5 ENVIRONMENTAL EVIDENCE

5.1 Bird bone, by Catherine Smith

Two bones from 004/6 (child, nine years) were positively identified as talons (third phalanges) of Golden Eagle (*Aquila chrysaetos*), after comparison with specimens of that species and the White-tailed Sea Eagle (*Halieetus albicilla*) in the collection of the National Museum of Scotland. Part of a second phalange of the foot was also recovered (context 004/2) and found to articulate with the more fragmentary of the two talons (illus 17).

The talons appear to be burnt, but they are not as badly affected as the other bone artefacts. They were not calcined but had certainly been affected by heat; the pinkish-yellow colour and the chalky texture of the bone indicate some degree of firing. They appeared to be identical in size to the comparative eagle specimen so did not seem to have shrunk much, if at all, and they did not seem distorted.

Although no other skeletal parts were recovered which might indicate the burial of a complete bird, the second phalange indicates a whole or partial foot was originally present, rather than a collection of disarticulated talons. If the talons formed part of a necklace or other item of personal adornment, they may still have been encased in the horny outer sheath of the claw, which would serve to hold the articulating phalanges together. Alternatively, the bones may have been placed in a bag or pouch which did not survive cremation and burial. The find is unusual, and seems to indicate some association between the buried individual and the eagle. Whether this association was an indication of the occupation or preferences of the dead person or was of a purely symbolic nature cannot be known.

Illus 17 Golden Eagle talons

At Skilmafilly, the association between the eagle bones and the buried human need not necessarily have been emblematic, however. A parallel may exist at Kellythorpe in Yorkshire. Here, a beaker grave group excavated in 1851 contained a male crouched inhumation whose grave-goods included a stone wristguard and the 'head and beak of a hawk', possibly indicating a falconer (Clarke et al 1985, 263–4). Eagles may be used in falconry, although males are preferred since they weigh less than females and are thus less exhausting to carry on the wrist (Parry-Jones 2003, 58). Although the associated burial at Skilmafilly was that of a child, making it unlikely that the child was the falconer, there may have been a family connection or apprenticeship in place.

Sea Eagle bones found in the chambered tomb at Isbister on Orkney had previously been interpreted as having had a totemic significance for the community who used the tomb. However, recent radiocarbon dating of two samples of Sea Eagle bone have produced dates with the range 2450–2050 BC, indicating that they were not contemporary with the original construction of the tomb and were added to the tomb at a much later date (British Archaeology 2006). At Isbister the bones came from all parts of the skeleton, not just the talons, and represented at least eight individual birds (Bramwell 1983). However, at both Isbister and a stalled cairn at Point of Cott, Westray (Harman 1997, 50), where Sea Eagle bones were found, it might perhaps be noted this was not the only bird species found, nor indeed the only vertebrate species. Sea Eagle bones have also been found at the Neolithic habitation site at the Links of Noltland, Westray, where the species was part of a large assemblage of birds and mammals (Armour-Chelu 1985).

At the present day, the breeding density of the Golden Eagle in Scotland varies widely, depending on availability of food and the level of persecution the species receives from humans (Thom 1986, 144–5). It is currently more abundant in the west of the country than in the east. In 1982 there were thought to be only 30 breeding pairs in an area approximating to the former counties of Angus and Aberdeenshire (ibid). Victorian gamekeeping practices did much to reduce the population, and there can be little doubt that in prehistoric and even Early Historic times the species was more widespread than it is today. Archaeological evidence of the Golden Eagle has been noted at two sites of medieval date in the north-east of Scotland, at 16–18 Netherkirkgate within the burgh of Aberdeen (Hamilton-Dyer et al 2001) and at Perth High Street (Smith & Clark forthcoming).

Seton Gordon, in his classic work on the species in Scotland, has said 'there are more myths woven around the eagle than any other bird', which he attributes to the power of its wings (Gordon 2003, 152). Eagle feathers must have been regarded as possessed of some of this power, and were worn as a badge of rank in the Highlands (ibid, 157). A more practical use was in arrow flights, but it is also easy to impute magic to the arrow which is carried aloft by the feather of such a powerful bird. Thus the talons at Skilmafilly may have had dual meaning: they may have been symbolic of the power of the dead person with whom they were buried, yet they may also have been a sign of his earthly occupation.

5.2 Archaeobotany, by Mhairi Hastie

The bulk samples were all fully processed, through a system of wet sieving and flotation, and each flot was divided into two main fractions, 1F (1mm mesh) and 0.3F (0.3mm mesh). The available flots from 25% of the cremation pits (nine pits) were randomly selected, including some which contained several discrete fills. Flots were available from each discrete fill and in total 30 flots were assessed. Each flot was scanned using a binocular microscope to assess the preservation and quantity of palaeoenvironmental remains present.

All the flots were dominated by wood charcoal and modern plant remains. Occasional degraded charred seeds of *Spergula arvensis* (corn spurrey) and nutlets of wild taxa including Chenopodiaceae (goosefoot) and *Carex* sp. (sedge) were found. In addition, small quantities of fungal sclerotia were recovered from nine samples.

The wild taxa are species commonly associated with arable land and waste places. The quantities present are extremely small. There are two probable explanations for the presence of carbonised seeds/nutlets within the pyre remains: either the cremation pyres were placed on grassland where the seeds were burnt in situ, or dried grass was used for kindling. Small quantities of charred fungal sclerotia were also present. These hard spherical mycelia are usually present in soil or turfs and the presence of such material suggests that the cremation pits contained burnt soil. There is no evidence to suggest that any of the archaeobotanical remains were the result of deliberate ritual deposits, the material present being derived from natural accumulation.

5.3 Charcoal, by Mike Cressey

Analysis was undertaken to obtain an insight into local woodland cover and to identify suitable specimens for radiocarbon dating. The entire >4mm charcoal assemblage recovered from flotation samples has been assessed to determine the relative frequency of the species exploited for pyre fuel. The degree of abrasion was also noted; where soil mass-movement is evident, typically the charcoal will be rounded and the edges worn.

Charcoal was collected by hand during the excavation and by post-excavation flotation of bulk soil samples. Large samples of charcoal (over 100g) were split in a riffle-box to produce sub-samples. Smaller samples were processed using routine methods. In all cases, counts were limited to 25 identifications per sub-sample using a binocular microscope at magnifications ranging between ×10 and ×200. Generally, identifications were carried out on transverse cross-sections. Anatomical keys listed in Schweingruber (1992) and in-house reference charcoal were used to aid identifications. Asymmetry and morphological characteristics were recorded. Vitrified charcoal fragments, possibly a result of secondary burning, were recorded but this material is not usually identifiable, owing to increased fusion of the vascular structure. Where applicable, wood-working evidence such as squaring and trimming has been noted. Samples <4mm are considered to be below the level of identification (BLOI).

5.3.1 Late Mesolithic Pit 036

Pit 036 yielded 25.7g of charcoal (Table 4). This assemblage was extremely poor in both the quality of the charcoal and the volume of material recovered during the flotation process. Oak and birch with small quantities of hazel are represented. In general the charcoal was amorphous in shape, suggesting some reworking during deposition, presumably by earthworm activity. None of the material from the pit provided evidence of trimming.

5.3.2 Cremation pits

Charcoal from the cremation pit assemblage has produced 802.65g of charcoal and 3708 individual identifications were obtained from this material. The detailed results are listed in the project archive and summarised in Table 4 and Table 9.

The assemblage is dominated by *Quercus* sp. (oak). *Betula* (birch) attains the second highest frequency followed by *Corylus avellana* (hazel). *Alnus glutinosa* (alder) is present but only in trace amounts. The level of preservation within the charcoal assemblage was very good, with only a minimal amount of abrasion or degradation recorded in one or two samples. No extraneous non-charcoal (cinder/coal) was present and very little iron (Fe) staining was recorded.

The oak charcoal assemblage is dominated by mature material that has fragmented into multiple blocky fragments. Mature oak charcoal tends to fracture along its large multiseriate rays and

Table 4 Charcoal species, weight and number of identifications

Context	Species	Weight (g)	No. of identifications
Pit 036	*Betula*	8.2	15
	Corylus avellana	0.6	4
	Quercus	17	95
		25.8	**114**
Cremation pits	*Alnus*	0.6	3
	Betula	154.05	379
	Corylus avellana	41.9	53
	Quercus	606.1	3273
		802.65	**3708**

commonly forms regular uniform blocks. The birch and hazel assemblage is much smaller and is represented by small branch and twig material.

The cremation pit assemblage included eight oak fragments and one birch fragment that provided positive evidence of tooling, in the form of a single oblique cut. This form of cut is typical where a sharp blade has been used to slash the branch from living stems.

5.3.3 Cremation fuel

The results from identification of the cremation pit assemblage confirm that oak was the most abundant species exploited for pyre fuel. Birch, hazel and alder are represented but in lower amounts. All four species are native to NE Scotland and were well-distributed within Bronze Age Scotland. Oak, birch and hazel thrive on well-drained soils, whereas alder is a tree found alongside rivers and streams. Oak is at the apex of climax forest and would have been an abundant source of local fuel. Birch is a light-demanding pioneer typical of open areas such as glades. Hazel is an under-storey shrub that can form small trees if not altered by trimming.

Oak is thought to have been commonly used during the cremation process as spars placed across cremation pits to support a body (J McKinley pers comm). Multiple spars of only small diameter oak would support a body as this particular species is very strong, even when it is not green wood (ie deadwood). This might explain why oak was selected. Cremation Pit 027/1 produced three fragments of hazelnut shell. Unfortunately there is insufficient material here to assess whether this was part of the funerary ritual or whether the shells were simply attached to smaller tinder material. Hazelnuts mature by autumn, although they could have been stored from the previous year.

The results of pollen analyses from three of the cremation pits have provided an insight into the types of material exploited for fire starting fuel (Cressey below). The pollen results strongly suggest that both ferns and heather formed the main tinder component in at least two of the cremations examined.

5.3.4 Charcoal conversion

The charcoal surviving in any cremation pit is likely to be only a small fraction of the original volume of wood required to cremate a body. The reducing conditions necessary to produce charcoal could occur deliberately if the pyre were clamped by throwing soil on top of the fire, or could occur naturally within a disintegrating pyre. This would produce the smouldering anaerobic conditions that would help convert wood to charcoal.

5.3.5 Conclusion

The charcoal assemblage from the cremation pits is dominated almost exclusively by oak, most of which appears to have been derived from mature wood. The quality of preservation within the pits is very good, with very little evidence of abrasion. Soil pollen (see below) obtained from the urns included heather and fern pollen (probably bracken). Both plants will burn well if dry, and it is highly likely that these plants, along with grass, were selected for tinder fuel.

5.4 Pollen, by Mike Cressey

5.4.1 Introduction and method

Scientific analysis associated with cremation pit fills has in the past mainly been confined to biostratigraphic descriptions and, later, charcoal analysis during post-excavation. Previous work elsewhere has shown that pyre deposits more often than not contain well-preserved human bone, artefacts and an abundance of charcoal and plant macrofossil remains. To date, however, very little work has

Table 5 Summary of the pollen assemblage

Context	Arboreal	Shrub	Herb	Spores	Microscopic charcoal
Pit 002 Sample 1	*Betula* (birch) and *Pinus* (pine) in trace amounts	Coryloid at 9%, heather at 55%	Poaceae (grasses), and Cyperaceae (sedges) are present. Caryophyllaceae, *Rumex*, Saxifragaceae and *Plantago lanceolata* at <1%	*Polypodium* at 11%	5–50μm size class is the most abundant
Pit 002 Sample 2	*Pinus*, *Alnus glutinosa* (alder) and *Betula* at <9%	Coryloid type is present, heather at 64%	Grasses at 18%, other herbs <4% (Caryophyllaceae, *Galium* type and *Taraxacum* type)	Filicales and *Polypodium* at 26%	5–100μm size class is the most abundant
Pit 005 Sample 1	*Betula* (birch) is present along with *Alnus glutinosa* and *Pinus*	Coryloid at 12%, heather at 16%	Grasses at 16%, Caryophyllaceae, *Filipendula*, *Galium* type and *Taraxacum* at <1%	*Typha latifolia* (bulrush), Filicales, *Sphagnum* and *Polypodium* are present but low in frequency	5–100μm size class is abundant
Pit 005 Sample 2	*Betula*, *Alnus glutinosa* and *Salix* (willow) are all low	Coryloid at >55%, heather at 8%	Grasses at 16%, *Taraxacum* low	*Polypodium* at 22%	Abundant in the 5–10μm and 50–100μm class
Pit 005 Sample 3	*Pinus*, *Betula* and Acer (maple) type at <3%	Heather at 41%, coryloid present in lower amounts	Grasses abundant, Caryophyllaceae and *Rumex* in low amounts	*Polypodium* abundant	50–100μm is abundant
Pit 005 Sample 4	*Acer* type, *Betula*, *Pinus*, *Quercus* (oak) and *Ulmus* (English elm) at <4%	Heather at 35%	Grasses at 15%, Caryophyllaceae at 9%. *Circium* type, *Chenopodium* (fat hen), *Filipendula* and *Galium* type pollen are represented by single grains	Fern spores are low	
Pit 022 Sample 1	*Alnus glutinosa* at 54%	Coryloid at 35%, trace amounts of heather (1%)	Grasses at 51%, Caryophyllaceae, *Rumex* and Saxifragaceae at 1%	Filicales at 64%, *Polypodium* at 35%	5–100μm size class is abundant
Pit 022 Sample 2	*Alnus glutinosa* and *Quercus* at <7%	Coryloid at 70%	Herbs are low (<1%)	Filicales and *Polypodium* at 50%	Only abundant in the 5–10μm class; 10–100μm or greater was rare
Pit 022 Sample 3	*Alnus glutinosa*, *Betula* and *Quercus* at <5%	Coryloid at 80%	Herbs are low (<1%)	Filicales attain 67% and *Polypodium* is represented by 32%	Abundant only in the 5–10μm size class
Pit 022 Sample 4	*Betula* (12%), *Alnus glutinosa* (3%)	Coryloid at 73%	All other herbs are below <1%		Virtually absent in all size classes

been undertaken on the examination of soil pollen obtained from these types of deposit.

Ten samples were extracted from three cremation burials (002, 005, 022). The samples were processed using acetolysis and hydrofluoric acid according to the method described by Moore et al (1991). Pollen was identified using an Olympus BX40 light microscope at ×400 magnification with critical identifications made at ×1000 and assisted by a pollen reference collection and photomicrographs (Moore et al 1991).

The preservation assessment method using five categories: normal, broken, crumpled, corroded and degraded (Berglund & Ralsa-Jasiewiczowa 1986; Tipping 1987) was initially adopted but was abandoned when it was found that most of the pollen grains had undergone some form of degradation. Where pollen was found to be low in frequency within a sample then that sample was considered to be barren and no further work on it was undertaken: only those samples that were considered to contain enough pollen grains to provide a valid statistical sample are considered here. A summary of the results is provided in Table 5.

5.4.2 Preservation factors

In most cases the pollen samples contained pollen with variable preservation. Many of the grains were poorly preserved. Factors influencing the preservation of soil pollen are varied and include the resistance of pollen grains themselves, soil microbial activity, oxidisation and desiccation.

5.4.3 Principal differences in pollen types and uses of tinder

There are some interesting differences between the three soil pollen assemblages derived from the three cremation pits (002, 005, 022). The first point is that arboreal pollen is very low throughout. It is interesting to note that charcoal analysis (Cressey above) identified, in decreasing order of abundance, oak, birch and hazel. Within the shrub pollen component, hazel is well represented with the Coryloid group (Pit 005). Hazel was identified within the charcoal assemblage and shows that this species was probably local. Within the same group, Ericaceae (heather) type pollen dominates the assemblage from Pit 002. No heather was identified within the charcoal assemblage from this context. The absence of this particular shrub might be explained by the fact that dry heather burns ferociously and in the right conditions, with plenty of wind, it is likely that heather would not survive as a macrofossil, albeit represented in the surviving pollen. That it was a useful tinder material would not have gone unrecognised. A small quantity of heather in flower during late summer and early autumn could produce a large amount of pollen that was readily released, for example during its collection as tinder for igniting the cremation pyre. This may give an indication of the time of year for the cremation within Pit 002.

Grasses are present within all three cremation pits but other herbaceous plants are low, all being below 4% TLP. Pollen derived from spores is high, especially in Pit 022. Filicales and *Polypodium* pollen are well represented. The latter is a fern reaching fair altitudes, growing on peat banks, trees, drystone walls and on the tops of rocky outcrops and cliffs. Its spores ripen in the summer (Jermy & Camus 1991). Dry fronds of this fern would also have made a suitable tinder material.

5.4.4 Conclusion

The results of pollen analyses from three of the cremation pits have provided an insight into the types of material exploited for igniting the pyres.

It is likely that the local environment close to the cremation site provided all the wood and tinder to supply the cremations. The pollen evidence strongly suggests that both ferns and heather formed the main tinder component in at least two of the cremations examined. The pollen results are also in accord with the charcoal record, showing that hazel was abundant in the surroundings.

5.5 Magnetic susceptibility, by Lucy Verrill

5.5.1 Introduction

Magnetic susceptibility samples were taken along two axes at Skilmafilly, an X-axis and a Y-axis; the material examined comprised only the Y-axis (illus 2). Distances along the axes are in centimetres (eg Y0100, Y1250).

Magnetic susceptibility measures the level of magnetic particles within a sediment body. Many of these particles are fixed in archaeological soils and sediments through human activity. By comparison with background measurements from non-anthropogenic sediments or soils away from the area of human activity, it is often possible to identify phases or areas of concentrated human activity. Magnetic susceptibility measurements therefore aid recognition and description of context types on archaeological sites (eg Peters et al 2004).

Two measurements of magnetic susceptibility were used: mass specific magnetic susceptibility and frequency dependent susceptibility. Mass specific magnetic susceptibility (χ) gives a rough indication of magnetic concentration or enhancement within a given sample (Peters et al 2004, 87–8) thus providing a quick, easy comparison between samples. Percentage frequency dependent magnetic susceptibility (χfd %), is used to detect the presence of superparamagnetic (SP) grains, which are common in archaeological sediments (ibid, 88), particularly those originating from burning and bacterial activity (Dearing 1994, 42). The percentage contribution of

SP grains to the sample can be estimated by the percentage value of frequency dependent susceptibility (ibid, 43). Dearing (1994, 43) has produced classificatory bands of χfd; interpreting low values (<2%) as containing less than 10% SP particles, medium values (2–10%) as containing a mixture of SP and larger grains, and high values (10–14%) as containing virtually all SP grains, probably >75%. An χfd value of 8% is equivalent to around 50% SP grains. Values of χfd higher than 14% are usually interpreted as erroneous measurements, contaminated or weak samples or anisotropy.

5.5.2 Methodology

Sixty-six transect samples were submitted for analysis. The samples were dried and sieved at 2mm (Peters et al 2004, 89). Magnetic susceptibility of 10cm^3 samples was measured at low frequency (LF; 0.46kHz) and high frequency (HF; 4.6kHz) using a Bartington MS2 dual frequency sensor on the 0.1 multiplier range (Dearing 1994). The readings were corrected for instrumental drift to give corrected LF and HF values; κlf and κhf. Two equations are used to obtain χ and χfd% (Dearing 1999, 46-47):

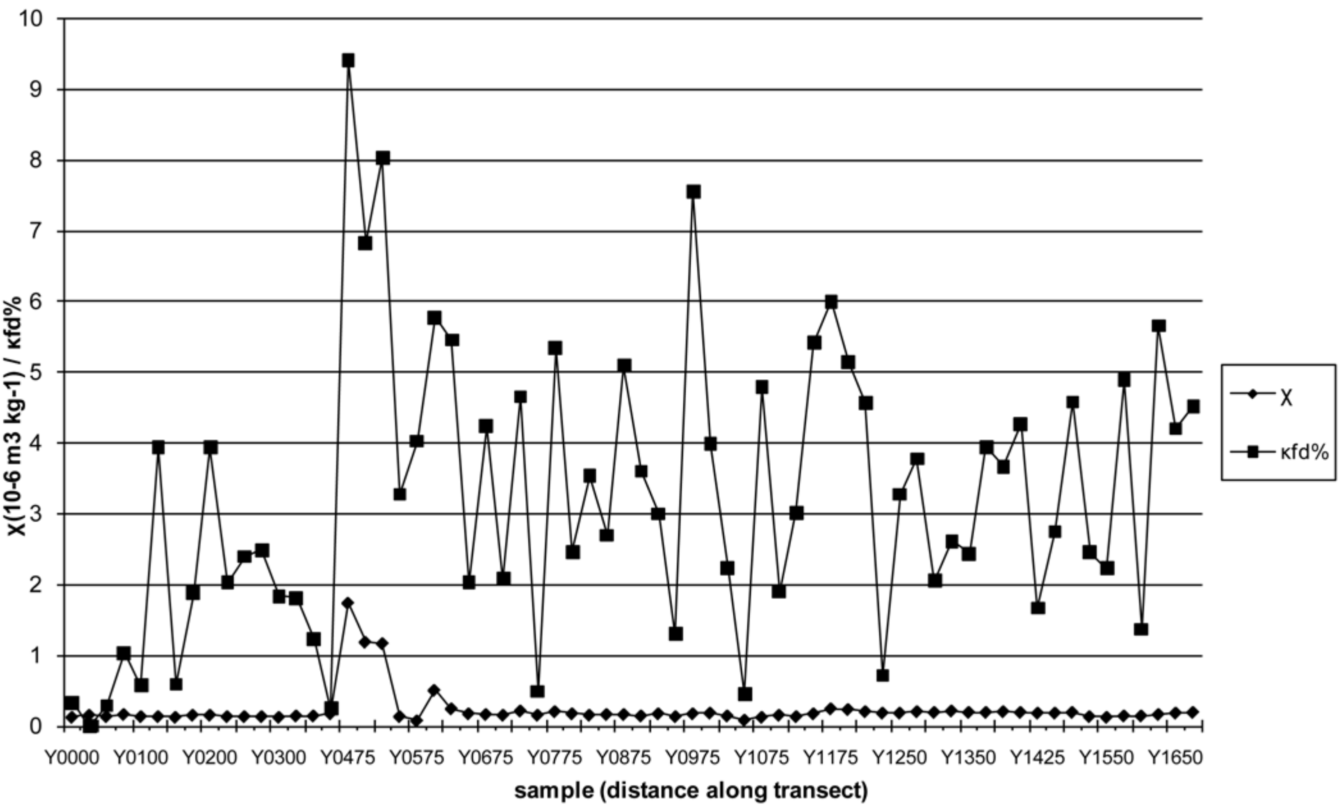
Mass specific (χ) magnetic susceptibility: $\chi = \{(\kappa lf/mass)/10\}$

Frequency dependent susceptibility measurements: $\chi fd\% = \{(\kappa lf - \kappa hf) / \kappa lf\} \times 100$

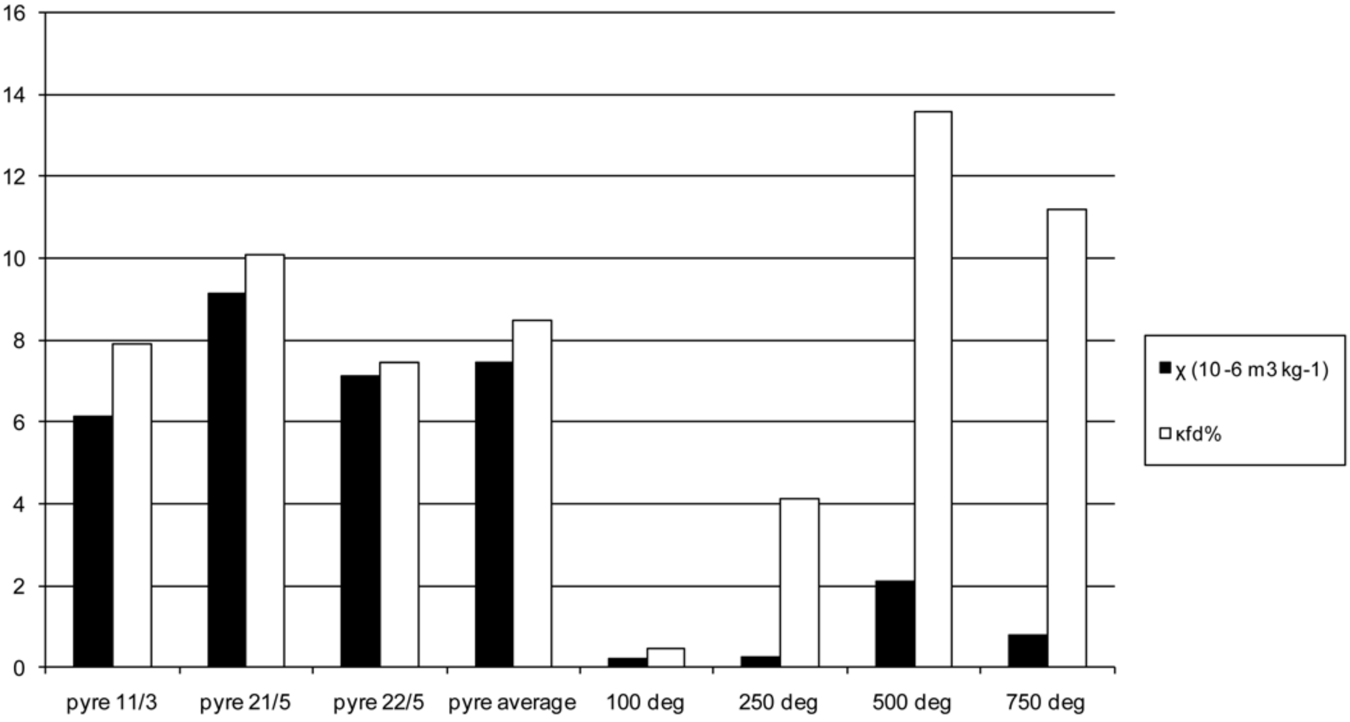
To ascertain whether pyres were built along the transect site, three samples from known cremation deposits were also analysed for χ and χfd% (pyre samples 022/5, 011/3 and 021/5). In addition, subsamples of the Y-axis samples were subjected to incineration at various temperatures: 100°C, 250°C, 500°C and 750°C for one hour each. It was hoped that these controls would provide different magnetic susceptibility values with which to compare and contrast any transect values exhibiting magnetic enhancement.

5.5.3 Results

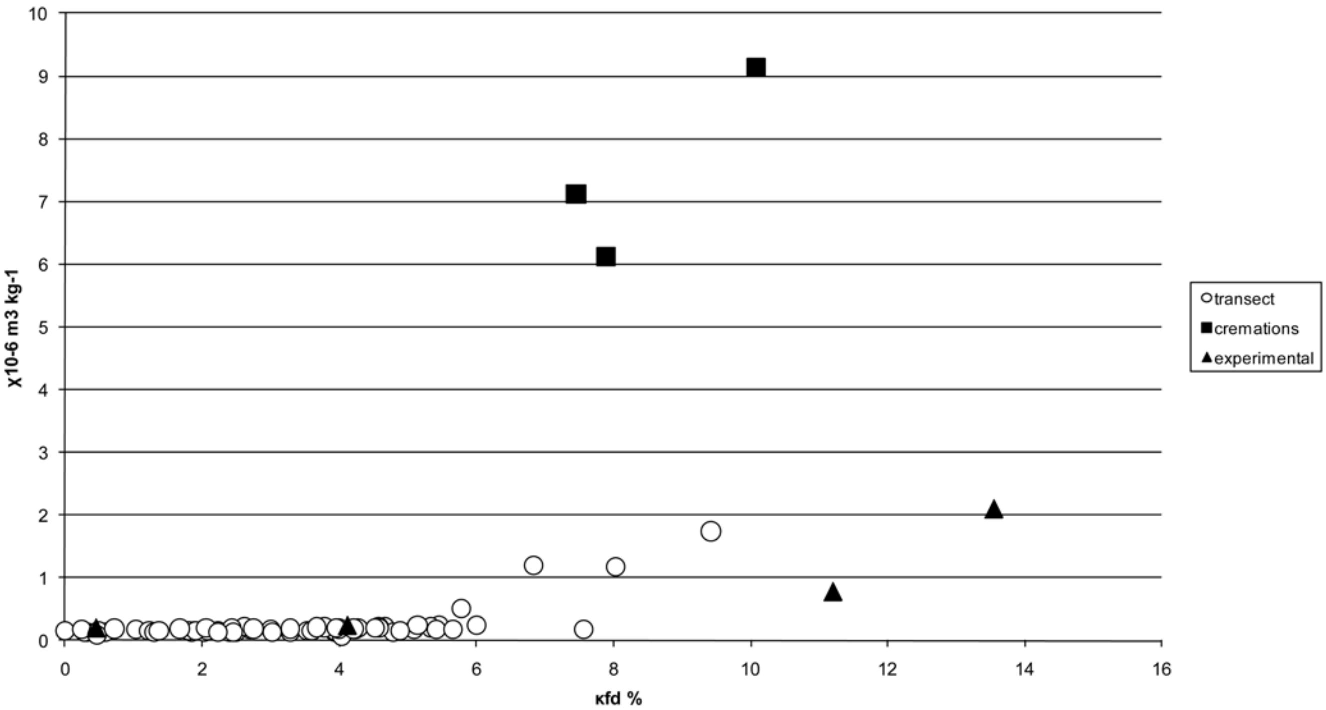
Illus 18 shows mass specific and frequency dependent susceptibilities of the transect samples. It is evident that the majority of the samples show susceptibility of between 0.1 and 0.25 × 10^{-6} m^3 kg^{-1}. These fall into the range of values commonly encountered for topsoil (Dearing 1994, 32). Four samples have significantly higher χ values: transect samples Y0475 (1.74 × 10^{-6} m^3 kg^{-1}), Y0500 (1.19 × 10^{-6} m^3 kg^{-1}), Y0525 (1.17 × 10^{-6} m^3 kg^{-1}) and Y0600 (0.51 × 10^{-6} m^3 kg^{-1}). These values are all within the range encountered for burned soils (ibid). When examining the χ values obtained by burning one of the soil samples at various temperatures (illus 19) similar results are seen, suggesting the transect samples with elevated susceptibilities may have been subjected to burning. By contrast, the cremation samples show



Illus 18 Mass specific and frequency dependent magnetic susceptibility of transect samples



Illus 19 Mass specific and frequency dependent magnetic susceptibility of cremation and experimental samples



Illus 20 Biplot of κfd % vs χ for all samples

much higher susceptibilities than both the transect and the experimental samples (illus 19).

The transect samples contain a range of κfd% values (illus 18), with most samples containing medium, and several containing low, SP concentrations. No samples contained high SP concentrations. The percentage frequency-dependent susceptibilities of the experimental and pyre samples are presented in illus 19. While some variation is evident, it can be seen from the experimental samples that χfd % values are positively correlated with burning temperature.

Illus 20 shows a biplot of χfd% and χ for all samples, enabling discrimination between different sample types. This method is commonly used to discriminate between grain-size and domain-state (Dearing 1999, 61).

5.5.4 Interpretation

While most have χfd values indicative of medium SP content, as might be expected in archaeological contexts, only four of the transect samples (Y0475, Y0500, Y0525 and Y0600) show enhanced magnetic concentration (χ). Although the samples with higher χ values also contain high χfd values, the relationship is not linear or clear. The experimentally ignited samples display similar χ values to the transect samples and the χfd values appear to be related to burning temperature. This suggests that the transect samples consist of soils variously subjected to modification, including burning.

The cremation samples display similar SP content to, but higher χ values than, the magnetically enhanced transect samples. Variations in values of χ have been correlated to the amount of, for example, ash dumped in archaeological contexts, with taphonomy also a crucial factor (Peters et al 2004, 90–91). Therefore the cremation fills may consist of concentrated, re-deposited selected material derived from the pyres, with the pyre material comprising burnt soil.

As three of the four magnetically enhanced transect samples are adjacent, and the other 0.75m away, it might be interpreted that this locality represents an area of former pyre activity, where efforts were made to clear away the resultant debris soon after the cremation process was completed.

5.5.5 Conclusion

Two different measurements of magnetic susceptibility were undertaken for sixty-six samples from a soil transect, and compared to results obtained from archaeological cremation deposits and from a series of experimentally heated soils from one subsample. The results indicate that there is evidence of admixture of heated soils along the transect, however this is of a different nature to the cremation deposits. The cremation deposits probably consist of intentionally re-deposited soils burnt along with the bodies and fuel. There is a possible indication of small amounts of pyre deposits being incorporated into the soils along the transect in the immediate locality of the Y0500 samples.