Figure 1: map of Elsham, North Lincolnshire

Figure 2: a completely cremated femur fragment from EL75CA(a)

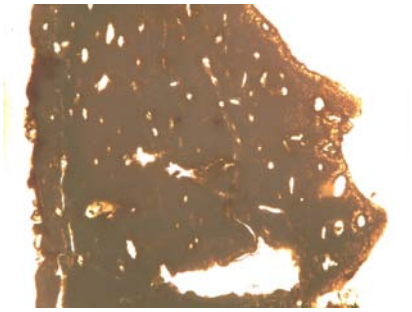


Figure 3: micrograph of EL75CA(a) under plane polarized light

Figure 4: an intensely cremated radius fragment from EL75CR

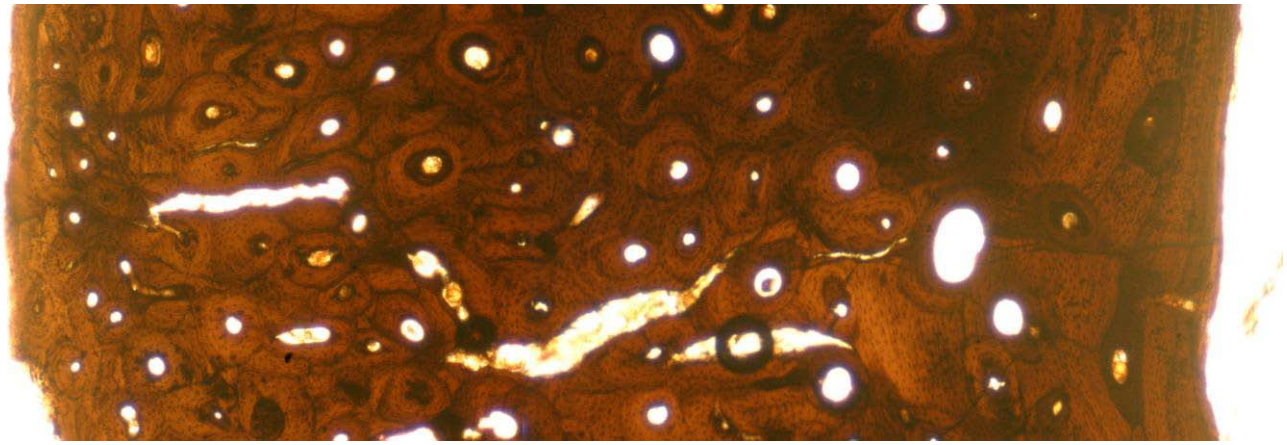


Figure 5: micrograph of EL75CR under plane polarized light

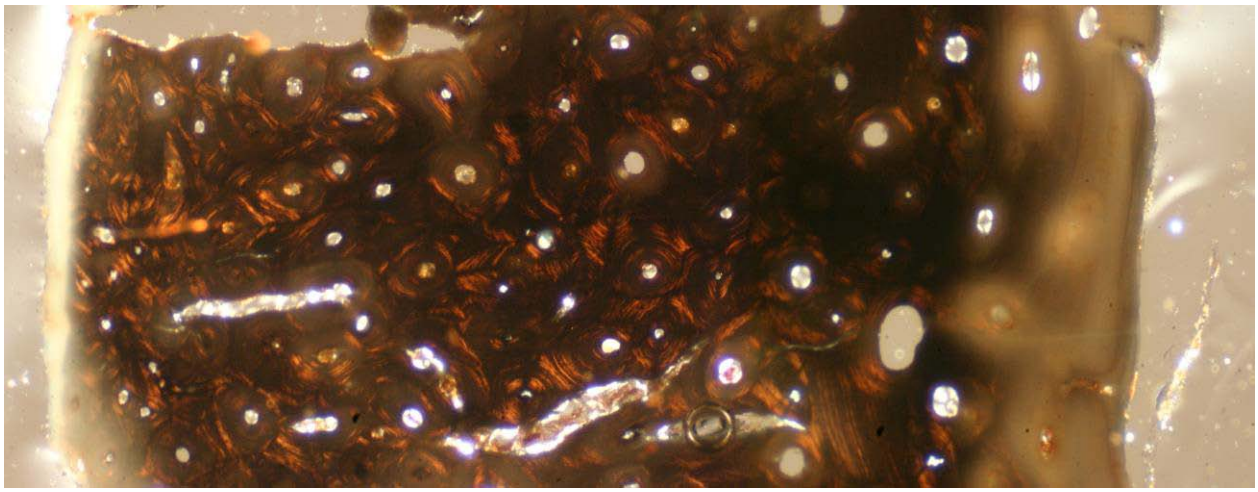


Figure 6: micrograph of EL75CR under cross polarized light

Figure 7: an intensely cremated radius fragment from EL75GA

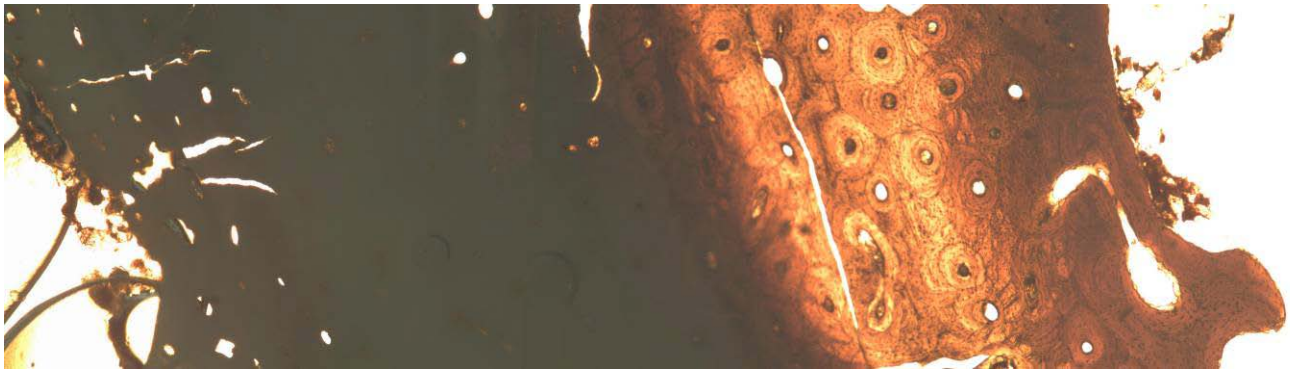


Figure 8: micrograph of EL75GA under plane polarized light

Figure 9: an intensely cremated humerus fragment from EL75PM(b)

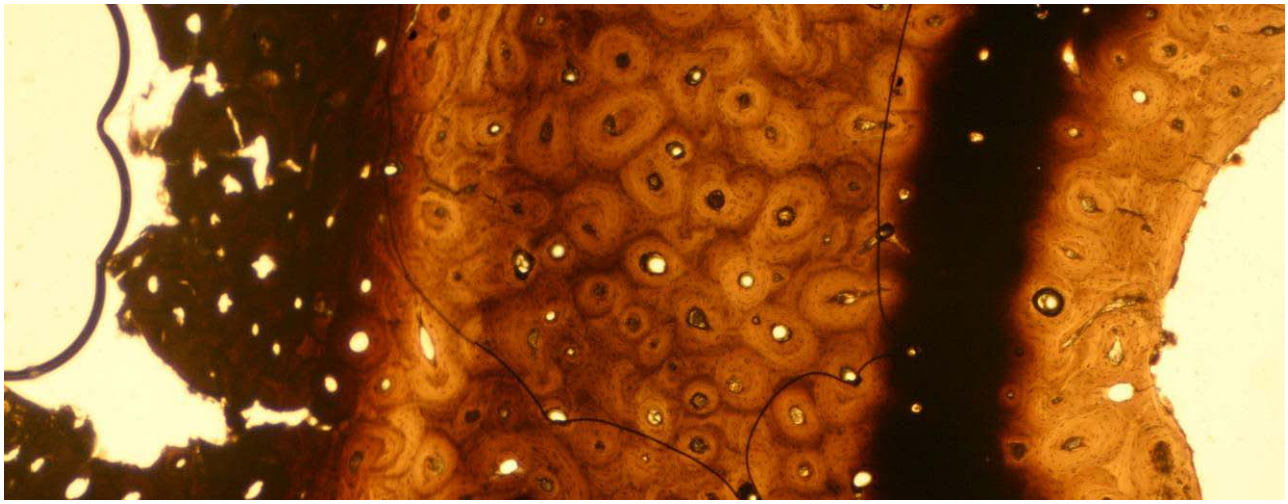


Figure 10: micrograph of EL75PM(b) under plane polarized light

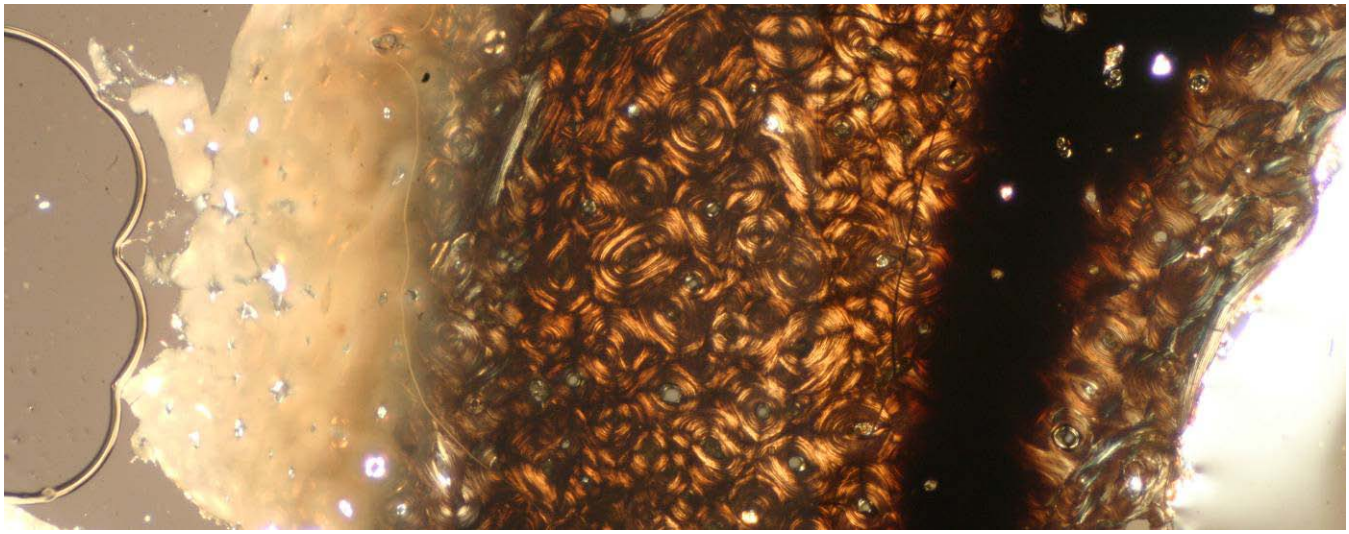


Figure 11: micrograph of EL75PM(b) under cross polarized light

Figure 12: an intensely cremated femur fragment from EL76NN

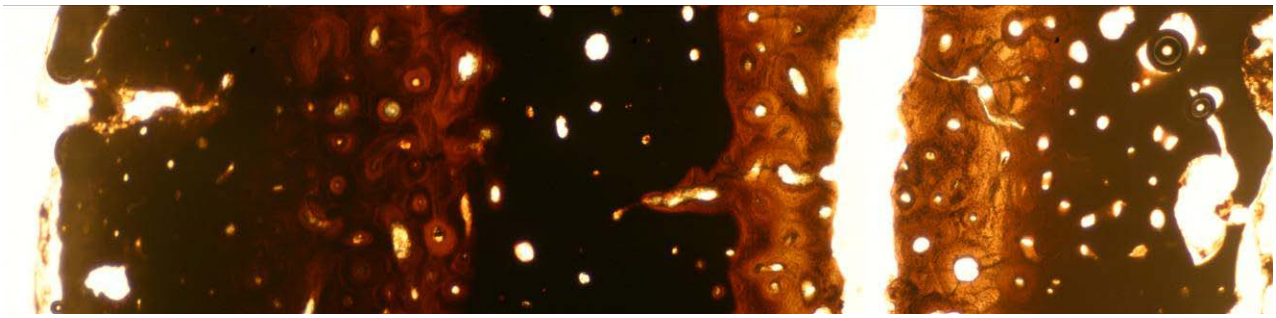


Figure 13: micrograph of EL76NN under plane polarized light

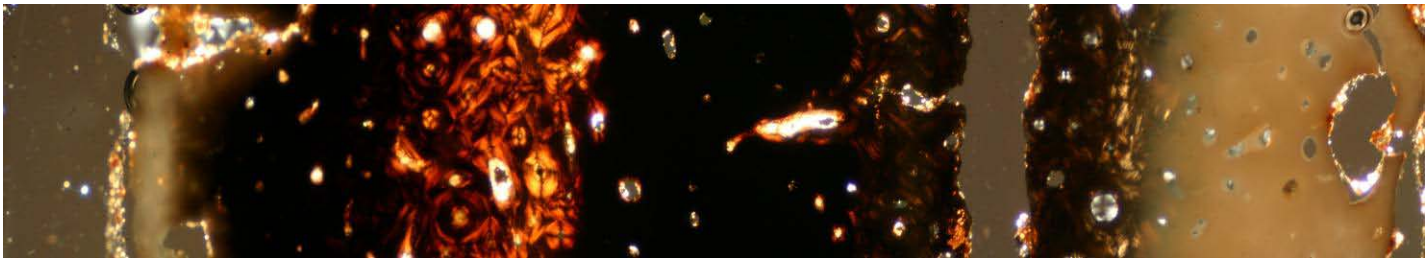


Figure 14: micrograph of EL76NN under cross polarized light

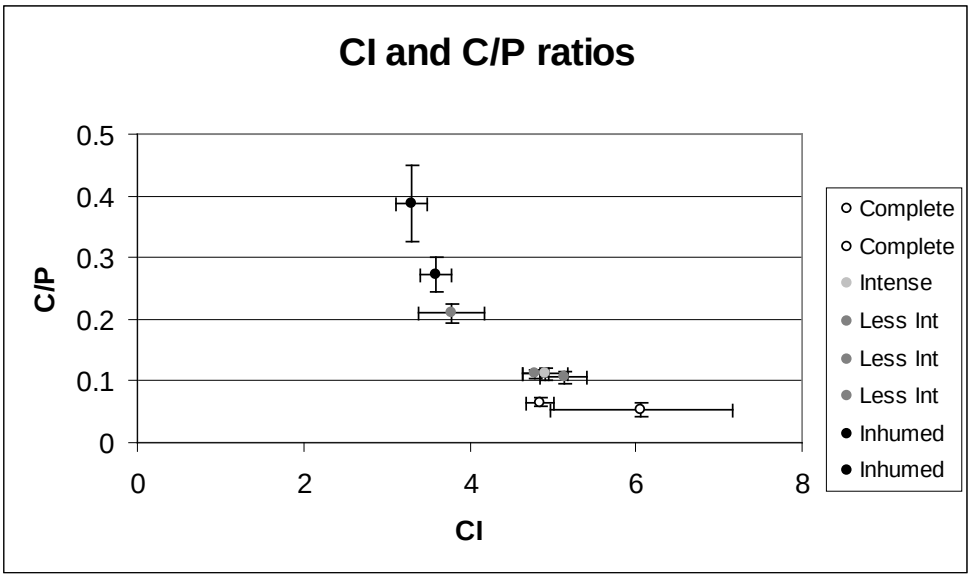


Figure 15: CI and C/P ratios for the Elsham skeletal material

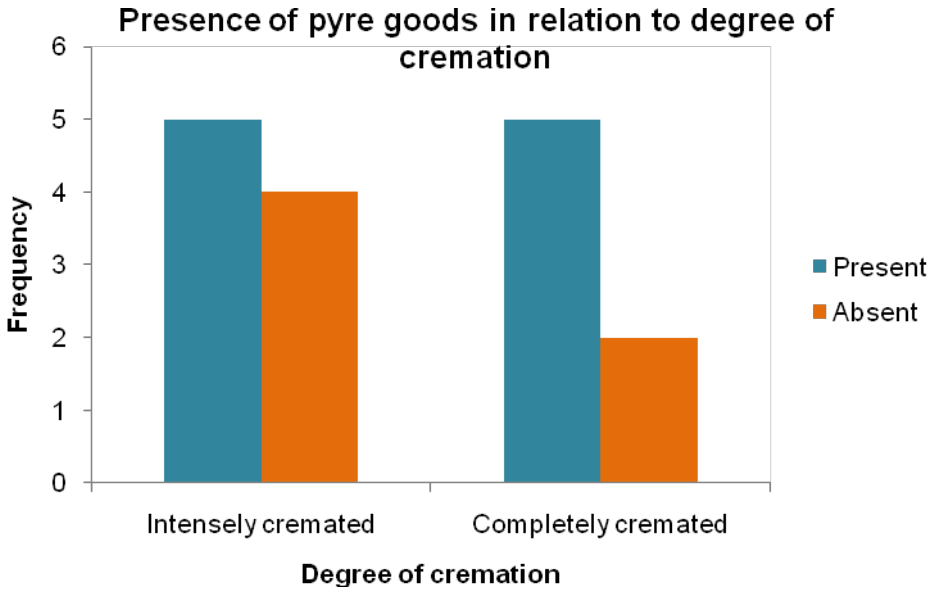


Figure 16: histogram displaying the presence of pyre goods in relation to degree of cremation

Method	Description of technique	References
Histological changes to bone	Thin-section analysis used to identify structural changes that occurred through the burning process	Forbes 1941; Herrmann 1977; Bradtmiller and Buikstra 1984; Hummel and Schutkowski 1993.
Scanning electron Microscopy (SEM)	Examines the structural changes of bone tissue when heated	Holden e*t a*l. 1995; Holden *et al*. 1995(b); Quatrehomme *et al*. 1998; Thompson 2004.
X-Ray diffraction (XRD)	Employed to illustrate that heating causes an increase in the crystal size of hydroxyapatite in cremated bone	Rogers and Daniels 2002; Hiller *et al*. 2003; Enzo *et al.* 2007; Piga *et al*. 2008
Small angle X-ray scattering (SAXS)	Determines the crystal size, shape, and orientation within bone, independent of crystal lattice perfection at different temperatures	Hiller *et al.*, 2003
Fourier Transform Infrared Spectroscopy (FTIR)	Employed to examine changes to the Crystallinity index; carbonate to phosphate ratio (C/P) and carbonate to carbonate ratio (C/C)	Shahack-Gross et al., 1997; Stiner et al., 2001; Surovell and Stiner 2001; Chakraborty *et al.* 2006; Nagy *et al.* 2008; Thompson, Gauthier and Islam 2009; Thompson et al. 2010.

Table 1: structural analyses performed on burned bone from archaeological and modern contexts

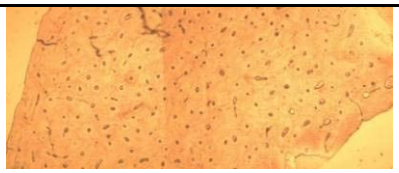
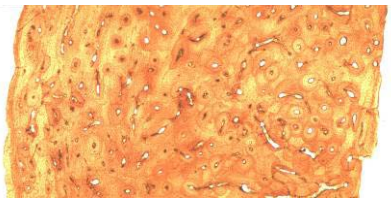
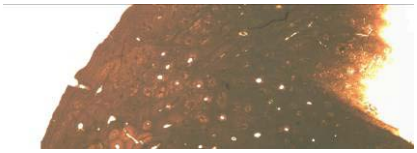
Category and category number	Degree of microstructure destroyed (%)	Temperature (°C)	Micrograph of comparative thin sections	Description of structure and appearance and other evidence used to establish temperature
Less intensely cremated (I)	<50%	300°C-600°C		Many Haversian systems, a small number of Volkmann's Canals, organic material and canaliculi clearly preserved. Some fusion of hydroxyapatite (inorganic) crystals. Should be very dark grey in colour throughout the bone when observed macroscopically.
Intensely cremated (II)	>50%	600°C-900°C		Outline of Haversian systems that are more defined and brown in colour under plane polarised light. Very few, if any, Volkmann's Canals and <50% organic material preserved. Canaliculi are still evident. Many hydroxyapatite crystals have fused causing a disorganised arrangement. Should be light grey to white in colour throughout the bone when observed macroscopically. Glass and copper alloy globules → 700 - 1000°C (McKinley 1994).
Completely cremated (III)	100%	900°C+		No Haversian systems, Volkmann's Canals, organic material or canaliculi preserved. Hydroxyapatite crystals have completely fused. Should be white in colour throughout the bone when observed macroscopically. Slag debris→ over 900°C (Henderson, Janaway and Richards 1987).

Table 2: categories used to classify cremated bone

Burial number	Bone	Section thickness (microns)	Intensity of burning	Munsell	Age group	Sex	Pyre goods
EL75AM (FN 5)	Femur	100	Completely cremated	5Y 8/1 (white); GLEY 2 5PB 3/1 (very dark bluish grey)	Older mature adult	?	Iron nail
EL75AO (FN 7)	Tibia	75	Completely cremated	5Y 8/1 (white)	Younger mature adult	?	None
EL75BK (FN 22)	Humerus	60	Completely cremated	5Y 8/1 (white); GLEY 2 10B 4/1 (dark bluish grey)	Child	-	Iron knife
EL75BQ (FN21)	Tibia	60	Completely cremated	5Y 8/1 (white)	Adolescent	?	None
EL76CA(a) (FN 355(a))	Femur	75	Completely cremated	5Y 8/1 (white)	Younger mature adult	Female	Glass globules; copper alloy globules; iron wire - ?brooch
EL76EI (FN 406)	Femur	100	Completely cremated	GLEY 2 10B 6/1 (bluish grey); GLEY 1 N 2.5/ (black)	Young adult-younger mature adult	Indeterminate	None
EL76EQ (FN 414)	Femur	60	Completely cremated	5Y 8/1 (white); GLEY 1 N 7/ (light grey)	Adolescent	?	Copper alloy globule; iron wire/pin; miniature comb; ivory
EL76MQ (FN 526)	Tibia	100	Completely cremated	5Y 8/1 (white)	Younger mature adult	Male	Decorated burnt bone object
EL75BY (FN 32)	Humerus	100	Intensely cremated	5Y 8/1 (white); GLEY 2 10B 6/1 (bluish grey)	Child	-	Iron knife
EL75CR (FN 43)	Radius	60	Intensely cremated	5Y 8/1 (white); GLEY 1 N 2.5/ (black)	Young adult-younger mature adult	?	Glass globules; copper alloy object; part of a comb; ivory
EL75GA (FN 101)	Radius	60	Intensely cremated	5Y 8/1 (white); GLEY 1 N 2.5/ (black)	Adult	?	None
EL75HL (FN 130)	Radius	75	Intensely cremated	5Y 8/1 (white); GLEY 1 N 2.5/ (black)	Younger mature adult-older mature adult	?	Glass globule; crystal ?bead; ivory
EL75PF (FN 268)	Tibia	100	Intensely cremated	GLEY 2 10B 4/1 (dark bluish grey); GLEY 1 N 2.5/ (black)	Older mature adult	Male	Ivory
EL75PM(b) (FN 273(b))	Humerus	60	Intensely cremated	5Y 8/1 (white); GLEY 2 10B 7/1 (light bluish grey); GLEY 2 5PB 4/1 (dark bluish grey); GLEY 1 N 2.5/ (black)	Older mature adult	Probable male	None
EL76NA (FN 536)	Ulna	100	Intensely cremated	5Y 8/1 (white); GLEY 2 5PB 7/1 (light bluish grey); GLEY 2 5B 3/1 (very dark bluish grey)	Adult	?	None
EL76NN (FN 549)	Femur	100	Intensely cremated	5Y 8/1 (white); GLEY 2 10B 7/1 (light bluish grey); GLEY 1 N 2.5/	Younger mature adult	Male	Bone point/awl

				(black)			
EL76AK (FN 321)	Femur	N/A	Inhumation	10YR 6/6 (brownish yellow)	Adult	?	None
EL76JO (FN 483(a))	Femur	N/A	Inhumation	10YR 6/6 (brownish yellow)	Older mature adult	Female	Iron buckle
EL75BB (FN 13)	Femur	N/A	Less intensely cremated	GLEY 2 5B 3/1 (very dark bluish grey)	Young adult-younger mature adult	Probable male	Glass bead
EL75ES (FN 82/83/86)	Femur	N/A	Less intensely cremated	GLEY 2 5B 2.5/1 (bluish black)	Young adult-younger mature adult	Indeterminate	Ivory
EL76DH (FN 380)	Femur	N/A	Less intensely cremated	GLEY 2 5B 3/1 (very dark bluish grey)	Young adult-younger mature adult	Indeterminate	Burnt copper alloy fragments; comb fragment
EL76PB (FN 576)	Femur	N/A	Intensely cremated	GLEY 2 5PB 4/1 (dark bluish grey)	Younger mature adult	Indeterminate	Glass bead; glass globule; comb; antler object
EL75MQ (FN 225)	Femur	N/A	Completely cremated	5Y 8/1 (white)	Young adult-younger mature adult	Probable male	Fragment of bone pin/needle
EL76NN (FN 549)	Femur	N/A	Completely cremated	GLEY 2 10B 7/1 (light bluish grey)	Younger mature adult	Male	Bone point/awl

Table 3: macroscopic observations of the samples employed for thin-section and FTIR analyses

Sample number	Intensity of burning	Munsell code	Mean CI	SD CI	Mean C/P	SD C/P
EL76AK	Inhumation	10YR 6/6 (brownish yellow)	3.31	0.19	0.39	0.06
EL76JO	Inhumation	10YR 6/6 (brownish yellow)	3.59	0.18	0.27	0.03
EL75BB	Less intensely cremated	GLEY 2 5B 3/1 (very dark bluish grey)	5.13	0.28	0.11	0.01
EL75ES	Less intensely cremated	GLEY 2 5B 2.5/1 (bluish black)	3.78	0.39	0.21	0.02
EL76DH	Less intensely cremated	GLEY 2 5B 3/1 (very dark bluish grey)	4.79	0.15	0.11	0.01
EL76PB	Intensely cremated	GLEY 2 5PB 4/1 (dark bluish grey)	4.91	0.26	0.11	0.01
EL75MQ	Completely cremated	5Y 8/1 (white)	4.84	0.17	0.07	0.01
EL76NN	Completely cremated	GLEY 2 10B 7/1 (light bluish grey)	6.07	1.10	0.05	0.01

Table 4: Combined colour and FTIR data for the Anglo-Saxon skeletal samples

Bone	Completely cremated	Intensely cremated
Humerus	1	2
Radius	0	3
Ulna	0	1
Femur	4	1
Tibia	3	1

Table 5: differential cremation between the upper and lower