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ARO39: Unexpected results - the palaeo-environmental analyses and dating of a palaeo-channel at Cammo, Edinburgh

By John James Atkinson, Warren Bailie, Donal Bateson, Natasha Ferguson, Carol Lang, Susan Ramsay and Clare Wilson

Archaeology Reports Online, 52 Elderpark Workspace, 100 Elderpark Street, Glasgow, G51 3TR
0141 445 8800 | info@guard-archaeology.co.uk | www.archaeologyreportsonline.com

ARO39: Unexpected results - the palaeo-environmental analyses and dating of a palaeo-channel at Cammo, Edinburgh

Published by GUARD Archaeology Ltd, www.archaeologyreportsonline.com

Editor Beverley Ballin Smith

Design and desktop publishing Gillian Sneddon

Produced by GUARD Archaeology Ltd 2019.

ISBN: 978-1-9164509-9-8

ISSN: 2052-4064

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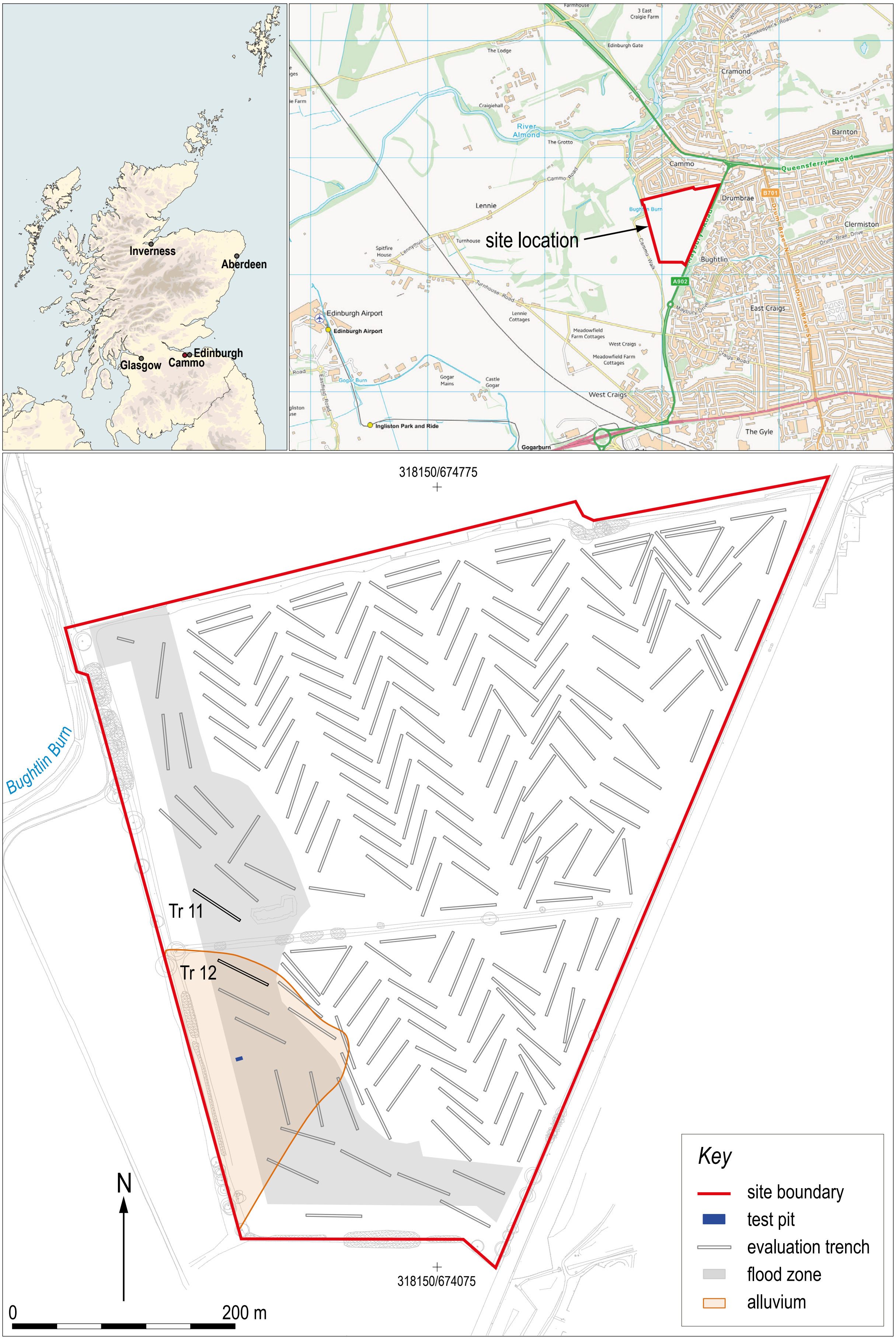


Figure 1: Site location

Introduction

This publication details the results of the field- and post-excavation-work near the east side of Edinburgh Airport. An archaeological evaluation and metal detecting survey was carried out by GUARD Archaeology Ltd at Cammo Fields (Cammo HSG 20 development), Maybury Road, Edinburgh to establish whether significant archaeological remains were present or absent on an area proposed for development. This work took place between the 23 April and 7 June 2018 at NGR: NT 18111 74422 (centred) on a 28.44 hectares area of two fields, previously agricultural land (Figure 1). The site is bordered by Cammo Grove and Cammo Gardens to the north, the A902 Maybury Road to the east, agricultural land and the canalised Bughtlin Burn to its south and west, and Cammo Country Park at its north-west corner.

During the evaluation only a possible palaeo-channel was noted in the south-west part of the site but the metal detecting survey recovered a number of interesting metal artefacts. During the post-excavation process, required by City of Edinburgh Archaeology Service (CECAS), sampling of the palaeo-channel and analysis of its sediments, as well as the analysis and conservation of key metal artefacts took place. Four organic samples for radiocarbon dating were submitted but only two of these returned dates, ranging from 3711 to 2476 cal BC, from the early Neolithic to the end of the late Neolithic.

Although the fieldwork did not produce evidence of past human use of the landscape, the post-excavation analysis revealed evidence for the development the landscape in early prehistory, and later use in post-medieval/modern times.

Archaeological and Historical Background

From an earlier cultural heritage assessment of the development area it was clear that there were no known prehistoric, Roman or early medieval sites within it or within a 100 m buffer zone surrounding it. An archaeological site, that of a standing stone (NRHE: NT17SE 55; SM 6189) of probable late Neolithic or Bronze Age date, is known from the *Garden and Designed Landscape Inventory* (GDL 00081) for Camo. The stone is located c. 350 m to the west of the project area, at approximately 50 m OD, and was positioned with extensive views over the surrounding landscape, now obscured by mature woodlands of the designed landscape. The presence of significant prehistoric remains in the wider surrounding area highlighted the potential for the survival of undiscovered sub-surface archaeological remains within the proposed development area (Rennie 2018).

Originally, the lands at Cammo belonged to the Abbey of Incholm until about 1400 when they were acquired by the Bishop of Dunkeld. The estate passed through a series of owners, including John Menzies of Coulterallers, Lanarkshire who built or remodelled Cammo House in 1693 (HES 2001). In the early eighteenth century Sir John Clerk, later 2nd Baronet of Penicuik acquired the estate and enclosed the park land and established the designed landscape. In the latter part of the eighteenth century the Watson family remodelled the designed landscape to include a ha-ha.

The estate remained in the hands of the Watson family until 1898 when a change of ownership allowed the northern and eastern policies to become temporarily a golf course. This later reverted to farmland until the estate was acquired by the National Trust for Scotland who continues to manage it in association with the City of Edinburgh Council (HES 2001).

Methodology

Metal Detecting Survey

A metal detecting survey took place in association with the archaeological evaluation across 209 trenches excavated across the development area (Figure 1), in order to establish the survival of any metal artefacts that within the topsoil. A total of 173 metal artefacts were discovered. The assemblage was dominated by iron objects (92.5%) most likely lost from agricultural machinery with the remaining 7.5% comprising 13 objects mainly copper alloy pieces and coins. In accordance with the requirements set out by CECAS, a conservation plan was prepared for the metal finds, which included numismatic analysis of the coins.

Archaeological Evaluation

The archaeological evaluation, comprising the machine excavation of 209 trenches, targeted 10% of the 18.61 hectares of the development area beyond the flood zone, and 5% of 4.46 hectares within the flood zone, but excluding the Bughtlin Burn. The topsoil in each trench was removed to the top of the subsoil.

A palaeo-channel was the main feature located in the south-west part of the site in alluvium deposits (Figure 1), and a trench positioned across it was excavated using a mechanical excavator down to the bottom of the alluvial layers. Two parallel sets of soil samples were taken at regular intervals through the soil profile in the deepest part of the trench section (Plate 1), and kubiena tin samples were taken at each key deposit interface. These samples were taken for micromorphological analysis, and radiocarbon dating.

Plate 1: The palaeo-channel with kubiena tins in place for sampling

Results of the fieldwork

Metal Detecting Survey

The metal detecting survey of all the trenches revealed a total of 173 metal artefacts, 160 of which were modern and largely of agricultural origin. In addition to the 13 retained finds, one shard of eighteenth century dark green bottle glass was recovered from the remains of rig and furrow and two pieces of natural flint. The artefacts recovered from the metal detecting survey are described below.

Evaluation and Sampling

From the total of 209 trenches machine excavated across the development area, two (trenches 11 and 12), which were located in the flood zone, were found to have deep alluvial deposits. Evidence for a palaeo-channel in the vicinity of the Bughtlin Burn was apparent across the western extent of the site. The alluvium extended 140 m from the current burn edge and was up to 1.8 m thick in the trenches where it was tested to its full depth. The evidence suggests that a much larger water course extended along the western edge of the field in the past. The palaeo-channel was subsequently sampled using kubiena tins and bulk samples (Figure 2). Post-medieval rig and furrow was uncovered and recorded in seventeen trenches across the area running predominantly along the cardinal points. The majority of trenches contained either ceramic or rubble field drains but no other archaeological features were uncovered.

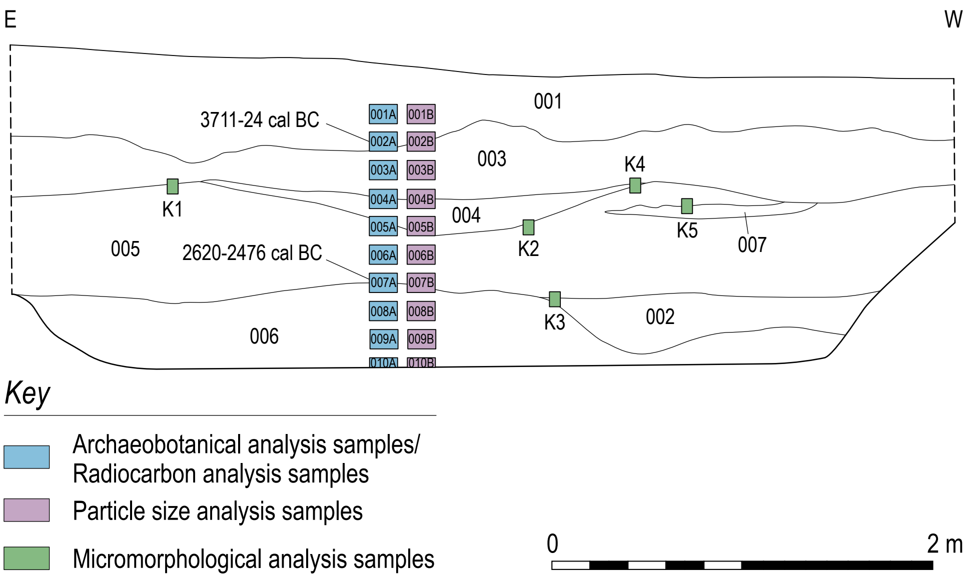


Figure 2: Section through palaeo-channel with the locaiton of samples.

Results of the post-excavation analysis

Dating

Organic material suitable for dating was recovered from four samples, but only two of these proved viable (Table 1). A single fragment of birch (Betula sp) from an upper sample provided a date range of 3711–3642 cal BC from the early Neolithic period. Hazel wood fragments (Corylus cf avellana) from a lower sample produced a date range of 2620–2476 cal BC, indicating activity during the end of the Neolithic and the transition into the early Bronze Age period.

Archaeobotanical Analysis

By Susan Ramsay

The processing, analysis and interpretation of botanical remains recovered during excavations at the site is described and discussed here. The initial archaeological fieldwork revealed the site to be largely archaeologically sterile, although a palaeo-channel was recorded (Henderson 2018). A cross-section of the palaeo-channel was opened using an excavator and two parallel sets of 10 sequential small bulk samples were taken through the section. One set of ten small bulk samples was analysed for archaeobotanical remains.

Methodology

Laboratory sieving of waterlogged contexts was undertaken on one set of the 10 small bulk samples taken from a section through the palaeo-channel. A 500 ml volume of soil from each sample was soaked in cold water and then sieved through a stack of 1 mm and 500 µm sieves. All material retained on the sieves was scanned using a dissecting microscope at variable magnifications of x4-x45. The bulk matrix composition of each sample was recorded and a representative sub-sample of each component part retrieved for storage. The concentration of each component was scored using a system of (+) being rare to (+++++) being very abundant. Subsequently, all seeds and other macrofossils were removed, identified and kept under cold conditions. Where possible, a sample of material suitable for AMS radiocarbon dating was removed and dried.

Wood samples were identified by taking a very small section with a razor blade, and then mounting that section on a microscope slide with methylene blue stain. Identification was undertaken using a high-magnification binocular microscope at x100-x400.

Charcoal fragments were initially analysed using the dissecting microscope but were further identified at x200 magnification using the reflected light of a metallurgical microscope.

Reference was made to Schweingruber 1990 and Cappers et al 2006 to aid identifications, and vascular plant nomenclature follows Stace 1997.

Results and discussion

The full results are shown in Table 2.

The bulk of the matrix of each of the 10 samples was composed of mineral elements, with clay, sand and larger gravel fragments present. The samples had a higher sand and gravel component towards the bottom of the sequence with a higher clay component towards the top of it (see Particle Size Analysis below). Very little organic material was present in the sequence. The uppermost sample 001A contained some very small wood and charcoal fragments but none large enough to identify. Traces of moss stems and leaves were also noted with both Sphagnum (bog moss) and Polytrichum commune (haircap moss) identifiable but again, not in sufficient quantities for AMS dating. Birch, sedge and violet seeds were recovered from the sample. Birch seeds are wind transported and so could have blown in from nearby, whereas sedges and some of the violet species will grow in the damp or more waterlogged conditions suggested by the mosses.

Sample	Lab Code	Context	Radiocarbon Age BP	Dates at 2 sigma (95.4% probability)	Period
002A	SUERC-84942 (GU50429)	Betula sp. charcoal from context 001/002	4905 ± 24	3711–3642 cal BC	Early Neolithic
007A	SUERC-84943 (GU50432)	Corylus cf avellana charcoal from context 005/006	4032 ± 24	2620–2476 cal BC	Late Neolithic

Table 1: The radiocarbon dates

The only organic material in sample 002A was a single fragment of birch (Betula sp) that was large enough for dating and a couple of fat-hen (Chenopodium album) seeds that may have blown in from agricultural land nearby. Two fragments of hazel (Corylus cf avellana) charcoal were identified from sample 003A but no other organic remains were present. Sample 004A contained only microscopic charcoal fragments but none large enough for identification. Sample 005A contained more fragments of charcoal, with birch, oak and indeterminate charcoal recorded. This charcoal was mineralised and so appears artificially heavy in the results table. Sample 006A produced only tiny fragments of what appeared to be hazel wood but there was not enough to provide an AMS radiocarbon date. Sample 007A also contained fragments of hazel wood but in this case enough fragments were collected to provide dating material. Sample 008 produced no organic material whilst 009A contained only traces of tiny wood fragments and sedge/grass stems. Sample 010A was also devoid of organic material.

Overall, the organic material in this section was very scarce and gives little indication of the vegetation growing in or around the palaeo-

	Context	1	001/2	3	003/4	004/5	5	005/6	6	6	6
	Sample	001A	002A	003A	004A	005A	006A	007A	008A	009A	010A
Volume of sample		500 ml	500 ml	500 ml	500 ml	500 ml	500 ml	500 ml	500 ml	500 ml	500 ml
AMS potential		N	Y	Y	N	Y	N	Y	N	N	N
Matrix composition											
Clay		+++++	+++++	+++++	++++	++++	++++	+++	++	++	++
Sand		++	+++	+++	++++	++++	++++	+++++	+++++	+++++	+++++
Gravel		+++	+++	+++	++	++	++	+++	+++	+++	++++
Coal		+	+++	++	+++	+++	+++	+++	+++	+++	++++
Charcoal		++	+	++	+	+++	-	-	-	-	-
Wood		++	-	-	-	-	+	++	-	+	-
Monocot stems	grass/ sedge stems	-	-	-	-	-	-	-	-	+	-
Trees / Shrubs											
Betula spp charcoal	birch charcoal	-	1 (0.11g)	-	-	1 (0.10g)	-	-	-	-	-
Corylus cf avellana charcoal	hazel charcoal	-	-	2 (0.51g)	-	-	-	-	-	-	-
Corylus avellana wood	hazel wood	-	-	-	-	-	+	++	-	-	-
Quercus spp charcoal	oak charcoal	-	-	-	-	4 (0.25g)	-	-	-	-	-
Indet charcoal	indet charcoal	-	-	-	-	2 (0.28g)	-	-	-	-	-
Mosses											
Sphagnum spp leaves	bog moss leaves	+	-	-	-	-	-	-	-	-	-
Polytrichum commune	haircap moss	+	-	-	-	-	-	-	-	-	-
Seeds etc											
Betula pendula seeds	silver birch seeds	1	-	-	-	-	-	-	-	-	-
Carex spp (biconvex) seeds	sedge (biconvex)	1	-	-	-	-	-	-	-	-	-
Chenopodium album	fat-hen	-	2	-	-	-	-	-	-	-	-
Viola spp	violet	5	-	-	-	-	-	-	-	-	-

Table 2: Botanical remains from the palaeo-channel

channel. The wood and charcoal fragments could have been transported from some distance away and could even be redeposited from earlier sediments, as the AMS radiocarbon dating shows (Table 1). The lack of organic remains suggests that the sediments may have been well oxygenated and so very biologically active, allowing little organic material to be preserved. The best preservation was in the uppermost sample and that indicates a damp environment with mosses and sedges probably growing on site.

Particle Size Analysis

By Clare Wilson

Particle size analysis was undertaken to provide information about flow velocity within the paleo-channel (old river bed) located at the south-west side of the development site.

The size and spatial distribution of river bed sediments is a result of transportation and depositional mechanisms and can be used to help reconstruct paleo-environments and climatic conditions (Guerit et al. 2018). Generally downstream fining is seen but the granular deposition can be affected by morpho-sedimentary elements (ibid). The late Quaternary period saw sea level variations due to glacial and interglacial periods this brought about variations in major river erosional dynamics and sedimentary loads and frequently lead to the formation of incised channels (Bae et al. 2018).

Methodology

Ten sequential samples were collected for particle size analysis indicated by those located on the right in Figure 2. The samples were sieved to 2 mm and homogenised. 50 ml plastic sample bottles were filled with the samples to a depth of approximately 50 mm and topped up to 15 mm with distilled water. Then 2 ml of dispersant sodium hexametaphosphate (Calgon) was added to each 50 ml plastic sample bottle to aid deflocculation. The samples were mechanically agitated overnight and the following morning each sample was shaken, with a drop magnetic stirrer in the bottle, ensuring that a good vortex was achieved and the sample was thoroughly homogenised. Once a vortex developed within each bottle the lid was replaced and the sample left to agitate for 15 to 20 minutes before being analysed using a Coulter Counter LS23.

Grain size (µm)	Grain type
≤1	Colloidal clay
1.1 - ≤2	Non-colloidal clay
2.2 - ≤10	Very fine silt
10.1 - ≤20	Fine silt
20.1 - ≤40	Medium silt
40.1 - ≤60	Coarse silt
60.1 - ≤125	Very fine sand

Table 3: Showing the ranges of grain size found within the samples

The samples were individually introduced to the sampling tube and the LS32 Coulter Counter performed three runs on each sample, which were averaged to form the results of the analysis.

The majority of the grains, in the samples from the site, were found to be below 60 µm with only three samples showing any grains larger than this: 004B, 006B and 007B (Tables 3 and 4). The highest percentage of coarse silt was found in samples 004B, 006B and 007B, with sample 006B having the highest percentage at 16.43%. The largest grain size found in samples 001B and 008B was coarse silt but this was still less than 1% of the overall proportion of the grains for these two samples.

Sample No.	Colloidal clay	Non- colloidal clay	Very fine silt	Fine silt	Medium silt	Coarse silt	Very fine sand
001B	6.72	11.71	58.00	18.77	4.49	0.31	0.00
002B	4.48	7.85	44.47	21.90	18.07	3.23	0.00
003B	7.40	10.57	42.37	22.57	15.87	1.23	0.00
004B	4.26	6.54	30.27	15.63	16.23	12.57	14.50
005B	5.67	8.70	38.60	21.80	22.80	2.43	0.00
006B	2.94	5.47	35.09	19.23	19.30	16.43	1.50
007B	6.01	9.22	35.80	17.93	18.13	12.50	0.40
008B	7.14	10.20	37.07	25.17	20.03	0.40	0.00
009B	6.08	9.16	35.47	18.80	24.03	6.47	0.00
010B	5.54	8.59	32.90	20.80	28.13	4.03	0.00

Table 4: Percentage volumes of different grain sizes found within each sample

The highest percentage volume across all samples was for very fine silt. Sample 001B had the highest overall percentage volume at 58% with 004B having the lowest at 30.27%. The values for fine silt all sat within a fairly close range of each other with the results being the lowest for 004B (15.63%) and the highest for 008B (25.17%). Medium silt was lowest in 001B (4.49%) and highest in 010B (28.13%).

Interpretation and conclusions

The very fine silt and smaller component found in the samples are indicative of deposition that occurred in very slow moving or potentially stagnant conditions such as might be characteristic of backwater deposits. The sandier deposits seen in 004B, 006B and 007B are indicative of the presence of some flowing water as the deposition of larger particles represents slightly higher energy environments, however these grains are still smaller than 125 µm so are unlikely to be river bed deposits and are more likely to represent overbank flood deposits.

Particle size analysis provides information to assist in the reconstruction of paleo-environments and in understanding the flow velocity and dynamics. In the case of the samples from Cammo it is unlikely that this is an old river channel and based on the analysis of these samples more likely to be still water or very slow moving conditions, potentially stagnant water conditions and overbank flood deposits.

Micromorphology

By Carol Lang

This report (a full version can be found in the site archive) summarises the findings arising out of the micromorphological analysis of undisturbed soil samples collected during archaeological fieldwork at Cammo. Micromorphological investigation of the soil thin sections provides high resolution analysis on the development of the palaeo-channel and identifies localised environmental changes in the alluvium.

Geoarchaeological and archaeological significance

The application of soil micromorphological techniques to the Cammo samples - the microscopic analysis of soil/sediment thin sections - can play a significant role in the archaeological investigation particularly when carried out with a methodical approach to observations and their interpretation.

Soil/sediment properties reflect the environment in which they have been formed, and the recovery of known anthropic sediments from archaeological contexts has the potential to assist archaeologists to understand complex site formation processes related to past land use and the palaeo-environment. By applying micromorphological investigation to undisturbed soils it enables soil development properties to be examined: thickness, bedding, particle size, sorting, coarse to fine ratios, composition of the fine material, groundmass, colour, related distribution, microstructure, and distribution of inclusions, the shape of inclusions, and finally the inclusions to be identified and quantified. Additionally, these analyses can provide details of micro-artefacts, not seen by the naked eye during macromorphological analysis.

Methodology

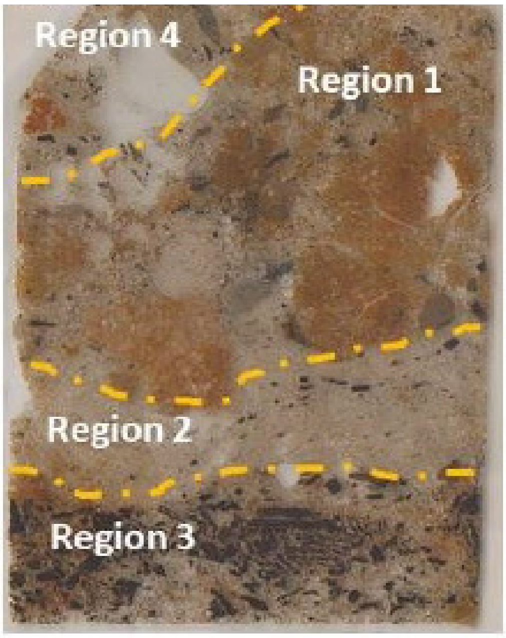
The undisturbed soil samples were collected from the north facing section of trench across the palaeo- channel, with all samples being collected across the boundaries between identified contexts. The samples were dried using the acetone exchange process to remove all the moisture and then impregnated using epoxy resin under vacuum. The impregnated soils were cured, and then sliced, bonded to glass slides (115 by 75 mm) and precision lapped to 30µm thickness to produce soil thin sections.

By following procedures described by Bullock et al. 1985, and Stoops 2003 soil properties were recorded semi-quantitatively and adapted specifically for the Cammo samples. The thin sections were analysed using an Olympus polarizing microscope at a range of magnifications (x10-x400) and under Plane Polarized Light (PPL), Crossed Polarized Light (XPL), and where applicable Oblique Incident Light (OIL). Each light source allowed identification of specific microscopic features, such as mineral and organic components, pedology and feature classification. All features observed were recorded on an Excel spread sheet with the limit of the coarse to fine material being 20µm (c/f20µm).

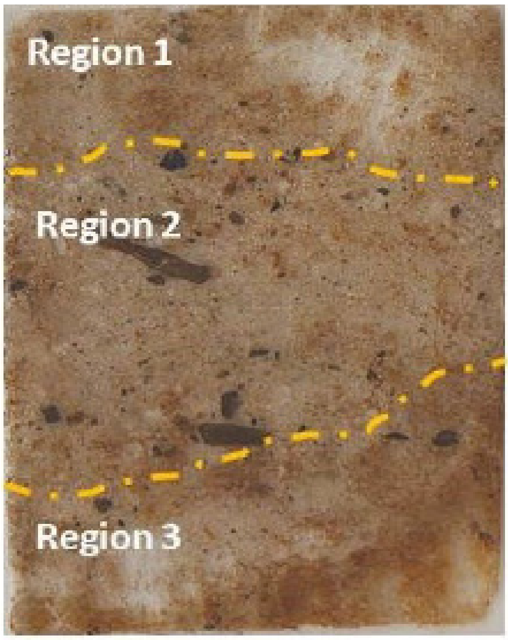
Results and Interpretation

The following sections show characterisation and interpretations of the micromorphological thin sections from Cammo, with a summary of the frequency and type of pedology in each thin section recorded in Table 1 in the site archive. The composition of the coarse rock/mineral fractions (c/f) in the samples was predominantly partially weathered sub-rounded quartz, with inclusions of basalt and microcline; composition corresponding to the local geology. The coarse fraction was well sorted, with the c/f distribution mainly 3:2 and the related distribution being enaulic[1], with only region 1 of sample K4 displaying a chitonic distribution (Figure 3). The fine material had a dotted appearance in PPL illumination, with sample K1 and K5 having a speckled limpidity. The dotted appearance is due to micro-debris (20 µm) derived from charcoal, amorphous organic matter and redoximorphic nodules[2] (Macphail and Goldberg 2018), while the speckle limpidity is derived from the presence of clay colloids (Stoops 2003) The b-fabric was speckled under XPL illumination and this is the due to inclusions of clay colloids in the fine matrix. Small areas of striations were visible in sample K3, K4 and K5, these developing due to sequential wetting and drying of the clay colloids in the fine material (Dalrymple and Jim 1984) allowing them to align.

A high frequency of amorphous organic matter was identified in the samples, this being particularly evident in samples K4 region 2 of (~20%) and K5 (~30%) (Figure 3). Woody fragments (Figure 4B) were also evident in most samples, the woody material of sample K3 region 3 all aligning parallel to the upper ground surface (Figure 3); K3 region 3 having the highest frequency of c. 50%. Sample K3 region 3 displayed a high frequency of fragmented phytoliths derived from the woody material. Additionally, charcoal (Figure 4C) was identified in most samples; only sample K1 and K5 displaying no fragments (>20 µm). Rubified clay inclusions were exhibited in sample K3, with burnt clay also being evident in K3 region 3.



Sample K3



Sample K4

Figure 3: Annotated soil thin sections from samples K3 and K4 displaying the different depositional layers.

1 Enaulic fabric is a skeleton of coarser particles with aggregates of finer material in the intergranular spaces.

2 Redoximorphic feature is caused by reduction and oxidation. It is a type of mottle that specifically identifies features created as a result of saturated conditions in the soil.

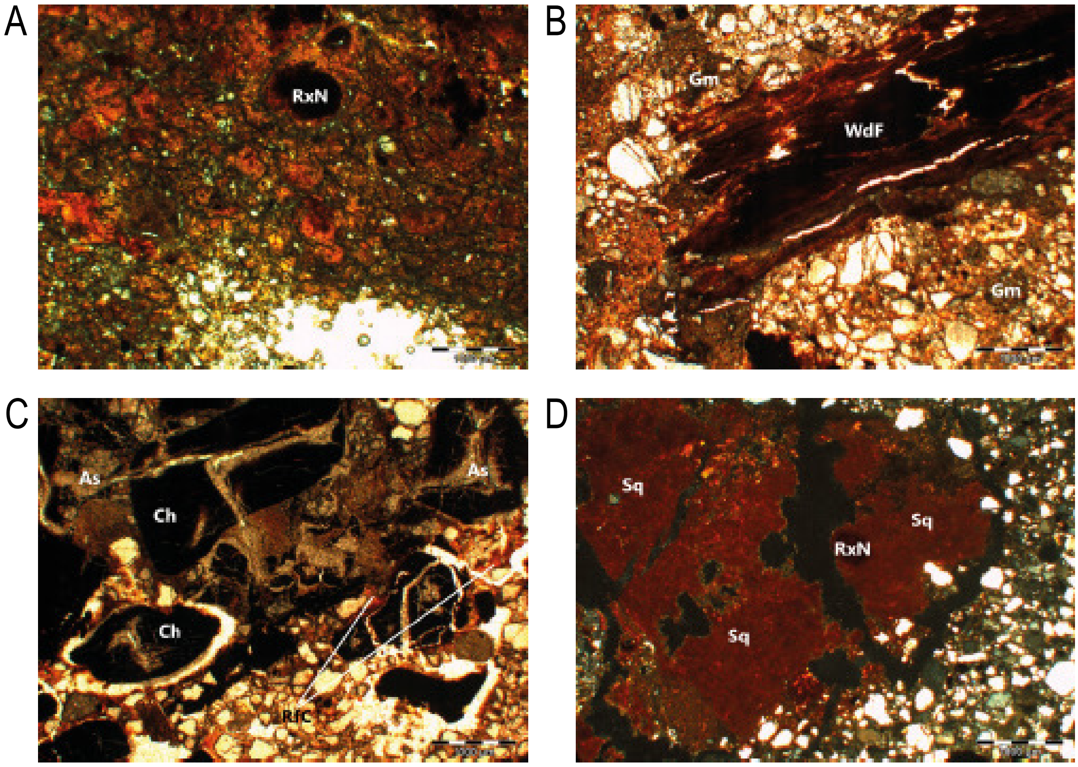


Figure 4: A. Clay inclusions within the groundmass for sample K1 and a dark red redoximorphic nodule (RxN); B. Woody fragments (WdF) identified in sample K3 region 3 situated in the groundmass (Gm); C. Charcoal (Ch) burnt in situ in sample K3 region 3 with evidence of ash (As) surrounding it and rubified clay (RfC); D. Iron sesquioxides (Sq) in sample K3 region 1 with the development of a redoximorphic nodule (RxN).

The microstructure of the samples varied between moderate (K2, K3 Region 3 and K5) to weakly developed, with the presence of small, medium and large sub-angular blocky ped[3] evident in most samples and regions. The peds were separated by inter-pedal channel void and there was evident in several of the samples, intra-pedal vughs[4] within the peds formed due to the aggregation/ disaggregation of soil colloids (Stoops 2003) Sample K4 region 3 displayed angular peds as a result of increased clay, these being separated by crack forming as a result of shrink swelling, while K4 region 3 was apedal, with only intra-pedal vughs visible. Differential deposition of deposits could be seen in samples K3 and K4 (Figure 3), however difference in deposition events could not be identified during micromorphological analysis in samples K1, K2 and K5 even though these samples had been collected at boundaries between contexts.

3 Peds are aggregates of soil particles formed as a result of pedogenic processes; this natural organization of particles forms discrete units separated by pores or voids.

4 Vughs are small cavities in a rock or vein, often lined with crystals

Excremental pedofeatures were evident in sample K2 and K3 region 3, these are normally evident in areas of high organic matter. A high frequency of iron sesquioxide and redoximorphic nodules (Figure 4D) were exhibited in all samples (c.20%), their development is attributed to reduction and oxidation of the iron (Fe) within the soil due to wetting and drying, this allows iron to undergo precipitation, translocation and dissolution into areas of high density iron, thus forming the nodules; increased levels of organic matter providing a catalyst for greater iron aggregation. Clay inclusions were displayed in sample K1 and K2 (Figure 4A).

Discussion

Micromorphological analysis identified that the coarse mineral/rock in the soil thin sections was derived from the local sedimentary and igneous parent material. The thin sections exhibited peds and voids, and it can be concluded that the samples were soils that had formed from the alluvial sediments deposited in the palaeo-channel identified during excavation. The coarse material in the samples was small, sub-rounded and well sorted; indicative of a slow flowing stream environment or area of river overbanking.

The differential development of the microstructure in the samples would suggest that aggregation of the soil colloids is due to variable levels of clay content, with increased levels of ped development identified in areas were striations were observed; these due to higher clay levels. Clay colloids provide the mechanism for the formation of cation bridges and the development of stabilising microaggregates (Oades 1984). The variability in the clay content would point to fluctuations in the flow of the water through the channel or in overbanking (Sundborg 1956).

The movement of iron was visible in the soil thin section through the development of redoximorphic nodules and the presence of iron sesquioxides (Figure 4D). The presence of these hydrological pedofeatures are used by the (USDA-NRCS 2010) to determine water fluctuation and localised waterlogging of soils from groundwater. The development of, the more visible, redoximorphic nodules, therefore indicating that there has been a series of wetting and subsequent drying events (Lindbo et al. 2010); indicative of variable water levels. There was little evidence, however, to determine the frequency or length of the waterlogging events.

The section drawing provided evidence to support several hypothesis: 1) The palaeochannel was seasonal; 2) It was part of an abraided system or; 3) It was an overbanking area for a larger channel. The composition of the coarse fraction, with fine clay and small coarse inclusions could relate to all three hypotheses for the channel with little other supporting evidence.

The presence of charcoal fragments in some of the samples indicates that there had been burning in the localised environment, with alluvial processes washing fragments downstream. However, due to several of the samples not containing charcoal fragments it is evident that there was intermittent burning. There is, nevertheless, evidence that burning did occur in the immediate area. This can be seen in sample K3 region 3, with not only the presence of charcoal and woody material aligned parallel to the upper ground surface, and suggesting the laying of wood, but there is also the presence of burnt and rubified clay. The fired clay is directly below the charcoal and wood.

The presence of charcoal with wood and burnt clay would point to an incomplete burn or the edge of a burning event, inclusions of rubified clay would indicate that the undisturbed samples had been collected on the edge of the burning event, with the intense heat, allowing rubification of the clay; close-by. The presence of burning in the location suggesting there was a significant level of anthropogenic activity both in the sampling location and in the upper areas of the channel. Amorphous organic matter is evident in many of the samples suggesting that there had either been the deposition of organic material through alluvial processes or there had been the incorporation of plant material into the soil, probably due to natural processes as there was no evident of soil tilling and turnover indicative of anthropogenic activity.

Conclusions

The undisturbed soil samples collected during archaeological fieldwork with evidence provided through soil micromorphology indicates that the samples were derived from similar localised parent material that had undergone alluvial weathering processes prior to soil development and that pedogenesis displayed hydrological pedofeatures.

The development of the soil structure was symptomatic of soil formation processes: the deposition of clay in the alluvial sediments laid down in the palaeo-channel providing the main mechanism for soil development. Although organic matter was evident in the samples, the variability in soil structural development corresponded with difference in clay content.

The presence of hydrological pedofeatures, indicative of wetting and drying, and the composition of the well sorted, small coarse fraction highlighted that the palaeo-channel did not flow continuously and was either seasonal, a small tributary or, was part of an abraided stream system. Evidence of burning in the sample indicates that there was anthropogenic activity in and around the site, with evidence of incomplete burning in one of the samples.

The finds

The coin assemblage

By Donal Bateson

The retained metal finds included four coins, two with milled edges (SF 003 and SF 013), a third coin (SF 012) being thinner had no clear milling, suggesting a possible earlier date and a fourth, which initially appeared to be the flattened end of a pewter serving spoon (SF 016). However, all the coins were heavily worn and corroded.

SF 003 is probably a copper halfpenny of the type issued by Georges II and III between 1729 and 1775, although this is difficult to confirm given corrosion and lack of detail remaining on the surface. Coins SF 013 and SF 012 are similar and are likely to be eighteenth century Georgian halfpennies. Coin SF 016 appears to be a plated (silver on copper core) forgery of a Queen Anne half-crown, issued between 1703 and 1714, although it is also corroded, it is nevertheless unusual and interesting.

The metal assemblage

By Natasha Ferguson

A small assemblage of modern finds were recovered during systematic metal detecting survey (see Table 5). The assemblage contains primarily domestic finds, such as the furniture handles, storage lid and a button and is typical of losses through the discarding of waste in the nineteenth and early twentieth century from urban and suburban areas. The lack of more agriculturally-related material is interesting, with only one object attributed to horse furniture and one small fragment of a ubiquitous machine part. The lead disc appears to have been an attempt to make a cast copy of an object from a mould, possibly made from the original object pressed into sand, but the cast failed. Cast copies of medals, coins, etc. are common finds due to the low melting qualities of lead. Dating such objects is problematic but dated examples of this practice occur from the mid-eighteenth century to modern periods.

The pocket-watch (Plate 2a and b) is an interesting find, dating stylistically to the 1920s-1930s and may be the result of casual loss rather than waste as it is unlikely to have been thrown out even if broken.

Plate 2a and b: Pocket watch

SF No.	Context	Transect	Type and metal	Description	Dimensions
004	001	026	Disc fitting or cap, copper alloy.	A disc was machine cut from sheet metal. There is a small broken attachment hole and a crescent shaped cut. On the reverse there are small pockets of iron (Fe) corrosion for fastenings or pins. A modern object used as an identification tag or cap covering.	31 mm by 0.9 mm
005	001	028	Button, copper alloy.	Button, copper alloy. Small 'sew-through' button with four central attachment holes within a central inverted dome. The decorative reverse side has a triangular geometric design in resin or enamel coating. On the button front around the rim is raised lettering, 'Ne Plus Ultra' meaning 'Nothing is higher/better' and appeared on a number of produced items in the twentieth century.	16 mm by 0.7 mm
006	001	029	Eyelet, copper alloy.	An eyelet with a circular section. There is some loss of surface area and possible traces of leather or fibre identified during conservation. Probably an eyelet for leather or canvas to secure a hole for looping through string/lace for attachment, dating to the late nineteenth or twentieth century.	15.2 mm by 2.8 mm
007	001	040	Machine part, copper alloy.	Solid cylinder, rough at one end and pinched or tapered at the opposed end, possibly cut. Likely to be a finial as part of machinery or a tool given its solid nature, dating to c. nineteenth/twentieth centuries.	n/m
008	001	057	Disc, lead	Cast disc, thick with rounded irregularly shaped sides. On one side there is a slight concave depression with seven irregular spaced pits or holes. The holes themselves have rounded sides and are irregular in shape. It is likely these are casting errors, with air-pockets formed due to the lead being poured when it was too hot and too quickly. On the reverse side there are traces of iron staining, and the faint outline around the border of a decorative pattern, or lettering resembling an 'R'. This is likely to be a failed casting attempt with the lead discarded or lost during the process.	33.6 mm by 5.8 mm
009	001	069	Drawer handle, copper alloy.	A drawer handle for a dresser or other large furniture piece with drawers. The knob is mushroomed shaped with a tapered waist. There are traces of wood or other organic material at the attachment end. Its suggested date is nineteenth/twentieth century.	23.7 mm by 18.4 mm
010	001	125	Horse tack hoop, copper alloy.	Large ring or hoop with a solid circular section. The material is very heavy and dense, and there is some loss of surface patina. Such heavy-duty brass objects are commonly found as part of horse tack for bridles, etc., especially on plough horses dating to the nineteenth /twentieth centuries.	60 mm by 7.8 mm
010	001	156	Pocket-watch, silver plate and copper alloy.	Large pocket watch with a hand winding movement and prominent winding crown. The outer casing is missing but appears to have left partial corroded fragments, particularly around the winding crown. The back plate is decorated with incised lines in a swirling decoration. Parts of the clock movements can be seen and the stamp 'MADE in GT BRITAIN' together with an engraved serial number '549 M' on the internal casing. The watch facing appears to be silver plate with Arabic numerals highlighted with a small inward facing triangle to aid accuracy. The hands are missing, as is the plate for the subsidiary seconds dial. There is what is assumed to be a maker's mark centrally placed below the '12', a lion rampant holding a shield marked with the letter I. It could also be a silver plate hallmark as it has similar characteristics, but neither the maker or the hallmark has been traced.	53.8 mm by 11.5 mm
014	001	184	Lid, copper alloy.	Thick set heavy brass lid with circular form and mushroom shaped handle. The lid has long sides to fit snugly into a jar and therefore functioned to keep the contents secure and dry. This type of lid was commonly used during the late eighteenth to twentieth century as part of storage containers for medicine or dry foodstuffs such as flour.	48.4 mm by 29.1 mm

Table 5: Catalogue of metal finds

General Discussion

The palaeo-channel

The ten bulk samples analysed for archaeobotanical remains indicated that organic material was very sparse due to biological activity, and gave little indication of the vegetation growing in or around the palaeo-channel. Wood and charcoal fragments were probably transported from some distance away and could have even been redeposited from earlier sediments. The best preservation was in the uppermost sample, which indicated a damp environment with mosses and sedges probably growing on site.

The particle size analysis of the ten sequential samples provided further information on the reconstruction of the palaeo-environment. The predominance of fine silt and smaller components in the palaeo-channel, indicated that the alluvial deposits represented still water, or very slow moving, or even potentially stagnant water conditions, in overbank flood deposits. These deposits dating from the early Neolithic and late Neolithic / early Bronze Age indicate precipitation and water level changes during these periods that affected the natural palaeo-environment in this part of Edinburgh. The radiocarbon dates results indicate that earlier material eroded away to be redeposited over later dated deposits. This is a not uncommon case of reverse geological stratigraphy often associated with river and watercourse edges where material can be eroded from the banks and/or from upstream, to be redeposited over later material.

The early Bronze Age period is noted elsewhere as a substantially wetter period in Scotland (Anderson 1998; Anderson et al 1998; Barber et al 1994). The higher precipitation possibly led to erosion up stream, and redeposition of the early Neolithic organic deposits dated from sample 002. Although this analysis did not draw any conclusions on the human use of the landscape in prehistory on the edge of the palaeo-channel, it does indicate that there was anthropogenic use of the wider landscape from the Neolithic into the Bronze Age period. The burning of fields and woodland close to the vicinity of the palaeo-channel from nearby settlement, introduced both charcoal and clay as deposits into the feature, as noted in the archaeobotanical and micromorphology sections (above). The radiocarbon dates provide a time frame for the movement of sediments and of anthropological activity in the nearby area in prehistory, and the use of the landscape. In this instance indirect evidence for human activity has been an important addition to this area, where the total absence of the direct evidence of contemporary settlement and of archaeological artefacts is most noticeable.

The finds

The finds from the evaluation and metal detecting date mainly from the eighteenth or nineteenth centuries, thus highlighting a lack of evidence of human use of the landscape prior to this time. The presence of rig and furrow and regular field drains indicate that the landscape has been predominantly used for agriculture over the last 300 years, since it was enclosed, improved and drained. The small assemblage of retained finds from the metal detecting survey contained primarily domestic objects, lost through discarding of waste in the nineteenth and early twentieth centuries, from urban areas. However, there is a notable absence of objects related to agricultural practice, beyond the piece which was attributed as horse furniture and one small fragment of a ubiquitous machine part. The pocket-watch is an interesting find, appearing stylistically to date to the 1920s-1930s. A valuable item, such as this, is probably the result of a casual loss.

The evaluation revealed the site to be largely archaeologically sterile. In addition to rig and furrow, the apparent evidence of burning in the vicinity of the alluvial deposits, comprise the only evidence of anthropogenic activity in the area since the middle to late third millennium BC. As was evident from the alluvium recorded in the trenches within the flood zone, this area has been susceptible to successive flooding, which may have deterred settlement in this area from the prehistory through to the present day.

The post-excavation information on vegetation, and the changes in flow of the channel over time, and the composition of deposits will provide useful comparison for other fluvial/terrestrial locations of similar date along the Bughtlin Burn and associated water courses, as well as other water courses of this era across the Edinburgh area.

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