17. APPENDIX 3: PLANT MACRO-REMAINS AND PALYNOLOGY

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17.1 Methodological approach

A total of 12 bulk soil samples, processed using standard flotation methods, were analysed for the presence of carbonised botanical remains. Charcoal fragments were examined using a binocular microscope at variable magnifications of ×4-×45and an estimation of the total volume of carbonised material >4mm was made. All charcoal fragments >4mm were identified and all carbonised seeds or other plant macrofossils present within the samples were removed and identified.

The internal anatomical features of all charcoal fragments were further identified at ×200 magnification using the reflected light of a metallurgical microscope. Reference was made to Schweingruber (1990) to aid identifications and vascular plant nomenclature follows Stace (1997).

Pollen analysis was undertaken on three contexts: (021) a buried soil beneath the cairn, (024) turf packing for kerbstones, and (036) the buried soil within the chamber.

Pollen samples were prepared by the University of Reading, using standard methodologies with sodium polytungstate heavy liquid separation to remove the mineral component and final mounting of the samples in glycerine jelly stained with safranin. Pollen identification and nomenclature follows Moore et al (1991), whilst vascular plant nomenclature follows Stace (1997). A minimum number of 500 identifiable land pollen grains is usually counted for each sample, but in this case pollen concentration was relatively low and so three slides, with coverslip dimensions of 40mm x 22mm, were counted instead. A pollen sum of Total Land Pollen (TLP) was used for the calculation of pollen percentages and a pollen sum of TLP + Pteridophytes was used for all spores.

17.2 Results

17.2.1 Carbonised plant remains (Table 3)

Only small amounts of hazel charcoal were recovered from the mixed soil and cremated bone deposit (017) within the passage, suggesting that hazel wood formed at least a component of the cremation pyre fuel. Similarly, the fill (037) of the primary pit (038) contained traces of hazel charcoal as did the soil and cremated bone deposit (035). The charcoal from cremated bone and soil (012) located against the edge of the chamber comprised traces of heather-type and possible oak charcoal. Oak is generally the preferred pyre fuel because it burns with a particularly intense heat and heather may be the remains of kindling or there may have been a layer of heather on top of the pyre on which the body was placed. A third deposit of silt and cremated bone (013) also contained traces of oak charcoal along with clumps of burnt soil, again indicating that along with the selected human bone some funerary pyre material was also collected for re-deposition.

No identifiable charcoal was recovered from the mixed soil and crushed sandstone floor deposit (034), but a small amount of burnt soil was present indicating that cremation material had been incidentally trampled into this surface.

Buried soil (021) produced small amounts of hazel charcoal, but deposit (022) produced only a trace of heather-type wood that may be much more recent in date. Similarly buried soils (020b) and (020a) contained small amounts of hazel charcoal but no other species of carbonised wood; together with the results of the pollen analysis from buried soil (021) there is no evidence for in situ burning of hazel woodland. It is possible that the hazel charcoal originated from hearth waste produced by fires built on the original ground surface around the cairn.

Turf and stone (018) were stacked between the chamber orthostats and the kerbstones. This material produced a more mixed charcoal assemblage of hazel, cherry-type, oak, and willow, suggesting that either some hearth waste had been incorporated into this deposit or perhaps a fire had been built on the original turf surface before it was cut and used within the structure.

A layer of peat and silt (002) which sealed the trampled sandstone surface of tumbled cairn material on the east side of the cairn produced only traces of birch charcoal.

17.2.2 Pollen analysis (Table 4)

Pollen analysis was undertaken on three contexts: (021) a buried soil beneath the cairn, (024) turf packing for kerbstones and (036) the buried soil below the soil and silt crushed sandstone deposit within the chamber. However, it is postulated that all three of these buried soil samples were originally part of the same soil sequence prior to the cairn being built (Ellis, pers comm). The pollen assemblages from contexts (021) and (024) show some similarities but context (036) differs quite significantly.

A pollen diagram from Machrie Moor, around 5km to the north, covers the entire post-glacial period (Robinson & Dickson 1988). Although the radiocarbon dates shown on this pollen diagram are not calibrated, calibration has been undertaken using the CALIB 8.2 calibration program (Stuiver & Reimer 1993), which indicates that Local Pollen Zones (LPZ) 4b, 5a, and 5b cover the period of approximately 3650–1550 cal BC and so are most appropriate for comparison with the current study.

[1] Trees and tall shrubs

The tree and tall shrub pollen assemblages for both the soil beneath the cairn (021) and the turf packing for the kerbstones (024) are similar in terms of overall percentage, with trees and tall shrubs making up 16–17% of Total Land Pollen (TLP) in both cases. Both samples show alder, hazel, and birch in the vicinity, with willow also present in (024). Willow trees are insect pollinated and so the pollen does not travel as far as other tree and shrub species, which tend to be wind pollinated. Both samples contained traces of pine pollen, but pine pollen can travel for very long distances and so it is not possible to be confident that pine was actually growing in the wider area.

The soil beneath the crushed sandstone surface (036) showed a slightly higher overall tree and shrub percentage (22.6%) but the types present were the same as in the other two contexts and this variation could just be due to the relatively low pollen counts achieved for (036), meaning anomalies are more likely.

The Machrie Moor pollen diagram shows a similar range of pollen types in the tree and shrub category, but with the addition of significant amounts of oak pollen, which was absent from the Carmahome samples. This suggests that there was no oak woodland in the immediate landscape around Carmahome or when these soils were developing. Therefore, the small amounts of oak charcoal identified in samples from the passage tomb would have had to have been transported from further afield, perhaps within collected cremation material or as fuel for cremation pyres.

[2] Heaths

There was a significant difference in the abundance of heather pollen between the three samples. Heather pollen made up only 21.7% of the TLP in (024), 29.8% in (021) but 51.8% in (036). Firstly, this suggests significant areas of heather heathland in the immediate vicinity when the cairn was constructed. This could potentially correspond with a significant increase in heather abundance shown in the Machrie Moor pollen diagram, after the end of LPZ 5a and so dating to sometime within the range 3350–2500 cal BC. Robinson and Dickson (1988) suggest that the increased occurrence of acid heath may be the result of expansion onto areas where abandoned cultivated soil was becoming increasingly acidic. The significantly higher percentage of heather pollen in (036) than in (021) and (024) might suggest an additional input of heather pollen to (036), such as trickle down from heather placed on the chamber floor. There were a few examples of other types of Ericales (heather family) pollen present in all contexts but these were too crumpled to be further identifiable. All that could be said was they were not heather (*Calluna*) pollen.

[3] Herbaceous plants

Grasses have a moderate presence in all three buried soil contexts with around 18% in (021) and (036) and 25% in (024). There is no evidence for any cereal type pollen from any of the contexts. However, there is a significant difference in the amount of sedge pollen present between context (036) at around 2%, but significantly higher at 11% in (021) and 13% in (024). This might suggest very local variations in the on-site vegetation, such as in situ flowering sedge plants being incorporated into some of the buried soils during the construction of the cairn.

Buried soil (021) contained a diverse range of

herbaceous 'weedy' pollen types, with knapweed, dandelion-type, and buttercup present at above 1% and devil's-bit scabious present at 14.4% suggesting it was growing very close by since it is an insect pollinated plant. Devil's-bit scabious is a perennial species growing in damp but free draining soils. It can be found in a range of habitats including hay meadows, damp pastures, woodland, marshes, and along riverbanks. It would seem likely that the habitat at the time the passage grave was built was open damp grassland and not recently cleared woodland. The high values of devil's-bit scabious in (021) may, like the high values of sedge discussed above, be evidence for on-site growth of this species and incorporation of one or more flowers into the buried soils given these very high values.

Turf (024) showed a pollen assemblage that also indicated significant areas of grassland. Dandelion-type (5.1%) and members of the pink family (7.4%) were particularly abundant. Devil's-bit scabious was also common (6.3%) but with a significantly lower percentage than in (021), perhaps just as a result of very local differences in the plant species growing directly on site. A small amount of ribwort plantain (1.1%) might suggest grazing nearby as it is a plant often linked with pastoral agriculture. The overall percentage (62.3%) of grasses, sedges, and herbs again indicates the local environment was open, possibly grazed, grassland. It has been suggested that (024) might represent the remains of redeposited turf cut from the immediate area prior to the construction of the cairn and the pollen evidence is consistent with this explanation.

Buried soil (036) had an overall percentage of grass, sedge, and herbs of 25.6%, which is significantly lower than the values from (021) and (024) and there was a reduction in the diversity of herbaceous types present. Only chamomile-type, meadowsweet and devil's-bit scabious were present at over 1% TLP. However, the low pollen counts for (036) and the extremely high values of heather pollen, that may be later additions to this pollen assemblage, could significantly affect the percentage values of the other types since these are relative, rather than absolute values.

None of the contexts contained any evidence for cereal-type pollen that might indicate arable agriculture. However, cereal pollen is large and, although wind-transported, does not travel far from the parent plant and so absence of cereal pollen does not mean absence of cereals in the wider locality.

[4] Ferns and Moss

Fern (including polypody) spores were abundant in (021) and very common in (024) and (036). This might suggest shady woodland areas in the vicinity but may also be an indication of differential preservation of pollen/spores in the samples. Fern spores are extremely robust and so will survive when other types have deteriorated. There were also occasional bracken spores in (021) and (024), which can be indicative of open ground that has previously been woodland. Only traces of bogmoss spores were identified from (021), suggesting no significant areas of bog nearby.

17.3 Conclusions

It is likely that only some of the wood used as fuel in the cremation pyres came from areas of woodland in the vicinity of the site. Oak charcoal made up a significant percentage of the cremation fuel, but this oak probably came from further afield as it does not appear in the pollen spectra from any of the three pollen contexts examined from the passage grave. However, the pollen spectra from Machrie Moor (Robinson & Dickson, 1988) for the time period in question show significant amounts of oak pollen and so, even if oak was not available in the immediate vicinity, it was probably growing within 5km of Carmahome. There is no evidence for foodplants in the carbonised remains and so no indication that foodplants were included as offerings on the cremation pyres. The passage tomb was probably built within an area of damp grassland that may have been used for animal grazing. Over time, some of this grassland became increasingly acidic and heather heathland expanded into this habitat.

Table 3 The charcoal from Carmahome

	Context	002	012	013	017	018	020	021	022	034	035	037	039
	Sample	-	002	003	004	005	006	007	008	013	-	-	015
	Description	Layer of peat and silt on the east side	Cremation deposit	Silt with cremated bone	Cremation	Turf and stone making bulk of cairn	Buried soil	Buried soil (same as 022?)	Buried soil (same as 021?)	Floor' layer	Cremation deposit	Cremation deposit	Fill of pit [040]
Total volume charcoal >4 mm		<1ml	1ml	<1ml	1ml	6ml	2ml	1ml	-	-	<1ml	1ml	<1ml
Charcoal													
Betula spp	birch	4 (0.02g)	-	-	-	-	-	-	-	-	-	-	-
Corylus cf avellana	hazel	-	-	-	2 (0.04g)	6 (0.28g)	8 (0.34g)	5 (0.24g)	-	-	1 (0.05g)	1 (0.15g)	-
Ericales	heather type	-	1 (0.05g)	-	-	-	-	-	-	-	-	-	-
Prunoideae	cherry type	-	-	-	-	1 (0.08g)	-	-	-	-	-	-	-
Quercus spp	oak	-	-	1 (0.03g)	-	21 (1.31g)	-	-	-	-	-	-	-
cf Quercus spp	cf oak	-	3 (0.15g)	-	-	-	-	-	-	-	-	-	1 (0.01g)
Salix spp	willow	-	-	-	-	1 (0.02g)	-	-	-	-	-	-	-
Indet charcoal	indet charcoal	-	-	-	1 (0.04g)	-	6 (0.20g)	-	-	-	-	-	-
Uncarbonised wood													
Ericales	heather type	-	-	-	-	-	-	-	1 (0.02g)	-	-	-	-
Misc													
Burnt soil	burnt soil	-	-	13 (0.56g)	-	-	-	-	-	1 (0.47g)	-	-	-

Table 4 The pollen from Carmahome

	Context	021	024	036
	Sample	7	10	14
	Description	Buried soil beneath cairn	Turf packing for kerbstone	Silt loam below crushed sandstone floor (034)
Trees & Tall Shrubs				
Alnus	alder	27 (9.0%)	5 (2.9%)	13 (7.9%)
Betula	birch	5 (1.7%)	1 (0.6%)	3 (1.8%)
Coryloid	hazel type	15 (5.0%)	15 (8.6%)	17 (10.4%)
Pinus	pine	4 (1.3%)	4 (2.3%)	4 (2.4%)
Salix	willow	-	3 (1.7%)	-
Total Trees & Tall Shrubs		*17.1%*	*16.0%*	*22.6%*
Heaths				
Calluna	heather	88 (29.4%)	35 (20.0%)	79 (48.2%)
Ericales	heather family	1 (0.3%)	3 (1.7%)	6 (3.7%)
Total Heaths		*29.8%*	*21.7%*	*51.8%*
Herbs				
Poaceae	grass	54 (18.1%)	44 (25.1%)	29 (17.7%)
Cyperaceae	sedge	34 (11.4%)	23 (13.1%)	3 (1.8%)
Anthemis type	chamomile type	-	-	2 (1.2%)
Artemisia	mugwort	2 (0.7%)	-	-
Aster type	daisy type	2 (0.7%)	-	-
Caryophyllaceae	pink family	1 (0.3%)	13 (7.4%)	1 (0.6%)
Centaurea	knapweed	3 (1.0%)	1 (0.6%)	1 (0.6%)
Filipendula	meadowsweet	-	1 (0.6%)	2 (1.2%)
Lactuceae	dandelion type	9 (3.0%)	9 (5.1%)	-
Plantago lanceolata	ribwort plantain	-	2 (1.1%)	-
Plantago major/ media	greater/hoary plantain	1 (0.3%)	-	-
Polygonum	knotweed	-	-	1 (0.6%)
Potentilla type	cinquefoil type	2 (0.7%)	-	-
Ranunculaceae	buttercup family	4 (1.3%)	2 (1.1%)	-
Rumex acetosa type	sorrel type	2 (0.7%)	2 (1.1%)	1 (0.6%)
Succisa pratensis	devil's-bit scabious	43 (14.4%)	11 (6.3%)	2 (1.2%)

Table 4 *cont.*

	Context	021	024	036
	Sample	7	10	14
	Description	Buried soil beneath cairn	Turf packing for kerbstone	Silt loam below crushed sandstone floor (034)
Trifolium type	clover type	2 (0.7%)	-	-
Viola	violet	-	1 (0.6%)	-
Total Herbs		*53.2%*	*62.3%*	*25.6%*
Total Land Pollen (TLP)		299	175	164
Pteridophytes				
Filicales	ferns	982 (37.3%)	443 (61.4%)	36 (12.7%)
Polypodium	polypody fern	1352 (51.3%)	102 (14.1%	83 (29.3%)
Pteridium	bracken	1 (<0.1%)	2 (0.3%)	-
Sphagnum	bogmoss	2 (0.1%)	-	-
Total Land Pollen + Pteridophytes		2636	722	283