APPENDIX 15: ASSESSMENT OF GEO-ARCHAEOLOGY - DOWNS ROAD

Jane Corcoran

1. Introduction

1.1 One monolith sample was obtained from slightly down-slope of a multi period area which showed evidence for burning on a north-facing slope to the north of Hazell's Farm. The monolith assessment aimed to investigate whether the deposits had accumulated as a result of Iron Age activity or rake-out from the post-medieval kiln and the processes that may have been involved.

1.2 The monolith sample was obtained by hammering a 500mm x 50m x 50m tin into the cleaned section face. The sediments and stratigraphy visible in section were described and drawn by the excavators on site. The monolith location was marked on the section drawing and a level, related to Ordnance Datum was taken on the top of the tin.

2. Methodology

2.1 The sediments sampled in the tin were cleaned and described using standard sedimentary criteria (Jones, 1999). This attempts to characterise the visible properties of each deposit, in particular relating to its colour, compaction, texture, structure, bedding, inclusions, clast-size and dip.

2.2 Every distinct unit was given a separate letter and the nature of the contact between each unit was noted. The units identified during description are related to the contexts described on site in the profile description and, where possible, the profile is discussed in terms of contexts as opposed to the units identified in the monolith tin, in section 4.

3. Quantification

3.1 This section gives the results of the monolith assessment. The sequence is described in the table below. In this table the elevation (in m OD) is given for the contacts between the units and brackets denote the thickness of the individual units.

Table 66: Assessment of Geo-Archaeology: ARC 330 98

Unit	**Elevation of contact (m OD)**	**Description and Contacts** **Sample <68>**	**Context**
	23.57	TOP OF MONOLITH SEQUENCE	
1	[0.15m thick]	Dark yellowish brown 10YR4/4 compact, slightly clayey fine sandy silt. Occasional angular and sub-angular chalk granules and very occasional granular sized flint gravel. Charcoal flecks are moderately abundant and increase but become more minute with depth. This unit has a slightly greyer colour than units 2 & 3 and may be derived from charcoal and clay. Very occasional iron concretions and CBM flecks.	[339]
		diffuse contact to:	
2	[0.20m thick]	Dark yellowish brown 10YR4/6 compact sandy silt. Colour becomes gradually paler downwards. Frequent minute charcoal speckles, more minute than in unit 1 and become less abundant downwards. Diffuse speckled patches of carbonate (?precipitations).	none
		sharp contact (follows irregular crack) to:	
3	[0.15m thick]	Yellowish brown 10YR5/4 sandy silt. Humic stained root channels terminate at contact with unit 2, some contain chalk granules. Fewer charcoal flecks and very occasional diffuse carbonate precipitations than in units 1 & 2.	none
	23.07	BASE OF MONOLITH SEQUENCE	

4. Provenance

4.1 The sediments are not specifically dated. However, they are from a sequence that appears to include the first evidence for human activity from this section, above a colluvial deposit. It is therefore likely that the humanly derived material relates to the Mid to Late Iron Age activity recorded further upslope, where there is extensive evidence for burnt material (furnaces [1427], charcoal, burnt daub, burnt flint).

4.2 Unit 3 at the base of the monolith sample appears to be a lower horizon of a soil, which developed in brickearth-like parent material (probably derived from colluvial processes).

4.3 This has been truncated, perhaps by the same activity or process that deposited unit 2. Although unit 2 is also brickearth-like it does not have root channels and contains many charcoal speckles, together with diffuse carbonate patches, which may be derived from ash. Unit 2 also becomes a darker, slightly greyer colour upwards.

4.4 This trend is continued into the upper unit (unit 1, context [339]) which is greyer, slightly clayey and contains larger charcoal flecks together with chalk and flint granules.

4.5 The monolith description suggests that there may have been deliberate truncation of the former vegetated ground surface. The sediment accumulation above this appears to have built up as a result of sediment movement down slope and inclusions of charcoal and possibly ash imply that at least some of the sediment may have been derived from burning. Larger particles of charcoal occur in the upper unit, which has a greyer colour, which may be caused by a soot or a finely comminuted charcoal component. This may have been washed down through the profile, or it may indicate an intensification or slight change in the activities and processes undertaken up slope.

5. Conservation

5.1 If thin sections are made of the monolith they will take up less storage space, stand a better chance of long term preservation and be amenable to a similar method of archiving to that for finds and environmental samples. As monoliths, samples are not easily stored, need to be kept in a cool to cold and dark environment and will be likely to deteriorate with time. Thin sections are easily available for further research and can be examined frequently without loss of information. Stored monoliths are less accessible and will gradually loose their potential for preserving information, especially as each time they are examined further cleaning will wear away the surface.

5.2 In the same way, processed sub-samples taken from the monolith will be easier to store and are less likely to deteriorate than the original soil material and will provide supporting information to the thin sections.

5.3 Long term storage as a monolith sample is likely to be costly and is not an efficient use of space or archive material. After analysis, if not impregnated with resin and converted to thin sections, the sample should be discarded.

6. Comparative material

6.1 The thin sections produced should be compared to those from the colluvial sediments from other parts of the CTRL route, including those from the dry valley in the eastern part of Zone 3, the Medway Valley and Whitehorse Stone. These thin sections would act as a control, representing the products of colluviation in 'un-modified' soil materials in this area. They should also be compared to thin sections of burnt brickearth (eg: floor slabs, as found in Boudican and Hadrianic fire deposits from London) and to slides of trampling and ash deposits (typically those from cave sediments). These comparisons would enable the characteristics of the deposits from the present site to be identified and interpreted.

6.2 The magnetic susceptibility results should also be compared to magnetic susceptibility values from other sites along the CTRL route, to provide a background level against which the values from the present site can be compared. Interpretation of the results should be made in the light of relevant published literature (Dearing 1999; Oldfield *et al* 1984)

7. Potential for further work

7.1 The data from the monolith samples has potential to address the following research objectives:

- *Farming communities (2,000 – 100BC): Consider environmental change resulting from landscape organisation and re-organisation*

7.2 The sediments sampled from ARC 330 98 would appear to have potential for further investigation into the activities occurring in the vicinity of Hazells Farm (Figure 5). This should involve thin section analysis and magnetic susceptibility determinations. The analysis should attempt to determine the mechanisms that deposited units 1 and 2: was it 'natural' erosion of waste materials as a result of hillwash or soil creep and wind blowing charcoal and ash? Or were they deliberately dumped deposits? It should also attempt to establish whether the changes in the characteristics of units 1 and 2 are the result of slightly different activities. Or are they a result of subsequent soil formation and weathering of waste materials, translocating the fine components down through the profile.

7.3 The magnetic susceptibility of a sediment is enhanced by burning (amongst other things). Thus the products of burning activities which produced the charcoal and burnt daub should, even if disintegrated and redeposited produce higher values than un-modified brickearth. As magnetic susceptibility is also enhanced by weathering, a soil will have higher values than un-modified brickearth.

7.4 Thus by comparison of the values obtained through the monolith profile with those for local unmodified brickearth and results would give an indication of if the sediment is derived from occupation burnings or industrial activities might be inferred.

7.5 If thin sections were to be made of the monolith sediments a more reliable indication of their components would be obtained. High incidence of components such as phytoliths (often found as the main component of ash) and burnt clay might indicate a brick-clamp and their micro-stratigraphic relationships may be able to suggest whether they have been dumped and become weathered *in situ* or transported downslope by hillwash or soil creep processes. Examination of the thin sections may also be able to interpret the difference that appears to exist between units 1 and 2. This may be a result of soil formation or different inputs or depositional processes.

7.6 Recommendations for further work:

Task
Further sedimentological work (Geo-archaeologist): • Scrape continuous 20mm sub-samples from the surface of the monolith for magnetic susceptibility and other analysis as required, to support the micromorphological results. • Carry out: magnetic susceptibility by pot sensor method (and possibly loss on ignition, phosphate and particle size analysis of these sub-samples as discussed with the micromorphologist) • Make the results of these techniques available to the soil micromorphologist
c) **Thin section analysis** (Soil micromorphologist): • Set monolith sample in resin • Manufacture thin sections, each 35mm x 90mm covering: 1 / 2 and 2/3 interfaces • Examination of these thin sections and production of a report
d) **Interpretation of the results** (Geoarchaeologist) • integration of the results of (a) with the results of (b), other CTRL sites, especially ARC-TGW97, published sources and this assessment report.

8. Bibliography

Dearing, J, 1999 'Magnetic susceptibility' in *Environmental magnetism: a practical guide* Quaternary Research Association Technical Guide, 6, 35-62

Jones A *et al*, 1999 *The description and analysis of Quaternary Stratigraphic Field Sections*

Oldfield, F, Krawiecki, A, Maher, BA, Taylor, JT & Twigger, S, 1984 'The role of mineral magnetic measurements in archaeology' in *Palaeoenvironmental Investigations: Research Design and Interpretations* BAR International Series S258, 29-53

APPENDIX 16: ASSESSMENT OF GEO-ARCHAEOLOGY – WEST OF TOLLGATE

Jane Corcoran

9. Introduction

9.1 This report presents the results of the assessment of four monolith samples recovered from the east-facing section of ARC TGW 97 trench 1472TT, located towards the base of the dry valley at the eastern end of Zone 3. The sediments sampled were provisionally interpreted as colluvial slope deposits during excavation.

9.2 The objective of the geoarchaeological assessment is to examine the depositional and post-depositional processes that have taken place on the site. In particular, this might enable periods of erosion landscape stability to be identified. Periods of erosion (and landscape instability) might be marked by accumulations of colluvial sediment transported downslope by gravity and water-aided slope processes. Periods of stability may be characterised by episodes of soil formation and vegetation growth. If these processes can be dated, they may be linked to episodes of human activity on the site and its environs. Thus it may be possible to investigate the impact and repercussions of human disturbance on the changing landscape in the environs of the site.

9.3 Each monolith sample was obtained by hammering a 500mm x 50mm x 50mm tin into the cleaned section face. The sediments and stratigraphy visible in section were described and drawn by the excavators on site. The monolith locations were marked on the section drawing and a level, related to Ordnance Datum was taken on the top of each tin. A column of associated bulk samples was taken adjacent to the monolith sequence for landsnail analysis.

10. Methodology

10.1 The sediments sampled in each tin were cleaned and described using standard sedimentary criteria. This attempts to characterise the visible properties of each deposit, in particular relating to its colour, compaction, texture, structure, bedding, inclusions, clast-size and dip.

10.2 The 4 monoliths were described as one profile. Every distinct unit was given a separate letter and the nature of the contact between each unit was noted. The units identified during description are related to the contexts described on site in the profile description (Table below) and, where possible, the profile is discussed in terms of contexts as opposed to the units identified in the monolith tins, in section 4.

11. Quantification

11.1 This section gives the results of the monolith assessment. The sequence is described in the table below. In this table the elevation (in m OD) is given for the contacts between the units and brackets denote the thickness of the individual units.

Table 67: Assessment of Geo-Archaeology: ARC TGW 97

tin	Unit	Elevation of contact (m OD)	Description and Contacts	context	Assoc. samples
		34.89	TOP OF MONOLITH SEQUENCE		
<4>	1	[0.05m thick]	Dark greyish brown 10YR4/2 sandy clay silt. Cloddy. Slightly humic and contains frequent modern roots. Crumbly blocky structure. Occasional flint and chalk clasts.	[001]	
			diffuse contact to:		
<4>	2	[0.40m thick]	Dark yellowish brown 10YR4/6 slightly sandy silt. Frequent chalk and flint granule to small pebble sized gravel. Crumbly blocky structure.	[002]	<5> <6>
			diffuse contact to:		
<4> + <1>	3	[0.23m thick]	Dark yellowish brown 10YR4/6 slightly sandy silt. Frequent chalk granule to small pebble sized gravel. Compact and cohesive. Occasional diffuse carbonate precipitations.	[002]	<7>
			Gradual contact to:		
<1>	4	[0.15m thick]	Dark yellowish brown 10YR4/4 slightly sandy silt. Slightly darker and less cohesive than unit 3. Frequent chalk granule to small pebble sized gravel.	[002]	<8>
			Sharp contact followed by pebble-sized gravel clasts and marked by chalk granules above the contact and none below.		
<1> + <2>	5	[0.22m thick]	Dark yellowish brown 10YR4/6 slightly sandy silt. Compact and cohesive. Occasional faint and diffuse carbonate precipitations. Occasional manganese speckles.	[003]	<9>
			Gradual contact to:		
<2> + <3>	6	[0.54m thick]	Dark yellowish brown 10YR4/6 slightly sandy silt. Compact and cohesive. Darker than unit 5 and characterised by a more clayey matrix with common charcoal flecks, occasional flint gravel <0.10m diameter and no carbonate precipitations.	[003]	<10> <11>
			Distinct contact to:		
<3>	7	[0.12m thick to base of profile]	Yellowish brown 10YR5/6 (ie: paler) silty fine sand. Very occasional manganese flecks, grit and possible rooting marked by white ?carbonate or bleached sand channels.	[010]	
		33.18	BASE OF MONOLITH SEQUENCE		

12. Provenance

12.1 Below the sampled sediments was a rubbly deposit of flint nodules in a reddish silty clay matrix [007] that may be derived from clay-with-flints, redeposited by solifluction processes in a periglacial environment at the end of the Pleistocene.

12.2 Unit 7 (context [010]) overlay context [007] and was at the base of the profile sampled. It was a very fine sand that may have been deposited by fluvial or aeolian processes as it was very well sorted. If of fluvial origin it probably accumulated during a period of swift river discharge in the late Pleistocene, as a result of seasonal snow-melt. If aeolian (it is too coarse for loess) it was probably the result of harsh winds redepositing loessic and fluvially derived sediments during the arctic winters of the late Pleistocene.

12.3 There is slight evidence that vegetation developed in this fine sand prior to the accumulation of unit 6 (context [003]).

12.4 Unit 6 represents the lower part of context [003]. This appears to be redeposited brown-earth soil material. The common charcoal flecks within it suggest that human deforestation activities may have been responsible for the erosion event, which transported it downslope.

12.5 The gradual contact between units 6 and 5 implies that further sediment gradually accumulated above the initially eroded topsoil material. This may have been the result of a prolonged period of agricultural activity on the cleared land (as discussed in Allen 1992). It would appear that, during this period, an accretionary soil developed in sediment gradually accumulating by soil creep processes, as indicated by the slightly leached upper part of context [003] and the faint carbonate precipitations observed within it.

12.6 A much higher magnitude erosion event appears to mark the contact between contexts [002] and [003] (units 4 and 5). This probably truncated the upper part of the soil that had developed in the earlier colluvium and the gravel found along the contact may be the lag deposit left by valley side gulley erosion, which probably took place during the erosion event.

12.7 It is possible that human activities may have triggered this event. Adoption of winter ploughing has been proposed as a cause of accelerated soil erosion during the Iron Age and Romano British periods elsewhere (Allen 1992).

12.8 The loose and possibly humic deposit (unit 4) directly above the interface of contexts [002] and [003] is probably soil material redeposited as a result of this second more dramatic erosion event. However it is different in character to the lower soil material (unit 6) as it contains chalk granules, indicative of shallower soils and possibly ploughing activities biting into the chalk bedrock.

12.9 This suggests that considerable erosion of soil material in the intervening period had denuded the valley sides, perhaps as a result of continued agricultural activity. Because of this soil deterioration, the soils available for exploitation on the valley sides had become shallower and more gravelly.

12.10 Further gradual soil erosion and deposition is indicated by the accumulation of the upper part of context [002] again perhaps as a result of soil creep mechanisms.

12.11 A later period of landscape stability is indicated by the (recent) soil [001] developed in these colluvial sediments.

13. Conservation

13.1 If thin sections are made of the monolith blocks they will take up less storage space, stand a better chance of long term preservation and be amenable to a similar method of archiving to that for finds and environmental samples. As monoliths the samples are not easily stored, need to be kept in a cool to cold and dark environment and will be likely to deteriorate with time. In addition thin sections are easily available for further research and can be examined frequently without loss of information. Stored monoliths are less accessible and will gradually loose their potential for preserving information, especially as each time they are examined further cleaning will wear away the surface.

13.2 In the same way, processed sub-samples taken from the monoliths will be easier to store and less likely to deteriorate than the original soil material and will provide supporting information to the thin sections.

13.3 Long term storage as monolith samples is likely to be costly and is not an efficient use of space or archive material. After analysis, for those monoliths not impregnated with resin and converted to thin sections, what remains of the samples should be discarded.

14. Comparative material

14.1 Similar studies elsewhere on the North and South Downs (Bell and Boardman 1992; Bell 1983) have been able to link periods of erosion with human activity, especially deforestation and agriculture, up-slope. However other causes of erosion such as those triggered by climatic fluctuations and general landscape evolution (eg weathering, soil deterioration and time) are likely to have contributed to the downslope movement of sediment. The nature, timing and duration of any colluvial processes identified must therefore be viewed in the light of other evidence for human activity and the geomorphology of the site and what is known of climatic trends, as obtained from published sources (Lamb 1981, Evans 1975, Bell & Walker 1992).

14.2 Colluvial deposits have been found in many of the CTRL sites along the North Downs (especially at White Horse Stone, near Aylesford). The erosion events represented should be compared in terms of their timing and characteristics, in a similar fashion as was done in Wessex (Allen 1992). This may provide valuable insights into the activities and impact of prehistoric and early historic people on the landscape in this area and the changing resource potential of the environment to successive human groups.

14.3 The evidence should also be compared with samples taken recently by MoLAS through colluvial sequences on sites during A2/M2 widening work alongside the CTRL corridor in Kent.

15. Potential for further work

15.1 The data from the monolith samples has potential to address the following research objectives:

- *Early Agriculturalists (4,500-2,000BC): Define nature of contemporary environment; and determine nature and effect of clearance for agricultural activity.*

- *Farming communities (2,000 – 100BC): Consider environmental change resulting from landscape organisation and re-organisation*

15.2 In order to refine the model for local environmental and landscape change on the site suggested here, it is suggested that thin sections be made from the monolith tins. The examination of these thin sections might enable ephemeral evidence of soil formation within the sedimentary sequence to be more reliably identified and interpreted (Rose *et al* 2000). It may also allow the causes of colluviation (such as agriculture up slope) to be identified (Macphail *et al,* 1990; Macphail 1992) and the characteristics of the redeposited soil material to be inferred.

15.3 The landscape evolution and possible causes outlined in Section 4 above might be tested and enhanced by pollen and soil micromorphological analysis, together with further analysis of the samples taken for mollusc analysis adjacent to the monolith profile. If preserved, pollen could reconstruct the changing vegetation of the valley. This might enable a better understanding of the causes of the colluvial events to be gained. Pollen assemblages might be able to tie in episodes of woodland clearance with colluvial events and perhaps link them to evidence for agriculture. Similarly evidence for different crop types or more intensive agriculture might be observed that would tie in with the second dramatic erosion event. Although these inferences have been obtained from analysis of colluvial sequences elsewhere (Bell & Boardman 1992) they need to be tested before they can be assumed to be the cause of the erosion events on the present site.

15.4 Pollen is not often preserved in calcareous soils, however the carbonate content of these sediments seems to be low. It is therefore suggested that, in order to tie in the erosion events with vegetation change and possibly correlate it with evidence for agricultural activity, pollen analysis be undertaken. This should preliminarily identify whether pollen is preserved within these sediments and if it is, analysis of pollen sub-samples should proceed.

15.5 The results of pollen assessment and soil micromorphology should be compared to the results of further analysis of the adjacent snail samples. This will allow a more reliable reconstruction the changing landscape processes and the changing environment of the dry valley and adjacent interfluves.

15.6 However unless datable materials (such as pottery or charcoal) have been found stratified within contexts [002] and [003] the episodes of erosion and stability identified would not be able to be tied in to a specific time frame. Nevertheless, if dateable inclusions were found within context [002] and [003] they should allow the possibility of a high magnitude erosion event immediately pre-dating the accumulation of context [002] to be related to other evidence for human activity or natural events in the environs of the site.

15.7 It may also be possible to obtain Accelerator Mass Spectrometry (AMS) radiocarbon dates on the snails obtained from the bulk samples, if required. As a sequence of samples for snail analysis was taken adjacent to the monolith sequence, AMS dating of the snails would probably be the best way of dating the sediment sequence. Unfortunately there were no snails preserved in the lowest redeposited soil material and it will not be possible to date the charcoal from the unit as there is insufficient, and the monoliths will be set in resin.

15.8 This evidence should be compared with samples taken recently by MoLAS through colluvial sequences on sites during A2/M2 widening work alongside the CTRL corridor in Kent and with previous work undertaken on colluvial deposits in Wessex (Allen 1992). This will help indicate any trends/anomalies over the wider region of southern England.

15.9 Further work can be summarised as a table:

Task
(a) **Further sedimentological work** (Geoarchaeologist): • Sub-sample the monoliths for pollen at 40mm intervals. • Scrape continuous 40mm sub-samples from the surface of the monoliths for further sedimentological analysis, to support the micromorphological results. • Carry out: loss on ignition and possibly magnetic susceptibility, phosphate and particle size analysis of these sub-samples as discussed with the micromorphologist • Make the results of these techniques available to the soil micromorphologist
b) **Pollen analysis** at 80mm intervals through the profile (16 samples: units 3-7) and production of a report (following preliminary scanning of the samples to ensure that pollen is preserved)
c) **Thin section analysis** (Soil micromorphologist): • Set monolith samples <1, 2 & 3> in resin • Manufacture 6 thin sections each 35mm x 90mm covering: ¾, 4/5, 5/6. 6/7 interfaces and from within units 6 & 7 • Examination of these thin sections and production of a report
d) **Radiocarbon (AMS)** on snails taken from samples <9> and <8> from the adjacent snail sample column.
d) **Interpretation of the results** (Geoarchaeologist) Integrate the results of (a) with: • The results of (b & c) • This assessment report • Other specialist reports from the site (especially the results of any further landsnail analysis if undertaken) • Data from other CTRL sites and work undertaken on colluvial sequences in the area Aim: to report on the sequence of colluvial and soil forming events and possible linkages and implications for human activity on the site and within the region.

16. Bibliography

Allen, MJ, 1992 products of erosion and the Prehistoric land-use of the Wessex chalk in *Past and Present Soil Erosion: Archaeological and Geographical Perspectives* Oxbow Monograph 22, 37-51 Eds. Bell & Boardman

Bell, M, & Boardman, J, 1992 *Past and Present Soil Erosion: Archaeological and Geographical Perspectives* Oxbow Monograph 22

Bell, M, & Walker, MJC, 1992 *Late Quaternary Environmental Change: Physical and Human Perspectives* Longman Scientific and Technical

Bell, M, 1983 'Valley sediments as evidence of prehistoric land-use on the South Downs' *Proceedings of the Prehistoric Society 49,* 119-150

Evans, J, 1975 *The Environment of Man in British Prehistory*

Lamb, HH, 1981 'Climate from 1000BC to 1000AD' in *The environment of man: Iron Age to Anglo Saxon period* BAR (British) 87

Macphail, RI, 1992 'Soil micromorphological evidence of ancient soil erosion' in *Past and Present Soil Erosion: Archaeological and Geographical Perspectives* Oxbow Monograph 22, 197-215 Eds. Bell & Boardman

Macphail, RI, Courty, MA, & Gebhardt, A 1990 'Soil micromorphological evidence for early agriculture in north-west Europe. *World Archaeology* 22(1) 53-69

Rose, J, Lee, J, Kemp RA & Harding, PA 2000 'Palaeoclimate, sedimentation and soil development during the Last Glacial Stage (Devensian), Heathrow Airport, London, UK' in *Quaternary Science Reviews 19,* 827-847