Channel Tunnel Rail Link

London and Continental Railways

Oxford Wessex Archaeology Joint Venture

Geoarchaeological recording at Northumberland Bottom, Southfleet, Kent

by Jane Corcoran

CTRL Specialist Report Series

2006

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1 INTRODUCTION

Quaternary deposits infilling a dry valley, a tributary of the Ebbsfleet Valley system, were examined in four monolith samples, forming one sequence. Examination of the monoliths has provided (undated) evidence for the Late Glacial environment and an indication of Pleistocene and Holocene landscape change in the vicinity of the dry valley. This information will be compared, in the route-wide synthesis, to the evidence from other CTRL dry valley profiles in the Northfleet area: 330 Zone 2 WB (ARC STP99), from another tributary of the Ebbsfleet Valley; and Tollgate (ARC TLG97), from a tributary of the dry valley sampled on the present site; and with White Horse Stone (ARC WHS98) located east of the Medway.

During the assessment stage the monoliths were described and illustrated according to the geoarchaeological methodology designed for the route-wide scheme. Further sedimentological analysis has subsequently been carried out on the sequence, which involved magnetic susceptibility and loss on ignition undertaken by MoLAS geoarchaeologists Graham Spurr, Craig Halsey and William Mills, following the methodologies established for the route-wide scheme. A summary of the results of assessment and analysis is given here. The original reports for the magnetic susceptibility and loss on ignition analysis (Halsey and Spurr 2004; and Mills and Spurr 2004 respectively) form part of the site archive. The location of the monolith samples is shown on Figure 18 of the site report (Askew 2006) and the monolith profile and results are illustrated in Figure 1.

2 DISCUSSION OF RESULTS

The monolith sequence was taken from the east-facing section of trench 1472TT, located towards the base of the dry valley (Askew 2006, Fig. 18). Below the sampled sediments was a rubbly deposit of flint nodules in a reddish silty clay matrix [7], which may be derived from clay-with-flints, redeposited by solifluction processes in a periglacial environment at the end of the Pleistocene. Although clay-with-flints mantles the Chalk further upslope, it is not recorded in the vicinity of the site today. However, it was probably more extensive prior to the Devensian, when dramatic erosion of the Pleistocene landscape took place.

Context [10] overlay context [7] and was recorded at the base of the profile sampled. It comprised well sorted very fine sand that may have been deposited by fluvial or aeolian processes. 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 was probably the result of harsh winds redepositing local material during the arctic winters of the late Pleistocene (it is too coarse for loess). The BGS Solid and Drift Sheet 271 (Dartford) shows that Thanet Beds outcrop on the interfluves in the vicinity of the site, although in the valleys themselves the bedrock has been eroded down to Chalk. Thus it is likely that the sandy sediment was redeposited from the Thanet Sands, when the modern topography was carved out during the Late Devensian.

Manganese flecks and faint channels, suggestive of rooting imply vegetation growth in the sand. Although organic and carbonate levels are low in context [7] (Fig. 1) its increasing magnetic susceptibility (MS) values upwards suggests it may represent the weathered subsoil of a soil former soil / landsurface. The increase in the MS values may be a result of pedogenetic processes, whereby the chemical action of bacteria in organic soils produces secondary ferromagnetic oxides. However**,** the proportion of organic material is very low with a range reading from 1.2% to 1.5% in context [7]. The lowest readings of carbonate ($CaCO_3$) of the entire profile are also displayed at these levels. These readings indicate a leached minerogenic horizon probably representing a sterile, fluvial or aeolian depositional environment that may have formed the subsoil during a subsequent period of pedogenesis.

The monolith description and magnetic susceptibility results suggest that context [3], a predominantly compact cohesive sandy silt, can be subdivided into an upper and lower horizon. In the lower part of context [3] a more clayey matrix together with charcoal flecks and higher MS values suggest an *in situ* or redeposited 'Bt' horizon of a brown-earth type soil. The peaks in magnetic susceptibility within this deposit may be the result of burning and might indicate forest clearance, which is supported by the frequent charcoal flecks within this part of the profile. Such clearance may have triggered soil erosion. However, the lack of dating evidence prevents this activity being related to a specific time in the past. Recent work (Wilkinson 2003) suggests that such erosion and its colluvial product is likely to be specific to localised events and discrete areas of human activity. Thus its distribution and timing will differ between and within dry valleys.

Lower MS values are recorded through the upper part of context [3] and it is likely that this part of the profile and the overlying deposit (the lowest part of context [2]), which has similar MS values, accumulated through soil creep/hillwash processes. The soil creep/hillwash may have been the result of a prolonged period of agricultural activity on the cleared land (as discussed in Allen 1992; Bell and Boardman 1992; Bell 1983 etc). Occasional higher magnitude erosion events may have occurred during this period of human activity. One such event appears to have taken place at the interface of contexts [3] and [2], where a sharp contact followed by gravel clasts was recorded. Such events might mark a more intensive period of activity, or could record an episode of (for example) bad weather coinciding with cultivation activities that laid the soil surface open and susceptible to erosion. In these periods rills and gulleys would have scoured into the valley side and transported coarse soil and subsoil material from upslope by water flow as opposed to gravity and rainsplash processes. During this period of colluviation, an accretionary soil developed in the gradually accumulating sediment.

Above the gravel clasts at the context [2]/[3] interface, the colluvium contains chalk granules, which could be indicative of shallower soils and possibly ploughing activities biting into the chalk bedrock upslope. Although this is not registered as an increase in carbonate in the loss on ignition analysis (Fig. 1), it suggests that considerable erosion of soil material had occurred by this time, perhaps as a result of continued agricultural activity. The erosion had denuded the valley sides and led to the soils available for exploitation on the valley sides becoming shallower and more gravelly. There is also a gradual increase in organic content through the lowest part of context [2], although the MS values stay relatively constant. This may reflect a period of relative landscape stability, when the influx of sediment was lower and soil forming processes/organic inputs outweighed the input of minerogenic sediment by slope processes. It is possible that the period of relative landscape stability recorded by the lower rates of colluviation is a result of a reduction of human activity owing to thinner soils and soil degradation upslope.

The upper and middle parts of context [2] are characterised by dramatic peaks of magnetic susceptibility, organics and carbonates (Fig. 1), which appear to correspond, although the organics peak slightly before the carbonates. The results at these levels significantly contrast with those below, although the deposits appeared similar during monolith description. Both contexts [2] and the upper part of [3] are of a similar texture, a slightly sandy silt, with the upper and middle part of [2] differentiated by eye only in its slightly paler colour. Thus it is only by use of magnetic susceptibility and loss on ignition techniques that differences and trends within this part of the profile can be picked up. Chalk / carbonate content has markedly increased along with organic levels in the upper and middle part of [2]. It is possible that ploughed-in waste material with inclusions of pot for example have been mixed with the sediment at these levels, causing the high levels and dramatic fluctuations in the carbonate, organic and magnetic susceptibility readings. This might reflect changing agricultural techniques, such as the introduction of manure and chalk for liming the soil. Unfortunately no dates are available to suggest when this might have begun to take place.

The blocky, crumbly nature of the soil in the uppermost context ([1]) along with the high chalk and gravel content seen in the monolith sample and evidence for modern rooting suggest it represents the subsoil of the recent soil. The low organic and carbonate and very high magnetic susceptibility readings probably reflect inclusions within the soil.

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