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Ancient Monuments Laboratory
Report 203/88

ARCHAEOMAGNETIC DATING. DRAYTON CURCUS, OXFORDSHIRE.

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Summary

Depositional remanent magnetisation and magnetic susceptibility measurements were made on a column of samples taken from the filling of a Neolithic curcus ditch at Drayton, Oxfordshire. A tentative dating scale was obtained for the alluviation sequence of the Thames valley from about 2000 to 950 cal BP.

Author's address :-

19 The Crossways
Onslow Village
Guildford
Surrey
GU2 5QG

0483 64566

ARCHAEOMAGNETIC DATING : DRAYTON CURSUS, OXFORDSHIRE, DRPG86

Neolithic ditch 408A

Excavator: G. Lambrick, Oxford Archaeological Unit

Sampled 25 June 1986

INTRODUCTION

Rescue excavation on the Thames valley gravels at Drayton had revealed part of a cursus. A section of one of the ditches was prepared under the supervision of Dr Mark Robinson to obtain information on the environmental development of the valley since Neolithic times, further to that already published by Robinson and Lambrick (1984). In addition to the types of evidence previously obtained, an archaeomagnetic column and magnetic susceptibility measurements were taken through the filling.

For archaeomagnetic directional dating, an almost continuous column of 22 tube samples (see notes) was obtained from the centre of the ditch section, from just below the modern A horizon soil, through an alluvial deposit and the original ditch filling to the top of the primary filling, which was too stony to sample. Samples 14, 15, 16 and 17 were duplicated in an attempt to compensate for the magnetic disturbance expected from inhomogeneities including burnt flecks, possibly of sandstone, that occurred around the surface of the ditch filling as it was before the alluvium began to accumulate. Orientation was by magnetic compass. Before measurement, the samples were stored in zero field for four months to remove any viscous magnetic components.

For susceptibility measurements, small samples were taken alongside each archaeomagnetic sample. These were prepared simply by drying and the removal of any obvious pebbles, etc., and measured with a Bartington MS1 meter and laboratory sensor.

Problems were expected from chemical remanence resulting from redistribution of iron compounds in the silt. There was much characteristic mottling of the sediments, and rusty deposition in root holes etc. The measurements did indeed prove to be erratic: six had to be rejected, and it was necessary to take 3-point running means of the remaining readings, or a reduced number where the unusable readings occurred. Where duplicate samples were taken, a single mean could be composed of up to 5 readings (the optimum of 6 was not possible because of rejected samples), which gave very useful smoothing in these difficult circumstances.

RESULTS

Directional measurements

The smoothed results are summarised in the table on p. 2. Because of the use of 3-point running means, the first reading is at sample 2 and the last at 21.

Measurement ref. **AJC-35**

Sample	Dec (degrees)	Inc (degrees)	Date (cal BP)
2	1.5W	71.9	?850
3	40.0E	72.0	950
4	21.7E	55.2	
5	0.6E	39.6	1150
6	10.0E	52.8	1300
7	10.1W	57.1	
8	23.6W	70.0	1600
9	15.8W	40.5	
10	9.6E	25.1	
11	0.8W	46.0	
12	14.9W	72.6	
13	26.1W	76.4	
14	41.8W	79.0	2000
15	27.0W	74.2	
16	21.3W	68.1	
17	10.1W	60.9	?2200
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18	92.5W	64.0	
19	139.3W	25.5	
20	51.5W	58.3	
21	78.3E	83.1	

Figures below the horizontal line, samples 18-21, are from the original ditch filling and too erratic to have any meaning, presumably because of bioturbation that may well have included human disturbance. Figures above the line are also extremely 'noisy', and for some reason very exaggerated in amplitude, but the declination values do show an easterly trend with advancing time, as well as other features characteristic of the archaeomagnetic curve during the second millenium BP (Turner and Thompson, 1983; Clark et al, 1988). These characteristics include the major turning points or extrema at cal AD 1000 and 50 cal BP, and lesser turning points in between. Such points are of great value for cross-matching, especially when dealing with ncisy data, and the dates to which they appear to correspond on the reference curves are shown in the table. It must be emphasised that, because of the quality of the data, this interpretation is tentative. Assuming their validity, the confidence limits of the dates given are about $\pm$ 50 at the 68% level.

A major cause of the poor quality of the data is almost certainly the redistribution and chemical change of iron compounds after deposition. It was thought that this might invalidate the whole exercise by giving magnetic directions due to chemical remanence, which would be too young. In fact, it seems most likely that its main effect has been to produce noisy results, and that a dominant proportion of the iron compounds has remained in situ and unchanged since deposition. The inclination values were especially erratic, and of no value for dating, probably in part because they tend to be the more sensitive to disturbing effects associated with gravity.

Magnetic susceptibility

These measurements are plotted as 2-point running means in Fig. 2, with the dating reference points transferred from the directional table above.

Two very clear peaks are immediately apparent. Both are probably due mainly to the initial heavy run-off of upstream iron-rich soils such as those of the Cotswolds, caused by phases of clearance and cultivation. However, it should be borne in mind that this pattern may be distorted, or emphasised, by the downward migration of iron compounds discussed above: for instance, there was a thin layer at the bottom of sample 6, so heavily iron-stained that the sample was cut short to avoid it.

Despite these reservations, the peaks fit in sensibly with the archaeomagnetic data. The maximum of the older peak corresponds with signs of human activity on the surface of the ditch filling, and also with the beginning of the late Iron Age/Roman period alluviation phase. Low values preceding the upper peak include the iron deficient layer 403, which seems to have been deposited at the end of the Roman period in relatively still conditions in which the silt was not transported over long distances. The upper peak coincides with a new accelaration of deposition between 1300 and 1150 BP.

REFERENCES

Clark, A. J., Tarling, D. H., and Noel, M., 1988. Developments in Archaeomagnetic dating in Britain. Journal of Archaeological Science 15, 645-667.

Robinson, M. A. and Lambrick, G. H., 1984. Holocene alluviation and hydrology in the upper Thames basin. Nature 308, 809-814.

Turner, G. M. and Thompson, R., 1982. Detransformation of the British geomagnetic secular variation record for Holocene times. Geophyical Journal of the Royal Astronomical Society 70, 789-792.

NOTES

1. Sampling methods: Hard materials, typically fired clay, are sampled by the disc method. A number of small levelled plastic discs are glued to the feature, marked with an orientation line related to true north, and then removed with a small piece of the material attached. Soft materials, typically silts, are sampled by the tube method. small pillars of the material are carved out from a prepared platform, and encapsulated in levelled plastic tubes by means of plaster of Paris, the orientation lines being marked on the top of the plaster. Alternatively, the tubes can be pushed directly into softer silts. Measurements are made in a Molspin spinner magnetometer, with partial demagnetisation, if necessary, in an alternating field (AF), or storage in zero field, to remove viscous magnetic components acquired since firing or deposition. This is measured in millitesla, and any figures quoted are the peak value of the treatment.

2. Comments from excavators on the archaeological acceptability etc of results would be welcomed.

FIG. 1. The ditch during sampling.

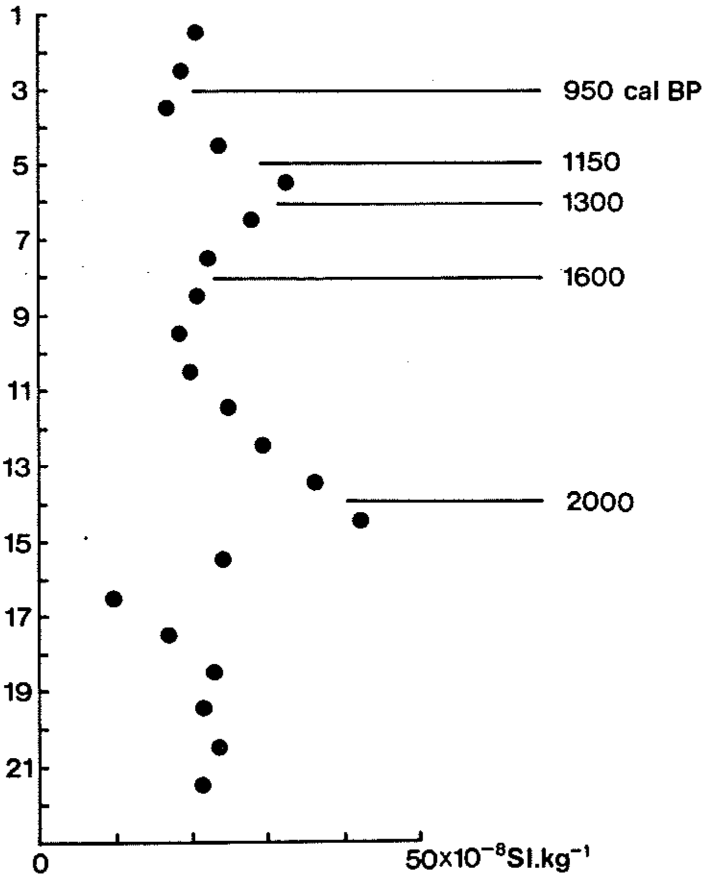

FIG. 2. Magnetic susceptibility plot. Running means of pairs of samples, the numbers of which are shown on the vertical scale