Appendices

APPENDIX 1: RADIOCARBON DATING

by Alex Bayliss, Alistair Barclay, Anne Marie Cromarty and George Lambrick

Introduction

Ten radiocarbon age determinations were obtained on samples from the archaeological investigations along the line of the Wallingford Bypass. Four were processed by the Queen's University of Belfast Radiocarbon Laboratory in 1989, three by the Oxford Radiocarbon Accelerator Unit in 1997, and three by the Scottish Universities Research and Reactor Centre at East Kilbride in 1998. All three laboratories maintain continual programmes of quality-assurance procedures, in addition to participation in international intercomparisons (Scott *et al.* 1990; Rozanski *et al.* 1992; Scott *et al.* in prep.). These tests indicate no laboratory offsets and demonstrate the validity of the precision quoted.

Samples processed in Oxford were measured using Accelerator Mass Spectrometry (AMS) and were prepared using the methods outlined in Hedges *et al.* (1989, 102) and Bronk Ramsey and Hedges (1997). Samples processed in Belfast and Glasgow were measured using liquid scintillation counting (Noakes *et al.* 1965). In Belfast they were processed according to methods outlined in McCormac *et al.* (1992) and references therein, and in Glasgow according to methods outlined in Stenhouse and Baxter (1983).

Results

The results are given in Table A1.1, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

Calibration

The calibrations of these results, which relate the radiocarbon measurements directly to the calendrical time scale, are given in Table A1.1 and Figure A1.1. All have been calculated using the datasets published by Stuiver and Pearson (1986) and Pearson and Stuiver (1986) and the computer program OxCal (v2.18 and v3beta2) (Bronk Ramsey 1994; 1995). The calibrated date ranges cited in the text are those for 95% confidence. They have been calculated according to the maximum intercept method (Stuiver and Reimer 1986) and are quoted in the form recommended by Mook (1986), with the end points rounded outwards to ten years. Probability distributions have been calculated using the usual probability method (Stuiver and Reimer 1993).

Table A1.1 Radiocarbon age determinations

Laboratory number	*Sample reference*	*Material*	*Radiocarbon Age (BP)*	*δ13C (‰)*	*Calibrated date range (95% confidence)*
Whitecross Farm					
UB-3138	WBP1 (WS39)	*Corylus* sp., roundwood containing 9 rings	2776±40	-27.7±0.2	1030–830 cal BC
UB-3139	WBP2 (WS58)	*Quercus* sp., outer rings of plank	2713±35	-28.1±0.2	930–800 cal BC
UB-3140	WBP3 (WS98)	*Quercus* sp., sapwood of a pile containing *c* 35 rings	2739±40	-27.7±0.2	1000–810 cal BC
UB-3141	WBP4 (WS97)	*Quercus* sp., sapwood of a pile containing *c* 35 rings	2736±45	-26.6±0.2	1000–810 cal BC
Grim's Ditch					
OxA-7173	WPB2-133(I)	charred cereal grain, indet.	3765±40	-26.8	2340–2040 cal BC
OxA-7174	WPB2-133(II)	charred cereal grain, emmer	3600±35	-24.2	2130–1880 cal BC
OxA-7175	WBP1-325/328	animal bone, dog	1755±35	-20.3	cal AD 140–390
Bradford's Brook					
GU-5712	CHBB91-7/3	animal bone, cattle skull	1950±70	-27.6	110 cal BC–cal AD 230
GU-5713	CHBB91-7/5(I) (WS3)	Pomoideae, roundwood	3260±70	-26.2	1740–1410 cal BC
GU-5714	CHBB91-7/5(II) (WS2)	*Sambucus* sp., roundwood	3050±60	-25.3	1440–1120 cal BC

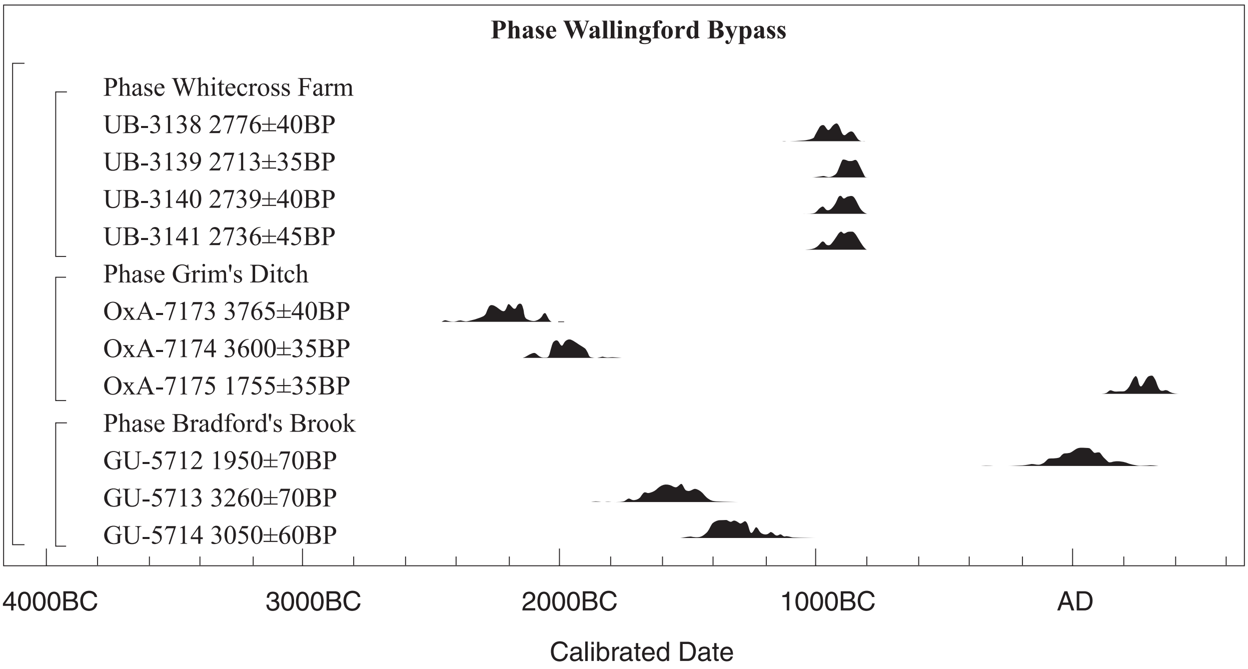

Figure A1.1 Radiocarbon age determinations from all sites on the Wallingford Bypass

Whitecross Farm

Aims

The four samples submitted were intended to address the following research questions:

1. To date the deposit of worked wood.
2. To date and provide a relative sequence for Structures A and B.
3. To provide a date for the first pre-midden phase of activity.

Analysis and interpretation

The four results are not statistically significantly different at 95% confidence (T′=1.4; T′ (5%)=7.8; v=3; Ward and Wilson 1978). This means that the period of activity represented by the wooden structures and the wood deposit was probably fairly short (see Fig. 2.5). UB-3141, from Structure A, is not significantly different in date from UB-3140, from Structure B, and so their relative chronology cannot be determined by radiocarbon analysis.

The wood deposits are securely late Bronze Age in date and provide a *terminus post quem* of *c* 1000 cal BC–800 cal BC for the midden deposits. If this midden is contemporary with the occupation layer found widely across the eyot which is associated with a Decorated Ware assemblage and Ewart Park metalwork (see Chapter 2), then this independent *terminus post quem* for these deposits fits well with the currently accepted chronologies for the late Bronze Age (Needham 1996).

Grim’s Ditch

Aims

The three samples submitted for radiocarbon dating were intended to address the following research questions:

1. To date the settlement beneath the earthwork bank.
2. To date the construction and primary use of the earthwork.

Analysis and interpretation

The structures beneath the bank of Grim’s Ditch are thought to be of late Bronze Age date because of the six-post structure (see Chapter 5, Fig. 5.5). The two radiocarbon results are not from this structure, but from a cluster of postholes (D) to the east in Area A. These two results are statistically significantly different at 95% confidence (T′=9.6; T′(5%)=3.8; v=1; Ward and Wilson 1978), and so are likely to represent residual material in a late Bronze Age posthole. Stratigraphically earlier activity consisted of ard marks and cultivation soils, and a scattering of late Neolithic/early Bronze Age ceramics and flintwork was recovered from later cultivation horizons. However, the possibility remains that this cluster of postholes is really of late Neolithic date.

The bank of Grim’s Ditch sealed a cultivation horizon which contained late Iron Age pottery. This provides a more useful *terminus post quem* than the dates of the cereals. OxA-7175 provides a *terminus* *ante quem* for construction because the dog remains, although recovered disarticulated, were probably originally an articulated burial deposit which had been placed near the bottom of the ditch. Therefore, all that can be said about the chronology of Grim's Ditch is that it was originally constructed in the later Iron Age or Roman period, and was recut at some point after the dog burial.

Bradford's Brook

Aims

Three radiocarbon dates were obtained for the later Bronze Age waterhole at Bradford's Brook. The dates obtained were intended to address the following research questions:

1. To date the period of primary use.
2. To date secondary activity within the waterhole.

Analysis and interpretation

The two pieces of wood from the bottom of the waterhole gave radiocarbon results which are statistically significantly different at 95% confidence (T′=5.2; T′(5%)=3.8; v=1; Ward and Wilson 1978), although they are not different at 99% confidence. Since the feature was probably open for a number of years, this difference may not be archaeologically significant. The middle Bronze Age dating for the waterhole agrees well with the recovery of a complete cylindrical loomweight from its lowest fill (see Figs 6.3, section 1, 6.9). From these dates the environmental sequence from this deposit can be shown to be earlier than the environmental evidence from Whitecross Farm.

The cattle skull, GU-5712, is of late Iron Age or Roman date. This is considerably later than expected, and suggests that the waterhole remained as a depression in the ground for a considerable period. On archaeological grounds, a placed cattle skull is more likely to fall in the earlier part of the calibrated date range.

APPENDIX 2: LEAD ISOTOPE ANALYSIS OF THE STOP-RIDGE FLANGED AXE

by S Stos-Gale

Methods

About 10 mg of the sample from the axe (see Chapter 3 and Fig. 3.2.4) was dissolved in triple-distilled reagents in a Class 100 clean room and the lead extracted by anodic deposition. The lead isotope composition was measured at the Isotrace Laboratory, University of Oxford, using thermal ionisation mass spectrometry (TIMS) with an overall accuracy of better than 0.1% and within run standard error of better than 0.02%. The analytical procedure is described by Stos-Gale *et al*. (1995, 407–10).

Results

The results of the lead isotope analysis of this sample is listed in Table A2.1, together with data from later early Bronze Age and early middle Bronze Age artefacts from Britain analysed by Rohl (1995) which are closest in their lead isotope composition.

The two objects from the Burley, Hampshire hoard are early palstaves, that from Betws-yn-rhos an unusual thin-bladed axe associated with a stop-ridge axe, and that from Poslingford Hall is a flanged axe from an Arreton period hoard.

Table A2.1 Lead isotope analysis together with comparative data from Britain

Sample number	*Site*	*Pb208/206*	*Pb207/206*	*Pb206/204*
Ox155	Wallingford	2.08498	0.084968	18.419
1927.1-7.1c	Burley hoard	2.08651	0.084795	18.478
1927.1-7.2	Burley hoard	2.08675	0.084984	18.369
37.555	Betws-yn-rhos	2.08533	0.084958	18.403
1845.5-10.2	Poslingford Hall	2.08518	0.084898	18.410

Conclusions

The lead isotope composition of the sample from the stop-ridge axe from Wallingford is similar to four British artefacts from the end of the early Bronze Age and the beginning of the middle Bronze Age analysed by Rohl (1995, tables A25–6). The lead in the Wallingford axe has an isotopic composition identical to that of the late early Bronze Age flanged axe from the Poslingford Hall and the early middle Bronze Age thin-bladed axe from the Betws-yn-rhos hoard. The two items from the Burley hoard in Hampshire are also similar and it is possible to say that all five artefacts could have been made from copper from the same ore deposit – but the flanged and thin-bladed axe are a much better isotopic match with the Wallingford axe. It can also be said that the typological connections are closer as well.

APPENDIX 3: LIST OF ANIMAL BONE MEASUREMENTS FROM WHITECROSS FARM

by Adrienne Powell and Kate M Clark

The animal bone from the late Bronze Age contexts at Whitecross Farm is discussed in Chapter 4. See Table A3.1.

Table A3.1 Animal bone measurements from Whitecross Farm (mm)

Horse		L	B						
	P3/P4	28.10	25.50						
Cattle	Mandible	7	8	9	15a	15b			
		136.20	87.70	50.30	66.50	33.00			
	M_3	L	B						
		35.90	11.80						
		34.70	13.40						
		34.00	13.60						
	Scapula	GLP	LG	SLC					
		53.80	44.10	-					
		-	-	41.90					
	Humerus	Bd	BT	HT	HTC				
		85.50	79.60	49.90	36.00				
	Astragalus	GL1	GLm	Bd					
		-	55.50	-					
		61.40	57.50	-					
		57.80	51.30	36.70					
	Calcaneus	GL							
		54.50							
Sheep/goat	Mandible	7	8	9	15a				
		69.60	45.80	23.00	14.20				
		-	28.00	34.60	-				
	M_3	L	B						
		21.90	8.20						
		18.60	6.80						
		23.10	7.40						
		20.80	7.80						
	Scapula	GLP	BG	LG	SLC				
		-	-	-	15.20				
		30.70	20.70	24.20	-				
		29.90	19.10	-	17.40		(sheep)		
		28.50	19.70	22.80	15.00		(goat)		
	Humerus	Bd	BT	HT	HTC				
		28.40	25.80	16.70	12.10	(sheep)			
	Radius	GL	Bp	BFp	SD	Bd	BFd		
		-	27.10	26.00	-	-	-		(sheep)
		147.20	26.40	24.90	13.70	24.30	21.50		"
		-	25.40	23.80	-	-	-		"
		-	27.20	26.00	-	-	-		"
		-	24.30	20.30	-	-	-		"
		-	28.80	27.50	-	-	-		(goat)
		-	28.80	27.90	-	-	-		"
	Pelvis	LA	SBpu	SHpu					
		26.30	-	-					
		28.10	-	-					
		24.60	6.90	5.70		(sheep)			
	Tibia	Bd	Dd						
		23.10	17.30						
		23.10	18.30						
	Metacarpal	GL	Bp	Dp	SD	Bd			
		-	20.90	15.90	-	-			
		116.50	23.70	16.60	15.50	26.60		(goat)	
	Astragalus	GL1	GLm	Bd					
		26.00	27.20	17.10					
		25.10	24.10	-					
		27.30	25.80	-					
Pig	M_3	L	B						
		-	16.20						
		-	15.70						
		27.70	13.90						

Table A3.1 (continued) Animal bone measurements from Whitecross Farm (mm)

	Scapula	GLP	BG	LG	SLC	
		-	-	-	26.70	
		29.20	22.00	25.40	18.20	
		30.80	22.40	-	-	
	Humerus	Bd	BT	HTC		
		38.50	33.00	18.90		
		38.20	32.40	18.30		
		39.40	33.00	19.40		
		-	-	20.70		
		-	-	18.30		
	Radius	Bp				
		25.90				
		29.10				
	Pelvis	LAR				
		32.10				
		33.30				
	Tibia	Bp				
		60.80				
	Metacarpal	GL	Bp	B	Bd	
		72.10	14.60	11.90	15.30	MC IV
	Metatarsal	GL	LeP	Bp	B	Bd
		83.40	82.10	13.90	11.70	15.20
		88.30	85.70	16.10	12.80	16.50
	Astragalus	GL1	GLm			
		41.50	37.50			
		39.90	37.10			
Red deer	Antler	41				
		213.00				
	Humerus	Bd	BT	HT	HTC	
		65.70	59.50	35.30	33.90	
		62.80	57.30	42.00	30.20	
	Pelvis	LA				
		55.60				
	Tibia	Bd	Dd			
		55.60	39.60			

Key

Teeth	
B	Breadth
L	Length
Mandible	
7	Length mandibular cheektooth row
8	Length mandibular molar row
9	Length mandibular premolar row
15a	Height of mandible behind M_3
15b	Height of mandible in front of M_1
Other bone	
B	Breadth in middle of diaphysis
Bd	Breadth of distal end
BFd	Breadth of distal articular surface
BFp	Breadth of proximal articular surface
BG	Breadth of glenoid cavity
Bp	Greatest breadth of proximal end
BT	Breadth of trochlea
Dd	Depth of distal end
Dp	Proximal depth
GL	Greatest length
GLl	Greatest length lateral half of astragalus
GLm	Greatest length medial half of astragalus
GLP	Greatest length of glenoid process
HT	Height of trochlea
HTC	Minimum diameter of trochlea
LA	Length of acetabulum
LAR	Length of acetabulum on the rim
LeP	Length excepting plantar projection (pig)
LG	Length of glenoid cavity
SBpu	Smallest breadth pubis
SD	Smallest breadth of diaphysis
SHpu	Smallest height pubis
SLC	Smallest length of neck of scapula
Antler	
41	Greatest diameter of base

APPENDIX 4: LATE BRONZE AGE POTTERY: PETROGRAPHIC ANALYSIS *by Chris Doherty*

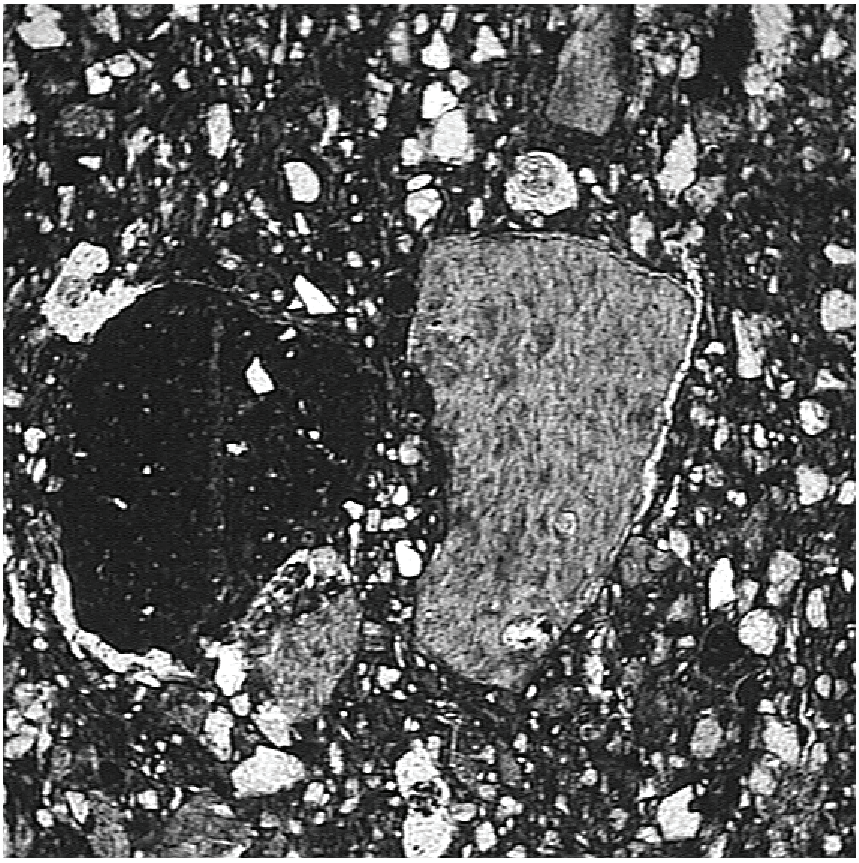

Plate A4.1 A flint-rich fabric with large (up to 2 mm diameter) angular flint grains in a sandy matrix that also contains flint. This range of grain sizes suggests a natural source for the larger flint grains, rather than added temper. Also present are occasional clay pellets (eg dark grain, centre), which lack coarse sand inclusions (TS2)

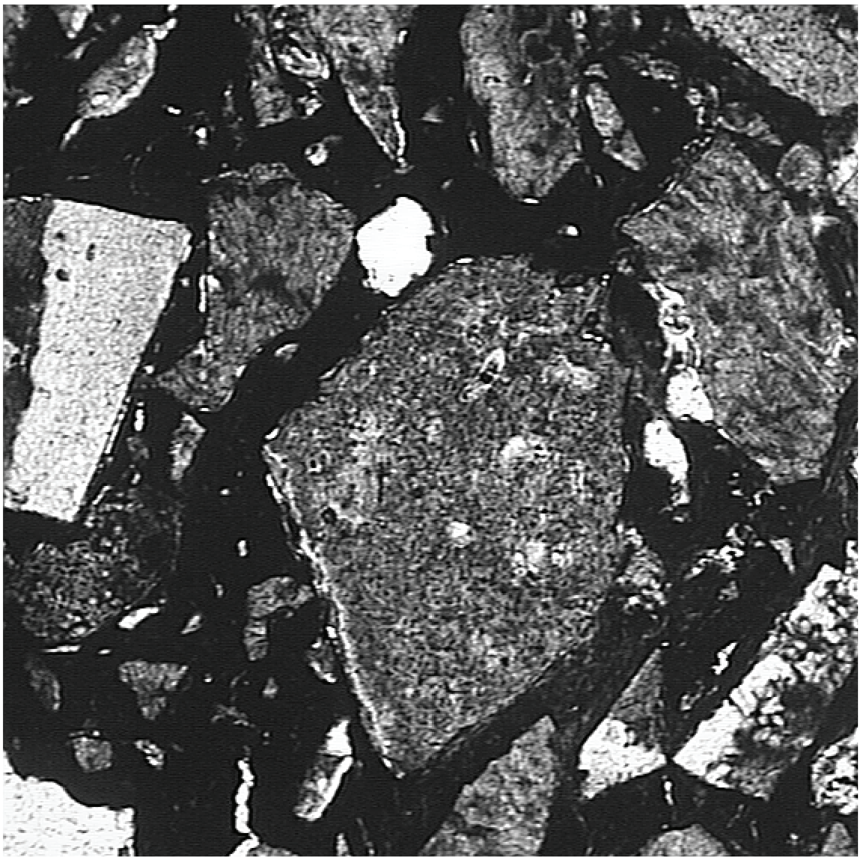

Plate A4.2 This fabric has an unusually high concentration of flint grains, estimated at 50–60% of the sherd. Notable also is the relatively narrow range of grain sizes. This is probably temper, in which case the finer flint has been winnowed out before addition to the body clay (TS3)

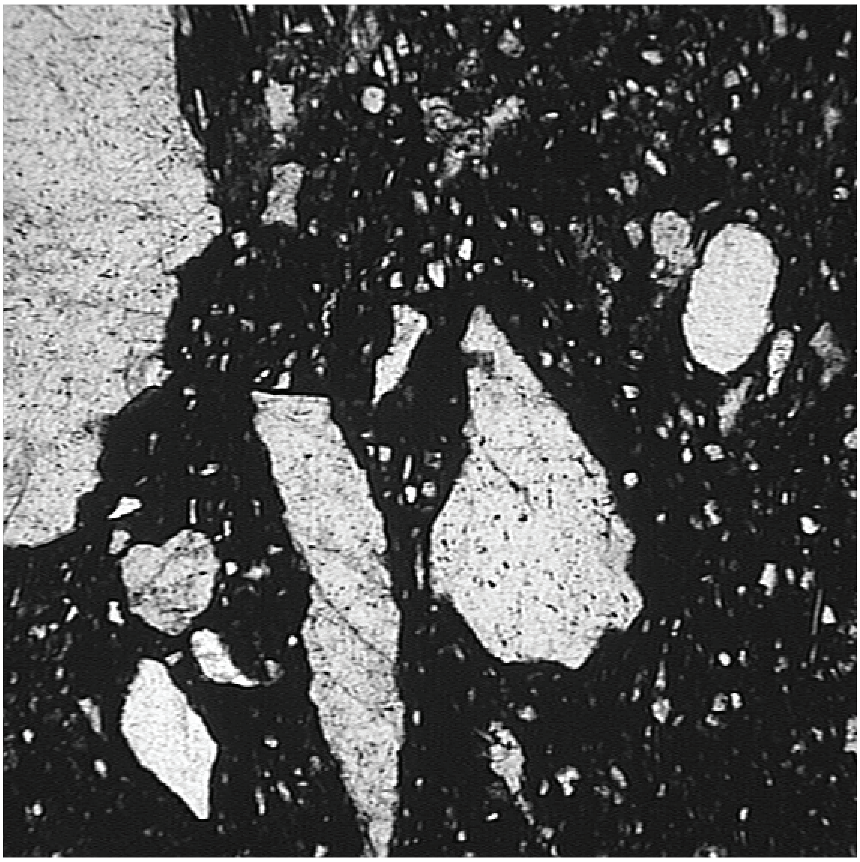

Plate A4.3 Angular quartzite temper in a very fine sandy clay. Interestingly this all appears to be monocrystalline quartz (or showing only moderate undulose extinction) whereas the quartzite pebbles of the Thames alluvium are typically a mix of monocrystalline and polycrystalline types. Unlike the polycrystalline quartzite, the monocrystalline variety is relatively easy to fragment (ie for temper) and may have been preferentially selected (TS4)

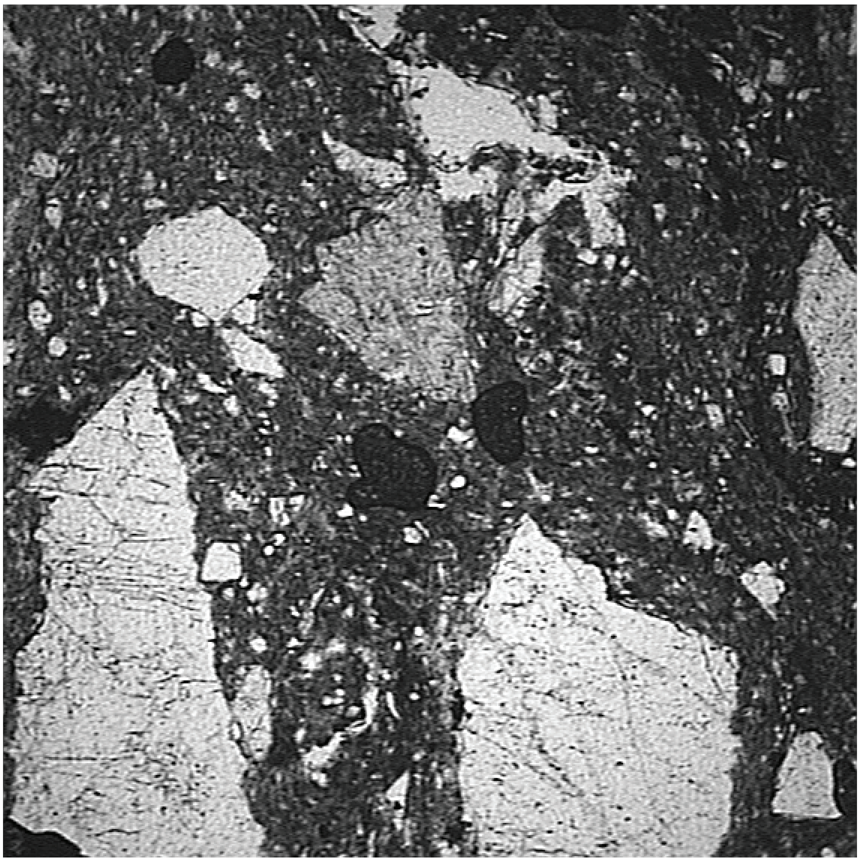

Plate A4.4 Quartzite temper (with lesser flint) in a very fine sandy body which contains small amounts of thin-walled shell and muscovite. Again this is almost entirely monocrystalline quartzite (TS5)

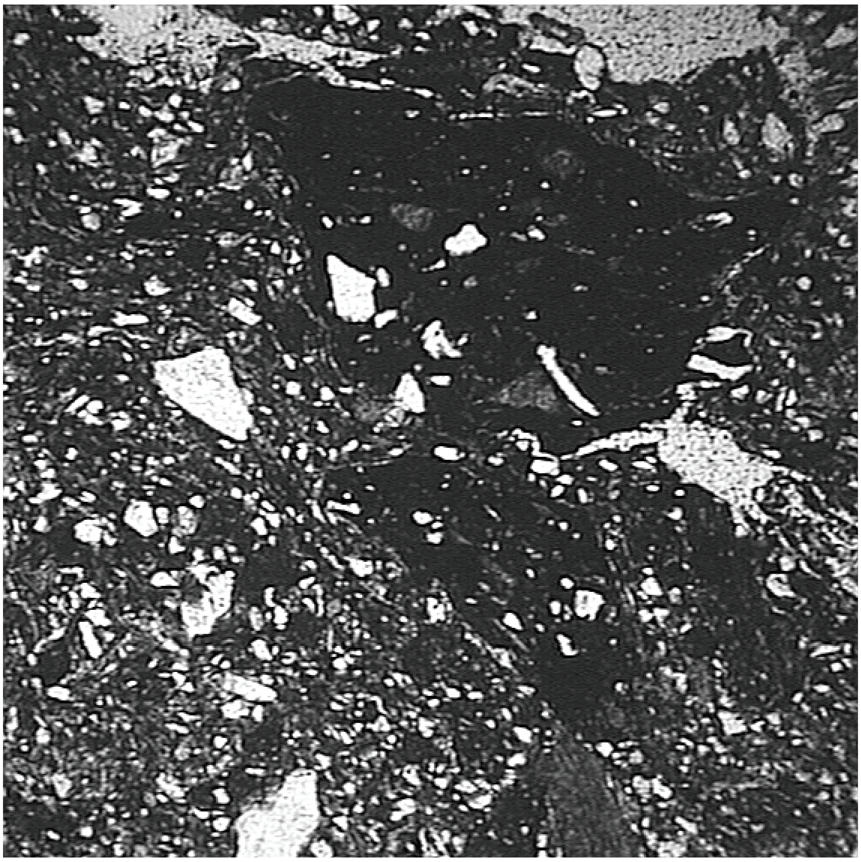

Plate A4.5 This fabric has a mixed temper comprising mainly grog (dark angular sandy grain) with lesser quartzite (monocrystalline), shell (fossil) and occasional flint. The fine sandy matrix is micaceous (TS8)

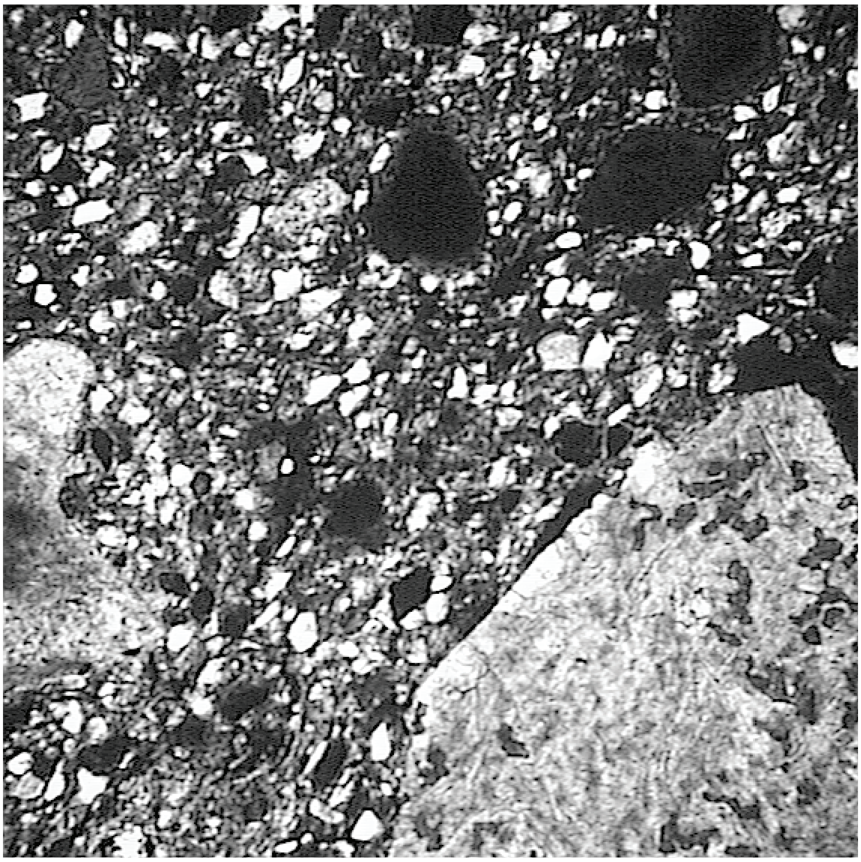

Plate A4.6 Photomicrograph showing coarse flint temper in a Greensand-derived clay. The latter has a very high concentration of angular quartz with muscovite mica and small rounded grains of glauconite (bottom right) (TS13)

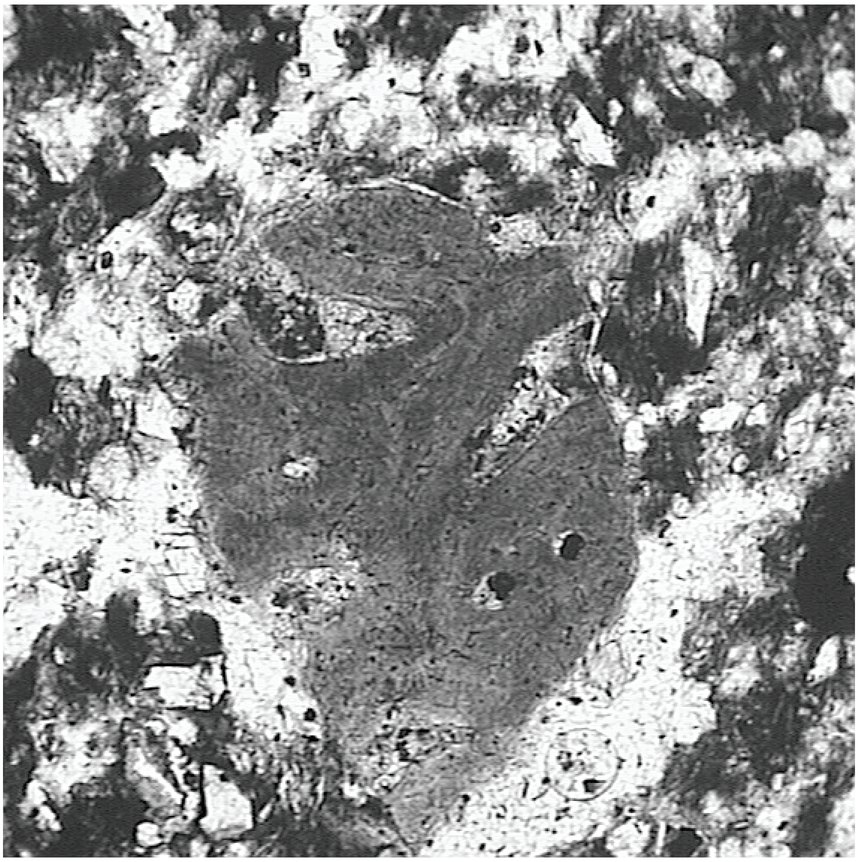

Plate A4.7 Photomicrograph showing bone inclusion in Greensand-derived clay. Probably incidental (TS15)