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Description and comparison of soil/sediment samples from Newark Bay, Deerness, Orkney Islands

by

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Summary

Four samples collected by Prof. Don Brothwell from the base of burials in Newark Bay, Deerness, Orkney Islands, were analysed and compared, mainly with macro-morphological and microscope observations.

The samples displayed several differences: two were made of two main components, in places discrete and in places adherent to each other, whilst the other two samples were more homogeneous, but differed from each other in their mineral components, consistence, quantity of calcium carbonate and organic matter.

All samples outside the Chapel Wall were characterized by the presence of coatings made of sand and silt.

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Introduction and aims

This report describes the analysis of four soil/sediment samples collected from the base of burials in Newark Bay, Deerness.

The aim of the analysis was to describe the major macro-morphological and other features, and to compare the four samples with each other.

Since the samples were not collected, nor the site visited, by the present writer, geo-archaeological interpretation is not pursued with this report.

Methods

The four samples were described using mainly the criteria of Hodgson (1976). The relative quantity of $CaCO_3$ was assessed observing the degree of HCl effervescence. Wet and dry colour was described with the method and terminology of Munsell Colour Charts (1994). The relative quantity of sand, silt and clay particles was assessed with 'finger texturing'. The method gives an approximate estimate of the particle size range of the sample, and its accuracy is affected by various unpredictable factors, such as the presence of $CaCO_3$ (this shifts the result to a more sandy texture) and organic matter (this shifts the result to a higher clay content).

Results

The results of the analysis are shown in Table 1.

Summary and discussion

All samples were characterized by the presence of small bone fragments. The four samples absorbed water very easily, were mainly sterile, and did not contain invertebrate/vertebrate remains except some fly puparia and woodlice, most probably modern (Harry Kenward, pers.comm).

Sample from Base of Chapel Wall

This sample was fairly homogenous in colour and was partly apedal or only contained subangular peds with packing and planar voids. No coatings were observed, and the sample did not show signs of intense pedogenetic processes. Colour was also homogenous, with the exception of some redder hues of brown (7.5YR4-5/4-6) on the faces of some fragments. This colour, however, was only superficial, did not extend into the fragments and was most probably caused by oxidation through exposure to air.

The sample only contained occasional very fine modern roots (<< 0.2 mm).

Sample 9(2)

Sample 9(2) was made of two main

components, the first one (Component 2 in Table 1) very similar to the sample from the Chapel Wall, whilst the second component (Component 1 in Table 1) was of redder colour, firmer consistence, richer in silt and nodules, and less calcareous than Component 2 and than the Chapel Wall sample.

The coarse fraction of Component 1 included mainly mineral sand grains, whilst the coarse fraction of Component 2 was rich in minute shell fragments, some of which were identified as land snails.

In parts of the sample, the two components, (1 and 2) were discrete, whilst in other parts they were well adherent to each other and formed subangular blocky peds. This suggested that, whilst the two components were probably initially completely separated, they have also been together in the same material for sufficient time to become coalescent, probably as a result of compaction or light pedogenesis. Since the samples were collected at approximately 1m below the ground, it is well possible that a light post-burial pedogenesis affected the materials.

Coatings and patinae made of sand, silt and clay were observed on the faces of planar voids.

Sample 9(5)

Similarly to Sample 9(2), Sample 9(5) consisted of two components, Component 1, similar to Component 1 of Sample 9(2), of yellowish brown (wet) or reddish brown (dry) colour, and Component 2, of a less red colour and similar to the Chapel Wall sample and to Component 2 of Sample 9(2).

Colour differences between the two components were less pronounced that in Sample 9(2), but this could be the result of local variability.

Similarly to Sample 9(2), the coarse fraction of Component 2 contained abundant minute shell fragments, whilst these were almost absent in Component 1.

In most of the sample, the two components (1 and 2) adhered to each other and formed peds together. As for Sample 9(2), this sample could have been subject to light compaction and pedogenesis, which could have amalgamated the two components to a different extent.

Silt coatings were observed on ped surfaces.

Sample 9(6)

Sample 9(6) was fairly homogeneous, of dark brown colour, and did not have a significant reddish component, except one isolated ped.

Particle size was in the range of a sandy loam, and organic concentrations were diffuse throughout the sample, giving it a characteristic brown shade. The organic concentrations observed under a binocular microscope appeared to be made of humified organic material agglomerated in < 1mm, commonly approximately 0.3 mm, particles.

In contrast with the other samples, this sample did not contain significant quantities of shell fragments, was characterized by a loose network of very fine modern roots, and was only very slightly calcareous in a few parts but, mostly, it did not react to HCl.

The material was friable and soft, with subangular blocky peds, though these were

much weaker than in other samples.

Coatings made with silt were present on some void or ped surfaces.

Sit and sand coatings

Silt and sand coatings were found in Samples 9(2), 9(5), and 9(6).

Such coatings can be interpreted in various ways and there is currently much debate in the geoarchaeological community concerning their genesis (e.g. Usai, in press). Often, such coatings result from transportation of silt and sand by water movement within the soil, starting from an upper unvegetated exposed surface. Such water movement could be quite light, simple through-flow within the soil, or even just rain-drop impact. Another cause of the formation of such coatings could be recent or old agricultural practices.

Retention/disposal

The samples are stored at the EAU.

Archive

Data are retained at the EAU.

References

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	Colour (dry)	Colour (wet)	Part. size	Consistence (dry) field	Consistence (wet)	Sand/silt fraction	Mineral nodules	Roots	Small inclusions
Base of Chapel Wall	10YR 5/3 (brown) (rare faces: 7.5YR5/4-6 (brown/strong brown)	10YR4/3 (brown) (rare faces: 7.5YR4/4 (brown)	SL	Hard; very weak to moderately firm	Very friable	Sand grains; 25% shell fragments (average: ~ 0.5 mm; rarely up to 1 mm)	None observed	Occasional very fine (<<0.2 mm), modern	Cochlicopa; woodlice; fly puparium; bone fragments
9(2) Component 1 (redder)	2.5YR5/6 (red)	2.5YR4/4 (dusky red)	SZL	Hard	Friable to firm	Sand grains (inl. quartz and angular calcite)	Fe oxides)	None	Fly puparium; bone fragments Unidentified organic tissue
9(2) Component 2	10YR5/3 (brown)	7.5YR3/3 (dark brown)	SL	Slightly hard	Very friable	Very frequent shell fragments (average: ~ 0.5 mm; rarely up to ~ 1 mm)	None observed		
9(5) Component 1 (redder)	5YR 5/4 (reddish brown)	5YR4/6 (yellowish red)	SL	Hard	Friable	Sand grains, inc. quartz, feldspars and others) Few to rare shell fragments (average: ~ 0.5 mm; rarely up to ~ 1 mm);	None observed	None	Bone fragments Unidentified organic tissue
9(5) Component 2	7.5YR 5/4 (brown)	7.5YR 5/4 or 5YR4/4 (reddish brown)	SL		Very friable	Frequent [less than in Component 2 of Sample 9(2)] shell fragments (av: ~ 0.5 mm; rarely up to ~ 1 mm)	None observed		
9(6)	10YR5/3 (brown)	7.5YR3/2 (dark brown)	SL	Soft	Very friable	Sand grains, incl. mainly quartz; occasional /very rare shell fragments (< 1mm).	None observed	Few ~ 0.5 to 1 mm (modern)	Bone fragments; Unidentified organic tissue
9(6) (one ped)	5YR5/4 (reddish brown)	5YR3/4 (dark reddish brown)	n.m.	n.m.	n.m.	n.m.	Fe oxides)	None	None observed

Table 1. Summary of sample descriptions, following the terminology of Hodgson (1976). SL = sandy loam; SZL = sandy silt loam; n.m. = non measurable. (Contd.)

ENDFIELD	**Peds**	**Peds**	**Voids**	**Coatings**	**$CaCO_3$ effervescence with HCl**	**Notes**
Base of Chapel Wall	Apedal	Moderately strong angular blocky fragments (<10 to 50 mm) Non composite apedal	Frequent micro (< 0.075) packing voids. Very few planes.	None	Calcareous (clear effervescence) to strongly calcareous (much effervescence)	Moderately homogenous sample; much more uniform than samples 9(5) and 9(2). Some small bone fragments are attached to soil matrix, others are not. Sample easily absorbs water.
9(2) Component 1 (redder)	<10 to 100 mm moderately strong subangular blocky peds		Frequent very fine (0.075 to 1mm) packing voids; micro to fine random (up to 2mm) planar voids	Moderately thin to thick sand+silt+clay coatings on planar voids.	Calcareous (clear effervescence). Less calcareous than Ch.Wall sample	Composite sample including two main components: 1 (reddish) and 2. In places the components are discrete; in places they are coalescent Sample easily absorbes water.
9(2) Component 2					Calcareous (clear effervescence) to strongly calcareous (much effervescence)	
9(5) Component 1 (redder)	< 10 to 100 mm moderately strong angular and subangular blocky peds		Very few micro (0.075 mm) packing voids and planes	Thin silt coatings on surfaces of pad fragments	Calcareous (clear effervescence). Less calcareous than Ch.Wall sample	Composite sample including two main components: 1 (reddish) and 2. Colour differences between the two components are less pronounced than in sample 9(2), but this could be the result of local variations. Sample easily absorbs water Only samples of Component 1 (or Component 2) with minute fragments of Component 2 (or Component 1) were available for finger texturing; results are therefore homogenized. Pattern of $CaCO_3$ effervescence similar to Sample 9(2)
9(5) Component 2			Few micro (0.075 mm) packing voids		Calcareous (clear effervescence) to strongly calcareous (much effervescence)	
9(6)	Weak 10 to >100 angular/subangular blocky peds		Very few micro (0.075 mm) packing voids; rare cavities	Silt coatings on void/ped surfaces	Non calcareous to slightly calcareous (none to slight effervescence)	Homogeneous sample. Easily absorbs water Mainly non/ very slightly calcareous. Organic concentrations are diffused throughout the sample. Such concentrations are made of humified organic material agglomerated in < 1mm, commonly 0.3 mm, particles. Also in contrast with the other samples, this sample does not contain significant quantities of shell fragments, but is characterized by of a loose net of fine roots.
9(6) one ped	Moderately strong 50-70 mm subangular blocky ped		Fine (1-2 mm) planar voids	Clay+silt coatings on surface of ped		

Table 1 (continued). Summary of sample descriptions, following the terminology of Hodgson (1976).