RESEARCH DEPARTMENT REPORT SERIES no. 60/2008 ISSN 1749-8775

GROUNDWELL RIDGE, SWINDON, WILTSHIRE
INVESTIGATIVE CONSERVATION OF FINDS RECOVERED DURING EXCAVATIONS 2003-2005

ARCHAEOLOGICAL CONSERVATION REPORT

Vanessa Fell, Zara Peacock and Jacqui Watson

ARCHAEOLOGICAL
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ENGLISH HERITAGE

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Research Department Report Series 60-2008

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NGR: SU 1408 8935

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SUMMARY

This report outlines the investigative conservation of a group of finds recovered from the excavation of this Roman villa, between 2003-2005. The finds include a group of wooden writing tablets, personal items such as beads and brooches along with a quantity of painted plaster from the area incorporating the bathhouse. The conservation and analysis of this rare group of writing tablets is discussed in detail, as well as the analysis of the pigments used on the painted plaster.

KEYWORDS

Investigative Conservation
Metal
Glass
Wood worked
Painted plaster

CONTRIBUTORS

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ACKNOWLEDGEMENTS

We would like to thank Roger Wilkes for assistance with the scanning electron microscope and undertaking the Infra red photography. We are also grateful to Sue Turnbull who carefully cleaned and packed the painted plaster sherds from 2004 excavations, and Sharon Penton who organized the packaging system for the writing tablets. Thanks also to Gill Campbell and Peter Popkin for identifying the fragment of tooth masquerading as a sherd of an iron vessel, and Jenny Jones for the loan of an original ink writing tablet to enable us to test the Infra red filter.

ARCHIVE LOCATION

Currently Fort Cumberland, and on completion of project will be transferred to Swindon Museum and Art Gallery.

CONTACT DETAILS

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INTRODUCTION

Vanessa Fell

The Roman villa at Groundwell Ridge, Swindon, Wiltshire (NGR: SU 1408 8935) was partially excavated during 2003 to 2005. The excavation (funded by English Heritage and Swindon Borough Council), involved several organizations, principally English Heritage and Wessex Archaeology, under the direction of Pete Wilson (see Brickstock et al 2006a). An appraisal of the material archive can be found in the excavation summary (Brickstock et al 2006a) and in more detail in the assessment report (Brickstock et al 2006b).

The following report describes the results of investigative conservation of selected finds as described in the conservation assessment report (Fell, in Brickstock et al 2006b, 109-113). The coins and finger ring, from the 2003 excavations, are not included as these items were conserved previously for the spot-dating and display.

CONSERVATION

The programme of investigative conservation and related analysis concentrated on the metal finds and wooden writing tablets. Other materials include glass beads, coral, painted plaster, shale/lignite, worked bone, and a small soil block.

The principal aims of the programme were:

- Investigative conservation to facilitate study, description and illustration
- Scientific analysis to identify materials
- Stabilization or controlled storage of artefacts.

To achieve these aims, all metal finds were x-rayed prior to assessment. Standard conservation methods were employed, principally the examination of artefacts under low-power optical microscopy and selective removal of accretions to examine underlying surfaces or deposits.

Where material types were uncertain, or where metal coatings were suspected, these were analysed qualitatively by X-ray fluorescence (Appendix 1). Organic materials were identified using optical microscopy, or where necessary, samples were removed and examined under a scanning electron microscope.

Finds were either actively stabilised, for example the writing tablets, or were placed in stable conditions, for example the metalwork was placed in desiccated micro-climates.

2. THE WRITING TABLETS

Zara Peacock and Vanessa Fell

Two small waterlogged blocks of thin wooden sheets (SF200428753 & SF200428700) were excavated in 2004 from context 5099, and kept in cold storage until the active conservation could start. Initial cleaning to remove surface soil had suggested that these were writing tablets (Figs 2.1 and 2.2), probably wax writing tablets in the case of block 8700, but the paper thin layers of wood in block 8753 may have been used for ink writing. Scientific analyses to investigate if any traces of wax or inks survive, together with wood identification are presented below.

Figure 2.1 Block 8753 after removal of some surface soil but before stabilisation (photo: V. Fell).

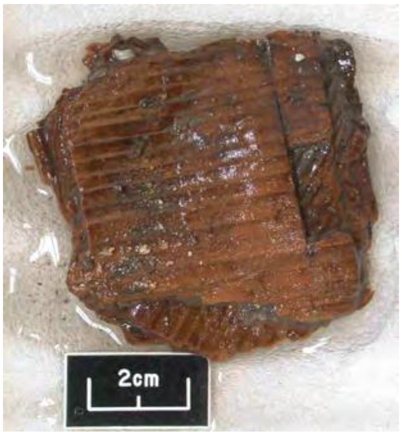
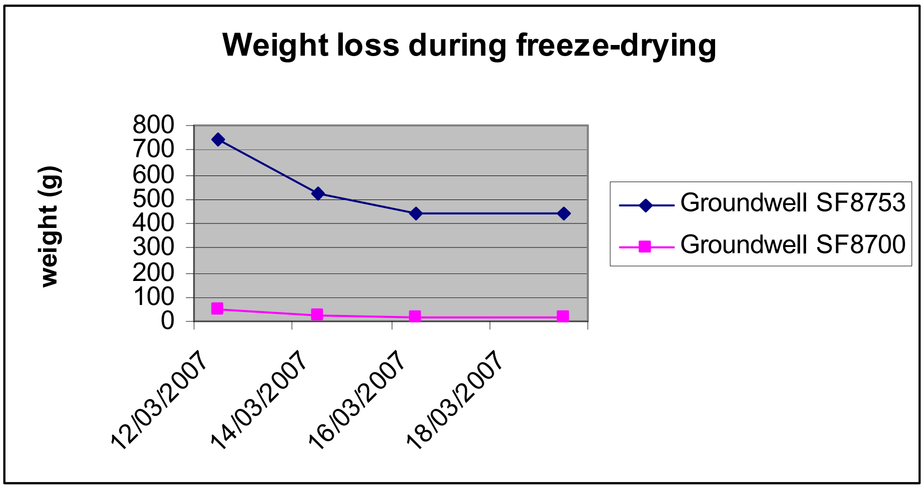


Fig 2.2 Block 8700 before freeze-drying (photo: V Fell)

Conservation

The superficial soil was removed with a soft brush and water while the blocks were still wet. Then the blocks were pretreated in 20% (wt/vol) polyethylene glycol (PEG) grade 400 for 14 weeks prior to freeze-drying, with a change of solution after the initial three weeks. The wood was then removed from the PEG bath and the excess solution removed before freezing. They were vacuum freeze-dried with the chamber set at -30°C, and the progress of freeze-drying process was monitored by regularly weighing the separate pieces (Fig 2.3).



	12/03/2007	14/03/2007	16/03/2007	19/03/2007
Groundwell SF8753	746.6	518.9	439.4	438.2
Groundwell SF8700	46.2	23.7	19.7	19.4

Fig 2.3 Weight loss during freeze-drying

The end point of freeze-drying is determined when the weight stabilizes, and at this point the wood can be returned to ambient conditions where it takes up a little atmospheric moisture. Once dry the loose soil was removed from surfaces, giving the appearances as shown in Figures 2.4 and 2.5.

The blocks were X-rayed (P2626–P2629) to investigate whether any additional details could be revealed. However, there was too much soil present to enable useful imaging.

Fig 2.4 Block 8753 after freeze-drying showing one surface of the soil block (top) and the four edges (bottom) (photos: Z. Peacock)

Fig 2.5 Block 8700 after freeze-drying showing both sides (top) and the four edges (bottom) (photos: Z. Peacock)

2.2 ANALYSIS

Jacqui Watson

Separating

After freeze-drying it was possible to separate the more flexible wood from the dry soil. In the case of block 8700 plans were made as each layer was removed, and it was possible to see that the different fragments were aligned at angles to one another and were not a book of tablets joined together as originally thought.

Identification

These fragments of writing tablets are probably made from larch (*Larix* sp.), a wood not native to the British Isles at this date. Wax writing tablets have been found on a number of sites in Britain, but most have come from Roman forts along Hadrian's Wall and are associated with the military occupation, and are dated to the 1^{st} and 2^{nd} centuries AD. The woods used for these objects form a small group including silver fir, larch, and cedar, with a few examples of maple or sweet chestnut (see table 2.1). Silver fir and larch were native to upland areas of southern Europe, while cedar was more common in the Eastern

Mediterranean territories of the Roman Empire (Hather, 2000; Gale and Cutler, 2000). Sweet chestnut is also not a native tree to the British Isles, and is presumed to have been introduced into England by the Romans. Out of the five wood species recorded for the wax writing tablets only the examples made from maple could have come from local supplies of timber.

The use of larch for these writing tablets also make it less likely for them to have been written on in ink. Ink writing tablets are usually about 1-2mm thick and made from wood peeled away from the circumference of a tree rather like the production of veneers, and pale-coloured woods, such as alder, birch and willow, were usually selected for this purpose

Table 2.1 Woods used for writing tablets from various sites in England.

	Alder	Birch	Willow	Maple	Silver fir	Larch	Cedar	Sweet chestnut
Vindolanda, Hadrian's Wall[1]	▲ (red)	▲ (red)	▲ (red)			● (green)		
Carlisle, Annetwell St.[2]	▲ (red)				● (green)		● (green)	
Carlisle, Millenium excs.[3]							● (green)	
Corbridge. Hadrian's Wall [4]				● (red)	● (green)			● (green)
London, St Thomas' St.[5]					● (green)			
London, St Magnus House[6]					● (green)		● (green)	
Groundwell Ridge, Wilts						● (green)		
Silchester, Berks[7]				● (red)				
	Alnus sp.	*Betula* sp.	*Salix* sp.	*Acer* sp.	*Abies* sp.	*Larix* sp.	*Cedrus* sp.	*Castanea* sp.

▲ (red) – ink writing tablets made from native wood species
● (red) – wax writing tablets made from native wood species
● (green) – wax writing tablets made from non-native wood

1- Bowman and Thomas 1983; 2- Jones 1991; 3- Watson; 4- Watson 1987b; 5- Keepax 1975; 6- Gale and Cutler 2000; 7- Watson 2008.

IR photography
The largest piece of worked wood was very thin, and it was thought that it might have been an ink writing tablet. After freeze-drying there was no obvious sign of any writing, but in order to be certain the large pieces were photographed using an infra-red filter (Wratten 87C) to enhance any writing that might remain, but we could find no evidence to presume that ink had been used on any of the pieces.

Figure 2.6 Block 8753 photographed using an infra-red filter.

FTIR
Attempts were made to try and analyse any traces of wax that might remain using UV light and Fourier Transform Infra-Red spectroscopy (FTIR). Unfortunately both techniques proved inconclusive. No traces of wax showed under ultra-violet light, but this only indicates that no fluorescent minerals were present as fillers. It was possible to produce a FTIR spectrum, but no definite match was found at this time so samples have been retained for further analysis when more comparative spectra are available.

Storage
The separated writing tablets have been put into customized acid-free card and tissue cells to protect them from damage in handling and any changes in humidity levels. The objects remain very fragile and could easily break on handling, and some pieces are so thin and lightweight that they could blow away. They should be handled with care, and always be returned to their boxes after use.

3. METALWORK

3.1 Soil block SF 200428768

Zara Peacock

Soil block SF 200428768 (Fig 3.1) was X-rayed (Fig 3.2) soon after excavation, and found to be a group of nails, which was then carefully excavated to determine if there had been an organic container such as a wooden box or leather bag that surrounded the nail group.

Fig 3.1 Four views of soil block 8768 before excavation.

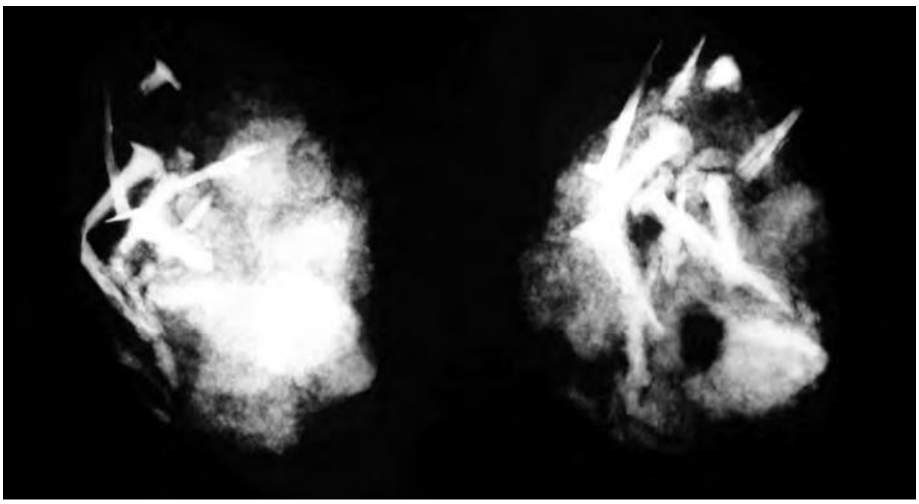


Fig 3.2 X-radiograph of soil block 8768 (X-ray and photo: K. Graham)

The block was photographed and the surface planned (see Appendix 2) at each phase of excavation, in four stages. Nails were numbered and bagged separately, and stored in a desiccated environment.

There were 13 iron nails (and an additional one found in the packaging) excavated from the soil block. They are in a relatively stable condition, and appear to retain a metal core, as suggested by the X-ray. Most of the nails are bent which suggests that they had been used, and just left in a pile. There was no visible evidence of mineral preserved organic materials on the nails or in the surrounding soil. Roots and snail shells were present at all levels of the block, suggesting that the soil around the cluster of nails had been disturbed and thus would have removed any trace of an organic container. This was further suggested by three voids in the lower level, likely to be worm holes. If, as suggested above, that the nails were discarded then it is possible that they were not in any type of container.

3.2 OTHER IRONWORK

Vanessa Fell

Other ferrous artefacts were investigated to clarify identity or to reveal additional information such as form or cross-section. Selective removal of corrosion products was usually sufficient intervention to distinguish between items such as possible implements and nail stems, or fragments of strip and blade fragments.

In addition, 200513063 an alleged iron vessel rim, was determined by XRF analysis to comprise principally calcium. This was later recognised as a fragment of tooth (G. Campbell pers. comm.), possibly sheep/goat rather than bovine on the basis of size (P. Popkin pers. comm.).

Table 3.1 Summary of investigative conservation of the iron finds

Lab no	Cxt	Identity	X-ray	Comment	Treatment
20042 7055	5003	Implement	P2659	Round-sectioned stem, broken across (probably in antiquity), with a paddle shaped end. The shoulders appear to be different although this item is corroded at that area and so it is difficult to be certain. Unlikely to be a chisel. Poor surface detail. L 87mm	Part cleaned
20042 7087	5000	Pipe collar junction	P1948 P2659 P2660	Two fragments, both bent and twisted. Width 20mm. Lengths 34mm and 70.5mm (bent). Wood survives on	Part cleaned for cross-section.

				the inner side of the smaller fragment.	
20042 7249	5008 / ?5000	Knife	P1948	Tang tip is absent (old break). Handle has not survived.	Part cleaned for cross-section.
20042 7326	5000	Pipe collar junction fragment	P2659 P2660	L 34mm. W 19mm, ridged at mid-width. No wood surviving.	Part cleaned for cross-section
20042 7341	5000	Curved strip	P2659	Shaped (tapered) and curved strip, with a slight ledge at the wider end. This is possibly a fragment of a brooch bow.	Cleaned.
20042 7558	u/s	Implement	P1954	Square-sectioned rod, tapering at both ends. One end tapers to a fine point, and the stem is bent at 26mm from the tip (ancient damage). This end is most likely the functional part. The other end of the rod, probably a tang, tapers to a blunt end over the terminal 18mm. No handle survives. The implement may have been an awl or scriber.	
20042 7694	5026	Curved strip fragment	P1952	Curved strip, poorly formed (so not necessarily a brooch bow). Irregular in thickness.	Part cleaned
20042 7732	5021	Bar fragment	P1953	Tapering in thickness and corroded away at one end; complete as buried at the other end.	Part cleaned
20042 7811	5021	Bar fragment	P1954	Rectangular sectioned bar or off-cut, complete as buried.	Part cleaned
20042 7897	5051	Tool ?	P1957	Square sectioned rod, splayed at one end to a chisel-shaped edge 13.5mm wide, tapered at the other end to a possible tang. No evidence for a handle survives. L 49mm.	Part cleaned
20042 7906	5051	Stylus – eraser	P1957 P1958	The two parts do not join (now) but are presumably from one implement (there is probably very little missing, but there is no clean join). The stem is round in section near the complete eraser. The writing tip is detached (corrosion damage) and it is	Part cleaned
20042 7907		Stylus – point	P1957		

				bent at 10mm from the pointed tip. The stem is decorated towards the writing tip – necked 3 times and expanded 3 times. Detail is poor owing to the corroded condition. Length overall (with bent tip), 162mm (115.5 and 47.5mm Diameter max of stem, 3.5mm	
20042 8591	5021	Strip fragment	P1845	Tapering strip, conceivably a blade fragment. Bent at the narrow end.	Part cleaned
20042 8737	5092	Pipe collar junction	P1910 P2659 P2660	4 fragments, width 17mm. Lengths 56.5mm, 40.7mm, 36.7mm, 12mm. No wood surviving.	Part cleaned for cross-section.
20042 8768	5097	Nail block (14 nails)	P2090	*See Section 3.1 above*	
20042 8915	5092	Pipe collar junction	P1910 P2659 P2660	The major part of a ring, width 18.5mm, diameter 85mm. Wood survives on inside and outside of the collar.	Wood examined on SEM for identification
20042 8937	5021	Nail stem or spike	P1846	Square sectioned rod, tapering to a point. Modern (corrosion) break at the wide end. L 95mm	Part cleaned for cross-section.
20051 3067	10019	T-clamp	10461	T-clamp broken across the stem (and incomplete). Long arched arms, more than 72mm across the two (one arm is probably incomplete because the two do not match.) The detached frags do not seem to belong to this item.	Part cleaned
20051 3071	10019	T-clamp	10461	T-clamp, corrosion fractured across the stem	Cleaned
20051 3110	10033	Implement frag	10463, 10465	Round-sectioned rod that was damaged at the end in antiquity. The purpose is therefore unknown. Short tang (L 21mm, tapering square-section).	Part cleaned
20051 3118	10019	T-clamp	10462 10465	T-clamp broken across one arm (modern fracture) and incomplete at that area (the detached fragment does not join). Crudely formed.	Part cleaned to clarify

20051 3142	10099	Rod	10462	Rod, length 86mm, complete as buried and probably complete as in use. This may be an implement (perhaps a small scriber or punch for soft material). Square-sectioned stem, broader in the middle, becoming more rectangular in section and flat at one end. The other end seems to be angled to a crude point but this end is damaged through corrosion.	Part cleaned
20051 3157	10037	Rod fragment	10462	Square-sectioned rod fragment (recent break), slightly bent, tapering to a blunt tip. Possible nail stem. Length bent 56mm.	Part cleaned

3.3 Identification of wood species on pipe junction SF 200428915:
Jacqui Watson

There is very little wood surviving on this pipe junction; traces are present on both the inside and outside of the collar. This was examined by optical microscopy and by SEM (Figs 3.3. and 3.4). The features suggest willow (*Salix* sp.) or poplar (*Populus* sp.).

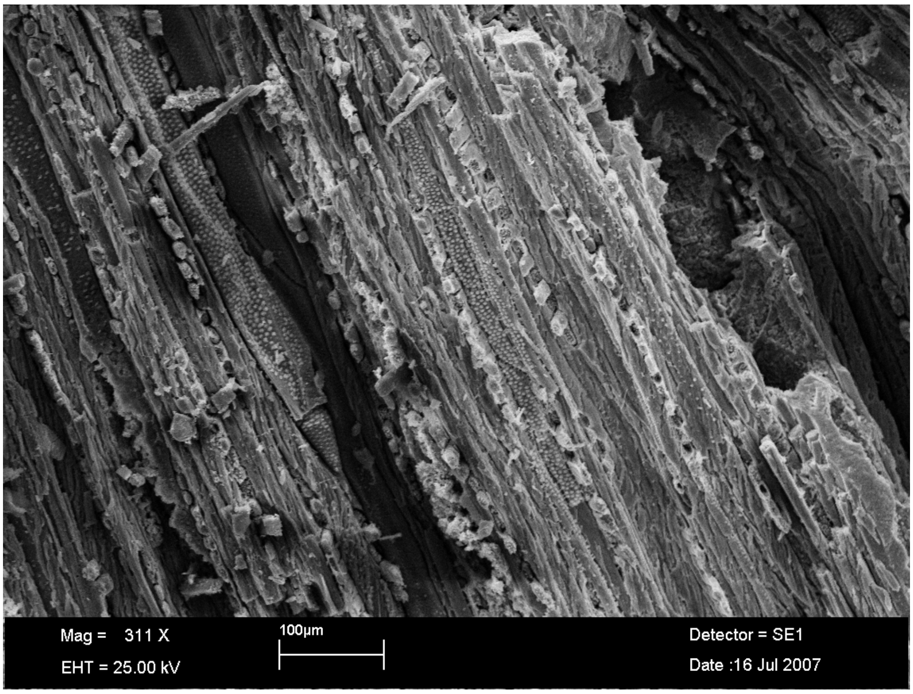


Figure 3.3 Scanning electron micrograph of wood from pipe collar sf 20042 8915

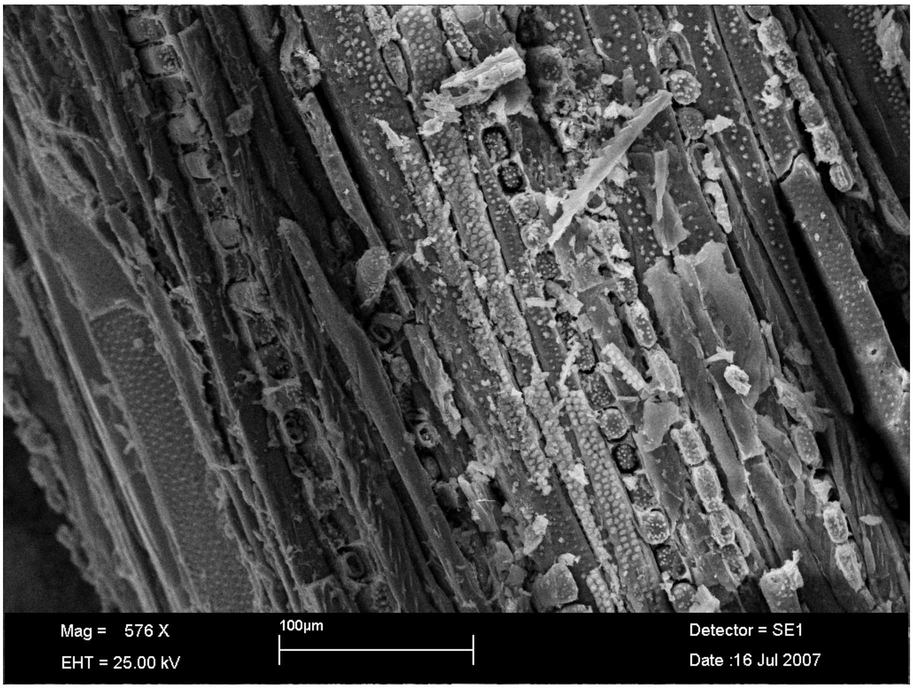


Figure 3.4 Scanning electron micrograph of wood from pipe collar sf 20042 8915

3.4 Non-ferrous metalwork

Vanessa Fell

Six copper alloy artefacts and two lead (alloy) artefacts were selected for further examination (Table 3.1). See Appendix 1 for XRF summary results.
In addition, a medieval ring (SF 200303088) was analysed and reported as gilded brass (M. Ponting, J. Schuster and L. Skinner, unpublished poster).

Table 3.1 Summary of examination and analysis of the non-ferrous artefacts

AML no.	Context	Metal	ID	Treatment	Comment
20030 3002	1102	Cu alloy	Annular brooch	Removed surface soil	Well patinated
20030 3458	u/s	Cu alloy	Brooch	Removed surface soil. XRF analysis	Poor surface detail
20042 7500	u/s	Cu alloy	Finger-ring	Removed surface soil	Inscribed design on shank. Well patinated. Insets for 7 'stones' but none survive.
20042 7553	u/s	Tin/lead (pewter)	Buckle	Removed slight surface soil. XRF analysis	The surface was already clean and shiny (!)
20042 7556	u/s.	Lead	Isis figurine	Removed surface soil	The surface has

	Probably Room 4				corroded to carbonates and oxides which are now stained brown (from the soil)
20042 7941	5021	Cu alloy	Tack (L 17mm) & sheet metal & possible organic material such as leather	Extracted from soil	The many tiny fragments of sheet, <1mm thick, may be from an object with a curved edge (but not a coin)
20051 3058	10000	Cu alloy	Pin	Removed surface soil. XRF analysis	The pin is made of brass and the white colour of the metal is not significant
20051 3076	10000	Cu alloy	Terminal	Removed surface soil	? Moulded or cast (not enamelled)

4. PAINTED PLASTER

Vanessa Fell

Twenty standard boxes (43 x 23.5 x 17cm) of wallplaster fragments were recovered from the excavations in 2004 and 2005 (Hembrey 2006, 87-93). Prior to processing the sherds in 2004, trials had shown that the plaster was in a relatively robust condition, and it was possible to do some preliminary processing by gently cleaning the decorated surfaces followed by repackaging, which was successfully accomplished by Sue Turnbull (finds assistant).

The bulk of the plaster seems to be white, cream, or variations in between – much of which may be due to staining. Decorated sherds were mainly blocks of single colour although a small proportion revealed straight or curved lines. Four decorated sherds are shown in Figure 4.1.

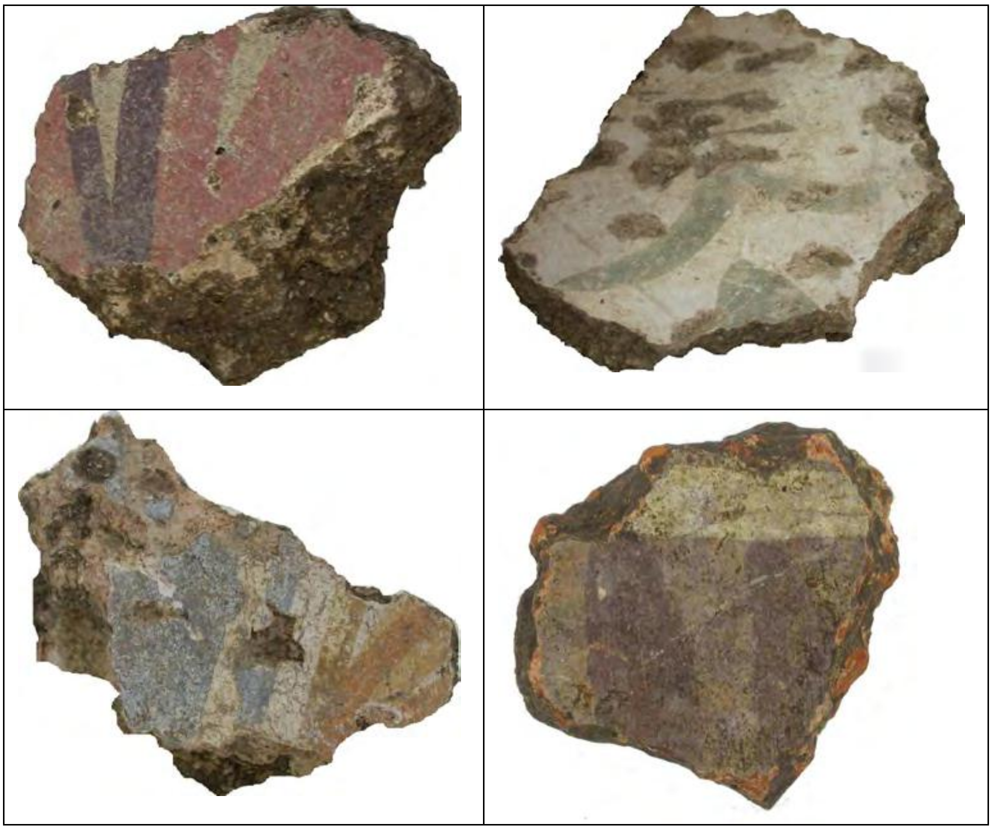


Figure 4.1 A selection of painted plaster sherds

A selection of sherds, taken mainly from the 'colour palette reference collection' derived from 2004 material (see Hembrey 2006, 89), were analysed to identify the pigments used.

Methods

a) The elements present were determined by X-ray fluorescence (XRF) analysis. Sherds were mounted whole in the instrument chamber so that a small area c. 0.3mm diameter could be targeted. These were analysed under vacuum at 40kV, 220A in an Eagle II X-ray fluorescent spectrometer with a lithium-drifted silicon detector. Results are qualitative.

b) Determination of the precise mineral forms were attempted by X-ray diffraction (XRD) analysis. Eight small samples were collected with the aid of a microscope, targeting the primary colouring agent such as bright blue crystals or particles, or areas of smooth and uniform colour, such as the reds.

Samples weighing approximately 1mg were ground in an agate mortar and mounted on a glass slide within the Philips PW 1840 diffractometer. X-ray diffraction data were collected using cobalt K□ radiation, and running parameters of 40kV 40mA for X-ray generation. A search-match computer programme was used to identify unknown components in the diffraction patterns by comparison with standards in the powder diffraction file (International Centre for Diffraction Data, ICDD, powder diffraction files (PDF) version 2).

Results and discussion

Description of the samples and the results of the XRF analysis are given in Table 4.1. All samples had high levels of calcium, presumably from the ground. Bright blue particles were shown to be due to copper containing minerals, for example in Sample 3 (Fig 4.2). Colours ranging from yellow through to red, purple, brown and green were due to iron, for example the green in Sample 7 (Fig 4.3).

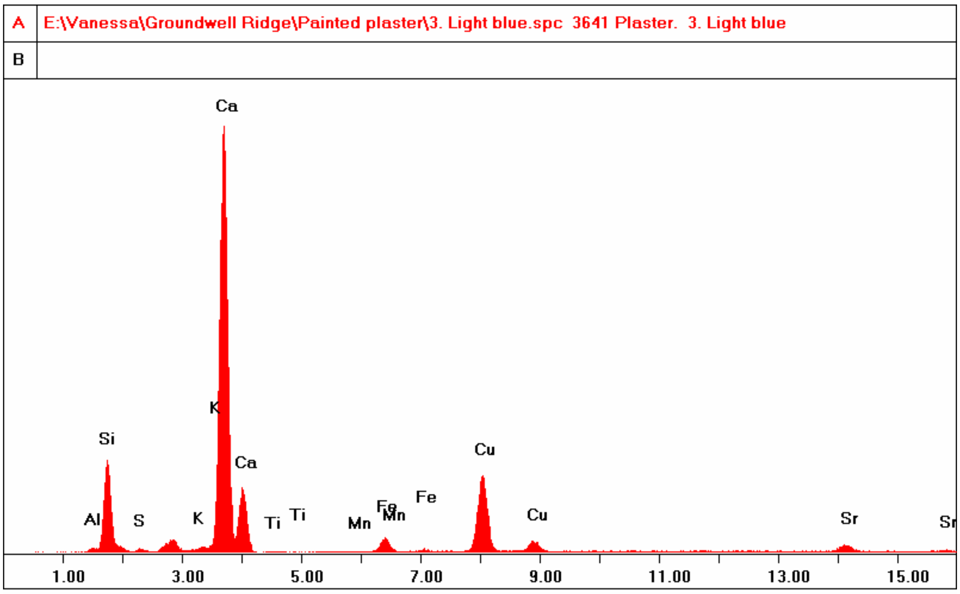


Figure 4.2 XRF spectrum for light blue plaster, Sample 3

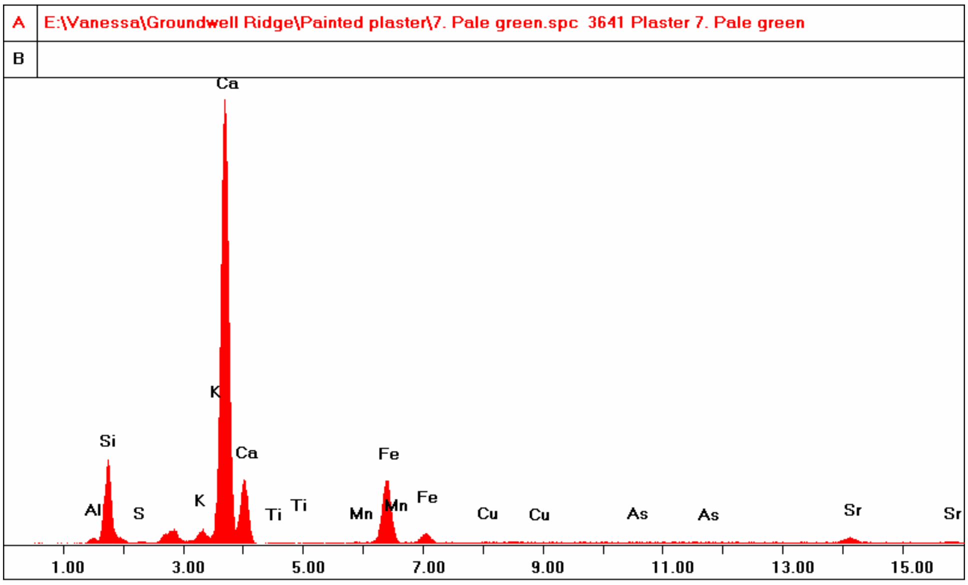


Fig 4.3 XRF spectrum for pale green plaster, Sample 7

Table 4.1 XRF results for selected sherds of painted plaster:

S	Cxt	Colour (NH*)	Description §	Pigments (small and trace amounts) ◊ Excluding Ca, Al, Si, K, Sr
1		Grey/green	Sherd colour is not green. A greeny-grey layer overlies some red, and also covers fractures and losses in the gound layer. Needs reclassification.	Blue'ish area = Fe (Mn, S)
2	5015	Red (dark), with white stripe	Both colours are very smooth and homogeneous.	Red = Fe (S, Mn) White is basically all Ca, with no added colour, although a trace of Fe was visible.
3	5015	Light blue	The colour is even, with occasional miniscule bright blue specks	Cu (Fe)
4	5015	Off-white	Is this really white; it has concretions on top.	(Fe)
5	5015	Purple-brown	Looks like 6 below, with blue specks sticking proud out of the white ground, above a grey layer	Darker grey = (Fe, Cu) Bright blue specks = Cu (Fe)
6	5015	Blue-green	Top layer is degraded white with bright blue specks (now standing proud). This sits on a greyish layer, that could be carbon or could be a degraded layer. All this is applied to an off-white ground.	Brown area (?degraded) = Fe (Cu) Very dark blue speck = Cu (Fe) Blue grains in white ground = Cu (Fe)
7	5015	Pale green	Smooth	Fe

8	5015	Yellow / Orange	Smooth. Like S.12 yellow (smaller piece sampled)	**Fe**
9	5000	Emerald green	Very smooth and thickish layer	**Fe**
-		Multi-colour	Not homogenous	Not analysed
EXTRAS (not in colour palette)				
10	5015	Blue	(looks decayed)	Blue grains = **Cu**, Fe
11	5015	Red+purple 200427659 See Fig 4.1	Both colours are very evenly applied	Red = **Fe** Purple = **Fe** (much more Fe than in the red)
12	Box 116	Yellows to reds	These are evenly spread and smooth colours. In addition there is a brown stripe on the sherd.	Yellow/Orange = **Fe** Pinky red = **Fe** Maroon = **Fe**

* Colours according to the preliminary colour palette by Nicola Hembrey (Hembry in Brickstock et al 2006b)

§ Many look decayed. Colours need to be reclassified with the aid of a microscope.

◊ Strong peaks shown bold; minor and trace shown bracketed.

The results from the XRD analyses were less successful (Table 4.2). The ground was shown to be calcite ($CaCO_3$) in all, and most of the samples also contained quartz (SiO_2).

The pigments could not be identified by this technique, probably because they are present in low concentration compared to the calcium and silica compounds – a common problem for this technique where these two elements dominate. Additionally, the technique only recognises crystalline compounds and therefore amorphous compounds are not determined.

Table 4.2 XRD results for selected sherds of painted plaster

Sample	XRD no.	Colour	Result
2	7047	Dark red	Calcite, quartz
3	7044	Light blue	Calcite
6	7045	Blue-green	Calcite, quartz, ?graphite
9	7046	Emerald green	Calcite, quartz
11	7048	Red	Calcite, quartz
12 a	7049	Yellow/Orange	Calcite, quartz
12 b	7050	Pinky red	Calcite, quartz
12 c	7051	Maroon	Calcite, quartz

5. GLASS BEADS AND OTHER ITEMS, AND CORAL, STONE, SHALE, LIGNITE ETC

Vanessa Fell

There are 17 glass beads, a button and a possible bottle top. In addition, several minute coral and stone items masquerading as beads – which may be natural in origin.

Table 5.1 Summary of glass, coral, stone, shale, lignite etc

No	Material	Identity	Context	Treatment	Comment
20030 3014	Glass & iron	Button	1739	Consolidated (Paraloid B72) and part repaired to 2 pieces. Not fully repaired because the iron stem is still corroding and will cause the bead to split.	The glass was wound around the iron stem and the latter is corroding. (This will yield relatively voluminous corrosion products that could continue to push the fragments apart.). Two of the three fragments have been joined. The other two could also be joined but that won't assist visibility of cross-section. Also, it would not be best to replace the corroding detached piece of iron – indeed this might not fit back anyway.)
20030 3095	Glass	Ferrule, ?bottle top	1102	-	This is glass, but could be relatively modern? There are shallow channels around the tapered part.
20042 7064	Glass	Beads and wire	5008	Removed some loose soil	Four blue glass beads, two of which are broken into two pieces. All have corroded copper alloy wire within (see X-ray P2646) and the second longest bead seems to have a terminal or a stop at the end of the wire.
20042 7252	Glass	Bead	5000	removed loose soil	
20042 7645	Glass	Bead	5000	removed loose soil	
20042 7647	Shale or lignite ?	Bangle fragment	5000	Consolidated (Paraloid B72)	Its not easy to distinguish between these materials without lengthy analysis. Because it was laminating very slightly, this suggests

					that it may be shale or lignite (rather than jet).
20042 7787	?Coal, lignite etc	unworked	5029	-	No treatment given, although it does look as if it may split.
20042 8541	Glass	Bead, large green	5021	removed loose soil	Decayed but transparent. There are deep swirls or holes some of which contain opaque pale blue powder, but uncertain if these swirls are deliberate. Did not consolidate in case this could upset any analyses.
20051 3101	Glass	Bead	10033	removed loose soil	
20051 3102	Glass	Bead	10033	removed loose soil	
20051 3103	Glass	Bead	10033	removed loose soil	
20051 3106	Glass Coral Stone	Beads and other items	10033	removed loose soil	1x ?stone (natural) 6x square green glass beads 4x ?fossil (stone, none fully perforated) 6x probable coral (XRF analysis showed mainly calcium)
20051 3107	Glass	Bead	10033	removed loose soil	

6. WORKED BONE

Vanessa Fell

Loose soil removed from two worked bone artefacts: (10033) sf200513114 and (10019) sf 200513132.

7. TEXTILE IMPRESSION ON TILE

Jacqui Watson

One of the tiles, or brick (10026 SF 13094), was found with distinct textile impressions on one surface covering an area of approximately 48 x 23mm and made by a slightly coarse but even weave fabric. The fabric seems to be a tabby weave, with Z,Z spin, and thread count of c.10 x 8 threads over 10mm. The impressions appear to have been made by hard and angular fibres, and most likely to come from plant materials such as flax or hemp rather than animal fibres such as wool.

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APPENDIX 1. X-RAY FLUORESCENCE ANALYSIS

Vanessa Fell

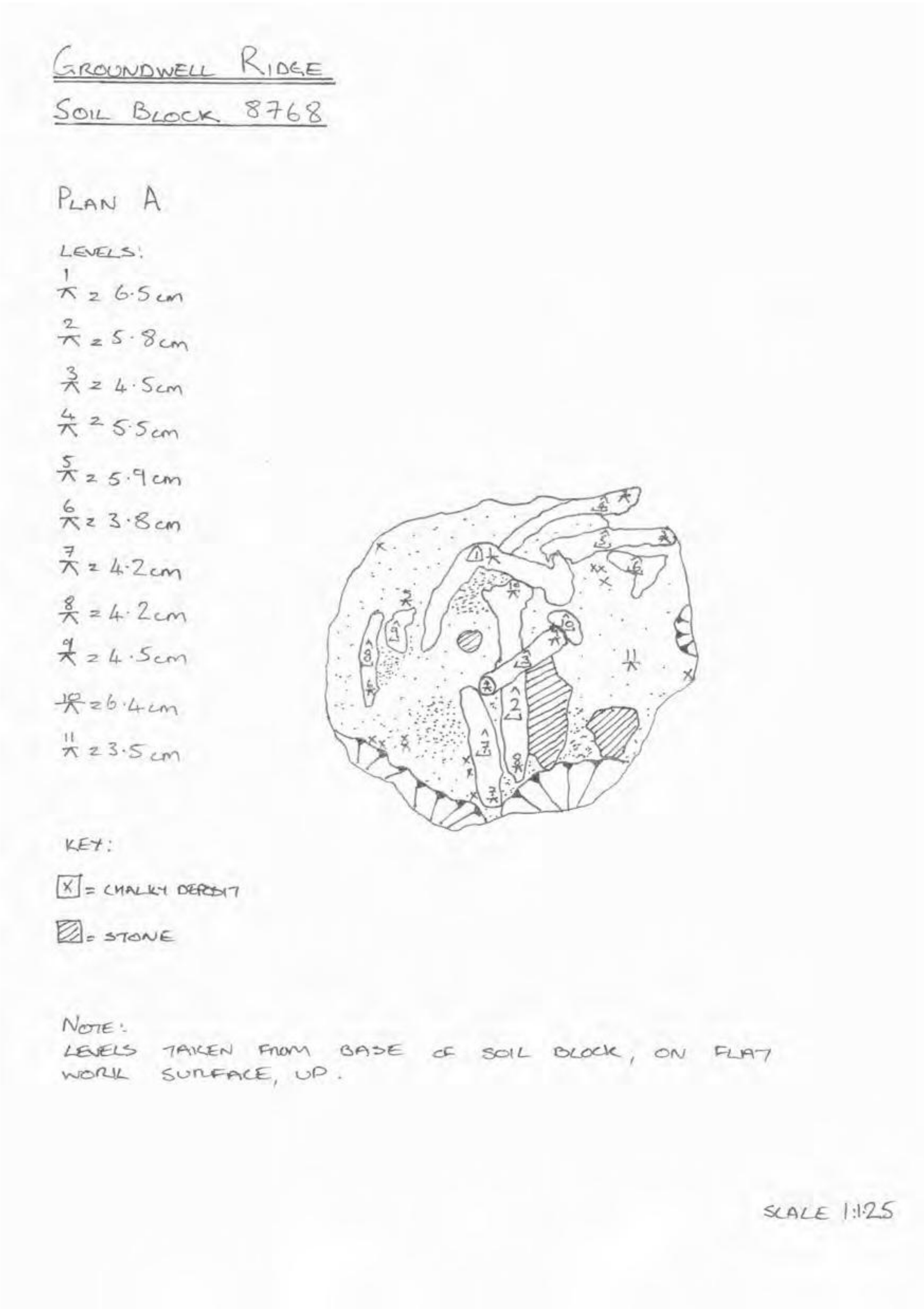
The composition of selected metal finds was determined by X-ray fluorescence analysis. This is a surface analytical technique and the results are qualitative only due to surface corrosion, but they serve to indicate the presence of applied metals, such as solder and platings. Analyses were made on a small area, c. 0.3mm diameter, under vacuum at 40kV, 220µA in an Eagle II X-ray fluorescent spectrometer with a lithium-drifted silicon detector.

No.	Item and area analysed	Elements detected	Interpretation
20030 3458 Brooch	Brooch	Cu Sn Pb	The buckle is a leaded tin-bronze. There was no evidence for metal coatings.
20042 7553 Buckle	Buckle body	Pb Sn (S Cu Fe)	The buckle is made of tin-lead alloy
20042 7915 Sheet	Sheet metal frag	Ag Cu (Au)	Silver alloy. The tarnished surface showed abundant silver, a lesser amount of copper, and a trace of gold.
20051 3058 Pin	Pin stem	Cu Zn (Fe Pb Si)	Brass
	Pin head (white metal)	Cu Zn (Sn)	Brass (the white colour could be due to de-alloying of the metal)
	Pin head filler	Pb (Cu Sn, Fe, Zn)	The filler is lead or mainly lead
20051 3063 Shaped frag	"Vessel rim"	Ca (P, Si)	This item comprises mainly calcium. The fracture shows a white fibrous structure suggesting therefore that it could be shell.
20051 3106 Bead	Possible coral bead	Ca (S Fe Cu Sr)	Coral comprises mainly calcium and so it seems very likely that these are coral and not plastic.

Trace elements are bracketed

APPENDIX 2. PLANS OF SOIL BLOCK SF 200428768 DURING EXCAVATION IN THE LABORATORY

Zara Peacock



Groundwell Ridge

Soil Block 8768

Plan B

Levels:

$\overset{1}{\pi}$ = 5·8cm

$\overset{2}{\pi}$ = 5·5cm

$\overset{3}{\pi}$ = 5·7cm

$\overset{4}{\pi}$ = 4·2cm

$\overset{5}{\pi}$ = 4·2cm

$\overset{6}{\pi}$ = 5·5cm

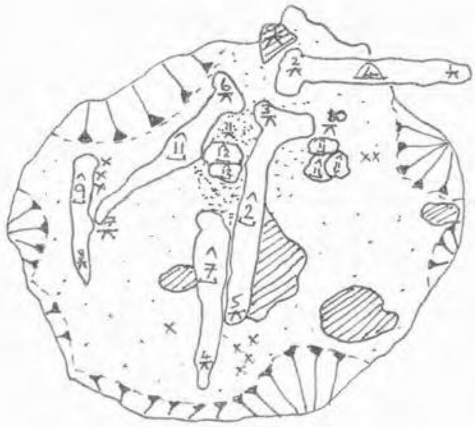
$\overset{7}{\pi}$ = 4·0cm

$\overset{8}{\pi}$ = 3·5cm

$\overset{9}{\pi}$ = 4·5cm

$\overset{10}{\pi}$ = 5·5cm

$\overset{11}{\pi}$ = 5·0cm



Key:

[X] = Chalky deposit

[hatched] = Stone

Note:

Levels taken from base of soil block, on flat work surface, up.

Scale 1:1·25

GROUNDWELL RIDGE

SOIL BLOCK 8768

PLAN C

LEVELS:

1 = 4.3cm

2 = 3.0cm

3 = 4.8cm

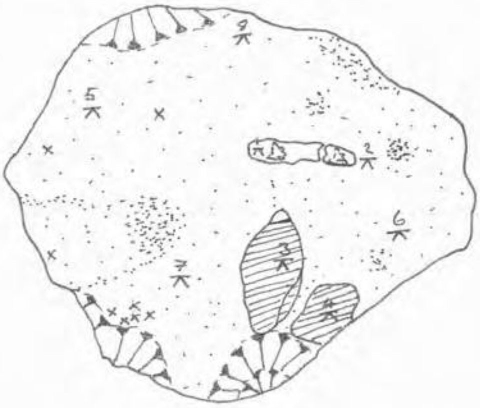
4 = 3.8cm

5 = 3.5cm

6 = 3.6cm

7 = 3.0cm

8 = 4.0cm



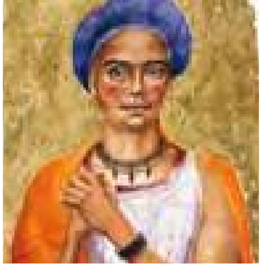
KEY:

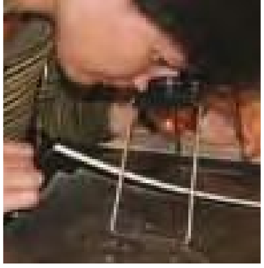
X = CHALKY DEPOSIT

= STONE

NOTE:
LEVELS TAKEN FROM BASE OF SOIL BLOCK, ON FLAT WORK SURFACE, UP.

SCALE 1:1.25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- *Archaeological Projects (excavation)*
- *Archaeological Science*
- *Archaeological Survey and Investigation (landscape analysis)*
- *Architectural Investigation*
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