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Assessment of soils at Segedunum Roman Fort, Wallsend, North Tyneside

by M.-Raimonda Usai

Summary

Macro-morphological analysis of soil monoliths and loose soils buried under Roman deposits in the Segedunum Roman Fort at Wallsend has been carried out. Field evidence and examination of samples showed a full succession of soil profiles with their upper part arranged in topographic irregularity with banks and ditches possibly pre-dating Roman deposits, and with traces of burning and other disturbance.

The assessment showed that soil analysis, including macro- and micromorphological analysis and organic carbon measurements, has a rare potential and can give original results in the field of geoarchaeological research, establishing benchmark sites for further works.

In fact, such analysis may allow the establishment of the extent to which post-burial modifications have affected the pre-Roman soils and of the extent of transportation of the burnt material above the prehistoric soils, and to obtain information on waterlogging before the present time, during and before burial. The analysis may also lead to an understanding of the nature of the features interpreted as ditches and banks and of whether they only partly resulted from pre-Roman ploughing or other agents.

With such information, the pre-Roman soils under examination would assume a great regional significance along the Hadrian's Wall area, where other pre-Roman soils with plough marks, at Stanwix Fort, Denton Burn, Tarraby, Knowfield, and Black Carts, are presently under investigation.

The establishment of the regional significance of the pre-Roman soils at Segedunum highlights the need for a permanent micro-morphological record of their features, expressed using standard international terminology in order to achieve comparability with other sites along the Wall and elsewhere.

Two set of recommendations are made: one for site-related problems, and the other for both site-related problems and research purposes of regional and international value.

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Introduction

In 1997 an excavation was carried out on part of the defences and interior of the Segedunum Roman Fort at Wallsend (NZ 300660), which, as illustrated in the excavation project design, was built for Roman auxiliaries and occupied from AD 125 until at least the end of the Roman period. The work is being carried out by Tyne and Wear Museums to create an archaeological park and museum with a scheme designed to meet the objectives of the Management Plan for the Hadrians Wall World Heritage Site, with the support also of the Heritage Lottery Fund and ERDF.

Research objectives

Research aims described in the project design include the examination of areas and features pre-dating the fort; understanding the potential of Roman sites to seal and preserve prehistoric features (previous excavations at Wallsend showed traces of pre-Roman agriculture); exploiting the potential for environmental work carrying out an environmental sampling strategy.

Specifically, research objective No 1 of th project design included the investigation of the pre-fort landscape (which, at South Shields, was probably occupied by Iron Age people) and the investigation of the presence of a buried landscape surface (paleo-landsurface) . This aim entailed excavation reaching natural layers in open areas in different locations of the fort.

Soil methods

The site was visited and samples of soils/sediments were collected in aluminium Kubiena boxes . During the site visit, advice was given to the excavator Roger Oram (Tyne and Wear Museums) on the procedure for the collection of further soil samples and on sample/section description following suitable methods and, for horizon/context boundaries, the terminology of Hodgson (1976). It is assumed therefore that the soil samples successively collected, are suitable for soil analysis.

Five sections (A, B, C, D and E) were excavated, of which Sections A, D and E along two pits (Section A with pit 5320) and Sections D and E with pits (5303). Samples include one 50 cm steel monolith per section and two monoliths in Section A. Samples and sections were drawn in vertical and horizontal sections by Roger Oram whose description also included a subjective colour definition, partial record of fragments and their colour, and a description of horizon/context boundary distinctiveness and form.

Two thirds of the samples, including the Kubiena boxes collected by the writer and the soil monoliths collected by the excavators, were assessed employing macro-morphological observation in relation to field evidence. In particular, degree of disturbance and horizon types and boundaries were assessed.

Full macro-morphological description of the samples corresponding to Kubiena boxes 1,

2 and 3 is described in the Appendix.

Results and potential

The evidence at the field scale was that top soils and related Ap horizons appeared to be arranged in ditches and banks, which were interpreted by the excavators as pre-Roman deposits buried below Roman materials.

Soils represented in the monoliths and Kubiena boxes showed the full succession of soil profiles from an ?Ap to a C natural horizon. In particular, monoliths 12 and 13 showed the full vertical succession from Ap to a 2Bg-BC and C profile. Charcoal or other burnt plant material was interspersed through the whole profile. Pseudo-gleying of the Bg and BC horizons suggested seasonal waterlogging.

Monolith 10 shows a similar succession of events, plus the presence of burnt layers above the standard profile. Kubiena boxes 2 and 3 also contain an undisturbed Ap horizon and the BC horizons and their undisturbed boundary.

The samples all seemed to have been sealed by the Roman materials, although it has to be established to what extent post-burial modifications have affected the pre-Roman soils.

Comparison between monoliths 12, 13 and 10 shows a high degree of similarity of the samples though a different degree of disturbance.

It remains to be established what the nature of the features interpreted as ditches and banks is, and whether they are only partly the result of pre-Roman ploughing.

If this is the case, i.e. if the topographic irregularities represent Iron Age or, broadly, a pre-Roman ploughing event, the site assumes a great regional significance along the Hadrian's Wall area.

In fact, besides some hypotheses of pre-Roman cultivation, research is presently being carried out by the writer on possibly pre-Roman soils with plough marks at other sites along the wall, such as Stanwix Fort, Denton Burn, Tarraby, Knowfield, Knowfield, and Black Carts.

Such research focuses on a strong field evidence of ploughing and aims to establish what are the resulting soil changes and their micromorphological evidence.

Comparability of this site to other sites along the Wall also depends on whether ploughing here was repeated again and again with time or was just a limited event. Establishing this will allow a comparison of the impact on the landscape of different types of cultivation along different fragments of Hadrian's Wall.

Extrapolation of the results to a broader context countrywide is not clear and would in any case be limited by intrinsic soil variability.

It is thought that macro- and micro-morphological analysis of the samples in the monoliths and tins at the Segedunum Fort may help to give some answers to the questions which have emerged from the preliminary observations.

Specifically, comparison between soil types, and their individual pedological features, of the Ap horizons and those of the horizons underneath, can give information on the degree of mobilization of organic matter (OM) and mineral materials and possibly to

the extent to which such changes resulted from local disturbance or ploughing. This can be achieved with macro- and micromorphological observations. Organic carbon content may also give an indication of the degree of OM mobilization.

The same analysis may also show whether there has been transportation of material above the natural soil before the possible ploughing and whether the possible plough soil is as the same nature of the underlying soil (thus it is *in-situ*) or whether, before cultivation, a different soil - and which, was also transported on the site.

Following the evidence from observations at the field scale, it would be important to confirm whether the presence of plant remains is visible in thin sections and to establish the type of distribution of such remains and their relationship to the soil. This may help in the understanding of the nature of riggs and furrows (vegetation distribution in furrows? movement of furrows in different positions?). However, it is unclear to what extent vegetable remains are preserved and it is hoped to understand this from the results of the assessment of J. Huntley on plant remains.

Macro- and micro-micromorphological comparisons of sections sampled below riggs and those below furrows may permit differences between the relative soils to be established and whether disturbance was intense (as it would probably occur from repeated ploughing) or light (e.g. if only an extemporary event of ploughing was carried out). It remains to be established whether disturbance could also have resulted from other agents (along the Stanwix Fort, for example, horses could have possibly caused significant soil changes).

It is important to confirm whether the burnt material (exemplified by Section 10) above the topographic irregularities, specifically in riggs but subordinately also in furrows, was transported or had an *in-situ* component, or both, and to what extent, and whether burning was prolonged in time, or was repeated at different times, or was short and rare, and to what extent burning affected the soil. This may be established by analysing how and to what extent the soil in the proximity of the layer is modified or affected by burning. There is a possibility that, again, macro- and micromorphological analysis of the burnt layer, the top soil containing burnt materials, and the underlying soils, can give information on these questions. However, due to the presently restricted state of the art on the subject, and little reference information on similar site evidence, there may be too little knowledge available to achieve precise results on this issue.

Micromorphological analysis, however, can add vital information to the description of the phenomenon (of burning) in different types of archaeological sites, thought this may not fall in the aims of this project design.

It is very important to establish the degree, extent, and relative duration of waterlogging, and thus answer questions such as: when waterlogging started? how long has it been seasonal and how long permanent? This may provide basis for establishing how preservation of organic remains was affected by waterlogging. Results and answers may be achieved with a systematic macro-morphological record of the type and distribution of gleying aided by more detailed thin section analysis.

Important questions also include: the establishment of the (relative) duration of the time passed between the deposition of the parent material and the formation of ?natural vegetation which allowed the development of soil profiles *before* cultivation.

The other soils buried under Roman materials at Stanwix, Tarraby, Knowfield, Knowfield and Black Carts, along the Wall, show traces of cultivation. At these sites, however, cultivation was expressed by plough marks. As mentioned before, research is being carried out by the writer on behalf of the Ancient Monument Laboratory of English Heritage on the effect of ploughing on soil micromorphological features.

Thus, similar analysis of the material from Wallsend will enable the regional importance of this site, through comparison with other sites along the Wall, to be established.

In order to achieve comparability of information and results with other sites along Hadrian's Wall, it is very important to have a permanent record, with standard international terminology, of these pre-Roman soils. Specifically, it is thought that the description of the macro-morphological and micromorphological characteristics of the Wallsend sections, following standard methods and terminology internationally recognized for paleopedological and geo-archaeological studies, will allow to obtain a permanent record of these pre-historic soils and, particularly, will allow this record to be compared with others along the Wall and elsewhere.

In short, the micromorphological and 1:1 (macro-morphological) analysis and interpretation of these samples has a rare potential which is increased by the presence of other sites with complementary evidence along Hadrian's Wall. Answering the above

questions will also give original results in the field of geoarchaeological research establishing benchmark sites for further work in the future.

Samples in monoliths and Kubiena boxes are sufficiently undisturbed to allow the production of good thin sections, and the sampling strategy is adequately recorded by the writer and by the excavator (R. Oram) to permit good correlations.

Recommendations

The extent to which micromorphological analysis will be useful depends on the degree of replication.

It is thought that to answer only site-related problems, nine thin sections and nine bulk samples will possibly suffice, whilst for research purposes of regional value particularly for geoarchaeology and micromorphology, analysis of 14 thin sections, macro-morphology of 14 loose samples, organic carbon measurement of 14 samples is recommended.

Recommended research and analysis and resources are described in the Appendix.

References

Hodgson, J.M. (1976) Soil Survey Field Handbook. Describing and sampling soil profiles. *Soil Survey Technical Monograph No 5*. Harpenden: Rothamstead Experimental Station.

Appendix

Example of macromrphological description of bulk samples of the same soils contained in Kubiena boxes.

Sample: 2 (TOP)
Horizon: Ap.
In places abrupt and in places gradual lower boundary.
10YR 3/2 with common, distinct sharp mottles. Clay loam, moderately weak (natural field condition, Hodgson, 1976), very hard when dry. Presence of fine (< 1 mm) roots and few fine root channels; few fine (1-2 mm) planes. Peds of unclear shape, possibly subangular blocky, of variable size between < 10 mm and 50 mm. Peds of larger size are difficult to identify at present, though presence, size and distribution of planes may suggest that peds of any size could have been present and later compacted, though there is no proof of this.
No effervescence with HCl.
Presence of patchy coatings of unclear composition needs confirmation through micromorphological analysis.
Plough soil; pre-Roman?

Sample 1 (TOP)
Construction material. Abrupt to clear boundary with horizon below.
10YR 3/1 and 4/2-3 with common sharp prominent red mottles along cracks and root channels and common, faint diffuse mottles in matrix. Sandy clay loam, moderately weak (natural field, Hodgson, 1976), hard when dry. Few gravel and stones, with no gradation.
No effervescence with HCl.
Very few (< 5%) fine ?rotten roots, and very few (< 5%) micro (<0.075 mm) and very fine (up to 1 mm) root channels. Few micro (<0.075 mm) and very fine (< 1mm) planes and very few (< 5%) micro packing voids. Weak peds of unclear shape, possibly subangular blocky, of 20-50 mm size and possibly very unclearly defined subangular Blocky peds of 10-20 mm.
Thin patchy coatings on ped or fracture surfaces. Presence and nature of coatings, apparently clay+Fe oxides, needs confirmation by micromorphology.
Ped definition also requires micromorphology.
Construction material - ?Roman material incidental to construction.

Sample 1 (Bottom)
Horizon BC. No visible lower boundary.
Dominantly 10 YR 4/2, with variations 10 YR 7/1 to 5/1 and 5/2, and abundant (> 60%) distinct, sharp to clear mottles 10YR 4/6.
Silt loam, very weak natural field (wet, waterlogged), hard when dry and very friable when moist.
Very few fine (<1 mm) roots); not readily visible root channels.
Unclearly defined peds or surfaces of weakness possibly describing subangular blocky shapes or apedal fracturing, of variable size between <10 mm and 50 mm (where those < 10 mm are more like peds than the larger units).
Dark black impregnation features of unclear nature (Fe or/and Mn oxides? Silt, OM, or Silt+OM?- very likely humified OM and in places silt+ OM) either lining channels or diffused in matrix between channels. Their arrangement in channels suggests transportation from horizon above though this needs confirmation through micromorphology.
Silt grey coatings along root channels.
In places roots are not present in channels, humified OM is absent too, but there are light colorations along root channels.
Nature, composition and type or provenance of all pedofeatures needs confirmation by micromorphology.
Local till.

Recommendations and resources for site related problems and broader research significance

Task	Analyst	No of samples	Time	Cost per day or per sample	Total cost
Micro-morphological analysis	Research fellow	No of thin sections (TS):14 including: Kubiena Tins: 3 TS; Section E: 3 TS Section D: 2 TS; Section A: 3 TS; Section C: 3 TS; Total: 11 TS	12 days	£ 254.86	£ 3058
Macro-morphological analysis	Research fellow	14 Loose samples	2 days	£ 254.86	£ 509.72
Thin section impregnation	Specialized technician	14 block samples		£ 38	£ 532
Interpretation of different methods	Research fellow		4 days	£ 254.86	£ 1019
Site report production	Research fellow		3 days	£ 254.86	764.58
Publication of paper in journal	Research fellow		5 days	£ 254.86	£ 1274
Thin section cutting	External	14 samples		£ 38	£ 532
Organic C	Specialized technician	14 samples		£ 140.90	£ 1973
TOTAL					£ 9662.3

(costs do not include V.A.T.)

Recommendations and resources for site-related problems only

Task	Analyst	No of samples	Time	Cost per day or per sample	Total cost
Micro-morphological analysis	Research fellow	Total thin sections: 9	5 days	£ 254.86	£ 1274
Macro-morphological analysis	Research fellow	9 Loose samples	2 days	£ 254.86	£ 509.72
Thin section impregnation	Specialized technician	9 block samples		£ 38	£ 342
Interpretation of different methods	Research fellow		2 days	£ 254.86	£ 509.72
Report production	Research fellow		1 day	£ 254.86	£ 254.86
Thin section cutting	External	9 samples		£ 38	£ 342
TOTAL					£ 3232

(costs do not include V.A.T.)