APPENDIX 14: ASSESSMENT OF GEO-ARCHAEOLOGY

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1. Introduction

1.1 Two monolith samples were taken from the south-facing section of trench 1071TT. The section cut through a sequence of soliflucted and colluvial slope deposits, which had infilled the dry valley running through the centre of the site. The aim of the geo-archaeological assessment was to determine the potential of the samples to provide information with which the changing landscape and geo-morphological processes operating on the site might be reconstructed. This might provide a better understanding of the environment available to be exploited by people in the past and of the impact of these people on the landscape. This would be of particular relevance in the Bronze Age, Iron Age and Anglo-Saxon periods, for which there is archaeological evidence for occupation on the site and its environs.

1.2 The two overlapping monolith tins (0.50x0.5x0.5m) were hammered into the cleaned section face. The sediments and stratigraphy visible in the section were described and drawn by the excavators on site. The monolith samples were marked on the section drawing and a level, relating to ordnance datum was taken on the top of each tin. Each tin was wrapped in cling film and plastic bags, labelled and temporarily stored in the MoLAS fridge prior to and following assessment.

2. Methodology

2.1 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.

2.2 For each 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 and where possible the profile is discussed in terms of contexts as opposed to the units identified in the monolith tins.

3. Quantification

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

4. Provenance

4.1 The monolith samples were taken from the lower half of the section. The upper part of the section (which was in total about 2m high) was not sampled due to its loose and flinty nature. However field descriptions describe the sediment directly above the tins (context [32]) as comprising a flinty lens at the base of about 0.50m of bedded silt and chalky mud with a further 0.30m thick flint-rich silt [7] underlying recent topsoil, which was about 0.30m thick.

4.2 The profile exposed might be interpreted as representing 5 main events. In the first, context [10] (unit D) formed. This was possibly as a result of the *in situ* weathering of the chalk bedrock, although it is more likely that this chalky sediment is not actually *in situ*, but has moved downslope by solifluction processes during the periglacial environment of the last cold stage. Fine pellety chalk rubble and chalky mud similar to context [10] have been recorded elsewhere towards the base of dry valley fills in the Kent area and have been attributed to meltwater deposition during the Younger and Older Dryas Stadials (Kerney 1965).

4.3 In the second event, a soil appears to have developed in the surface of this weathered chalk material (context [45]: unit C). This unit can be differentiated from the upper part of the context (unit B) by a) its angular, blocky structure; b) its darker colour; c) its finer pellety chalk inclusions and lack of coarser flint and chalk; and d) by its more frequent snail shell inclusions, which are very rare in unit B. The darker colour is probably a result of both the addition of humic material and the leaching out of carbonates, which is likely to occur in a soil. The more rounded nature of the chalk granules in this unit is also probably a result of weathering within a soil. Whilst the fragmented snail shells might indicate that the soil may be redeposited soil material, this may not have moved far. The whole shell of *Pomatias elegans* may be derived from burrowing (as is characteristic of this species: Kerney & Cameron 1979, 53) however, the bands of flint that occur higher in the profile, and the depth of the context would have prevented it burrowing from the present day landsurface. Thus an earlier stable landsurface is implied, either at the surface of unit C or pre-dating the accumulation of [32].

4.4 In the third stage, sediment derived from upslope appears to have accumulated above the soil (context [45]: unit B). This is likely to be the result of devegetation and disturbance upslope, but whether this was due to human activity or natural causes such as a change to a harsher climate regime is not known. The diffuse contact between units B and C (from the lower to upper part of context [45]) suggests that the cause was not a sudden catastrophic event, causing severe erosion and sediment movement. Instead a gradual accretion of sediment seems to have taken place, as the stable soil became buried by more poorly sorted material from upslope.

4.5 The greater abundance of coarser chalk and flints in the upper part of context [45]: unit B compared to the lower part (unit C) is probably a result of the shallower topsoil developed upslope through time, due to continued erosion. This is very likely to indicate continued agricultural activity upslope (which in itself would dislodge and disturb the chalk subsoil).

4.6 This more rubbly series of colluvial deposits context [32] constitutes the fourth event represented by the profile. Severe erosion and downslope movement is represented by the lens of flints and chalk of much larger clast size, found at the base of context [32]. This deposit is likely to represent a debris fan accumulated at the foot of temporary rill or gulley carved into the valley side.

4.7 Such fans occur today in valley edge locations on the North Downs where water aided slope processes have taken place, for example after winter storms when open fields are unvegetated. Surface flowing water will carry finer material away, but deposit coarse chalk and gravel at the foot of the slope. The decay of organic debris, accumulated in the hollows and open spaces above and between the flints may have contributed to the darker silt band observed above the flint lens in context [32].

4.8 Context [32] is therefore likely to represent an intensification of farming practices on the adjacent slopes. However it is possible that harsher weather conditions and a continuation of pre-existing land-use patterns would have the same effect.

4.9 The silty bands, with occasional flints, which form the upper part of [32] are also likely to represent sediment transported downslope, but as a result of less dramatic events, probably gradual soil creep. The chalky mud bands within the silts are probably from hillwash. They suggest that the erosion events responsible for their accumulation were not severe enough to transport coarser material this far (although flinty rubble may have accumulated further upslope). Thus context [32] appears to represent a series of erratic and episodic erosion events, some rapid and high magnitude, others more gradual.

4.10 Context [7] is also flinty and would suggest a further, more dramatic, erosion event in this locality. However, rills and gulleys do not always occur in the same place. Debris fans will accumulate at the edge of the valley floor in different places at different times during the same episode of land use upslope.

4.11 The topsoil developed at the surface of these deposits implies a stabilisation of the landscape (stage 5). This might be a result of arable farming being replaced by grassland and grazing. But it is quite likely that it is an accretionary soil, developing at the same time as sediment accumulates above it, as from the context descriptions it did not appear to be particularly well developed.

4.12 The frequent carbonate precipitations seen throughout context [45] are likely to represent carbonate dissolved by rainwater in the upper horizons of the soil, washed down through the soil profile and precipitated out at the limit of water percolation, especially in association with rooting. This may have occurred as part of the period of recent soil formation, or it may have taken place incrementally as the valley sediment accumulated. It is particularly concentrated in the upper part of context [45] possibly because this zone is directly below the looser (and very permeable) context [32].

4.13 But it is also possible that the event that deposited the flint lens at the base of context [45] also eroded a former topsoil. In this case the carbonate translocation may relate to a period of soil formation and landscape stability post-dating the accumulation by soil creep of context [45] and pre-dating the period of more intensive upslope disturbance and erosion represented by context [32]. That is, it might represent an additional stage in the sequence of events described. This would fit in between the more gradual accumulation of the upper part of context [45]: unit B in the monolith tins and the more episodic, erratic and coarser accumulation of colluvium represented by context [32].

4.14 The sediments deposited by slope process are likely to be laterally variable. As a result a specific event, such as the erosion of an arable field following a rain storm , might be represented by different sediments in different places along the valley, yet the result of a succeeding event, of similar characteristics to the first, might be to deposit different sediment in each location to that deposited by the first event. It is therefore not possible, without very good dating evidence, to correlate the sequence at any one location to that at another with any high precision. Nor would such correlation mean very much.

4.15 However the outline sequence of broad depositional events, as set out above, should be representative of the changing nature of the processes operating within the dry valley as a whole, for the timespan represented by the profile. If dating evidence was recovered from any of the contexts sampled, this sequence might therefore be linked to human activity in and upslope of the dry valley. This information would contribute to a better understanding of the character of the landscape during episodes of human occupation and abandonment. It may also enable inferences to be made regarding the impact of past human activity on the local environment.

4.16 An important division was made in the monolith description within context [45]. This was subdivided into an upper unit (B) representing unstable landscape conditions; and a lower unit (C) representing an earlier period of landscape stability and soil formation. Finds evidence is unlikely to be able to differentiate between these two units, as it was all part of context [45]. However the abundant snail shells in unit (C) might be radiocarbon dated and this would give a date for the period of landscape stability and soil formation, preceding the earliest erosion event likely to be caused by human disturbance. It would also suggest whether this soil developed in the late glacial or Holocene period. However there are limitations to the radiocarbon dating of shells.

5. Conservation

5.1 Despite careful storage, some drying out of the monolith samples has occurred. In addition, in order to reliably describe the sequence sampled, much of the sediment within the tins has been disturbed. This was unavoidable given the condition of the samples and was necessary, as accurate sediment description is the most important part of monolith assessment and analysis.

5.2 The state of the monolith samples means that soil micromorphology is no longer appropriate for these samples and there are no samples from this site to be set in resin or cut into thin sections. There will therefore be no long-term stable archive record of the sediments sampled.

5.3 Although the state of the monolith samples will constrain the techniques possible in any further analysis of the samples, the techniques recommended in Section 7 should enable further information to be extracted. This will enhance the description and interpretations given in this assessment.

5.4 As the further analysis suggested is likely to also be destructive, long term storage of these samples as monoliths would also not be appropriate. It is therefore recommended that whatever remains of the monolith samples after the analysis stage should be discarded.

6. Comparative material

6.1 Much geo-archaeological research has been undertaken on the slope deposits in the dry valleys of south-east England. This has focussed on identifying periods of instability (sediment accumulation) and stability (soil formation) and attempting to correlate these events with evidence for human activity (Burleigh & Kerney 1982; Bell 1983).

6.2 Landsnail and micromorphological analysis of colluvial sediments have been able to link periods of woodland clearance for agriculture with erosion events (Macphail *et al* 1990). Examination of deeply stratified colluvial profiles have shown that, as a result of accelerated soil erosion, the deep brown earth soils that developed in the early Holocene below woodland have been removed, to be replaced by the thin and less well-developed rendzina soils typical of chalk downland today (Bell and Boardman 1992). In a few cases, where the colluvial deposits have been well dated (mostly by pottery inclusions or the burial of dated features) the periods of accelerated erosion and stability have been directly correlated with episodes of human occupation and activity upslope (Bell & Walker 1992, 193).

6.3 The colluvial and soliflucted sediments infilling dry valleys have also been investigated by Quaternary Scientists, with the aim of reconstructing Late Glacial environments. Evidence for buried interstadial soils have sometimes been found within the chalky rubble and silt sediments that were deposited by solifluction processes in a periglacial environment towards the end of the late Glacial period (Preece 1994). Of particular importance to the present site is the work done at Upper Halling (Kerney 1963; Preece 1998). Here landsnail assemblages from the buried rendzina soil and from the chalky meltwater muds above and below it were used to reconstruct the changing climate during the Late Glacial.

6.4 Valley sediments of both the Holocene hillwash type (as in contexts [45] and [32]) and the lower periglacial soliflucted chalky rubble and silt (as context [10]) have been recorded and sampled from several of the CTRL sites (assessment currently in progress). As such they record sequences and chronologies for periods of landscape stability and instability that might be compared with each other and to other evidence for human settlement and activity across a transect of the North Downs landscape.

7. Potential for further work

7.1 The data from the monolith samples has potential to address the following landscape zone and fieldwork aim:

- *Farming communities (2000 BC-100 BC)*
- *Provide information on Iron Age landuse, environment and economy*

7.2 Information on the impact on the landscape caused by occupation on the site in the prehistoric and historic periods, particularly the Iron Age might be inferred. This will be particularly useful when compared to mollusc evidence for changing prehistoric habitats and environments (as obtained from bulk samples from cut features and snail column samples) and to ceramic evidence for the type and intensity of Iron Age occupation.

7.3 In addition the episodes of colluviation on the site might be related to other CTRL sites. In particular those where colluvial events have been interstratified with direct evidence of human occupation and activity (eg: White Horse Stone).

7.4 Episodes of landscape stability and instability are represented in the profile by evidence for soil formation and sedimentation respectively. However, in order to reconstruct this information it is necessary to date the sediments sampled.

7.5 Although no ceramic dating evidence was found in contexts ([45] and [32]) the sequence of events might be placed within a chronological framework by AMS dating of snail shells from these contexts.

7.6 The frequent snail shells in the lower part of context [45] are likely to relate to a period of soil formation, prior to the accumulation of the upper part of the context. These could be dated by AMS (on shell protein) to provide a date for this period of landscape stability, prior to the initial onset of colluviation. This would allow inferences to be made regarding the onset of colluviation: whether it was triggered by the Bronze or Iron Age activity in the area – or whether it had already begun by that time.

7.7 However, it should be noted that, owing to the fragmentary nature of the snail shells there is a strong possibility that this dating will not be possible, but without a good dating framework the techniques suggested will also be less meaningful.

7.8 The existence of soil formed in the lower part of context [45] might be tested by carrying out loss-on-ignition and (pot sensor) magnetic susceptibility determinations at regular (30mm) intervals through the profile. Together these techniques have the potential to identify trends in weathering, organic composition and carbonate content through the profile. This, combined with the descriptions already done should allow possible zones of stability, weathering and soil formation to be identified with more precision than this assessment has allowed.

Further Work

7.9 Further work should include:

- Radiocarbon (AMS) dating of the snail shells from context [45]
- Loss on ignition and magnetic susceptibility determinations at 30mm intervals through profile (30 sub-samples)
- Comparison of the sequence and chronology of events at ARC CXT 97/ARC CXT 98 with the archaeological evidence on-site and with valley sediment profiles from other CTRL sites and from the published literature for the area.

Task	**time requirement**
Radiocarbon (AMS) dating of the snail shells from context (45: unit C)	2 months Beta-analytic
Loss on ignition and magnetic susceptibility determinations at 30mm intervals through profile (30 sub-samples)	Geoarchaeologist
Comparison of the sequence and chronology of events at ARC-CXT97 with the archaeological evidence on-site and with valley sediment profiles from other CTRL sites and from the published literature for the area.	Geoarchaeologist

8. Bibliography

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Table 26: Assessment of Geo-Archaeology

Context	Unit	Elevation of contact (m OD)	Description and contacts	tin
		14.40	Top of sequence sampled	
32	A	[0.10m thick]	Loose, yellowish brown 10YR5/6 slightly sandy clay-silt. Frequent flint (<60mm) and some SA/SR chalk (<20mm) gravel. No visible bedding or clast orientation. Contact marked by increased compaction to:	1
45	B	[0.50m thick]	Compact, yellowish brown 10YR5/6 slightly sandy clay-silt. Frequent flint (<50mm) and some SA/SR chalk (<20mm) gravel. No visible bedding or clast orientation. Matrix has holey, porous structure. Frequent thread-like carbonate precipitations follow root voids in haphazard orientation, especially in upper 0.20m of unit; they become fainter and less frequent towards unit base.	1 + 2
		c.13.90	Diffuse contact over 0.10m, marked by a darkening of colour downwards.	2
45	C	[c.0.30m thick]	Compact, 10YR5/3 brown, slightly sandy clay-silt. Frequent mainly sub-rounded but also sub-angular chalk granules (<5mm: pea-grit-like or pelletty). Very occasional flint pebbles (<30mm). Frequent snail shells – mostly fragmented, but occasionally whole (*Pomatias elegans* observed). Fine angular blocky ped structure. Ped surfaces are coated by carbonate precipitations.	2
		13.58	Distinct, but irregular	
10	D	[0.08m thick]	Compact, greyish brown 10YR4/6 chalky, carbonate rich clay-silt matrix with frequent SA/SR chalk granules and fine gravel (<10mm).	2
		13.50	Base of profile sampled	