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A REPORT ON SOME SOIL SAMPLES FROM CARLISLE, CUMBRIA.

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Summary

This report describes a number of soil columns and samples collected by the Carlisle Archaeological Unit during excavations in Carlisle at Castle Street, Annetwell Street and The Lanes. Interpretation as required by the excavator has been carried out as far as possible. In general the buried soils appeared to be gleys, indicating that much of the area was subject to waterlogging prior to occupation and may have been marshy in places.

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# A REPORT ON SOME SOIL SAMPLES FROM CARLISLE, CUMBRIA.

By Helen C.M. Keeley

# Introduction

At Carlisle the Eden and Caldew rivers constrain the town site on a slight promontory with the Castle located on a steep bluff near their confluence. It is thought that in Roman times the course of the River Eden came much closer to the town than it does today. Evidence of prehistoric activity is slight - ard marks were found at Annetwell Street (Period 1) relating to a prehistoric rig system and root hollows indicative of possible remains of prehistoric hedge boundaries. There was also evidence pre-Roman agriculture at Blackfriars Street below the southof east part of the town. The first fort at Annetwell Street seems to have been built about A.D. 79 under the governor Agricola. By second century the main urban development was taking place the around a continuing military nucleus but there was a contraction of the occupied area in the early to mid-fourth century.

The distribution of Middle Saxon finds (c. 9th. century A.D.) is related to the higher ground on the west side of the town. By about 1200 most of the modern street pattern is clearly present.

# Geology and Soils

The solid geology of the Carlisle basin comprises Permo-Triassic sandstones of the St. Bees formation - reddish, soft and medium grained and including beds of red mudstone - and the less extensive Kirklinton Sandstones. Also present are the St. Bees Shales and the Stanwix Shales. At Carlisle itself the red sandstone is covered by reddish till or boulder clay.

The National soil map at 1:250,000 shows the city of Carlisle to be surrounded by a variety of soil associations, which have been described by Jarvis et al (1984). These are the <u>Clifton</u> Association (seasonally waterlogged soils developed in fine loamy till and related glaciofluvial deposits) to reddish the north and south, the Wick Association (deep well drained coarse loamy typical brown earths, Wick series, intermixed with gleyic brown earths, Arrow series, and typical brown sands, Newport series) to the west, the Salwick Association (fine loamy with seasonal waterlogging and well drained coarse loamy soils developed in reddish till and glaciofluvial drift) to the soils east, the Alun Association (coarse and fine loamy brown alluvial soils) beside the River Eden to the north-east, the <u>Newport</u> <u>Association</u> (freely drained medium and occasionally coarse sandy soils formed in glaciofluvial sands and gravels and river terrace dceposits) to the north-east, the <u>Blackwood</u> <u>Association</u> (deep permeable sandy and coarse loamy soils in glaciofluvial drift) to the east and the Rockcliffe Association (coarse and fine silty typical alluvial gley soils, Rockcliffe and Tanvats series, and coarse silty gleyic brown alluvial soils, Snargate series) beside the River Eden to the north-west.

During excavations at Castle Street, Annetwell Street and the Lanes a number of soil columns and samples were taken by the Carlisle Archaeological Unit. These are described below and individual interpretations provided, as required by the excavator, as far as possible.

# Soil Descriptions

KLA G, Samples 1 and 2 were columns taken from section SG9.

Layer 1 (0-14/15 cms.) was brown (7.5YR4/4) moist and pale brown (10YR6/3) dry with abundant yellow, dark brown and pink mottles from mixed material. Intimate organic matter in patches. Sandy clay loam. Many very small to medium subrounded mainly olive grey sandstones. Apedal, massive. Moderately firm, deformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 2 (14/15 - 18/19 cms.) Very dark grey (10YR3/1) moist and greyish brown (10YR5/2) dry. Mottles and streams of pale brown sand from below. High intimate humus content. Clay loam. Apedal, massive. Abrupt smooth boundary to:

Layer 3 (18/19 - 31/34 cms.) Pale brown (10YR6/2) moist and (10YR8/1) dry with very many fine and medium, prominent clear and sharp mottles of 10YR5/8 and 10YR2/2. Sandy loam. Few very small angular fragments of olive grey sandstone. Weak, medium subangular blocky. Very weak, semi-deformable, slightly sticky, slightly plastic. Abrupt irregular boundary to:

Layer 4 (31/34 - base) Yellowish brown (10YR5/4) moist and pale brown (10YR6/3) dry. Few very fine and fine, distinct clear mottles of yellowish brown; occasional organic matter streams and patches. Loamy sand. Apedal single grain. Weak, brittle, nonsticky, non-plastic.

<u>Interpretation:</u> dumped clay (1) overlies a gley soil: reduction in the upper layers has occurred as a result of waterlogging. The high clay and humus contents of the buried topsoil suggest that the surface was receiving fine material at some stage while it was open, e.g. in marshy/stagnant water conditions, although further reduction in the profile may have been caused by the effect of the overlying dump on soil redox conditions. There was no indication that the buried topsoil was an occupation deposit and this most likely represents the natural soil prior to occupation of the site. Perhaps the overlying material was dumped to provide a drier surface.

KLA G Sample 1 was similar to KlA G Sample 2 in all significant respects, although there was less mottling in layer 3.

KLA G, Sample 3 comprised a buried soil below gravel and cobbles.

Layer 1 (0-18/19 cms.) consisted of large cobbles (6-10 cms. diameter).

Layer 2 (18/19 - 25/26 cms.) was black (10YR2/1) moist and dark grey (10YR4/1) dry, very humose silt loam with few small and medium stones (various shapes). Apedal, massive (compacted). Moderately weak, semi-deformable, non-sticky, moderately plastic.

# Clear smooth boundary to:

Layer 3 (25/26 - base) Brown (10YR4/3) moist and light yellowish brown (10YR6/4) dry matrix, with common fine and medium prominent clear mottles of yellow (10YR7/8). Silt loam. Single large (10 cms.) cobble, otherwise common small and very small subangular stones. Moderately developed medium subangular blocky. Moderately weak, semi-deformable, moderately sticky, moderately plastic.

## Interpretation

Layers 1 and 2 represent the topsoil and subsoil of a gley soil (subject to periodic waterlogging). This indicates that prior to occupation the area was poorly drained and the cobbles were deposited in a marshy area - perhaps to provide a relatively dry surface.

<u>KLA</u> <u>G</u>, <u>Sample</u> <u>4</u> appeared in the section drawing as a possible soil buried by gravel metalling but this could not be seen in the profile examined.

Layer 1A (0 - 1/2 cm.) Overburden.

Layer 1B (1/2 - 10/12 cms.) Very dark brown (10YR2/2) moist and brown (10YR5/3) dry. Intimately humose sandy loam. Few angular limestone fragments. Moderately developed angular blocky structure. Moderately weak, deformable, non-sticky, moderately plastic. Abrupt, smooth boundary to:

Layer 2 (10/12 - 20/22 cms.) Brown (10YR5/3) moist and pale brown (10YR6/3) dry, with common fine distinct clear mottles of strong brown (10YR5/8). Streams of intimate organic matter near top of horizon. Sandy clay loam. Few small and medium rounded stones. Weakly developed subangular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Abrupt boundary to:

Layer 3 (20/22 - 30/40 cms.) Dark yellowish brown (10YR4/4) moist and same dry matrix, with few fine faint clear mottles of strong brown (10YR5/8). Sandy loam. Few small and very small rounded and sub-rounded stones. Weakly developed subangular blocky (almost apedal). Very weak, semi-deformable, weakly cemented in places, non-sticky, slightly plastic. Clear irregular boundary to:

Layer 4 (30/40 - base) Dark reddish brown (5YR3/4) moist and light reddish brown (5YR6/3) dry, with pockets of material from layer 3. Sandy clay. Many small and medium rounded stones. Weakly developed medium angular blocky structure. Moderately firm, deformable, non-sticky, very plastic.

### Interpretation

Layers 1B and 2 appear to be, respectively, the topsoil and subsoil of a surface water gley - drainage having been impeded by the heavy till horizon (layer 4). Layer 3 appears to be a natural sand lens. The transition from 1B to 2 is streaky, suggesting disturbance of the topsoil prior to burial, probably by trampling, but in general this appears to be a natural soil profile with a slight amount of overburden at the top (1A). KLA G, Sample 8 was taken from a buried soil section.

Layer 1 (0-9/10cm) was very dark greyish brown (10YR3/2) moist and brown (10YR4/3) dry, with mottles of light yellowish brown (10YR6/4) and reddish brown (5YR5/4). Few, small rounded stones. Weak, medium subangular blocky. Loam. Moderately firm, semideformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 2 (9/10-24/26cm) Very dark greyish brown (10YR3/2) moist and dark greyish brown (10YR4/2) dry. Various mottles from waste materials (yellowish brown, black, pale grey). Intimate organic matter. Loam. Few very small and small subrounded stones. Moderately developed medium subangular blocky. Moderately firm, semi-deformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 3 (24/26-43/45cm) Brown (10YR4/3) moist and light grey (10YR7/2) dry. Loam. Few fine distinct, clear mottles of dark yellowish brown (10YR4/6) and flecks of yellow (10YR7/8). Some intimate organic matter near top of horizon. Common small and medium subangular and subrounded stones. Moderately developed medium angular blocky. Moderately firm, semi-deformable, slightly sticky, moderately plastic. Abrupt boundary to:

Layer 4 (43/45-base) Brown (7.5YR4/4) moist and light brown (7.5YR6/4) dry. Yellow flecks as above. Sandy clay loam. few very small subangular stones. Moderately developed medium angular blocky. Moderately weak, semi-deformable, slightly sticky, slightly plastic.

<u>KLA</u> <u>G</u>, <u>Sample</u> <u>9</u> comprised a mixed brown deposit overlying a ?buried soil.

Layer 1 (0-32/34cm) was mixed soil material of two main colours (a) Black (10YR2/1) moist and dark grey (10YR4/1) dry; (b) Brown (10YR4/3) moist and yellowish brown (10YR5/4) dry. Clay loam. Common medium subangular and subrounded stones. Moderately developed medium angular blocky. Moderately weak deformable, moderately plastic, moderately sticky. Clear irregular boundary to:

Layer 2 (32/34-44/46cm) Dark grey (10YR4/1) moist and greyish brown (10YR5/2) dry, with few faint clear mottles of greyish brown (10YR5/2). Low content of intimate organic matter. Clay loam. Common small and medium subangular and subrounded stones. weakly developed medium subangular blocky. Moderately weak, deformable, moderately sticky, moderately plastic. Clear smooth boundary to:

Layer 3 (44/46-base) Brown (10YR5/3) moist and very pale brown (10YR7/3) dry. Few small distinct clear mottles of yellowish brown (10YR5/8). Sandy clay loam. Apedal, massive. Moderately weak, semi-deformable, moderately sticky, moderately plastic.

### Interpretation

Layer 1 appeared to consist of mixed topsoil and subsoil from a brown earth which had been dumped at the site. Layers 2 and 3 may represent a palaeosol but it was not possible to confirm this from the profile. KLA G, Sample 10 was taken from material filling a ditch.

Layer 1 (0-6/7cm) Sandy clay ditch infill, similar to layer 3.

Layer 2 (6/6-25/27cm) Black (10YR2/1) moist and dry, with common fine and medium distinct clear mottles of yellowish brown (10YR5/8). Mixed organic and mineral material with clear evidence of rotted brushwood towards the base of the horizon. Weakly developed subangular blocky structure. Moderately weak, semideformable, slightly sticky, moderately plastic. Abrupt, irregular (angled) boundary to:

Layer 3 (25/27-base) Dark reddish brown (5YR3/4) moist and light reddish brown (5YR6/3) dry. Various types of pink and red mottle from other materials. Large patch (6 cm max.) of cemented sandy material (7.5YR3/4). Sandy clay. Common small and medium subrounded and rounded stones. Moderately firm, deformable, nonsticky, very plastic.

#### Interpretation

There is little direct evidence for the length of time taken for the organic layer 2 to build up. The presence of the brushwood, the sharpness of the 2/3 boundary and the occurrence of mineral patches suggest dumping or rapid deposition.

<u>KLA</u> <u>G</u>, <u>Sample 11</u> was a section through a soil buried by upcast clay.

Layer 1 (0-5/6cm) Reddish brown (5YR4/4) moist and light reddish brown (5YR6/4) dry. Common pale grey mottles and sand patches. Sandy clay loam. Common medium subangular stones. Apedal massive. Moderately firm, deformable, slightly sticky, very plastic. Abrupt smooth boundary to:

Layer 2 (5/6-11/15cm) Black (7.5YR2/0) moist and dark grey (10YR4/1) dry. Humose sandy loam with charcoal. Medium fine angular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Clear smooth boundary to:

Layer 3 (11/15-32/37cm) Brown (10YR5/3) moist and light grey (10YR7/1) dry. Few, fine, distinct, clear brownish yellow (10YR6/8) mottles. Streams of intimate organic matter - mainly old root channels. Sandy clay loam. Few medium subangular stones. Weak medium subangular blocky. Moderately firm, deformable, moderately sticky, moderately plastic. Clear wavy boundary to:

Layer 4 (32/37-41/43cm) Brown (7.5YR4/4) moist and pale brown (10YR6/3) dry, with indistinct but abundant mottling of reddish brown (5YR4/4). Sandy clay loam. Structureless or very weak fine subangular blocky. Moderately firm, deformable, moderately sticky, moderately plastic. Abrupt irregualr boundary to:

Layer 5 (41/43-base) Mixed colours mainly a) yellowish brown (10YR5/8) and b) strong brown (7.5YR4/6). Sandy clay. Abundant small and medium subrounded and rounded stones. Stucture indeterminate. Moderately firm, deformable, moderately sticky, very plastic.

# Interpretation

An occupation horizon/topsoil (Layer 2) is buried by upcast clay. The remainder of the profile appears to be the undisturbed subsoil - a sandy clay loam with moderately impeded drainage due to the heavy sandy clay below.

<u>KLA G, Sample 12</u> was a section through organic deposits overlying thin metalling above a truncated soil.

Layer 1 (0-39/40cm) Black (10YR2/1) moist and dry. Patches of other colours, notably dark yellowish brown (10YR3/6) towards the base of the horizon. Stream of pale sand. Large rotted wood fragment, charcoal, etc. Humose sandy clay loam. Few small subangular and subrounded stones. Apedal massive. Moderately weak, deformable, slightly sticky, slightly plastic. Abrupt smooth boundary to:

Layer 2 (39/40-44/46cm) Dark brown (7.5YR3/2) moist and dry. Humose sandy clay loam. Many small and medium rounded and subrounded stones. Indeterminate structure. Moderately weak, deformable, slightly sticky, slightly plastic. Abrupt wavy boundary to:

Layer 3 (44/46-base) Reddish brown (5YR5/3) moist and dry. Sandy clay. Abundant small and medium rounded and subrounded stones. Indeterminate structure (too stony). Moderately firm, deformable, slightly sticky, very plastic.

### Interpretation

There was no evidence of profile development and layer 1 is probably the result of dumping or colluviation.

<u>CAL</u> <u>Sample B1 SB2</u> was a section through deposits to the north of the road in SB4.

Layer 1 (8-33/37cm) was very dark brown (10YR2/2) moist and very dark greyish brown (10YR3/2) dry, very humose and with few, medium prominent sharp mottles of yellowish brown (10YR5/8). Clay loam. Common small and medium subangular and subrounded stones. Weakly developed medium angular blocky. Moderately weak deformable, slightly sticky, slightly plastic. Clear smooth boundary to:

Layer 2 (33/37-base) Dark yellowish brown (10YR4/4) moist and pale brown (10YR6/3) dry. Common fine and medium, distinct and faint mottles of various colours (very dark brown, greyish brown, strong brown). Sandy clay loam. Common medium subrounded stones. Moderately weak semi-deformable, slightly sticky, slightly plastic.

<u>CAL</u>, <u>Sample</u> <u>SB4</u> was a section through a soil buried by a major road running east to west into the town centre.

Layer 1 (6-12/20cm) Very dark brown (10YR2/2) moist and very dark greyish brown (10YR3/2) dry. Few fine distinct sharp mottles of 10YR5/6, especially towards the base of the horizon. Streams and patches of pale grey sand. Highly organic. Few small and medium subangular stones. Apedal massive. Moderately weak, deformable, slightly sticky, slightly plastic. Gradual smooth boundary to: Layer 2 (12/20-42cm) Dark brown (10YR3/3) moist and yellowish brown (10YR5/4) dry. Many fine and medium distinct clear mottles of strong brown (7.5YR4/6) and streams of intimate organic matter. Clay loam. Common small and medium subrounded stones. Weakly developed medium subangular blocky. Moderately firm, deformable, moderately sticky, moderately plastic.

## Interpretation

Horizons 1 and 2 merged, with no distinct boundary, so modal horizon forms have been described. The section appears to represent a buried gley soil, with occupation disturbance in the topsoil.

<u>KLA E, Sample 7</u> was a north-facing section in Trench 2.

Layer 1 (0-10/12cm) Very dark grey (10YR3/1) moist and greyish brown (10YR5/2) dry. Intimate organic matter and occasional mottles from in-mixed materials. Sandy clay loam. Few medium subangular stones. Weakly developed subangular blocky. Moderately weak deformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 2 (10/12-23/24cm) Very dark greyish brown (10YR4/2) moist and pinkish grey (7.5YR6/2) dry. Large areas of material in-mixed from 1. Sandy clay loam. Few small and medium subangular and subrounded stones. Weakly developed medium subangular blocky. Moderately firm, deformable, moderately sticky, moderately plastic. Abrupt smooth boundary to:

Layer 3 (23/24-32/34cm) Reddish brown (5YR4/4) moist and light brown (7.5YR6/4) dry. In-mixed intimate organic matter producing dark mottling. Clay loam. Few small and very small subangular and subrounded stones. Weakly developed fine and medium subangular blocky. Moderately firm, deformable, moderately sticky, moderately plastic. Abrupt smooth boundary to:

Layer 4 (32/34-43/44cm) Dark grey (10YR4/1) moist and light brownish grey (10YR6/2) dry. Pale sand producing fine mottles. Clay loam. Few small subangular and subrounded stones. Apedal massive. Moderately firm, deformable, moderately sticky, moderately plastic. Abrupt smooth boundary to:

Layer 5 (43/44-base) Light brownish grey (10YR6/2) moist and light grey (10YR7/2) dry. Very many fine prominent clear mottles of yellowish brown (10YR5/8). Sandy clay loam. Weakly developed medium and fine subangular blocky. Moderately weak, deformable, slightly sticky, slightly plastic. Analytical results are shown in the table below:

<u>Sample</u>	Depth Loss	on <u>Co</u>	arse l	Med. Fi	ne Sand	<u>Silt</u> Cla	<u>ay</u>
		8	8	8	8	રું	ક
Layer1	0-10/12	4.60					
Layer2	10/12-23/24	1.22	5.35	23.98	32.90	18.77	16.74
Layer3	23/24-32/34 top	1.83					
Layer4	32/34-37/38	4.38					
	37/38-43/44	1.83					
Layer5	43/44-base	0.20	4.18	15.18	29.70	22.60	23.20

# Interpretation

Layer 1 appeared to be a soil (possibly a garden soil) developed in dumped material. Layers 2 and 3 also appeared to be dumped materials. Layers 4 and 5 represent a buried gley soil, the topsoil being clearly demonstrated in the upper part of Layer 4 by the increase in organic matter content.

<u>OGL C, Sample 1</u> was a sample from a ? 2nd. century AD turf rampart. It comprised the humus and leached (E) horizons of podzols, local till and some signs of occupation (charcoal) - all of which had been mixed together in the digging/building process. The material appeared to contain turf from a heathland environment, developed on podzols, rather than from grassland as in sample 465 (described later).

LEL A, Sample 10 comprised two of a large number of turves, which may have been laid in a trench, and consisted of peat with a subsoil layer (the latter being out of its natural position). The material appeared to have come from a partially waterlogged peat bog environment, with <u>Calluna</u> sp./<u>Erica</u> sp. growth.

<u>ANN A, Sample 93, SA 244</u> was a buried soil profile below a Flavian building.

Layer 1 (0-20/23cm) Brown (7.5YR4/4) moist and yellowish brown (7.5YR5/4) dry. Few very fine and fine distinct clear yellowish red (5YR4/6) mottles. Occasional streams of intimate organic matter. Sandy clay loam. Weakly developed coarse subangular blocky. Moderately weak, deformable, moderately sticky, slightly plastic. Clear irregular boundary to:

Layer 2 (20/23-28/29cm) Very dark grey (10YR3/1) moist and very dark greyish brown (10YR3/2) dry. Intimately humose sandy clay loam. Medium angular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 3 (28/29-45/49cm) Yellowish brown (10YR5/4) moist and very pale brown (10YR7/3) dry matrix. Many horizontally oriented streams of organic matter, building up towards the top of the horizon to be the main colour (10YR2/2); only an isolated stream towards the base. Weak angular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Abrupt smooth boundary to:

Layer 4 (45/49-base) As 3 but with many prominent clear dark yellowish brown (10YR4/6) mottles. Developing towards base into the predominant colour.

#### Interpretation

Layer 1 was dumped material with little evidence of soil development. 2 was a relict topsoil/occupation horizon and 3 a relict subsoil, with topsoil in-mixed by anthropogenic activity probably trampling. 4 represented the gleyed subsoil, subject to periodic waterlogging.

ANN A, Sample 405, SA 229 was a section through a buried soil with Roman disturbance on top, overlain by a cobbled surface.

Large rounded cobblestones occurred at the top. Layer 1 (5/6-6/7cm) Very dark grey (10YR3/2) moist and dark greyish brown (10YR4/2) dry. Mainly compressed plant remains and some mineral matter (sandy loam). Sharp smooth boundary to:

Layer 2 (6/7-22/24cm) Very dark brown (10YR2/2) moist and dark greyish brown (10YR4/2) dry. Streams, mottles and patches of dark brown (10YR5/2), particularly towards the base. Clay loam. Coarse and medium angular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Clear wavy boundary to:

Layer 3 (22/24-32/35cm) Very dark greyish brown (10YR3/2) moist and greyish brown (10YR5/2) dry matrix with streaks and mottles of various colours (mainly 10YR4/3) and sizes. Clay loam. Patchy intimate organic matter. Weakly developed fine and medium subangular blocky. Moderately weak, deformable, slightly sticky, moderately plastic. Clear smooth boundary to:

Layer 4 (32/35-47/48cm) Matrix/mottles indistinguishable. a) yellowish brown (10YR5/4) b) dark brown (7.5YR4/4). Clay loam. Weakly developed subangular blocky. Moderately weak, deformable, moderately sticky, moderately plastic. Abrupt smooth boundary to:

Layer 5 (47/48-base) Grey (10YR5/4) with many fine, strong brown (7.5YR5/8) distinct clear mottles. Clay loam. Common small rounded and subrounded stones. Moderately weak, semi-deformable, weakly cemented, moderately sticky, slightly plastic.

#### Interpretation

This appeared to be the complete profile of a buried groundwater gley soil, with a deep humose topsoil. The sample was apparently taken through a plough (ard) mark and the deep topsoil may be the result of cultivation.

ANN A, Sample 465, SA 246 was taken from a turf rampart.

Layer 1 (0-12/13cm.) Black (10YR2/1) moist; almost pure humus. Occasional quartz grains. Homogeneous. Coarse angular blocky. Sharp smooth boundary to:

Layer 2 (12/13-17cm.) Very dark greyish brown (10YR3/2) moist and dark greyish brown (10YR4/2) dry. Loamy sand. Apedal single

grain. Large wood fragment present. Very weak, brittle, nonsticky, non-plastic. Sharp boundary to:

Layer 3 (17-25/26cm.) Almost pure humus. Occasional quartz grains. Black (10YR2/1) moist. Structureless, apedal massive. Boundary delineated by thick band of semi-rotted plant material (0.5cm.).

Layer 4 (25/26-32/33cm.) As Layer 3 but with diffuse inclusions of loamy sand as in Layer 2. Boundary plant material 0.5 to 1cm. thick.

Layer 5 (32/33-42/43cm.) Same as Layer 4.

Layer 6 (42/43-49/50cm.) Same as Layer 4.

Layer 7 (49/50-base) Reddish brown (5YR4/4) moist and light reddish brown (5YR6/3) dry. Clay. Sample too small to ascertain structure. Moderately firm, semi-deformable, moderately sticky, very plastic.

#### Interpretation

The rotted plant material appears to represent the turf layer - probably a riverine peat (? reeds). Wooden ties may have been placed as a layer and then infilled with clay (Layer 7) or sand (Layer 2).

ANN A, Sample 466 was taken from a turf rampart.

Layer 1 (0-2/3cm.) Brown (10YR4/3) moist and greyish brown (10YR5/2) dry. Some streaking with intimate organic matter. Loamy sand. Apedal single grain. Very weak, brittle, non-sticky, non-plastic. Sharp wavy boundary to:

Layer 2 (2/3-7/9cm.) Black (10YR2/1) moist. Almost pure humus. Occasional quartz grains. Apedal massive. Inclusions of brown sand similar to Layer 1. Sharp smooth boundary of 0.25-0.5 cm. rotted plant material.

Layer 3 (7/9-20/22cm.) Black (10YR2/1). Humus similar to Layer 2. Sharp smooth boundary of 0.5-1 cm. rotted plant material. Some streams of brown sand as in Layer 1.

Layer 4 (20/22-28/31cm.) Black (10YR2/1) humus as in Layer 2. Strongly angled sharp smooth boundary of 0.25-0.5cm. rotted plant material.

Layer 5 (28/31-38/42cm.) Similar to Layer 2. Boundary material 1-1.5 cm. thick.

Layer 6 (38/42-base) Similar to Layer 2.

# Interpretation

This material appeared to be similar to Sample 465.

ANN A, Profiles 467, 468 and 469, SA 157 were taken from 2nd. century AD soil layers. These 3 profiles are described as one, with the horizon depths calculated from the overlaps, which were taken from the scaled dyeline sheet of SA 157. Layer 1 (6/10-32/34cm.) Very dark brown (10YR2/2) moist and brown (10YR5/3) dry matrix. Numerous other colours from waste matter. sandy clay loam. Common very small and small subrounded and subangular stones. Weakly developed, very coarse subangular blocky. 2.5% fine macropores. Moderately weak, semi-deformable, slightly sticky, slightly plastic. Abrupt wavy boundary to:

Layer 2 (32/42-56/57cm.) Very dark greyish brown (10YR3/2) moist and brown (10YR4/3) dry. Abundant mottling and streaming with light olive brown (2.5Y5/6), as well as numerous other colours from waste matter (e.g. brick). Sandy loam. Many very small and medium subangular and subrounded stones and brick fragments in 467. The 468 overlap consists of 1 large (8 cm.) rounded cobblestone. Very weak medium subangular blocky. Moderately weak, semi-deformable, slightly sticky, slightly plastic. Sharp smooth boundary to Layer 3 in 468:

Layer 3 (56/57-64/68cm.) Very dark brown (10YR2/2) moist and dark brown (10YR3/3) dry. Upper parts of the horizon have staining of strong brown (7.5YR4/6) and the whole horizon has flecks of other colours from waste materials and streams of intimate organic matter, particularly towards the base. Loam. Common very small and small subrounded and subangular stones. Apedal massive. Moderately weak, semi-deformable, slightly sticky, slightly plastic. Clear smooth boundary to:

Layer 4 (64/68-77/81cm.) Black (10YR2/1) moist and black (2.5Y2/0) dry, with other colours from waste matter. Loamy sand with intimate organic matter, charcoal and wood fragments. Common small and medium stones of all shapes. Apedal single grain. Very weak, brittle, non-sticky, non-plastic. Sharp boundary delineated by large wood fragment.

Layer 5 (77/81-base) Indeterminate horizon of various mixed materials. All sizes of stone and wood fragments, charcoal and brick. Intimate organic matter throughout. Fine earth fraction generally loamy and/or sandy.

# Interpretation

Although the mode of deposition of Layer 1 cannot be ascertained, this horizon has possibly undergone pedological development in the form of structure and porosity creation and appears to represent a stabilisation phase.

Layer 4 is an occupation horizon - probably a stabilisation phase - but there is no evidence of soil development. The other horizons are dumped material. The greenish streaking noted in Layer 2 is an iron/phosphorus/organic compound (exact mineralogy unknown) commonly found on waterlogged urban sites.

ANN A, Sample 470 was taken froma 2nd. century AD dump.

Layer 1 (11/12-16/17cm.) Dark brown (7.5YR 3/2) moist and brown (10YR5/3) dry. Common, fine, distinct sharp and clear yellowish cbrown (10YR5/8) mottles. Sandy loam. Moderately developed medium subangular and angular blocky. 0.1% fine macropores. Moderately weak, semi-deformable, slightly sticky, slightly plastic. Abrupt smooth boundary to:

Layer 2 (16/17-43/44cm.) Various waste material colours.

Generally brown (10YR4/3) with pale brown, brick red, and charcoal black. Few very small, small and medium stones. Highly compacted and apedal massive. Moderately weak, deformable, moderately sticky, moderately plastic. Abrupt smooth boundary to:

Layer 3 (43/44-base) Very dark grey (10YR2/1) moist and dark greyish brown (10YR4/2) dry. Intimate organic matter. Sandy loam. Few small and medium angular and subangular stones. Weak medium subangular blocky. Few, fine macropores. Moderately weak, deformable, slightly sticky, moderately plastic.

#### Interpretation

Layer 1 appeared to be a compacted soil horizon with some pedological development (pores and structure), indicating a stabilisation phase, although the material had been originally dumped. Layer 2 was a waste dump and Layer 3 may have been a buried topsoil. The sample was not the same as 467.

# ANN A, Sample 471, SA 246 was taken from a soil below a rampart.

Layer 1 (0-6/8cm.) H or Oh horizon. Black (10YR2/1) moist and dry. Highly organic with occasional sand grains. Structureless, massive apedal. Very weak, non-sticky, slightly plastic, deformable. Many fine and very fine fibrous roots in the lower part. Sharp irregular boundary to:

Layer 2 (6/8-10/11cm.) Very dark grey (10YR3/1) moist and brown (7.5YR5/2) dry matrix. Many fine and very fine, distinct, clear brown (10YR4/3 moist) mottles. Intimate irregularly distributed organic matter. Sandy loam. Massive apedal. Moderately weak, non-sticky, non-plastic, semi-deformable. Sharp irregular boundary to:

Layer 3 (10/11-29/31cm.) Very dark greyish brown (10YR3/2) moist and dark greyish brown (10YR4/2) dry. Intimate humus. Sandy loam. Few very small and small subangular stones. Apedal massive. Moderately weak, non-sticky, non-plastic, semi-deformable. Sharp irregular boundary to:

Layer 4 (29/31-32/34cm.) Black (10YR2/1) moist and very dark greyish brown (10YR3/2) dry. Intimately humose. Sandy loam. Apedal massive. Moderately weak, non-sticky, non-plastic, semideformable. Sharp irregular boundary to:

Layer 5 (32/34-41/43cm.) Very dark greyish brown (10YR3/2) moist and brown (10YR5/3) dry matrix. Common fine and medium, distinct, diffuse streams of very dark brown (10YR2/2 moist) intimate organic matter. Few, fine and medium, distinct sharp dark brown (7.5YR3/4 moist) mottles. Loamy sand. Massive apedal. Very weak, non-sticky, non-plastic, semi-deformable. Diffuse irregular boundary to:

Layer 6 (41/43-base) Dark brown (10YR3/3) moist and greyish brown (10YR5/2) dry. Loamy sand. Common, fine medium and coarse, distinct, clear dark brown (7.5YR3/4) mottles. Massive apedal. Very weak, non-sticky, non-plastic, semi-deformable.

### Interpretation

Layer 1 was the bottom of the rampart. Layer 2 may have been partially leached and thus a stabilisation horizon. Layer 3 appeared to consist of imported soil - it is unlikely to be locally derived if layers 4,5 and 6 are local. Layers 4,5 and 6 appear to comprise horizons of a buried stagnopodzol or gley soil.

## Conclusions

In general the buried soils appear to be gleys, indicating that much of the area was subject to waterlogging (at least sporadically) prior to occupation. The humose nature of some of the topsoils suggests marshy conditions may have prevailed in places. Similar buried soils were noted by the author during earlier excavations at Annetwell Street (D. Charlesworth) and Fisher Street (D. Neal). The rampart turf blocks appear to have come from soils in the immediate locality, i.e. marshy soils close to the river bank.

It appears that prior to the Roman period the area where the city of Carlisle now stands was waterlogged, probably marshy, for much of the year. Patches of better-drained soils were exploited for arable agriculture but otherwise the area was probably used for pastoral activities. The rig system may have been partly a response to dampness. Many of the samples examined showed signs of anthropogenic activity resulting from occupation but it is not possible to attribute this to cultivation. The nature of the soils would have rendered them relatively unattractive for arable agriculture. Clearly the Romans had to dump material in many places over the existing soil in order to produce drier surfaces for their activities and, no doubt, the damp soils continued to cause problems for the medieval occupants of the town.

### Reference.

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