	0	white
4.4.9	Auchtercairn 3	0	4	0	qz	0	white
4.4.10	Auchtercairn 3	0	4	0	qz	0	white
4.1.1	Auchtercairn 3	0	4	0	qz	0	white
4.1.2	Auchtercairn 3	0	4	0	qz	0	white
4.1.3	Auchtercairn 3	0	4	0	qz	0	white
4.1.4	Auchtercairn 3	0	4	0	qz	0	white
4.1.5	Auchtercairn 3	0	4	0	qz	0	white
4.1.6	Auchtercairn 3	0	4	0	qz	0	white
4.1.7	Auchtercairn 3	0	4	0	qz	0	white
4.1.8	Auchtercairn 3	0	4	0	qz	0	white
4.1.9	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.10	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.11	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.12	Auchtercairn 3	0	4	0	qz	0	white
19	Loch R	2.4	2	0	qz	0	grey trans

Type: Gene	Type: Speci	cortication	L (mm)	W	T	
shatter	shatter	na	0	0	0	
flake	flake	na	18.5	13.5	3.5	
flake	flake	na	22.6	13.7	4	
flake	flake	na	23	15.5	5.8	
flake	flake	na	24.3	15.6	2.5	
flake	flake	na	21.2	16.5	8.2	
flake	flake	na	26	19	8	
flake	flake	na	16	13.2	5.5	
flake	flake	na	21	19.6	8.4	
core	platform	na	18	16.5	14.2	
shatter	shatter	na	0	0	0	
tool	borer	na	30.5	19.4	9	
core	bipolar spall	na	34.3	12.8	7.7	
core	bipolar spall	na	22.2	11.2	6.3	
core	bipolar spall	na	20.5	12.2	5.8	
core	bipolar spall	na	27.5	12.2	8	
flake	flake	na	38.2	27.8	15	
flake	bipolar	na	23.2	22.4	8.4	
flake	flake	na	20.6	16.4	6	
flake	flake	na	10	12.2	2	
core	amorphous	na	25.5	20.8	23	
core	fragment	na	28	25	14.7	
flake	flake	na	20.6	21	8.2	

Notes	No.
Blocky shatter of poor quality	9
	1
	1
	1
	1
	1
	1
	1
	1
crushed distal end, worked 100%	1
Blocky shatter of poor quality	42
borer made on flake with distal dorsal face roughly re	1
	1
	1
	1
	1
flake crushed platform	1
	1
	1
	1
	1
	1
	1

WEDIG PROJECT 2012

Loch Raa Hut Circle, Achiltibuie and Auchtercairn 3 Hut Circle Gairloch

CHIPPED STONE

Rob Engl

Introduction and methodology

A total of 83 pieces of chipped quartz was recovered from the 2012 excavations at the hut circles of Loch Raa and Auchtercairn 3, all but one of these artefacts was retrieved from the latter site. This total consisted of material derived from stratified deposits.

The entire collection was macroscopically examined and a general characterisation of the material was undertaken. General classifications and descriptions of the artefacts were based on those proposed by Ballin (2000). A complete catalogue of all the lithic material is given within the record and a selection of artefacts are illustrated in Illus 18a to 20.

The Quartz

The majority of the assemblage consisted of relatively coarse fine grained quartz with occasional pieces of the more translucent 'greasy' variety. No skin was observed within the assemblage and it is likely that the quartz was obtained from locally derived bed rock rather than cobble sources.

The Assemblage

The assemblage is summarised in Table one.

Table 1. The assemblage by type

	Auchtercairn 3	Loch Raa
Flakes	17	1
Shatter	55	
Amorphous Core	2	
Bipolar Remnant	4	
Platform Core	2	
Core Fragment	1	
Borer		
Total	**82**	**1**

The assemblage itself reflects an expedient flake based industry in which a combination of reduction techniques was used. The appearance of four bi-polar remnants suggests that this was the primary method of working the material, yet the presence of the two small platform cores and the amorphous and fragmentary examples suggest that a more hybrid approach was involved. This would initially involve the free-hand reduction of larger pieces, until size restrictions necessitated the use of an anvil from which finally the bi-polar technique was used in order to maximise the material. (Ballin 2008, 26). At Lairg the analysis of a quartz assemblage associated with roundhouse structures of the second Millennium BC, revealed that the majority of flakes were obtained through the application of a direct hard hammer technique (Finlayson 1998 137)

The seventeen flakes obtained from Auchtercairn appear to support this idea. The majority of flakes appear short and thick with platforms appearing crushed or simple in form. This suggests a poorly controlled hard hammer technique was employed.

A single modified tool was recovered in the form of the borer (SF 4.1.2). This artefact was formed on a thick flake. Simple retouch had been applied along the right lateral edge creating a strong point.

Selected Catalogue (dimensions in mm)

SF 4.1.2 Borer. 30.5 x 19.4 x 9. Flake with rough retouch applied along the right lateral edge creating a solid point.

SF 4.4.10 Platform Core. 18 x 16.5 x 14.2. Small core with a 100% worked platform. The core has crush marks on its base consistent with use on an anvil.

SF 4.4.10a Platform Core. 76 x 60 x 24. Large core with single simple worked platform leading to the removal of several flakes.

SF 4.1.11 Amorphous Core. Translucent grey quartz. 25.5 x 20.8 x 23. core with several irregular flake removals.

SF 4.1.11a Amorphous Core. Translucent grey quartz. 46 x 32 x 22. core with several irregular flake removals.

Distribution & Discussion

The lithic assemblages of northern Scotland are heavily dominated by quartz with the majority of them dating to the Late Neolithic/Early Bronze Age.

Given the available evidence it is likely that the small assemblage recovered at Achtercairn is of a similar date.

With the obvious exception of the single flake associated with Loch Raa, the material was recovered from the stone setting and associated cobbled surface of Achtercairn 3, situated down-slope of the roundhouse at Achtercairn 2 and in direct association with well defined areas of charcoal (Wildgoose & Welti 2012).

Given the apparent distribution of material, it is probable that no primary reduction took place within Achtercairn 2 itself. It is therefore likely that the cobbled area on the platform of Achtercairn 3 may represent a discrete zone in which the working of lithic material was undertaken perhaps in conjunction with other activities.

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WEDIG PROJECT 2014

Auchtercairn 3 Hut Circle Gairloch

CHIPPED STONE

Rob Engl

Introduction and methodology

A total of 11 pieces of chipped quartz was recovered from the 2014 excavations at the structure Auchtercairn 3. This total consisted of material derived from both unstratified and stratified deposits.

The entire collection was macroscopically examined and a general characterisation of the material was undertaken. General classifications and descriptions of the artefacts were based on those proposed by Ballin (2000). A complete catalogue of all the lithic material is given within the record.

The Quartz

The majority of the assemblage consisted of relatively fine grained translucent grey quartz. No skin was observed within the assemblage and it is likely that the quartz was obtained from locally derived bed rock rather than cobble sources.

The Assemblage

The assemblage is summarised in Table one.

Table 1. The assemblage by type

	Auchtercairn 3
Flakes	5
Shatter	4
Amorphous Core	1
Platform Core	1
Total	**11**

The assemblage itself reflects an expedient flake based industry in which a combination of reduction techniques was used. The appearance of the platform and amorphous cores suggests simple, hard hammer reduction was the primary method of working the material.

Bipolar working was also identified in the form of ‘orange segment’ shatter. This reinforces the identification of a hybrid approach to the working of lithic materials on the platform of Auchtercairn 3.
(Engl 2013).

Selected Catalogue (dimensions in mm)

SF 4.4.10 Platform Core. 76 x 60 x 24. Large core with single simple worked platform leading to the removal of several flakes.

SF 4.1.11 Amorphous Core. Translucent grey quartz. 46 x 32 x 22. core with several irregular flake removals.

Distribution & Discussion

The material was recovered from the same contexts of Achtercairn 3 as was the quartz assemblage recovered during the 2012 excavation. Similarly the material may represent in situ working of lithic material in a discrete zone on the platform of the structure.

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SF No.	Site	Context	trench	sample	Material	Condition	Colour
4.4.1	Auchtercairn 3	0	4	0	qz	0	white
4.4.2	Auchtercairn 3	0	4	0	qz	0	white
4.4.3	Auchtercairn 3	0	4	0	qz	0	white
4.4.4	Auchtercairn 3	0	4	0	qz	0	white
4.4.5	Auchtercairn 3	0	4	0	qz	0	white
4.4.6	Auchtercairn 3	0	4	0	qz	0	white
4.4.7	Auchtercairn 3	0	4	0	qz	0	white
4.4.8	Auchtercairn 3	0	4	0	qz	0	white
4.4.9	Auchtercairn 3	0	4	0	qz	0	white
4.4.10	Auchtercairn 3	0	4	0	qz	0	white
4.1.1	Auchtercairn 3	0	4	0	qz	0	white
4.1.2	Auchtercairn 3	0	4	0	qz	0	white
4.1.3	Auchtercairn 3	0	4	0	qz	0	white
4.1.4	Auchtercairn 3	0	4	0	qz	0	white
4.1.5	Auchtercairn 3	0	4	0	qz	0	white
4.1.6	Auchtercairn 3	0	4	0	qz	0	white
4.1.7	Auchtercairn 3	0	4	0	qz	0	white
4.1.8	Auchtercairn 3	0	4	0	qz	0	white
4.1.9	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.10	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.11	Auchtercairn 3	0	4	0	qz	0	grey trans
4.1.12	Auchtercairn 3	0	4	0	qz	0	white
19	Loch R	2.4	2	0	qz	0	grey trans

Type: Gene	Type: Speci	cortication	L (mm)	W	T	
shatter	shatter	na	0	0	0	
flake	flake	na	18.5	13.5	3.5	
flake	flake	na	22.6	13.7	4	
flake	flake	na	23	15.5	5.8	
flake	flake	na	24.3	15.6	2.5	
flake	flake	na	21.2	16.5	8.2	
flake	flake	na	26	19	8	
flake	flake	na	16	13.2	5.5	
flake	flake	na	21	19.6	8.4	
core	platform	na	18	16.5	14.2	
shatter	shatter	na	0	0	0	
tool	borer	na	30.5	19.4	9	
core	bipolar spall	na	34.3	12.8	7.7	
core	bipolar spall	na	22.2	11.2	6.3	
core	bipolar spall	na	20.5	12.2	5.8	
core	bipolar spall	na	27.5	12.2	8	
flake	flake	na	38.2	27.8	15	
flake	bipolar	na	23.2	22.4	8.4	
flake	flake	na	20.6	16.4	6	
flake	flake	na	10	12.2	2	
core	amorphous	na	25.5	20.8	23	
core	fragment	na	28	25	14.7	
flake	flake	na	20.6	21	8.2	

Notes	No.
Blocky shatter of poor quality	9
	1
	1
	1
	1
	1
	1
	1
	1
crushed distal end, worked 100%	1
Blocky shatter of poor quality	42
borer made on flake with distal dorsal face roughly re	1
	1
	1
	1
	1
flake crushed platform	1
	1
	1
	1
	1
	1
	1

Wedig Project
Report on the stone, steatite and ceramic finds

AOC 60044
12th July 2013

AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

WEDIG PROJECT: REPORT ON THE STONE, STEATITE AND CERAMIC

Dawn McLaren

OVERVIEW

Coarse stone tools, in the form of cobble tools, were recovered in small numbers from Achnahaird, Gairloch 1, Gairloch 2 and Rhue hut circles. The tool types present form a homogenous group, dominated by general purpose tools which had been used for pounding, none of which display well-defined wear indicative of extensive or long-term use. Only a small number of the stones show any variation of this wear type but a possible burnisher from Achnahaird has been recognised and a heavy-duty pounder or maul from Rhue had also seen use as a working surface. All of the cobbles used were water rounded stones with no evidence of modification prior to use. Arkosic sandstone and other coarse sandstones were almost exclusively used indicating the tools were made on stones typical of the area.

In addition to the stone finds a sherd of steatite-rich pottery and a fragment of a small steatite cup or bowl were recovered from Loch Raa. Although steatite is best known from outcrops on Shetland, the less well studied west coast mainland sources, such as that at Glenelg, are a more likely source of this material.

The following report discusses the finds by site with individual catalogue entries for each artefact. A small number of stones collected in the field are natural.

Abbreviations used in text: L length, W width, T thickness, D diameter, H height, R remaining, mm millimeter.

Loch Raa

A single sherd of heavily steatite tempered pottery (LR05) and a damaged rim sherd of a small steatite cup or bowl were recovered from humic-rich soil underlying the turf and overlying the core of the roundhouse wall (context 2.1, trench 2). Both are abraded and the pottery fragment has signs of re-working after breakage as an abrasive or burnisher.

The high proportion of steatite present within the ceramic sherd makes it likely that a steatite-rich clay source was utilised and further angular crushed pieces of steatite added rather than the presence of steatite simply being the product of tempering alone. Temper, in the form of crushed rock or organics, was often added to clay for potting in an attempt to improve the chances of a vessel surviving the firing process (MacSween 2009, 37). Steatite is valued not only for aesthetic purposes but also for its refactory qualities and its use as temper may have improved the thermal properties of a vessel (*ibid*, 37).

In terms of form, the rim of the Loch Raa pot is slightly everted with a flat angled interior bevel similar to Early Iron Age shouldered vessels from Kebister, Shetland, some of which were also steatite tempered (Dalland & MacSween 1999, 181, illus 159.2, no. C76) and conforms generally to Topping's type 5 Early Iron Age rim form but with a more sharply angled well-defined shoulder (1987, illust 2). Steatite backed pottery sherds were recovered from the excavation of hut circle I at Kilphedar, Sutherland (Fairhurst & Taylor 1971, 75-7). Although similar in fabric, the Kilphedar pottery appears to be much finer than that recovered at Loch Raa and the vessel form discussed here finds no parallel amongst the Kilphedar assemblage. Steatite sources in Scotland are rare; the best known are the numerous outcrops on Shetland which have evidence of exploitation from early prehistory (Bray *et al* 2009) but smaller less well known sources are present at Glenelg on the west coast and Strath Naver in Sutherland (Fairhurst & Taylor 1971, 77). Locally-known steatite sources such as that between Achmelvich and Alltan A Bradhan, Highland, (B. Ritchie, pers comm.) could also have been exploited during prehistory.

An Early Iron Age date (2374±27BP; GU30611 (SUERC-47072)) was returned from a piece of hazel charcoal associated with a slab-built hearth (Feature 1.3) in the interior of the round house. The form of the steatite tempered pottery from Loch Raa, by reference to similar shouldered vessels from Atlantic Scotland, is consistent with this Early Iron Age date.

In addition to the steatite-tempered pottery there is also a sherd from a small rounded cup or bowl. Bowl-shaped stone and steatite lamps are well known from broch sites, such as those from Dun Telve, Glenelg (Curle 1916, 250-2, fig 9), Kintradwell and Carn Liath, Sutherland (Maxwell Joass & Aitken 1890, 102, 105), but these tend to be far more robust, thick-walled vessels than the rim sherd present at Loch Raa implies. Instead, a small simple rounded cup or bowl is indicated by the surviving fragment.

Although the provenance of the steatite used for both these items cannot be confirmed with visual analysis alone, a likely source for both would be the outcrop at Glenelg.

CATALOGUE

Pottery

LR05 Re-worked rim fragment from steatite-rich clay and/or heavily tempered steatite pottery shouldered vessel. Slightly everted rim with flat angled bevel suggesting a closed mouth vessel, the wall of the pot at a steep angle suggestive of a shouldered vessel. The fabric is more than 85% steatite with small to large angular steatite inclusions suggesting the use of both naturally steatite-rich clay and crushed steatite temper. The visible clay has fired grey throughout. The sherd has been heavily re-worked evidenced by abrasion and flattening of the broken edge opposing the bevelled rim and one adjacent corner, probably from use as a burnisher. The extensive re-working of the sherd makes accurate estimate of dimensions impossible but a minimum diameter of 160 mm at the rim is indicated. Shouldered vessels with similar rim profiles and tempered with steatite are known from Kebister, Shetland (Dalland & MacSween 1999, 181, illus 159.2, no. C76) and Clickhimin, Shetland

(Hamilton 1968, 92) where their form and context dates them to the Early Iron Age. Surviving H 29 W 33.5 T 8 mm. Context 2.1.

Steatite

LR08 Small damage rim sherd of a small rounded cup or bowl. The rim, which is heavily damaged appears plain and upright. Only a small portion of the inner surface survives which is smoothed with shallow fine scrape marks or striations from abrasion during manufacture. The external surface is rounded suggesting a squat globular or rounded body but is uneven and is marked by recent scratches and gouges. The extent of damage to the rim makes accurate dimensions impossible but a diameter of around 60 mm in suggested. No residues or sooting is present. Surviving H 27 T 5-9 mm. Context 2.1

Achtercairn, Gairloch 1

A single pounder, displaying wear from use as a pounder, came from the core of the round house wall (context 2.4). It had been produced on a flattened spherical cobble with water worn smooth surfaces which displays no evidence of shaping or preparation prior to use. The tool, which could have been used for a range of tasks including food processing and preparing clay for potting, displayed evidence of wear in the form of a band of peckmarks around the circumference of the stone and in a circular patch at the centre of one rounded face. After use as a tool, the cobble had been used as a pot boiler demonstrated by significant heat damage and fire-cracking of the surfaces.

Cobble tools are not inherently datable, seeing use from early prehistory through to the medieval period in some areas, and their chronology of use must be inferred from the dating evidence of their associated context. Two contexts within the interior of the roundhouse (Context 1.3 and 1.4) returned Iron Age dates for activity. The cobble tool and it's re-use as a pot boiler are entirely consistent with a later prehistoric date.

CATALOGUE

G.07 Pounder (fire-cracked). Plano-convex spherical coarse sandstone cobble, heat damage to most surfaces causing cracking and spalls to be detached from both faces and edges. The centre of the convex is pitted (D 38 mm), possibly as the result of use as a pounder. Rounded edges are also heavily pitted through heat damage and pecking from use. L 95.5 W 93.5 T 48.5 mm. Context 2.4. Trench 2.

Achnahaird

Eight possible worked stone items were collected in the field in association with this stone-built roundhouse. Three are dismissed after examination as natural water worn cobbles with no evidence of use or modification (Achd 14, 27 & 33). The remaining five cobbles all display signs of use and form a very homogeneous assemblage dominated by tools used as pounders. Such tools are thought to be general purpose tools which could have fulfilled a range of functions including, but not necessarily restricted to, food processing.

Such tools are often referred to as hammerstones but the term 'pounder' is preferred here to distinguish between two quite distinct levels of use. In contrast to pounders which are characterised by the presence of peckmarked damage or pitting from percussion damage during use, hammerstones are defined as those which have seen use with heavy physical force leading to the point of impact flaking or fracturing. None of the tools from Achnahaird display extensive damage consistent with use as a hammerstone.

None of the pounders from Achahaird showed signs of extensive use and in most cases the wear traces were so ephemeral it is likely that the tools may have seen only light or even single use prior to discard. This implies that these tools were easily sourced, lightly used and readily discarded. All of the cobble tools have been produced using water-rounded cobbles with a preference for small ovoid stones of durable arkosic sandstone. None of the stone tools display any form of preparation or modification prior to use.

The majority of the worked stone from Achnahaird came from contexts associated with the stone wall of the structure in trench 2. An Iron Age date has been returned from charcoal associated with collapsed material from the round house wall. Although simple tools such as these cannot be closely dated, they are entirely consistent with the later prehistoric date.

CATALOGUE

Achd 01 Possible burnisher. Small water-rounded quadrangular pebble, one face convex the other distinctly concave which is smooth with a light sheen suggesting use as a smoother or abrasive to burnish pottery or possibly wood. Three corners and one edge have recent damage. L 46 RW 41 T 17.5 mm. Context 2.1

Achd 06 Pounder (light-use) Small flat ovoid waterworn pebble. One rounded end has small oval pecked facet (16 x 24 mm) at the tip. L 81 W 59 T 24 mm. Context 2.2

Achd 09 Pounder (light-use) Ovoid arkosic sandstone water worn cobble, one edge of narrow rounded tip is pitted and a narrow band of irregular pits are present along both long edges. The surface damage is so ephemeral that only light use as a pounder is indicated. L 104 W 55 T 34 mm. Context 2.5

Achd 13 Pounder. Flattened ovoid arkosic sandstone cobble. One wide-rounded corner flattened with facetted peckmarks (W 57) and a further small circular area of pitting (D 15 mm) at one narrow rounded tip. Possible band of abrasion is present adjacent to peckmarked tip along one edge (10 x 52 mm). L 107.5 W 69.5 T 30.5 mm. Context 2.4

Achd 21 Pounder (light-use). Flattened sub-oval sandstone water-rounded cobble, one rounded edge flattened by a band of light pitting (13 x 61 mm) from use. The adjacent edge has been lost, possibly as the result of wear. L 98 RW 83 T 35 mm. Context 4.2

Rhue

Two items of stone were collected in the field as possible worked stone tools: one (R.08) has seen heavy percussion use as a maul with further peckmarked damage suggestive of expedient use as a working surface. The second stone (R.09) has been dismissed as natural.

The maul is defined as such due to the extent and character of the peckmarked damage which encircles the circumference of the water rounded boulder in an irregular band, concentrating at the wide rounded ends. The peckmarks are distinct and large and have softened through wear suggesting the tool was used to both pound and crush. What material type was being worked with this tool is unknown but it could have been used to crush temper for pottery, to peck other stone items or to process foodstuffs. Two small patches of smaller, deeper peckmarks are present on one rounded face and may be the result of expedient use of the stone as a working surface. The stone used is a water rounded boulder with no evidence of modification or shaping prior to use.

Tools of this type cannot be closely dated as they had a long currency of use from early prehistoric times through the medieval period in some areas but is consistent with an Iron Age date from an interior hearth feature.

CATALOGUE

R.08 Maul/working surface. Flattened spherical boulder of sandstone with distinct bands of quartzite, surfaces water worn and smooth throughout. An irregular band of deep, wide, peckmarks (W 46.5- 105 mm) made as the result of percussion damage from pounding, encircles the circumference at the widest point with wear concentrating at the rounded ends, particularly one wide, thick blunt end. Two small oval clusters of deep peckmarks (W 54 mm; W 32 mm) off-centre on one concave smooth face may be the result of limited expedient use as a working surface. L 172 W 165 T 140 mm. Context 2.4

Gairloch 2

A single lightly-used pounder came from a clay-rich layer (context 1.10), possibly the remains of a floor.

CATALOGUE

Acht 1.5 Pounder (light-use). Large ovoid arkosic sandstone cobble, one rounded end with very restricted (SF 13.5 x 17 mm) pecked facet from use as a pounder. L 157 W 110 T 107 mm. Context 1.10

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Recommendations

The steatite-tempered pottery sherd and fragment of steatite bowl from Loch Raa merit illustration for publication, as does the pounder/maul from Rhue.

There is no merit in retaining stones identified as natural within the site archive. Discard of natural stones is recommended.

APPENDIX 1

ARCHIVE CATALOGUE OF STONE, STEATITE & CERAMIC OBJECTS

Abbreviations used in text: L length, W width, T thickness, D diameter, R remaining, mm millimetre.

Loch Raa

Pottery

LR05 Re-worked rim fragment from steatite-rich clay and/or heavily tempered steatite pottery shouldered vessel. Slightly everted rim with flat angled bevel suggesting a closed mouth vessel, the wall of the pot at a steep angle suggestive of a shouldered vessel. The fabric is more than 85% steatite with small to large angular steatite inclusions suggesting the use of both naturally steatite-rich clay and crushed steatite temper. The visible clay has fired grey throughout. The sherd has been heavily re-worked evidenced by abrasion and flattening of the broken edge opposing the bevelled rim and one adjacent corner, probably from use as a burnisher. The extensive re-working of the sherd makes accurate estimate of dimensions impossible but a minimum diameter of 160 at the rim is indicated. Shouldered vessels with similar rim profiles and tempered with steatite are known from Kebister, Shetland (Dalland & MacSween 1999, 181, illus 159.2, no. C76) and Clickhimin, Shetland (Hamilton 1968, 92) where their form and context dates them to the Early Iron Age. Surviving H 29 W 33.5 T 8 mm. Context 2.1

Steatite

LR08 Small damage rim sherd of a small rounded cup or crucible. The rim, which is heavily damaged appears plain and upright. Only a small portion of the inner surface survives which is smoothed with shallow fine scrape marks or striations from abrasion during manufacture. The external surface is rounded suggesting a squat globular or rounded body but is uneven and is marked by recent scratches and gouges. The extent of damage to the rim makes accurate dimensions impossible but a diameter of around 60 mm in suggested. No residues or sooting is present. Surviving H 27 T 5-9 mm. Context 2.1

Gairloch 1

G.07 Pounder (fire-cracked). Plano-convex spherical coarse sandstone cobble, heat damage to most surfaces causing cracking and spalls to be detached from both faces and edges. The centre of the convex is pitted (D 38 mm), possibly as the result of use as a pounder. Rounded edges are also heavily pitted through heat damage and pecking from use. L 95.5 W 93.5 T 48.5 mm. Context 2.4. Trench 2.

Achnahaird

Achd 01 Possible burnisher. Small water rounded quadrangular pebble, one face convex the other distinctly concave which is smooth with a light sheen suggesting use as a smoother or abrasive to burnish pottery or possibly wood. Three corners and one edge have recent damage. L 46 RW 41 T 17.5 mm. Context 2.1

Achd 06 Pounder (light-use) Small flat ovoid water worn pebble. One rounded end has small oval pecked facet (16 x 24 mm) at the tip. L 81 W 59 T 24 mm. Context 2.2

Achd 09 Pounder (light-use) Ovoid arkosic sandstone water worn cobble, one edge of narrow rounded tip is pitted and a narrow band of irregular pits are present along both long edges. The surface damage is so ephemeral that only light use as a pounder is indicated. L 104 W 55 T 34 mm. Context 2.5

Achd 13 Flattened ovoid arkosic sandstone cobble. One wide-rounded corner flattened with facetted peckmarks (W 57) and a further small circular area of pitting (D 15 mm) at one narrow rounded tip. Possible band of abrasion is present adjacent to peckmarked tip along one edge (10 x 52 mm). L 107.5 W 69.5 T 30.5 mm. Context 2.4

Achd 14 Natural. Flattened quadrangular arkosic sandstone water rounded cobble. One corner lost but likely to be accidental damage rather than damage from use. L 85 T 69.5 T 38.5 mm. Context 2.4

Achd 21 Pounder (light-use). Flattened sub-oval sandstone water-rounded cobble, one rounded edge flattened by a band of light pitting (13 x 61 mm) from use. The adjacent edge has been lost, possibly as the result of wear. L 98 RW 83 T 35 mm. Context 4.2

Achd 27 Natural. Quadrangular water-rounded arkosic sandstones cobble; no modification or working in ends. L 79.5 W 51 T 37.5 mm. Context 2.8

Achd 33 Natural. Ovoid coarse sandstone cobble, much of the original surfaces lost and pitted due to weathering/erosion. No evidence of modification due to wear. L 95.5 W 77 T 49 mm. Context 4.2

Rhue

R.08 Maul/working surface. Flattened spherical boulder of sandstone with distinct bands of quartzite, surfaces water worn and smooth throughout. An irregular band of deep, wide, peckmarks (W 46.5- 105 mm) made as the result of percussion damage from pounding, encircles the circumference at the widest point with wear concentrating at the rounded ends, particularly one wide, thick blunt end. Two small oval clusters of deep peckmarks (W 54 mm; W 32 mm) off-centre on one concave smooth face may be the result of limited expedient use as a working surface. L 172 W 165 T 140 mm. Context 2.4

R.09 Natural. Heavily eroded coarse quartz-rich sandstone cobble, the ends, edges and much of one rounded face lost through erosion or wreathing. No obvious heat damage or modification through wear. Remaining L 135 W 135 T 81 mm. Context 2.4

Gairloch 2

Acht 1.5 Pounder (light-use). Large ovoid arkosic sandstone cobble, one rounded end with very restricted (SF 13.5 x 17 mm) pecked facet from use as a pounder. L 157 W 110 T 107 mm. Context 1.10

Acht 1.6 Natural. Plano-convex sub-oval waterworn boulder of arkosic sandstone. No evidence of use or modification. L 204 W 174 T 97 mm. Context 1.12

AOC Archaeology Group

AOC Archaeology Group, **Edgefield Industrial Estate, Edgefield Road, Loanhead EH20 9SY**
tel: **0131 440 3593** | fax: **0131 440 3422** | e-mail: **edinburgh@aocarchaeology.com**