Rhynie, A Powerful Place of Pictland

Edited by Gordon Noble

Sequence Sequence
Boundary Start
Phase Phase
Phase Well deposits
R_Date SUERC-86461
R_Date SUERC-86462
R_Date SUERC-86463
R_Date SUERC-86467
R_Date SUERC-86468
R_Date SUERC-86469
R_Date SUERC-86470
R_Date SUERC-86460
Phase U-Shaped banks
Sequence
R_Date SUERC-86471
R_Date SUERC-86472
R_Date SUERC-86488
R_Date SUERC-86489
Phase NE Rampart and occupation
R_Date SUERC_77916
R_Date SUERC-77917
R_Date SUERC-77918
R_Date SUERC-77919
R_Date SUERC-77920
R_Date SUERC-77959
R_Date SUERC-77963
R_Date SUERC-77957
R_Date SUERC-77958
Sequence
R_Date SUERC-77924
R_Date SUERC-77925
R_Date SUERC-77926
R_Date SUERC-77927
Phase Interior occupation
R_Date SUERC_86497
R_Date SUERC-86498
R_Date SUERC-86492
R_Date SUERC-86493
Phase Southwest Rampart and occupation
Sequence
R_Date SUERC-86473
R_Date SUERC-86477
R_Date SUERC-86478
R_Date SUERC-86479
R_Date SUERC-86480
R_Date SUERC-86481
R_Date SUERC-86482
R_Date SUERC-86483
R_Date SUERC-86487
R_Date SUERC-86490
R_Date SUERC-86491
Boundary End

| 1000 | 800 | 600 | 400 | 200 | 1BC/1AD |

Modelled date (BC/AD)

Illus 8.1
Overall site model for Tap o' Noth upper fort and activity

<center>Chapter 8</center>

ENVIRONMENT AND SCIENTIFIC ANALYSES

8.1 Introduction

Alongside the excavations a programme of scientific analysis took place during the course of the excavations and in a post-excavation stage. This included extensive radiocarbon dating with over 150 radiocarbon dates obtained for the three sites: Tap o' Noth, the Craw Stane complex and Cairn More (Hamilton & Noble, Section 8.2). In addition a range of established and newer analytical techniques were adopted to examine some of the bioarchaeological material recovered from the excavations. Extensive charred plant and wood remains were recovered from an extensive soil sampling and flotation initiative as part of the excavations. This (Niehaus & Ramsay, 8.3) allowed questions of the plant component of diet, agricultural practices, and firewood and structural timber use to be explored through the identification of archaeobotanical material. The environmental evidence was complimented by high resolution pollen, non-pollen palynomorphs (NPP) and XRF conducted on sediment samples extracted from a mire on Barflat farm, found just downslope from the Craw Stane complex and from a well at Tap o' Noth (Jones, 8.4) providing insights into the environment of the Rhynie area through time. An innovative phytolith analysis was also undertaken to provide an alternative way of tracking plant use in the valley (Prado, 8.5). This enabled us to assess agricultural production and consumption, the use of difficult to identify architectural materials such as turf in early medieval architecture, and human interaction with a range of ecological niche zones in different ways. Bone preservation was very poor at all three sites excavated, but an extensive burnt-bone assemblage from the Craw Stane complex, along with some very partial survival of bone from Tap o' Noth has provided some insight into the animal economy during the Roman Iron Age and early medieval periods (Masson-MacLean & Mainland, 8.6 and 8.7). Finally, a series of analyses were conducted on the fragmentary human skeleton recovered from the cist within the square barrow excavated the outskirts of Rhynie in 2013. These analyses included osteology of human remains from the cist (McManus et al, 8.8) and multi-isotope analysis of the individual including diet and mobility (Britton, 8.9). The evidence from all of these scientific analyses are outlined in this chapter.

8.2 Radiocarbon dating and Bayesian modelling

Derek Hamilton and Gordon Noble

8.2.1 Dating methods

For the Rhynie Environs Project 162 radiocarbon dates were funded by Historic Environment Scotland, by the University of Aberdeen through University of Aberdeen Development Trust funding and in the early years of the project a small number of dates were funded through small grants from the Society of Antiquaries of Scotland, the Carnegie Trust for the Universities of Scotland and the British Academy. These were all processed at the University of Glasgow's SUERC Radiocarbon Laboratory with samples pre-treated, combusted, graphitised and measured by accelerator mass spectrometry (Dunbar et al 2016). The results are presented as conventional radiocarbon ages (Stuiver & Polach 1977) and quoted according to the international standard set at the Trondheim Convention (Stuiver & Reimer 1986). The date ranges in the tables (Table 8.1–8.4) have been calculated using the maximum intercept method and have been rounded to 10 years where the measurement error is greater than or equal to 20 years or to 5 years when the error is less than 20 years. The ranges given in the figures were calculated using the probability method (Stuiver & Reimer 1993). The calibrations used the internationally-agreed calibration curve for terrestrial samples (IntCal20) (Reimer et al 2020), and were calculated using OxCal v4.4 (Bronk Ramsey 2009). These dates were modelled following a Bayesian approach to chronology building (Buck et al 1996) and the modelled results are rounded outward to 5 years and given in *italics* to differentiate them from the simple calibrated dates.

8.2.2 Tap o' Noth Upper Fort

Forty radiocarbon dates were obtained for the oblong fort at Tap o' Noth (Table 8.1) Most samples were short-lived species of wood charcoal, but one barley grain (SUERC-86473) was dated from C410. The good bone preservation of bone by the north-eastern wall face also allowed five animal bone samples to be dated from context 1708. Dating was compiled for five different areas of the oblong fort: well deposits, the U-shaped banks, the north-east rampart and occupation, interior occupation and south-west rampart and associated deposits.

Two separate models were constructed in OxCal for the Upper Fort at Tap o' Noth. One comprised an overall site model

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) cal BC	Stratigraphy
			Well deposits			
Tap o' Noth, Aberdeenshire	SUERC-86460	*Alnus* sp.	Context 210 – basal well fill	2181±28	360–170	
Tap o' Noth, Aberdeenshire	SUERC-86461	*Salix* sp.	Context 210 – basal well fill	2152±28	360–90	
Tap o' Noth, Aberdeenshire	SUERC-86462	*Salix* sp.	Context 209 – well lining	2204±28	370–190	
Tap o' Noth, Aberdeenshire	SUERC-86463	*Corylus avellana*	Context 209 – well lining	2197±28	370–190	
Tap o' Noth, Aberdeenshire	SUERC-86467	*Corylus avellana*	Context 205 – upper fill/edge of well	2197±28	370–190	Early dates below suggest these are occupation layers cut through by well
Tap o' Noth, Aberdeenshire	SUERC-86468	*Pinus* sp.	Context 205 – upper fill/edge of well	2367±28	540–380	Early dates suggest these are occupation layers cut through by well
Tap o' Noth, Aberdeenshire	SUERC-86469	*Alnus* sp.	Context 209 – upper fill/edge of well	2396±28	730–390	Early dates suggest these are occupation layers cut through by well
Tap o' Noth, Aberdeenshire	SUERC-86470	*Corylus avellana*	Context 209 – upper fill/edge of well	2229±28	390–200	Early dates suggest these are occupation layers cut through by well
			U-shaped banks			
Tap o' Noth, Aberdeenshire	SUERC-86471	*Corylus avellana*	Context 210 – Charcoal layer under Inner U-shaped bank	2234±28	390–200	Earlier than context 215
Tap o' Noth, Aberdeenshire	SUERC-86472	*Salix* sp.	Context 215 – Inner U-shaped bank matrix	2269±28	400–210	
Tap o' Noth, Aberdeenshire	SUERC-86488	*Betula sp.*	Context 408 – Outer U-shaped bank matrix	2187±28	360–170	
Tap o' Noth, Aberdeenshire	SUERC-86489	*Alnus* sp.	Context 408 – Outer U-shaped bank matrix	2223±28	380–200	
			Trench 1 Northeast rampart and occupation			
Tap o' Noth, Aberdeenshire	SUERC-77916	Animal bone: *bos* sp.	Context 1708 – layer against inner wall face	2148±25	360–90	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77917	Animal bone: *Ovis* sp.	Context 1708 – layer against inner wall face	2178±29	370–160	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77918	Animal bone: Other.	Context 1708 – layer against inner wall face	2184±26	360–170	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77919	Animal bone: *Bos* sp.	Context 1708 – layer against inner wall face	2148±29	360–60	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77920	Animal bone: *Bos* sp.	Context 1708 – layer against inner wall face	2165±29	360–110	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77959	*Corylus avellana*	Context 1708 – layer abutting inner wallface	2188±26	360–180	Early occupation prior to destruction?
Tap o' Noth, Aberdeenshire	SUERC-77963	*Betula* sp.	Context 1708 – layer abutting inner wallface	2236±26	390–200	Early occupation prior to destruction?

Table 8.1
Radiocarbon determinations from Tap o' Noth upper fort

to provide the probability ranges for the start and end date for the oblong fort and occupation and another to allow individual site elements to be modelled and their relative dating to be compared. Site stratigraphy was incorporated into the second model where there were clear indications of relative chronology. In both models dates were grouped by context and by site element.

The overall model site model (Illus 8.1) showed good agreement (Amodel=85), demonstrating good correlation between the archaeological stratigraphy and modelled sequence. The model estimates that all of the dated activity at the oblong fort began in *440–395 cal BC* (*95% probability*), or in *425–405 cal BC* (*68% probability*) (Illus 8.1: Boundary Start). Dated activity ended in either *310–275 cal BC* (*3% probability*) or *240–140 cal BC* (*92% probability*), and probably in *210–165 cal BC* (*68% probability*) (Illus 8.1: Boundary End). The difference between these two dates provides an estimated span of all dated activity at Tap o' Noth oblong fort of *175–285* years (*95% probability*), and probably *205–255 years* (*68% probability*) (Illus 8.2).
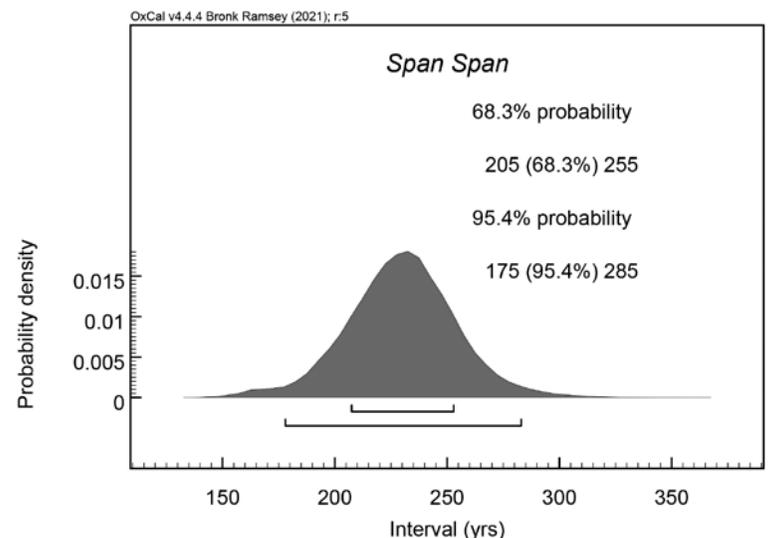
Illus 8.2
Span for activity at Tap o' Noth upper fort

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) cal BC	Stratigraphy
Tap o' Noth, Aberdeenshire	SUERC-77957	*Alnus* sp.	Context 1708 – Towards bone-rich deposit, but over layer of collapse	2265±26	400–210	Collapse of wall core?
Tap o' Noth, Aberdeenshire	SUERC-77958	*Betula* sp.	Context 1708 – Towards bone-rich deposit, but over layer of collapse	2234±24	390–200	Collapse of wall core?
Tap o' Noth, Aberdeenshire	SUERC-77924	*Betula* sp.	Context 1710 T1 – Peat/Charcoal layer	2256±27	400–200	
Tap o' Noth, Aberdeenshire	SUERC-77925	*Betula* sp.	Context 1710 T1 – Peat/Charcoal layer	2250±24	400–200	
Tap o' Noth, Aberdeenshire	SUERC-77926	*Corylus avellana*	Context 1712 T1 – Silty/turf layer	2248±24	400–200	Overlies 1710
Tap o' Noth, Aberdeenshire	SUERC-77927	*Betula* sp.	Context 1712 T1 – Silty/turf layer	2200±26	370–190	Overlies 1710
Trench 3 Interior						
Tap o' Noth, Aberdeenshire	SUERC-86497	*Betula* sp.	Context 307 – OGS/Basal deposit	2300±28	410–230	
Tap o' Noth, Aberdeenshire	SUERC-86498	*Corylus avellana*	Context 307 – OGS/Basal deposit	2192±28	370–180	
Tap o' Noth, Aberdeenshire	SUERC-86492	*Alnus* sp.	Context 306 – Charcoal spread within Trench 3 under stone tumble	2366±28	540–380	
Tap o' Noth, Aberdeenshire	SUERC-86493	*Alnus* sp.	Context 306 – Charcoal spread within Trench 3 under stone tumble	2222±28	380–200	
Trench 4 Southwest rampart and rampart occupation						
Tap o' Noth, Aberdeenshire	SUERC-86473	Charred plant remains: *Hordeum* sp. (Barley)	Context 410 – Peat/OGS basal deposit Trench 4	2172±28	360–120	Stratigraphically earliest
Tap o' Noth, Aberdeenshire	SUERC-86477	*Betula* sp.	Context 411 – Floor layer of structure built up against wall face	2255±28	400–200	Later than 410
Tap o' Noth, Aberdeenshire	SUERC-86478	*Alnus* sp.	Context 411 – Floor layer of structure built up against wall face	2297±28	410–230	Later than 410
Tap o' Noth, Aberdeenshire	SUERC-86490	*Betula* sp.	Context 412 – Stone layer abutting inner bank	2135±28	360–50	Later than 411, 410 and 407
Tap o' Noth, Aberdeenshire	SUERC-86491	*Corylus avellana*	Context 412 – Stone layer abutting inner bank	2174±28	360–160	Later than 411, 410 and 407
Tap o' Noth, Aberdeenshire	SUERC-86479	*Alnus* sp.	Context 416 – Post hole cut into floor 411	2292±28	410–230	Later than 411
Tap o' Noth, Aberdeenshire	SUERC-86480	*Alnus* sp.	Context 416 – Post hole cut into floor 411	2226±28	390–200	Later than 411
Tap o' Noth, Aberdeenshire	SUERC-86481	*Alnus* sp.	Context 407 – Destruction layer	2275±28	410–210	Later than 411/416
Tap o' Noth, Aberdeenshire	SUERC-86482	*Betula* sp.	Context 407 – Destruction layer	2255±28	400–200	Later than 411/416
Tap o' Noth, Aberdeenshire	SUERC-86483	*Alnus* sp.	Context 424 – Rampart collapse	2204±28	370–190	Later than 407 but may include wall core materials
Tap o' Noth, Aberdeenshire	SUERC-86487	*Betula* sp.	Context 424 – Rampart collapse	2223±28	380–200	Later than 407 but may include wall core materials

Table 8.1 (*cont.*)
Radiocarbon determinations from Tap o' Noth upper fort

The second model with the site elements individually modelled also showed good agreement (Amodel=78) (Illus 8.3). This model suggests that the interior occupation and deposits in association with the well were amongst the earliest on site with little appreciable difference in the start dates of the north-east rampart, south-west rampart and U-shaped banks (Illus 8.3: See start and end dates at base of diagram). The model also suggests that all five elements – well deposits, the U-shaped banks, the north-east rampart and occupation, interior occupation and south-west rampart and associated deposits – came to an end around the same time, most likely in the later 3rd or earlier 2nd century cal BC.
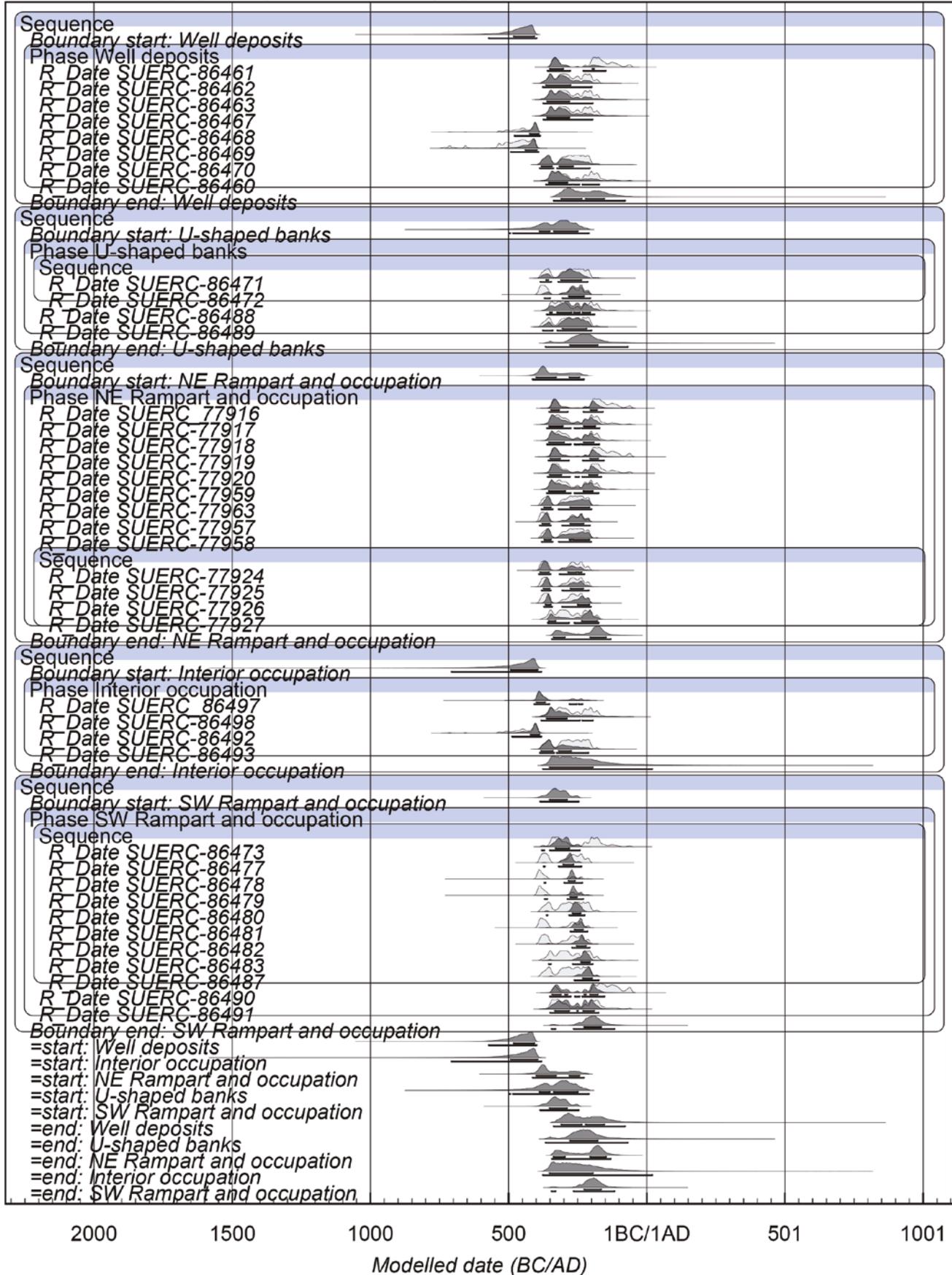
8.2.3 Tap o' Noth Lower Fort and Platform Settlements

For the lower fort at Tap o' Noth and the associated platform settlements 42 radiocarbon determinations were available for chronological modelling (Table 8.2). All of the determinations were on charcoal given that bone was almost completely absent from the lower fort. All the samples were round-wood of short-lived species: birch, alder, willow and hazel. All of the

determinations were of first-millennium AD date with the exception of SUERC-108423 which produced a range spanning the last centuries BC to early first century AD in date. Three additional dates were treated as outliers as they were older determinations from hearths that had later dates and/or the samples appeared to be out of sequence (Table 8.2).

Two models were compiled to analyse the Tap o' Noth lower fort and platform settlement. One comprised an overall site model to provide the probability ranges for the start and end date for activity on the lower hill and another to allow individual site elements to be modelled and their relative dating to be compared. Site stratigraphy was incorporated into the second model where there were clear indications of relative chronology. In both models dates were grouped by context and by site element – eg the rampart and the various platforms investigated in T5, T6, T11, T12, T15, T16 and T17.

The overall model site model showed good agreement (Amodel=94.1), demonstrating good correlation between the archaeological stratigraphy and modelled sequence (Illus 8.4). The model estimates that all of the dated first-millennium AD activity in association with the rampart and

Sequence
    Boundary start: Well deposits
    Phase Well deposits
        R_Date SUERC-86461
        R_Date SUERC-86462
        R_Date SUERC-86463
        R_Date SUERC-86467
        R_Date SUERC-86468
        R_Date SUERC-86469
        R_Date SUERC-86470
        R_Date SUERC-86460
    Boundary end: Well deposits
Sequence
    Boundary start: U-shaped banks
    Phase U-shaped banks
        Sequence
            R_Date SUERC-86471
            R_Date SUERC-86472
            R_Date SUERC-86488
            R_Date SUERC-86489
    Boundary end: U-shaped banks
Sequence
    Boundary start: NE Rampart and occupation
    Phase NE Rampart and occupation
        R_Date SUERC-77916
        R_Date SUERC-77917
        R_Date SUERC-77918
        R_Date SUERC-77919
        R_Date SUERC-77920
        R_Date SUERC-77959
        R_Date SUERC-77963
        R_Date SUERC-77957
        R_Date SUERC-77958
        Sequence
            R_Date SUERC-77924
            R_Date SUERC-77925
            R_Date SUERC-77926
            R_Date SUERC-77927
    Boundary end: NE Rampart and occupation
Sequence
    Boundary start: Interior occupation
    Phase Interior occupation
        R_Date SUERC_86497
        R_Date SUERC-86498
        R_Date SUERC-86492
        R_Date SUERC-86493
    Boundary end: Interior occupation
Sequence
    Boundary start: SW Rampart and occupation
    Phase SW Rampart and occupation
        Sequence
            R_Date SUERC-86473
            R_Date SUERC-86477
            R_Date SUERC-86478
            R_Date SUERC-86479
            R_Date SUERC-86480
            R_Date SUERC-86481
            R_Date SUERC-86482
            R_Date SUERC-86483
            R_Date SUERC-86487
        R_Date SUERC-86490
        R_Date SUERC-86491
    Boundary end: SW Rampart and occupation
    =start: Well deposits
    =start: Interior occupation
    =start: NE Rampart and occupation
    =start: U-shaped banks
    =start: SW Rampart and occupation
    =end: Well deposits
    =end: U-shaped banks
    =end: NE Rampart and occupation
    =end: Interior occupation
    =end: SW Rampart and occupation

2000   1500   1000   500   1BC/1AD   501   1001

Modelled date (BC/AD)

Illus 8.3
Model for individual site elements at Tap o' Noth upper fort

OxCal v4.4.4 Bronk Ramsey (2021); r:5 Atmospheric data from Reimer et al (2020)

Sequence
  Boundary start: Tap o' Noth lower fort
Phase Tap o' Noth lower fort
  Phase Rampart and occupation
    R_Date SUERC-92208
    R_Date SUERC-92210
    R_Date SUERC-92204
    R_Date SUERC-92209
    R_Date SUERC-92214
    R_Date SUERC-92207
  Phase Platform T5
    R_Date SUERC-92197
    R_Date SUERC-92196
  Phase Platform T6
    R_Date SUERC-92198
    R_Date SUERC-92199
    R_Date SUERC-92206
    R_Date SUERC-92205
    R_Date SUERC-92200
    R_Date SUERC-92215
  Phase Platform T11
    Sequence
      R_Date SUERC-102591
      R_Date SUERC-102590
      R_Date SUERC-102589
  Phase Platform T12
    R_Date SUERC-102587
    R_Date SUERC-102588
  Phase Platform T15
    Sequence
      R_Date SUERC-108404
      R_Date SUERC-108403
      R_Date SUERC-108405
      R_Date SUERC-108406
      R_Date SUERC-108412
    R_Date SUERC-108401
    R_Date SUERC-108402
    R_Date SUERC-108410
    R_Date SUERC-108411
  Phase Platform T16
    Sequence
      R_Date SUERC-108414
      R_Date SUERC-108413
      R_Date SUERC-108415
      R_Date SUERC-108416
  Phase Platform T17
    Sequence
      R_Date SUERC-108420
      R_Date SUERC-108421
      R_Date SUERC-108425
      R_Date SUERC-108422
    R_Date SUERC-108423?
    R_Date SUERC-108424?
    R_Date SUERC-108426?
    R_Date SUERC-108430
    R_Date SUERC-108432
    R_Date SUERC-108431
  Boundary end: Tap o' Noth lower fort

600   400   200   1BC/1AD   201   401   601   801

Modelled date (BC/AD)

Illus 8.4
Overall site model for Tap o' Noth lower fort and house platforms

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) cal AD (unless stated)	Stratigraphy
Rampart						
Tap o' Noth, Aberdeenshire	SUERC-92208	Charcoal: *Corylus avellana*	Context 7007 – Structure within entranceway	1704±24	250–400	Should be later than 7012, redeposited?
Tap o' Noth, Aberdeenshire	SUERC-92210	Charcoal: *Betula* sp.	Context 7011 – Palisade fill	1697±24	250–410	
Tap o' Noth, Aberdeenshire	SUERC-92204	Charcoal: *Betula* sp.	Context 7006 – Basal layer below rampart	1644±23	340–530	
Tap o' Noth, Aberdeenshire	SUERC-92209	Charcoal: *Corylus avellana*	Context 7011 – Palisade fill	1593±24	410–540	
Tap o' Noth, Aberdeenshire	SUERC-92214	Charcoal: *Salix* sp.	Context 7012 – Structure within entranceway	1563±23	420–550	
Tap o' Noth, Aberdeenshire	SUERC-92207	Charcoal: *Corylus avellana*	Context 7006 – Basal layer below rampart	1558±24	420–560	
T5 Platform						
Tap o' Noth, Aberdeenshire	SUERC-92197	Charcoal: *Betula* sp.	Context 5004 – Charcoal from occupation layer	1605±23	400–540	
Tap o' Noth, Aberdeenshire	SUERC-92196	Charcoal: *Corylus avellana*	Context 5004 – Charcoal from occupation layer	1593±24	410–540	
T6 Platform						
Tap o' Noth, Aberdeenshire	SUERC-92198	Charcoal: *Betula* sp.	Context 6004 – Post-hole fill	1781±24	130–340	
Tap o' Noth, Aberdeenshire	SUERC-92199	Charcoal: *Salix* sp.	Context 6004 – Post-hole fill	1773±24	140–340	
Tap o' Noth, Aberdeenshire	SUERC-92206	Charcoal: *Betula* sp.	Context 6017 – Hearth 1 lower fill	1750±24	230–380	
Tap o' Noth, Aberdeenshire	SUERC-92200	Charcoal: *Corylus avellana.*	Context 6012 – Hearth 1 upper fill	1599±24	400–540	
Tap o' Noth, Aberdeenshire	SUERC-92205	Charcoal: *Betula* sp.	Context 6014 – Hearth 2 fill	1651±23	330–510	
Tap o' Noth, Aberdeenshire	SUERC-92215	Charcoal: *Corylus avellana*	Context 6014 – Hearth 2 fill	1503±24	430–630	
T11 Platform						
Tap o' Noth, Aberdeenshire	SUERC-102589	Charcoal: *Corylus avellana*	Context 11005 – Floor layer	1747±26	240–390	
Tap o' Noth, Aberdeenshire	SUERC-102591	Charcoal: *Corylus avellana*	Context 11015 – Hearth 3 fill	1733±26	240–410	
Tap o' Noth, Aberdeenshire	SUERC-102590	Charcoal: *Betula* sp.	Context 11008 – Hearth 1 fill	1597±26	420–550	Later than 11015
T12 Platform						
Tap o' Noth, Aberdeenshire	SUERC-102587	Charcoal: *Betula* sp.	Context 12002 – Floor layer	1697±26	250–420	
Tap o' Noth, Aberdeenshire	SUERC-102588	Charcoal: *Corylus avellana*	Context 12003 – Floor layer	1675±26	250–430	
T15 Platform						
Tap o' Noth, Aberdeenshire	SUERC-108404	Charcoal: *Betula* sp.	Context 15015 – Floor layer H2	1799±24	210–340	
Tap o' Noth, Aberdeenshire	SUERC-108403	Charcoal: *Betula* sp.	Context 15015 – Floor layer H2	1720±23	250–410	
Tap o' Noth, Aberdeenshire	SUERC-108401	Charcoal: *Betula* sp.	Context 15006 – Floor layer H1	1670±24	260–440	
Tap o' Noth, Aberdeenshire	SUERC-108405	Charcoal: *Betula* sp.	Context 15013 – Mid floor layer H2	1623±24	400–540	Later than 15015
Tap o' Noth, Aberdeenshire	SUERC-108406	Charcoal: *Alnus* sp.	Context 15013 – Mid floor layer H2	1606±24	410–540	Later than 15015
Tap o' Noth, Aberdeenshire	SUERC-108412	Charcoal: *Salix* sp.	Context 15012 – Upper floor layer H2	1557±23	430–570	Later than 15013
Tap o' Noth, Aberdeenshire	SUERC-108410	Charcoal: *Alnus* sp.	Context 15005 – Burnt bone spread H1	1551±24	430–580	Later than 15006
Tap o' Noth, Aberdeenshire	SUERC-108402	Charcoal: *Salix* sp.	Context 15006 – Floor layer H1	1486±24	550–640	
Tap o' Noth, Aberdeenshire	SUERC-108411	Charcoal: *Corylus avellana*	Context 15005 – Burnt bone spread H1	1430±24	590–660	Later than 15006
T16 Platform						
Tap o' Noth, Aberdeenshire	SUERC-126733	Animal bone: *Equus* species (Horse).	Context 16011 – Platform foundations	1719±24	250–410	Earlier than 16012, 16007
Tap o' Noth, Aberdeenshire	SUERC-108414	Charcoal: *Salix* sp.	Context 16012 – Lower hearth fill	1616±24	410–540	

Table 8.2
Radiocarbon determinations from Tap o' Noth lower fort

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) cal AD (unless stated)	Stratigraphy
Tap o' Noth, Aberdeenshire	SUERC-108413	Charcoal: *Betula* sp.	Context 16012 – Lower hearth fill	1572±24	420–560	
Tap o' Noth, Aberdeenshire	SUERC-108415	Charcoal: *Corylus avellana*	Context 16007 – Upper hearth fill	1542±24	430–600	Later than 16012
Tap o' Noth, Aberdeenshire	SUERC-108416	Charcoal: *Betula* sp.	Context 16007 – Upper hearth fill	1515±23	440–640	Later than 16012
			T17 Platform			
Tap o' Noth, Aberdeenshire	SUERC-108423	Charcoal: *Betula* sp.	Context 17007 – Lower hearth fill	2063±24	160 cal BC–cal AD 10	Later than 17011 Residual?
Tap o' Noth, Aberdeenshire	SUERC-108424	Charcoal: *Betula* sp.	Context 17010 – Lower hearth fill	1840±24	120–250	Later than 17011 Residual?
Tap o' Noth, Aberdeenshire	SUERC-108426	Charcoal: *Betula* sp.	Context 17008 – Hearth fill	1838±24	120–310	Residual?
Tap o' Noth, Aberdeenshire	SUERC-108420	Charcoal: *Betula* sp.	Context 17011 – Lowest hearth fill	1733±23	250–410	
Tap o' Noth, Aberdeenshire	SUERC-108421	Charcoal: *Corylus avellana*	Context 17011 – Lowest hearth fill	1633±24	400–540	
Tap o' Noth, Aberdeenshire	SUERC-108422	Charcoal: *Salix* sp.	Context 17007 – Lower hearth fill	1604±23	410–540	Later than 17011
Tap o' Noth, Aberdeenshire	SUERC-108425	Charcoal: *Corylus avellana*	Context 17010 – Lower hearth fill	1656±23	260–540	Later than 17011
Tap o' Noth, Aberdeenshire	SUERC-108430	Charcoal: *Corylus avellana*	Context 17008 – Hearth fill	1616±24	410–540	
Tap o' Noth, Aberdeenshire	SUERC-108432	Charcoal: *Corylus avellana*	Context 17009 – Hearth fill	1579±24	420–550	
Tap o' Noth, Aberdeenshire	SUERC-108431	Charcoal: *Betula* sp.	Context 17009 – Hearth fill	1543±24	430–600	

Table 8.2 (*cont.*)
Radiocarbon determinations from Tap o' Noth lower fort

platform settlements began in *cal AD 230–325* (*95% probability*), or in *cal AD 270–320* (*68% probability*) (Illus 8.4: Start: Tap o' Noth lower fort). Dated activity ended in *cal AD 570–645* (*95% probability*), or in *cal AD 585–625* (*68% probability*) (Illus 8.5: Start: Tap o' Noth lower fort). The difference between these two dates provides an estimated span of all dated activity at Tap o' Noth lower fort of *260–390 years* (*95% probability*), or *280–350 years* (*68% probability*) (Illus 8.5).

Illus 8.5
Span for activity at Tap o' Noth lower fort and house platforms

The second model with the site elements individually modelled also showed good agreement (Amodel=96.9) (Illus 8.6). The model indicates that platforms T6, T11, T12 and T15 are likely to have been in existence before activity in association with the rampart began in *cal AD 230–410* (*95% probability*), or in *cal AD 325–400* (*68% probability*) (Illus 8.6: See start and end dates at bottom of plot). Platforms T5 and T17 are likely to post-date the construction of the rampart. Despite showing some of the earliest activity on site, platform T6 also has one of the latest end dates at *cal AD 445–820* (*95% probability*), or in *cal AD 550–670* (*68% probability*) (Illus 8.6: Start: end Platform T6), similar to that of T15 in *cal AD 585–780* (*95% probability*), or in *cal AD 605–680* (*68% probability*) (Illus 8.6: Start: end Platform T15).
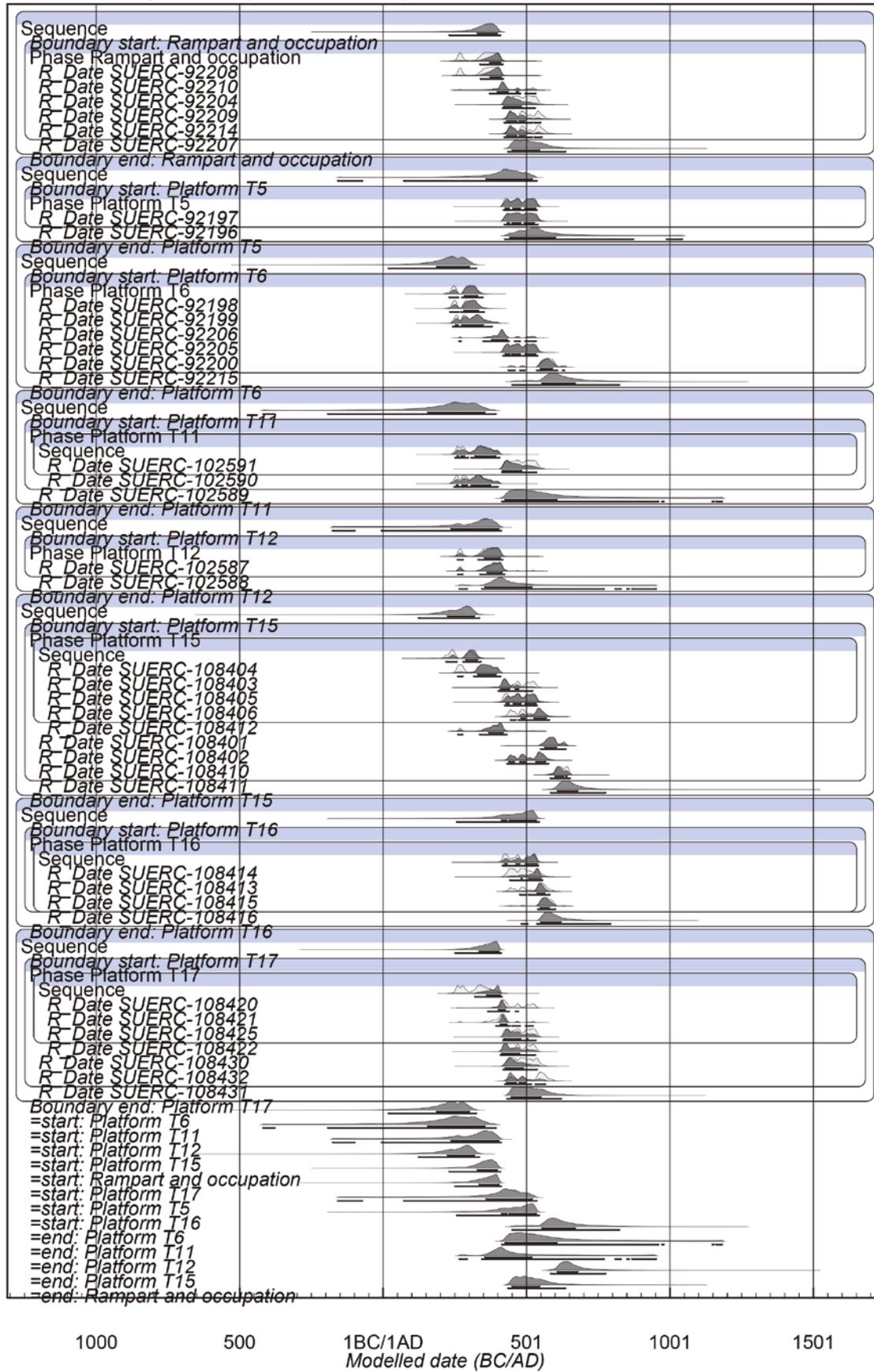
8.2.4 Craw Stane Enclosure Complex

At the Craw Stane complex 63 radiocarbon dates were available for modelling (Table 8.3). These were all charred botanicals given the relatively poor bone preservation on site. Nearly all were charred wood with short-lived species targeted for dating, though one sample of oak was selected for dating from the palisade. The botanical analysis (Niehaus and Ramsay this volume) suggests that the charcoal is likely to be predominately from hearth waste with a few exceptions and thus in many cases is likely to be from incidental incorporation into ditch fills, post holes and pits from acts of digging and reworking these features. The chances of residuality is high given the intense level of activity on this small glacial knoll and the clear indications of the recutting of major features, most notably the outer ditch. Indeed five Iron Age determinations (SUERC-66392, SUERC-66393,
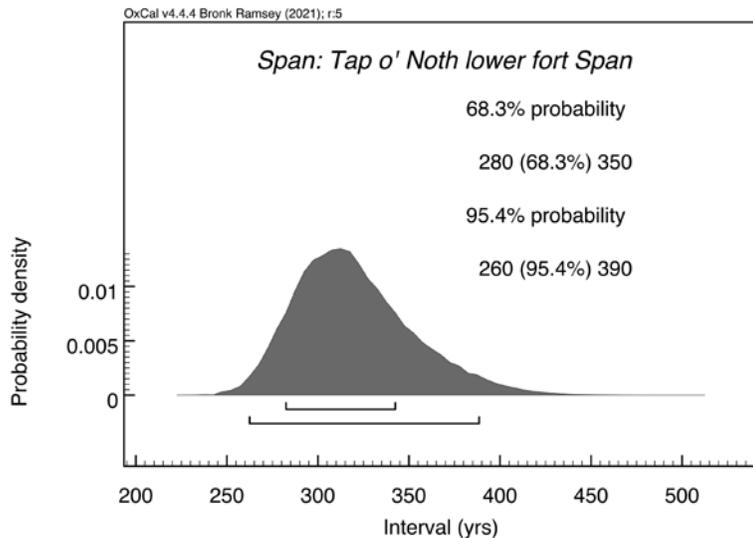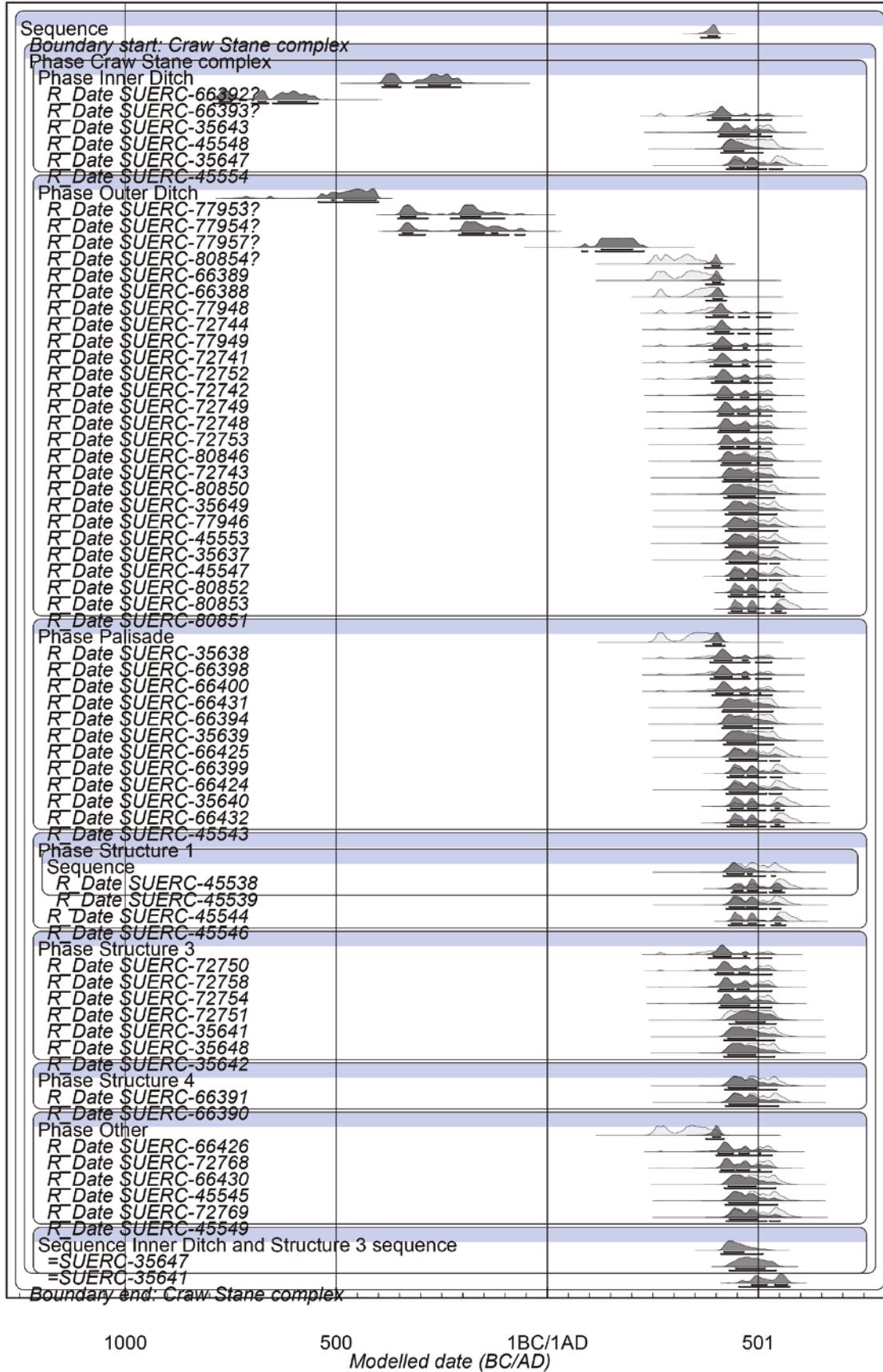
Illus 8.6
Model for individual site elements at Tap o' Noth lower fort and house platforms

Sequence
Boundary start: Craw Stane complex
Phase Craw Stane complex
Phase Inner Ditch
R_Date SUERC-66392?
R_Date SUERC-66393?
R_Date SUERC-35643
R_Date SUERC-45548
R_Date SUERC-35647
R_Date SUERC-45554
Phase Outer Ditch
R_Date SUERC-77953?
R_Date SUERC-77954?
R_Date SUERC-77957?
R_Date SUERC-80854?
R_Date SUERC-66389
R_Date SUERC-66388
R_Date SUERC-77948
R_Date SUERC-72744
R_Date SUERC-77949
R_Date SUERC-72741
R_Date SUERC-72752
R_Date SUERC-72742
R_Date SUERC-72749
R_Date SUERC-72748
R_Date SUERC-72753
R_Date SUERC-80846
R_Date SUERC-72743
R_Date SUERC-80850
R_Date SUERC-35649
R_Date SUERC-77946
R_Date SUERC-45553
R_Date SUERC-35637
R_Date SUERC-45547
R_Date SUERC-80852
R_Date SUERC-80853
R_Date SUERC-80851
Phase Palisade
R_Date SUERC-35638
R_Date SUERC-66398
R_Date SUERC-66400
R_Date SUERC-66431
R_Date SUERC-66394
R_Date SUERC-35639
R_Date SUERC-66425
R_Date SUERC-66399
R_Date SUERC-66424
R_Date SUERC-35640
R_Date SUERC-66432
R_Date SUERC-45543
Phase Structure 1
Sequence
R_Date SUERC-45538
R_Date SUERC-45539
R_Date SUERC-45544
R_Date SUERC-45546
Phase Structure 3
R_Date SUERC-72750
R_Date SUERC-72758
R_Date SUERC-72754
R_Date SUERC-72751
R_Date SUERC-35641
R_Date SUERC-35648
R_Date SUERC-35642
Phase Structure 4
R_Date SUERC-66391
R_Date SUERC-66390
Phase Other
R_Date SUERC-66426
R_Date SUERC-72768
R_Date SUERC-66430
R_Date SUERC-45545
R_Date SUERC-72769
R_Date SUERC-45549
Sequence Inner Ditch and Structure 3 sequence
=SUERC-35647
=SUERC-35641
Boundary end: Craw Stane complex

	1000	500	1BC/1AD	501

Modelled date (BC/AD)

Illus 8.7
Overall site model for Craw Stane enclosure complex and associated activity

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) AD unless otherwise stated	Stratigraphy
			Inner ditch			
Craw Stane complex	SUERC-66392	Charcoal: *Betula* sp.	Context 15301 – inner ditch basal fill of terminal	2253±29	400–200 cal BC	Likely to be residual date
Craw Stane complex	SUERC-66393	Charcoal: *Betula* sp.	Context 15301 – inner ditch basal fill of terminal	2526±29	800–540 cal BC	Likely to be residual date
Craw Stane complex	SUERC-35643	Charcoal: *Betula* sp.	Context 072 – inner ditch fill	1655±30	260–530	
Craw Stane complex	SUERC-45548	Charcoal: *Betula* sp.	Context 264 – inner ditch fill	1623±29	350–540	
Craw Stane complex	SUERC-35647	Charcoal: *Betula* sp.	Context 73 – inner ditch fill	1590±30	400–550	Structure 3 stratigraphically later than this fill
Craw Stane complex	SUERC-45554	Charcoal: *Corylus avellana*	Context 385 – inner ditch fill	1547±29	420–580	
			Outer ditch			
Craw Stane complex	SUERC-77953	Charcoal: *Betula* sp.	Context 1731 – basal fill of early recut	2400±23	730–400 cal BC	Stratigraphy shows residual
Craw Stane complex	SUERC-77954	Charcoal: *Corylus avellana*	Context 1731 – basal fill of early recut	2159±24	360–110 cal BC	Stratigraphy shows residual. Also not same age as SUERC-77953
Craw Stane complex	SUERC-77957	Charcoal: *Betula* sp.	Context 1712 – basal fill of secondary recut	2147±26	360–90 cal BC	Stratigraphy shows residual
Craw Stane complex	SUERC-80854	Charcoal: *Betula* sp.	Context 1703 – uppermost surviving fill of ditch	1883±25	60–220	Stratigraphy shows residual
Craw Stane complex	SUERC-66389	Charcoal: *Betula* sp.	Context 15191 – lower fill	1746±24	230–380	Early in stratigraphy
Craw Stane complex	SUERC-66388	Charcoal: *Corylus avellana*	Context 15191 – lower fill	1726±29	240–390	Early in stratigraphy
Craw Stane complex	SUERC-77948	Charcoal: *Corylus avellana*	Context 1714 – mid fill	1692±26	250–410	Early in stratigraphy, just above lowest fill, but could be in recut
Craw Stane complex	SUERC-72744	Charcoal: *Betula* sp.	Context 161062 – upper fill below 161003	1662±29	360–530	Late in stratigraphy but should be earlier than 161003
Craw Stane complex	SUERC-77949	Charcoal: *Betula* sp.	Context 1714 – mid fill	1654±26	330–530	Early in stratigraphy, just above lowest fill, but could be in recut
Craw Stane complex	SUERC-72741	Charcoal: *Salix* sp.	Context 161003 – Outer ditch final fill with large metalworking dump. Trench T1	1649±29	260–540	Latest in stratigraphy yet early dates – dump of earlier material?
Craw Stane complex	SUERC-72752	Charcoal: *Alnus cf glutinosa*	Context 164042 – Outer ditch lower fill with crucible stand. T4	1647±29	330–540	Mid stratigraphy, base of recut yet early dates – dump of earlier material?
Craw Stane complex	SUERC-72742	Charcoal: *Corylus avellana*	Context 161003 – Outer ditch final fill with large metalworking dump. T1	1642±29	330–540	Latest in stratigraphy yet early dates – dump of earlier material?
Craw Stane complex	SUERC-72749	Charcoal: *Betula* sp.	Context 162054 – Outer ditch upper layer with large metalworking dump including zoomorphic moulds. T2	1636±27	340–540	Mid-late stratigraphy yet early dates – dump of earlier material?
Craw Stane complex	SUERC-72748	Charcoal: *Corylus avellana*	Context 162054 – Outer ditch upper layer with large metalworking dump including zoomorphic moulds. T2	1628±27	340–540	Mid-late stratigraphy yet early dates – dump of earlier material?
Craw Stane complex	SUERC-72753	Charcoal: *Corylus avellana*	Context 164042 – Outer ditch lower fill with crucible stand. T4	1625±29	350–540	Mid stratigraphy, base of recut yet early dates – dump of earlier material?
Craw Stane complex	SUERC-80846	Charcoal: *Betula* sp.	Context 1730 – Outer ditch basal fill of primary ditch	1622±25	380–540	Early in stratigraphy in this part of ditch
Craw Stane complex	SUERC-72743	Charcoal: *Corylus avellana*	Context 161062 – Outer ditch upper layer below 161003. T1	1608±29	390–540	Late in stratigraphy but should be earlier than 161003
Craw Stane complex	SUERC-80850	Charcoal: *Corylus avellana*	Context 1730 – Outer ditch basal fill of primary ditch	1599±25	400–540	Early in stratigraphy in this part of ditch
Craw Stane complex	SUERC-35649	Charcoal: *Salix* sp.	Context 026 – Outer ditch uppermost fill	1580±30	410–550	Late in stratigraphy
Craw Stane complex	SUERC-77946	Charred Plant Remains: *Corylus* nutshell	Context 1712 – Outer ditch basal fill of secondary recut	1572±26	410–550	Mid stratigraphy
Craw Stane complex	SUERC-45553	Charcoal: *Betula* sp.	Context 229 – Outer ditch base of layer in recut	1567±29	410–560	Probably mid stratigraphy (ditch section by baulk not bottomed)
Craw Stane complex	SUERC-35637	Charcoal: *Betula* sp.	Context 025 – Outer ditch (025), directly below (026)	1565±30	410–560	Late in stratigraphy, but should be earlier than 026
Craw Stane complex	SUERC-45547	Charcoal: *Betula* sp.	Context 215 – Outer ditch upper fill 215/263 later than SUERC-45553	1559±29	420–570	Late in stratigraphy, later than 339
Craw Stane complex	SUERC-80852	Charcoal: *Corylus avellana*	Context 1726 – Pit cut through outer ditch fills with metalworking waste	1554±25	420–570	Late in stratigraphy, latest dates
Craw Stane complex	SUERC-80853	Charcoal: *Betula* sp.	Context 1707 – Outer ditch upper fill with hand-coiled pottery	1537±25	420–590	Late in stratigraphy

Table 8.3
Radiocarbon determinations from the Craw Stane complex

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) AD unless otherwise stated	Stratigraphy
Craw Stane complex	SUERC-80851	Charcoal: *Betula* sp.	Context 1726 – Pit cut through outer ditch fills with metalworking waste	1526±25	420–610	Late in stratigraphy, latest dates
Palisade						
Craw Stane complex	SUERC-35638	Charcoal: *Quercus robur.*	Context 027 – Palisade fill	1710±30	250–400	Oak date
Craw Stane complex	SUERC-66398	Charcoal: *Salix* sp.	Context 15333 – Palisade post fill	1647±29	330–540	
Craw Stane complex	SUERC-66400	Charcoal: *Betula* sp.	Context 15334 – Palisade fill	1646±29	330–540	Mixed charcoal suggests material incorporated in construction/destruction?
Craw Stane complex	SUERC-66431	Charcoal: *Betula* sp.	Context 15345 – Palisade fill	1640±29	330–540	
Craw Stane complex	SUERC-66394	Charcoal: *Betula* sp.	Context 15314 – Palisade fill	1601±29	390–540	
Craw Stane complex	SUERC-35639	Charcoal: *Corylus avellana*	Context 030 – Palisade post fill	1600±30	390–540	Mixed charcoal suggests material incorporated in construction/destruction?
Craw Stane complex	SUERC-66425	Charcoal: *Betula* sp.	Context 15333 – Palisade post fill	1585±29	400–550	
Craw Stane complex	SUERC-66399	Charcoal: *Corylus avellana*	Context 15334 – Palisade fill	1558±29	420–570	
Craw Stane complex	SUERC-66424	Charcoal: *Betula* sp.	Context 15313 – Palisade fill	1551±25	420–570	
Craw Stane complex	SUERC-35640	Charcoal: *Betula* sp.	Context 032 – Palisade post fill	1550±30	420–580	
Craw Stane complex	SUERC-66432	Charcoal: *Salix* sp.	Context 15345 – Palisade fill	1535±29	420–600	
Craw Stane complex	SUERC-45543	Charcoal: *Betula* sp.	Context 217 – Palisade post fill with animal bone and metalworking tongs	1535±29	420–600	One of latest dates – from clear example of structured deposition as part of decommissioning event
Structure 1						
Craw Stane complex	SUERC-45538	Charcoal: *Betula* sp.	Context 233 – post-hole fill	1566±29	410–560	Stratigraphically earlier than 255
Craw Stane complex	SUERC-45544	Charcoal: *Corylus avellana*	Context 244 – post-hole fill	1554±29	420–570	
Craw Stane complex	SUERC-45539	Charcoal: *Betula* sp.	Context 255 – post-hole fill	1539±27	420–590	
Craw Stane complex	SUERC-45546	Charcoal: *Corylus avellana*	Context 250 – post-hole fill	1529±25	420–600	
Structure 3						
Craw Stane complex	SUERC-72750	Charcoal: *Alnus cf glutinosa*	Context 164013 – lower arc spread	1651±29	260–540	These dates from construction?
Craw Stane complex	SUERC-72758	Charcoal: *Alnus cf glutinosa*	Context 164013 – Craw Stane structure, lower arc spread plank fragment	1635±29	340–540	
Craw Stane complex	SUERC-72754	Charcoal: *Betula* sp.	Context 164013 – lower arc spread plank fragment	1626±27	350–540	
Craw Stane complex	SUERC-72751	Charcoal: *Alnus cf glutinosa*	Context 164013 – lower arc spread	1619±29	380–540	
Craw Stane complex	SUERC-35641	Charcoal: *Corylus avellana*	Context 042 – Post-hole [12052]	1595±30	400–540	Later than inner ditch and probably outer ditch
Craw Stane complex	SUERC-35648	Charcoal: *Corylus avellana*	Context 065 – charcoal spread overlying post hole [12064]	1580±30	410–550	These 3 dates from destruction/final use?
Craw Stane complex	SUERC-35642	Charcoal: *Betula* sp.	Context 077 – charcoal spread overlying lower arc features	1580±30	410–550	
Structure 4						
Craw Stane complex	SUERC-66391	Charred seeds: *cf Hordeum vulgare*	Context 15112 – Exterior structure floor layer	1572±29	410–560	
Craw Stane complex	SUERC-66390	Charred seeds: *cf Hordeum vulgare*	Context 15112 – Exterior structure floor layer	1563±29	420–560	
Other features						
Craw Stane complex	SUERC-66426	Charcoal: *Betula* sp.	Context 15189 – Stone socket fill	1726±29	240–390	Mixed charcoal suggests material incorporated in construction/destruction?
Craw Stane complex	SUERC-72768	Charcoal: *Betula* sp.	Context 15189 – Stone socket fill	1632±27	340–540	
Craw Stane complex	SUERC-66430	Charcoal: *Corylus avellana*	Context 15189 – Stone socket fill	1620±25	380–540	
Craw Stane complex	SUERC-45545	Charcoal: *Corylus avellana*	Context 204 – Isolated post hole	1577±29	410–550	
Craw Stane complex	SUERC-72769	Charcoal: *Corylus avellana*	Context 15189 – Stone socket fill	1568±29	410–560	
Craw Stane complex	SUERC-45549	Charcoal: *Corylus avellana*	Context 265 – post-hole fill	1557±29	420–570	

Table 8.3 (*cont.*)
Radiocarbon determinations from the Craw Stane complex

SUERC-77953, SUERC-77954 and SUERC-77957) were identified from the inner and outer ditch and in case of the outer ditch the stratigraphy shows these were all residual. It is likely that the two Iron Age determinations from the inner ditch were also residual and all five determinations were modelled as outliers in the Bayesian models.

Two models were compiled to analyse the Craw Stane enclosure complex. One comprised an overall site model to provide the probability ranges for the start and end date for the complex and another to allow individual site elements to be modelled and their relative dating to be compared. Site stratigraphy was incorporated into the second model where there were clear indications of relative chronology. In both models dates were grouped by context and by site element – eg Outer ditch, Inner ditch, Palisade, Structure 1, Structure 3, Structure 4 and other features.

The overall model site model showed good agreement (Amodel=81.2), showing good correlation between the archaeological stratigraphy and modelled sequence (Illus 8.7). The model estimates that the dated first-millennium AD activity in association with the Outer ditch, Inner ditch, Palisade, Structure 1, Structure 3, Structure 4 and other features began in *cal AD 360–410 (95% probability)*, or in *cal AD 380–405 (68% probability)* (Illus 8.7: Start: Craw Stane complex). Dated activity ended in *cal AD 455–575 (95% probability)*, or in *cal AD 485–570 (68% probability)* (Illus 8.5: Start: Craw Stane complex). The difference between these two dates provides an estimated span of all dated early medieval activity at the Craw Stane complex of *50–205 years (95% probability)*, or *85–190 years (68% probability)* (Illus 8.8).

The second model with the site elements individually modelled also showed good agreement (Amodel=81) (Illus 8.9). Given that the charred samples from individual features are in the most part from incidental inclusion from hearth waste etc, we cannot put too much weight on the relative dating of features. However, the start date for activity associated with Structures 1 (*cal AD 345–570 (95% probability)* or in *cal AD 435–560 (68% probability)*; Illus 8.9: Boundary start: Structure 1), and Structure 3 (*cal AD 375–530 (95% probability)*) or in *cal AD 400–525 (68% probability)*; Illus 8.9:

Boundary start: Structure 1) are relatively late in the sequence which accords with observations from the stratigraphy and supports the notion that the structures evident are those from towards the final use of the enclosure complex. The start dates for the inner ditch (*cal AD 250–520 (95% probability)*, or in *cal AD 370–470 (68% probability)*) and outer ditch (*cal AD 320–410 (95% probability)*, or in *cal AD 360–405 (68% probability)*) are early in the overall sequence, as is the palisade (*cal AD 300–470 (95% probability)*, or in *cal AD 365–415 (68% probability)*) (Illus 8.9; See start and end dates at base of plot). The latest end dates out of all of those for the individual site elements are that of Structure 1 (*cal AD 445–700 (95% probability)*, or in *cal AD 540–605 (68% probability)*) and Structure 4 (*cal AD 435–1075 (95% probability)*, or in *cal AD 450–630 (68% probability)*), albeit there are only two determinations available from Structure 4. The end date of activity associated with the palisade (*cal AD 445–610 (95% probability)*, or in *cal AD 490–585 (68% probability)*) is also later than that of the inner ditch (*cal AD 420–675 (95% probability)*, or in *cal AD 440–545 (68% probability)*) and outer ditch (*cal AD 445–585 (95% probability)*, or in *cal AD 460–570 (68% probability)*), providing tentative support for the ditched elements of the complex being earlier than the palisade (Illus 8.9).
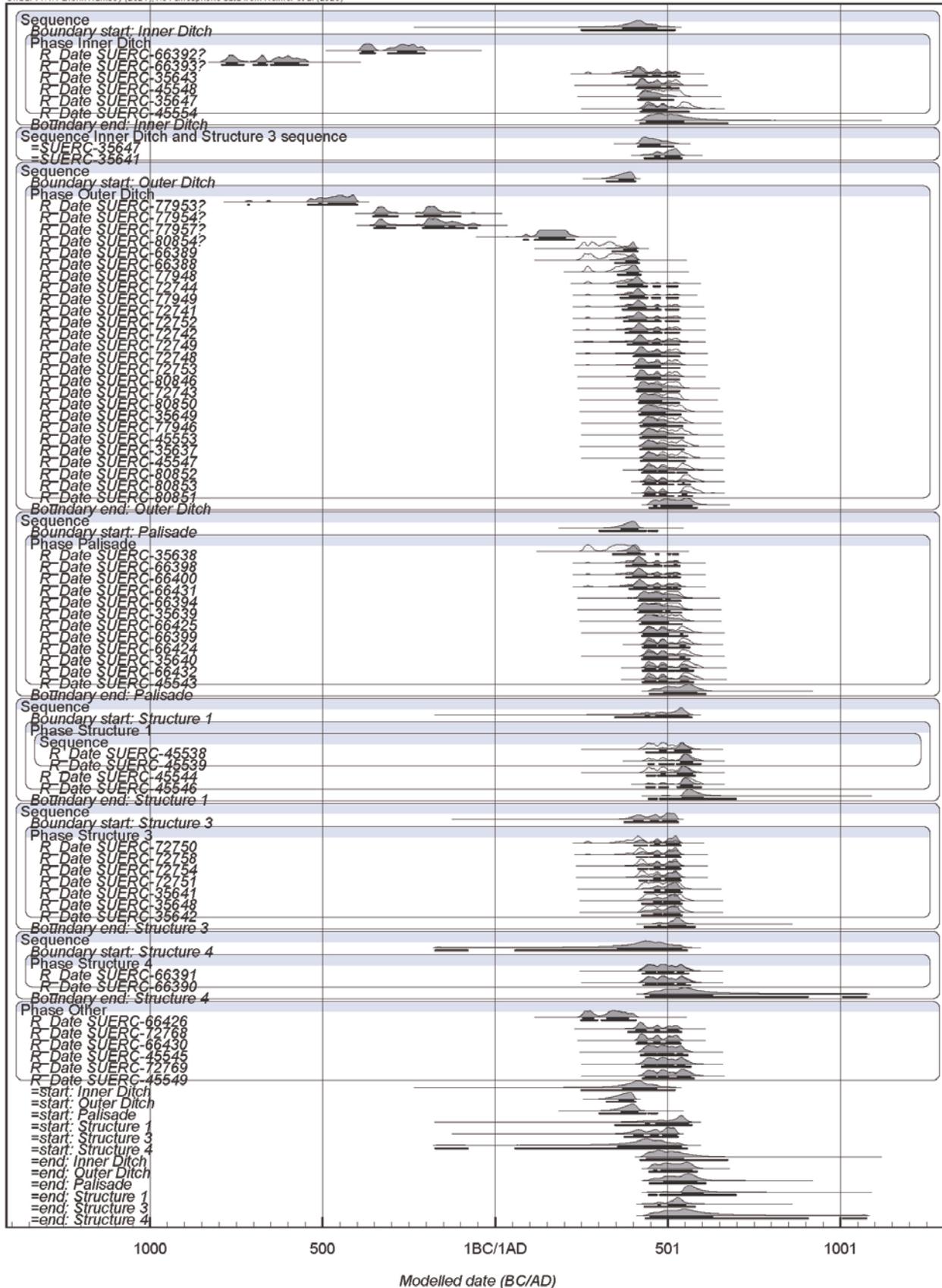
8.2.5 Cairn More

At Cairn More 17 radiocarbon determinations were available for modelling including two determinations from Murray Cook's work at the site (Table 8.4). These were all on short-lived species of charred wood. The overall model (Illus 8.10) showed good agreement (Amodel=94.1), correlating well between the archaeological stratigraphy and modelled sequence. The model estimates that all of the dated activity in association with Cairn More began in *cal AD 405–545 (95% probability)*, or in *cal AD 450–535 (68%*
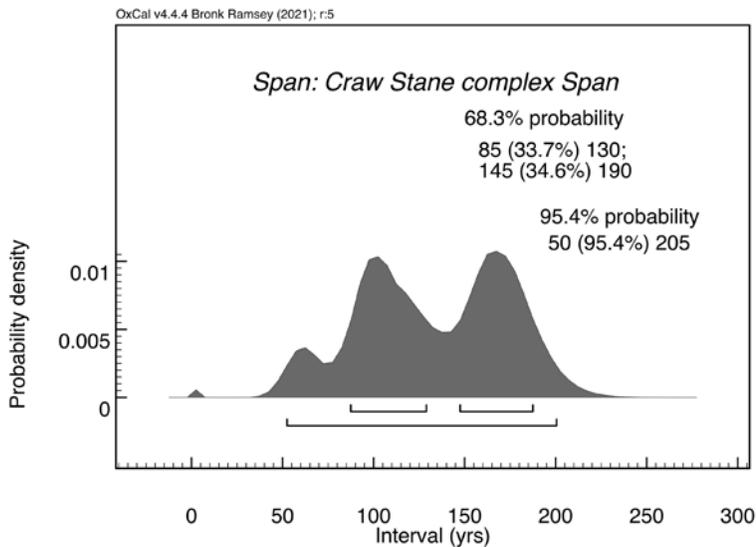
Illus 8.8
Span for activity at the Craw Stane enclosure complex
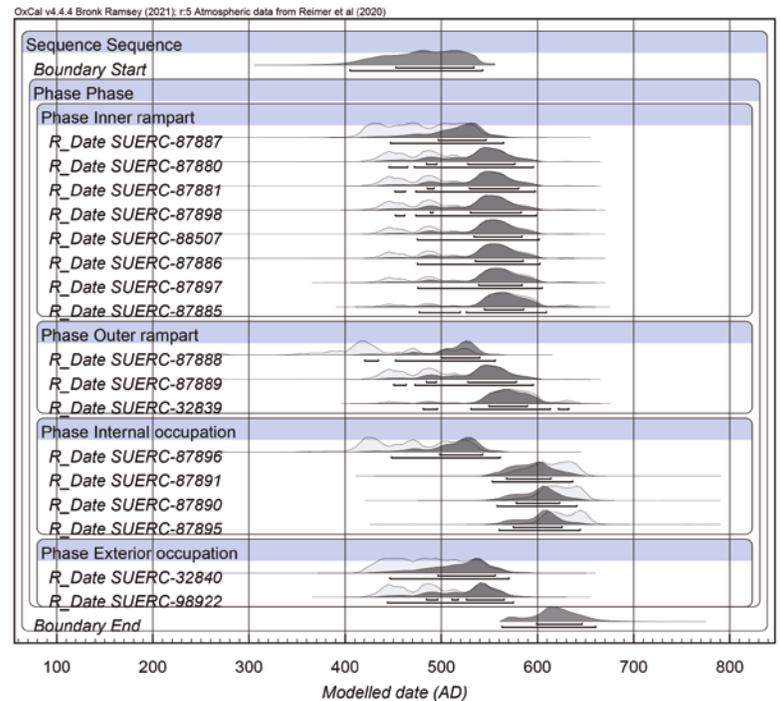
Illus 8.10
Overall site model for the Cairn More enclosure and associated activity

OxCal v4.4.4 Bronk Ramsey (2021); r:5 Atmospheric data from Reimer et al (2020)

Sequence
Boundary start: Inner Ditch
Phase Inner Ditch
R_Date SUERC-66392?
R_Date SUERC-66393?
R_Date SUERC-35643
R_Date SUERC-45548
R_Date SUERC-35647
R_Date SUERC-45554
Boundary end: Inner Ditch
Sequence Inner Ditch and Structure 3 sequence
=SUERC-35647
=SUERC-35641
Sequence
Boundary start: Outer Ditch
Phase Outer Ditch
R_Date SUERC-77953?
R_Date SUERC-77954?
R_Date SUERC-77957?
R_Date SUERC-80854?
R_Date SUERC-66389
R_Date SUERC-66388
R_Date SUERC-77948
R_Date SUERC-72744
R_Date SUERC-77949
R_Date SUERC-72741
R_Date SUERC-72752
R_Date SUERC-72745
R_Date SUERC-72749
R_Date SUERC-72748
R_Date SUERC-72753
R_Date SUERC-80846
R_Date SUERC-72743
R_Date SUERC-80850
R_Date SUERC-35649
R_Date SUERC-77946
R_Date SUERC-45553
R_Date SUERC-35637
R_Date SUERC-45547
R_Date SUERC-80852
R_Date SUERC-80853
R_Date SUERC-80851
Boundary end: Outer Ditch
Sequence
Boundary start: Palisade
Phase Palisade
R_Date SUERC-35638
R_Date SUERC-66398
R_Date SUERC-66400
R_Date SUERC-66431
R_Date SUERC-66394
R_Date SUERC-35639
R_Date SUERC-66395
R_Date SUERC-66399
R_Date SUERC-66424
R_Date SUERC-35640
R_Date SUERC-66432
R_Date SUERC-45543
Boundary end: Palisade
Sequence
Boundary start: Structure 1
Phase Structure 1
Sequence
R_Date SUERC-45538
R_Date SUERC-45539
R_Date SUERC-45544
R_Date SUERC-45546
Boundary end: Structure 1
Sequence
Boundary start: Structure 3
Phase Structure 3
R_Date SUERC-72750
R_Date SUERC-72758
R_Date SUERC-72754
R_Date SUERC-72751
R_Date SUERC-35641
R_Date SUERC-35648
R_Date SUERC-35642
Boundary end: Structure 3
Sequence
Boundary start: Structure 4
Phase Structure 4
R_Date SUERC-66391
R_Date SUERC-66390
Boundary end: Structure 4
Phase Other
R_Date SUERC-66426
R_Date SUERC-72768
R_Date SUERC-66430
R_Date SUERC-45545
R_Date SUERC-72769
R_Date SUERC-45549
=start: Inner Ditch
=start: Outer Ditch
=start: Palisade
=start: Structure 1
=start: Structure 3
=start: Structure 4
=end: Inner Ditch
=end: Outer Ditch
=end: Palisade
=end: Structure 1
=end: Structure 3
=end: Structure 4

1000   500   1BC/1AD   501   1001

Modelled date (BC/AD)

Illus 8.9
Model for individual site elements at the Craw Stane enclosure complex

Site	Lab No	Material	Context	Radiocarbon Age (BP)	Calibrated date (95% confidence) cal AD	Stratigraphy
			Inner rampart			
Cairn More	SUERC-87887	Charcoal: Betula sp.	Context 5007 – pit/post-hole [5010] underlying inner rampart	1604±30	390–540	
Cairn More	SUERC-87880	Charcoal: Alnus sp.	Context 5004 – occupation spread sealed by inner rampart	1550±30	420–580	
Cairn More	SUERC-87881	Charcoal: Betula sp.	Context 5004 – occupation spread sealed by inner rampart	1546±30	420–580	
Cairn More	SUERC-87898	Charcoal: Betula sp.	Context 5002 – rampart collapse	1544±30	420–580	
Cairn More	SUERC-88507	Charcoal: Corylus avellana	Context 5007 – pit/post hole [5010] underlying inner rampart	1538±30	420–590	
Cairn More	SUERC-87886	Charcoal: Betula sp.	Context 5006 – spread sealed by inner rampart	1536±30	420–590	
Cairn More	SUERC-87897	Charcoal: Salix sp.	Context 5002 – rampart collapse	1530±30	420–600	
Cairn More	SUERC-87885	Charcoal: Salix sp.	Context 5006 – spread sealed by inner rampart	1519±30	420–610	
			Outer rampart			
Cairn More	SUERC-87888	Charcoal: Betula sp.	Context 6003 – spread sealed by outer rampart	1642±30	330–540	
Cairn More	SUERC-87889	Charcoal: Alnus sp.	Context 6003 – spread sealed by outer rampart	1549±30	420–580	
Cairn More	SUERC-32839	Charcoal: unidentified	Murray Cook – under outer rampart	1510±30	430–630	
			Internal occupation			
Cairn More	SUERC-87896	Charcoal: Alnus sp.	Context 7006 – lower hearth deposit	1621±30	350–540	
Cairn More	SUERC-87891	Charcoal: Salix sp.	Context 7003 – hearth deposit	1456±30	550–650	
Cairn More	SUERC-87890	Charcoal: Corylus avellana	Context 7003 – hearth deposit	1433±30	570–660	
Cairn More	SUERC-87895	Charcoal: Corylus avellana	Context 7006 – lower hearth deposit	1419±30	580–670	
			Exterior			
Cairn More	SUERC-32840	Charcoal: unidentified	Murray Cook – exterior activity? (described as foundation cut for outermost rampart). External settlement?	1580±30	410–550	
Cairn More	SUERC- 98922	Charcoal: unidentified	17001 House floor – exterior house	1562±24	430–570	

Table 8.4
Radiocarbon determinations from Cairn More
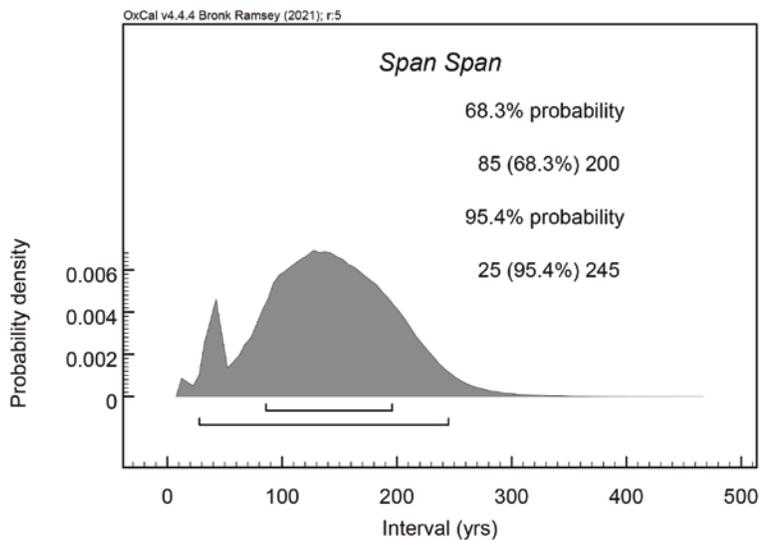
Illus 8.11
Span for activity at the Cairn More enclosures

probability) (Illus 8.10: Boundary Start). Dated activity ended in *cal AD 560–660* (*95% probability*), or in *cal AD 595–650* (*68% probability*) (Illus 8.10: Boundary End). The difference between these two dates provides an estimated span of all dated activity of *25–245 years* (*95% probability*), or *85–200 years* (*68% probability*) (Illus 8.11).

8.2.6 The sites compared

A model to compare the start and end dates of Tap o' Noth lower fort, the Craw Stane complex and Cairn More was also compiled (Illus 8.12). This provides a sequence for the three sites with Tap o' Noth being the earliest of the three followed by the Craw Stane complex and finally by Cairn More. The sequence at Cairn More goes the latest into the first half of the 7th century AD, whereas the Craw Stane complex appears to have ended in the 6th century AD, with the Tap o' Noth sequence likely to have ended between the two other sites around the turn of the 7th century AD.
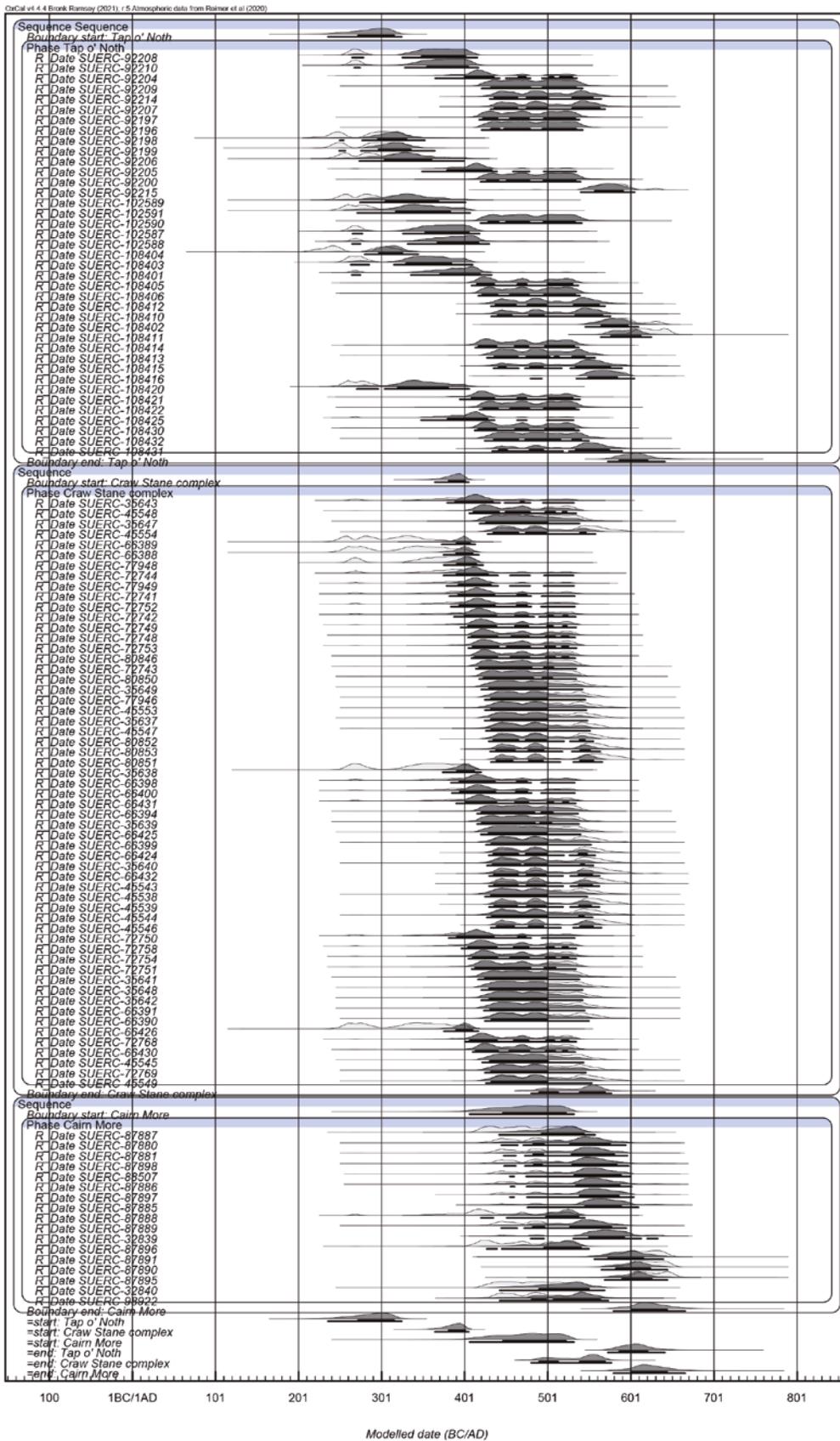
Illus 8.12
A comparison of the start and end dates of Tap o' Noth lower fort, the Craw Stane complex and Cairn More

8.3 The charred assemblages

SESILIA NIEHAUS AND SUSAN RAMSAY

8.3.1 Introduction

The recovery of charred wood and plant remains from archaeological contexts often serves the primary purpose of collecting material for radiocarbon dating, but further analysis of these assemblages can reveal valuable information on human–environment interactions. Depending on the types of charred remains present, questions of the plant component of diet, cultivation practices, and firewood and construction wood use can be explored through the identification of archaeobotanical material. This chapter section presents and discusses the results of archaeobotanical analyses of charred material from the Craw Stane complex, Cairn More and Tap o' Noth, all located in the Upper Strathbogie valley. Extensive environmental sampling was undertaken at the three sites, resulting in excellent spatial coverage and an abundance of charred material for analysis.

8.3.2 General methods

Botanical identifications were carried out by Susan Ramsay (2018c; 2019b; 2019c; 2019d), with the exception of the Cairn More 2020 material, which was analysed by Sesilia Niehaus (2021) (see below for methodology used at Cairn More). All samples were processed by bucket flotation using standard methodology for the recovery of carbonised remains. Flots and retents were examined using a binocular microscope at variable magnifications of x4–x45 and an estimation of the total volume of carbonised material greater than 4mm was made. For each sample, all of the charcoal larger than 4mm in size was identified unless this proved to be too large an amount, in which case a known percentage of the total charcoal was identified. All carbonised seeds were also identified and any other botanical remains were noted. The internal anatomical features of all charcoal fragments were further identified at x200 magnification using the reflected light of a metallurgical microscope. Reference was made to Schweingruber (1990) and Cappers et al (2006) to aid identifications. Vascular plant nomenclature follows Stace (1997) except for cereals, which conform to the genetic classification of Zohary and Hopf (2000).

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8.3.3 Cairn More 2020 assemblage methods

Air-dried flots and retents of 32 bulk soil samples were sent to the University of Sheffield, where they underwent analysis as part of a MSc dissertation project (Niehaus 2021). Each sample was split into four size fractions using a stacked sieve with mesh sizes of 0.3mm, 1mm, 2mm and 4mm. The complete >1mm material and 1/8 of the >0.3mm material were subsequently analysed for the presence of charred non-wood macrobotanical remains. The decision to target only 1/8 of the smallest fraction was based on the high volume of fine material, and the number of botanical remains recovered from this fraction was multiplied by eight. Plant macroremains were identified based on external morphology using a low-power stereo microscope at magnifications up to x64. Cappers et al (2006) and Stace (2019) were consulted to aid identification, and the broad botanical reference collection at the University of Sheffield was utilised where necessary.

Fourteen samples were selected for the charcoal analysis based on sample richness, as time constraints for the completion of the dissertation did not allow for the analysis of the entire assemblage. A total of 50 charcoal fragments per sample were identified from the >2mm and >4mm fractions. While larger sample sizes are generally recommended (Kabucku and Chabal 2021), the decision to target 50 fragments was justified by maximising spatial coverage of the site by analysing a smaller amount of material from a wider range of contexts.

Feature	Information	Recorded as
Growth rings	Age and diameter	Number of rings
Pith and bark	Age and diameter	Present/absent
Ring curvature	Age and diameter	Weak/moderate/strong
Radial cracks	Temperature and dampness	Present/absent
Tyloses	Heartwood	Present/absent
Vitrification	Combustion process	Absent/low/moderate/severe
Fungal hyphae	Deadwood, dampness	Present/absent
Insect damage	Deadwood	Present/absent

Table 8.5
Summary of recorded botanical information

Context		264	385	15301
Sample		212	231	15025
Description		Fill of inner ditch [203]	Lower fill of inner ditch [203]	Inner ditch terminal
Volume of charcoal >4mm			25ml	5ml	<2.5ml
% charcoal >4mm ID			100%	100%	100%
Charcoal					-
Betula spp	birch	67 (4.03g)	1 (0.04g)	7 (0.05g)
Corylus cf avellana	hazel	11 (0.79g)	3 (0.40g)	-
Quercus spp	oak	2 (0.08g)	-	-
Salix spp	willow	-	-	-
Indet charcoal	indet charcoal	-	-	1 (0.01g)

Table 8.6
Botanical remains from the Craw Stane complex inner ditch contexts

Context		263	263	314	339	15191	161003	161062	162054	164042	1703	1707	1712	1714	1726	1730	1731
Sample		214	215	225	229	15007	161004	161013	162019	164019	1702	1701	1715	1703	1711	1716	1713
Description		Upper fill of outer ditch [262]	Upper fill of outer ditch [262]	Fill of large pit [256]	Basal fill of outer ditch [262]	Lower fill of outer ditch	Upper fill of outer ditch [15004]	Fill of outer ditch [15004]	Fill of outer ditch [15004]	Fill of outer ditch [15004]	Fill of ditch recut [1734]	Fill of ditch recut [1734]	Fill of ditch recut [1735]	Fill of ditch [15004]	Fill of pit [1725] in ditch [15004]	Fill of ditch [15004]	Fill of ditch recut [1732]
Vol of charcoal >4mm		5ml	10ml	100ml	30ml	10ml	60ml	250ml	500ml	200ml	2.5ml	<2.5ml	<2.5ml	10ml	10ml	5ml	5ml
% charcoal >4mm ID		100%	100%	50%	100%	100%	50%	50%	20%	50%	100%	100%	100%	100%	100%	100%	100%
Charcoal																	
Alnus cf glutinosa	alder	-	-	-	-	4 (0.09g)	-	7 (0.46g)	-	41 (8.94g)	-	-	-	-	-	-	-
Betula spp	birch	23 (1.44g)	12 (1.25g)	99 (11.29g)	52 (7.36g)	33 (0.82g)	22 (1.26g)	116 (8.42g)	183 (19.20g)	30 (4.67g)	6 (0.12g)	1 (0.04g)	1 (0.02g)	29 (1.20g)	50 (1.82g)	8 (0.33g)	15 (0.81g)
Corylus cf avellana	hazel	2 (0.25g)	5 (0.47g)	3 (0.27g)	-	8 (0.20g)	40 (2.60g)	56 (3.56g)	8 (0.42g)	40 (3.65g)	1 (0.02g)	-	-	17 (0.61g)	1 (0.04g)	1 (0.05g)	3 (0.08g)
Ericales	heather type	-	-	-	-	-	-	-	-	-	-	-	1 (0.01g)	-	-	-	-
Quercus spp	oak	-	-	2 (0.47g)	-	-	4 (0.22g)	28 (1.54g)	12 (1.00g)	-	-	-	-	-	-	3 (0.10g)	-
Salix spp	willow	-	1 (0.05g)	3 (0.50g)	-	-	10 (0.69g)	9 (0.33g)	5 (0.24g)	6 (0.57g)	-	-	-	-	-	-	-
Cereals																	
Hordeum vulgare sl	barley	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
Cereal indet	cereal indet	-	-	-	-	-	-	-	-	-	-	-	1	15	-	-	-
Carb seeds																	
Corylus cf avellana	hazel nutshell	-	-	-	-	-	-	4 (0.19g)	-	-	-	-	1 (0.01g)	8 (0.19g)	1 (<0.01g)	-	-
Misc																	
Bone	bone	-	-	-	-	-	-	7 (1.04g)	9 (2.36g)	-	-						
Fucoid seaweed	seaweed	-	-	-	-	-	-	-	-	-	-	-	-	-	1 (0.03g)	-	-

Table 8.7
Botanical remains from the Craw Stane complex outer ditch contexts

Context		237	288	353	15007	15311	15313	15314	15333	15334	15345	15346
Sample		217	226	233	15034	15028	51030	15031	15042	15043	15048	15049
Description		Fill of palisade post hole [236]	Palisade slot 1	Palisade slot 4	Upper fill of palisade slot – destruc-tion level	Fill of post shadows in palisade fill below 15007	Fill of post shadows in palisade fill below 15007	Fill of post shadows in palisade fill below 15007	Interior post hole – post-pipe fill	Fill of post shadows in palisade fill below 15007	Fill of post shadows in palisade fill below 15007	Fill of post shadows in palisade fill below 15007
Volume of charcoal >4mm			60ml	100ml	20ml	40ml	10ml	5ml	15ml	10ml	5ml	15ml	10ml
% charcoal >4mm ID			50%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal													
Betula	birch	31 (6.84g)	18 (2.25g)	29 (1.80g)	21 (1.83g)	17 (1.02g)	9 (0.14g)	17 (0.53g)	23 (1.51g)	20 (0.88g)	22 (1.29g)	39 (1.94g)
Corylus	hazel	2 (0.22g)	4 (0.18g)	2 (0.10g)	1 (0.012g)	-	-	-	7 (0.35g)	1 (0.05g)	1 (0.01g)	1 (0.02g)
Prunoideae	cherry type	-			-	-	-	-	-	-	1 (0.02g)	-
Quercus	oak	-	84 (6.93g)	21 (1.00g)	83 (5.89g)	-	23 (0.39g)	83 (2.10g)	-	9 (0.10g)	18 (1.07g)	-
Salix	willow	1 (0.51g)	3 (0.80g)	1 (0.59g)	-	-	-	-	1 (0.15g)	-	1 (0.12g)	7 (0.39g)
Carbonised seeds etc													
Corylus avellana nutshell	hazel nutshell	-	2 (0.01g)	2 (0.02g)	-	-	-	-	-	-	1 (0.01g)	-

Table 8.8
Botanical remains from the Craw Stane complex palisade and post-hole contexts

Charcoal fragments were prepared by sectioning along trans-verse, radial, and tangential planes, and identified using a MEIJI high–power dark field microscope at magnifications up to x500. Identification manuals by Schweingruber (1990) and Hather (2000), as well as the wood and reference collection at the University of Sheffield, were consulted to ensure the accuracy of identifications. In addition to taxonomic identification, a range of additional information was recorded in order to collect data for a more nuanced discussion of the assemblage (Table 8.5).

8.3.4 Results: Craw Stane complex

The complete botanical results for the Craw Stane complex are shown in Tables 8.6–8.10.

INNER DITCH
The upper fill (385) of the inner ditch [203] produced only small amounts of hazel and birch charcoal, whilst the lower fill (264) contained larger amounts of birch charcoal, with smaller quanti-ties of hazel and oak also present. The fill of the inner ditch

Area		Interior features		Structure 1				Structure 4
Context		249	266	7 (=233)	244	250	255	15112
Sample		204	216	202	230	203	209	15013
Description		Fill of double post hole [248]	Fill of post hole [265]	Fill of post hole [232]	Packing from post hole [213]	Fill of post hole [213] post-pipe	Fill of post hole [232] post-pipe	Fill of spread 15111
Volume of charcoal >4mm		40ml	10ml	10ml	5ml	2.5ml	5ml	400ml
% charcoal >4mm ID		100%	100%	100%	100%	100%	100%	100%
Charcoal								
Betula spp	birch	11 (1.04g)	9 (0.48g)	51 (3.78g)	1 (0.02g)	-	7 (0.33g)	-
Corylus cf avellana	hazel	2 (1.05g)	16 (0.75g)	14 (0.58g)	4 (0.15g)	3 (0.29g)	4 (0.08g)	2 (0.37g)
Quercus spp	oak	1 (0.08g)	17 (1.29g)	1 (0.03g)	7 (0.58g)	2 (0.10g)	-	212 (141.37g)
Salix spp	willow	6 (5.74g)	-	5 (0.21g)	-	-	1 (0.02g)	-
Carbonised cereals								
Hordeum vulgare var vulgare	six-row hulled barley	-	-	-	1	-	-	2
Hordeum vulgare sl	six-row barley	-	-	-	1	-	-	14
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	7
Cereal indet	cereal indet	-	-	-	-	-	-	5
Carbonised seeds etc								
Corylus avellana nutshell	hazel nutshell	-	-	-	-	-	1 (0.05g)	-

Table 8.9
Botanical remains from the Craw Stane complex interior features, Structure 1 and Structure 4

Area		Structure 3			Stone socket found next to Craw Stane				
Context		164013	164013	164013	15022	15022	15189	15189	15195
Sample		164003	164005	164020	15027	15033	15044	15045	15014
Description		Fill of post hole [164012]	Fill of post hole [164012]	Fill of post hole [164012]	Upper fill of stone socket [15359]	Upper fill of stone socket [15359]	Basal fill of stone socket [15359]	Basal fill of stone socket [15359]	Mid fill of pit [15359]
Volume of charcoal >4mm		c 1500ml	c 600ml	30ml	10ml	30ml	10ml	2.5ml	5ml
% charcoal >4mm ID		100%	100%	100%	100%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	-	2 plank sections	32 (5.85g)	-	-	-	-	-
Betula spp	birch	-	-	3 (0.04g)	21 (1.42g)	2 (9.13g)	3 (0.19g)	6 (0.11g)	14 (0.31g)
Corylus cf avellana	hazel	-	-	-	13 (0.53g)	-	7 (0.90g)	6 (0.17g)	3 (0.05g)
Quercus spp	oak	Large plank section	-	1 (0.01g)	-	-	-	-	-
Salix spp	willow	-	-	-	-	-	1 (0.04g)	-	-
Indet charcoal	indet charcoal	-	-		-	-	-	-	14 (0.56g)
Carbonised seeds etc									
Corylus avellana nutshell	hazel nutshell	-	-	-	-	3 (0.07g)	-	-	-
Misc									
Fucoid seaweed	seaweed	-	-	-	241 (1.25g)	-	3 (<0.01g)	7 (0.03g)	-

Table 8.10
Botanical remains from the Craw Stane complex Structure 3 and stone socket contexts

terminal (15025) produced only small traces of birch charcoal. There is little indication that this material derives from any structural remains and most likely represents the remains of hearth or midden waste dumped into the ditch.

OUTER DITCH
The fills of the outer ditch were dominated by birch charcoal (67% of the total charcoal from this feature), with smaller amounts of hazel, alder, oak and willow also present. A few of the ditch fills also contained traces of hazel nutshell, carbonised barley, bone and a fragment of carbonised seaweed. Birch is not usually associated with structural remains and, combined with the other botanical finds, it is more likely that these assemblages are the remains of hearth or midden waste that have either been dumped into the ditch or have trickled down into the ditch fills from general occupation scatter across the site.

PALISADE DITCH AND POST HOLES
The contexts denoted as post shadow fills contained mixed carbonised assemblages that tended to be dominated by birch and oak charcoal, but with hazel, willow and cherry type also present. The palisade slot fills also produced mixed assemblages but, in these cases, oak tended to be a more prominent part of the assemblage than was seen in the post–hole shadow fills. Overall, birch makes up almost 50% of the palisade contexts, with oak being over 40% of the total charcoal found. Traces of hazel nutshell were found in a few of the palisade contexts.

The carbonised assemblages from many of the palisade contexts are very similar to those from the outer ditch fills and so may have had a similar origin, ie hearth or midden waste. There are no indications from any of the palisade post holes that there are significant remains of posts burnt in situ. However, oak charcoal does comprise a more substantial percentage of the charcoal in the palisade contexts than was noted in the ditch contexts, particularly those identified as upper fills of the palisade slots. This might imply that there is a structural component to at least some of these carbonised assemblages but that this was 'above ground' timber that was burnt and then became mixed with more general domestic hearth or midden waste rather than posts burnt in situ.

INTERIOR SETTLEMENT
Within the interior of the enclosure were a series of features representing plank settings and a post hole, although their relationships were complicated. Feature [248] was a double-post setting that appeared to have had the posts removed or dug out. The fill (249) of this post setting contained a carbonised assemblage dominated by willow charcoal, with lesser amounts of birch, hazel and oak. Although this assemblage could also be just midden or hearth waste, the preponderance of willow might suggest that there is a structural component within this assemblage that originated from a burnt wattlework structure or panel. A short distance to the north–east was feature [265], which was a post hole with evidence for possible burning in situ. Although the carbonised assemblage from the fill (266) was dominated by oak, which may be the remains of the original post, hazel and birch charcoal were also present. This suggests that some other hearth or midden material had become incorporated into this fill along with the burnt remnants of the post.

STRUCTURE 1

Within Structure 1, one of the larger post holes [213] was exca-vated and revealed a clear post-pipe fill (250) and packing material (244). The post-pipe fill (250) contained only small amounts of hazel and oak charcoal, whilst the packing was similar but with the addition of a trace of birch charcoal. This does not appear to be the remains of a post burnt in situ but rather evidence for midden or hearth waste, particularly because two carbonised grains of barley were also recovered from the packing material. Post-hole [232] on the opposite side of the building contained fill (233) and post-pipe fill (255), both of which produced mixed char-coal assemblages of birch, hazel, willow and oak, with a single fragment of hazel nutshell. This assemblage appears to represent hearth or midden waste that was either deliberately dumped into the post hole or incorporated into the fill over time.

STRUCTURE 3

To the south-west of the Craw Stane was a shallow curving ditch and an arrangement of post holes that may be the remains of a further structure. Only the fill (164013) of the inner post hole or arc of burnt material [164012] was examined for the presence of carbonised botanical remains. The fill produced three carbonised plank sections as well as other charcoal fragments. Sample <164005> contained two plank sections measuring 12 x 10 x 2cm and 17 x 10 x 2–2.5cm, which were both identifiable as alder and had 20–30 visible rings but no obvious sapwood. Sample <164003> contained a single section of plank measuring 28 x 18 x 3–4cm, which was identified as oak. At least 30 rings were vis-ible, but the plank appears to have been cut from a much larger tree. Sample <164020> came from a mixed deposit that contained a large quantity of alder charcoal, perhaps from another alder plank, together with traces of birch and oak. During excavation, cleaning revealed that [164012] appeared to be the spread from collapsed debris from a burnt structure overlying a series of post holes, presumably from the burnt structure. It appears that this structure was built using planks, rather than wattle, for the walls but that both alder and oak planks were used.

STRUCTURE 4

Just outside the palisaded enclosure on the east was a sub-circular feature (15111) with a shallow bowl-shaped profile. Large burnt timbers were identified on the east side of the fill (15112) and analysis of the carbonised assemblage from this fill identified large quantities of oak, but this was very fragmented and it was impos-sible to give any estimate of size for the original timber. In addition, small amounts of hazel charcoal were also present together with 28 cereal grains. The identifiable cereals were all barley, including a few grains that were further identifiable as the hulled variety. Feature (15111) may be the floor layers of a sunken building or other structure. The carbonised assemblage does suggest an oak structure that may have been destroyed by fire. The presence of carbonised cereal grains also indicates either food preparation or storage of grain.

STONE SOCKET

Feature [15359] had a collection of stones (15888) arranged tightly in a ring at its base, making it likely that these stones were packing for a standing stone. Beneath the fill (15189), and underneath the area of stone packing, a cattle jaw and other animal bone were identified lying at the very base of the pit on its southern side. The carbonised assemblages from the basal fill (15189) of the stone socket comprised birch, hazel and willow charcoal, together with traces of carbonised seaweed. A second, later cut [15362] was iden-tified cutting into (15189), containing two fills (15195) and (15022), which may represent disturbance of the standing-stone socket, possibly during its extraction. The upper fill (15022) produced only birch and hazel charcoal, a few fragments of hazel nutshell, together with numerous fragments of carbonised seaweed. Fill (15195) produced only birch and hazel charcoal. The charcoal and hazel nutshell are consistent with collection of resources from the local environment, but the seaweed is difficult to interpret. The presence of this burnt seaweed in the fill of the stone socket is very unusual and this material had been transported some considerable distance from the coast.

8.3.5 Results: Cairn More

The complete botanical results for Cairn More are shown in Tables 8.11–8.15.

RAMPARTS AND PRE-HILLFORT ACTIVITY

An old ground surface (5003) lay under the core of the inner ram-part wall [5005] and extended westwards into the interior of the enclosure. It produced a charcoal assemblage dominated by birch, with small amounts of willow and alder also present, probably indicating scattered hearth waste on the original surface. The original ground surface (5003) overlay fill (5007) of a shallow pit or ditch terminal [5010]. Fill (5007) produced charcoal of birch, hazel and willow, again suggesting the remains of hearth waste, possibly deliberately dumped into the pit as infill.

Deposit (5006) also lay under the core of wall [5005] and beneath (5003) on the south side of the trench. It produced a very diverse charcoal assemblage of birch, alder, hazel, oak and willow, again consistent with scattered hearth waste. Underlying (5006) was a layer of redeposited natural (5008) which produced a large amount of birch charcoal with only traces of hazel charcoal. This may be hearth waste but could also be evidence of clearing of vegetation from the original ground surface.

A charcoal-rich deposit (6003) was located directly under-neath the main core of the outer rampart wall. It produced an assemblage dominated by birch, but with smaller amounts of alder, hazel, oak and willow also present. This deposit is consist-ent with hearth scatter and very similar to that identified from (5006), beneath the wall core of the inner rampart.

A potential wattle floor or fence panel (16004) underlying the outer rampart was likely to be related to earlier, pre-ringfort occupation. The 4mm fraction consisted nearly entirely of small hazel roundwood, with the three fragments with both bark and pith present measuring 2.04, 2.55 and 3.12cm in diameter (6, 8 and 7 growth rings respectively). These are best interpreted as young trees or medium-sized branches, and the complete lack of fungal hyphae or insect damage supports the harvesting of fresh wood for the wattle panel. The remaining roundwood fragments ranged between 1–11 rings, with an average of 6.35. Traces of birch, willow/poplar and hazel were present in the 2mm fraction, likely representing small amounts of intrusive hearth waste.

Trench		Trench 5				Trench 6	Trench 7				Trench 9			
Context		5003	5006	5007	5008	6003	7003	7006	7119	7120	9004	9009	9011	9013
Sample		5002	5004	5006	5007	601	701	702	733	734	901	902	903	-
Description		OGS under wall [5005] of fort	Deposit under inner rampart wall	Fill of shallow pit or ditch terminal [5010]	Soil under rampart core	Spread underlying rampart core	Deposit directly overlaying hearth	Lower hearth fill	Upper fill of post hole [7121]	Fill of post-pipe [7121]	Inner rampart post hole [9003]	Charcoal under rampart	Fill of post hole [9010]	Fill of post hole [9012]
	Vol charcoal >4mm	30ml	40ml	25ml	60ml	30ml	40ml	30ml	5ml	15ml	30ml	40ml	5ml	50ml
	% charcoal ID	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal	**Common name**													
Alnus cf glutinosa	alder	1 (0.02g)	18 (1.53g)	-	-	5 (0.81g)	-	5 (0.27g)	-	5 (0.30g)	-	8 (1.38g)	-	-
Betula spp	birch	99 (5.36g)	64 (6.27g)	34 (2.61g)	142 (17.28g)	89 (5.95g)	38 (3.40g)	34 (2.56g)	5 (0.24g)	-	42 (4.42g)	28 (4.79g)	11 (0.69g)	21 (5.63g)
Corylus cf avellana	hazel	-	15 (1.22g)	4 (0.15g)	4 (0.20g)	4 (0.24g)	25 (2.41g)	20 (1.03g)	13 (0.42g)	17 (1.20g)	14 (0.76g)	8 (1.08g)	7 (0.39g)	23 (2.81g)
Ericales	heather type	-	-	-	-	-	-	1 (0.02g)	-	-	-	-	-	-
Quercus spp	oak	-	1 (0.05g)	-	-	9 (0.44g)	3 (0.19g)	5 (0.26g)	2 (0.07g)	29 (1.05g)	-	-	2 (0.30g)	2 (0.11g)
Salix spp	willow	19 (0.86g)	1 (0.05g)	3 (0.60g)	-	11 (0.56g)	16 (2.67g)	7 (0.39g)	-	-	4 (0.27g)	2 (0.32g)	-	4 (1.33g)
Seeds														
Corylus avellana nutshell	hazel nutshell	-	-	-	-	-	-	1 (0.02g)	1 (0.02g)	-	-	-	-	-

Table 8.11
Botanical remains from Cairn More – Trenches 5, 6, 7 and 9

Trench		Trench 13									Trench 14					Trench 15
Context		13005	13007	13009	13011	13013	13015	13016	13018	13021	14001	14005	14007	14008	14010	15002
Sample		13007	13002	13001	13003	13004	13005	13006	13008, 13009	13009	-	14002, 14007	14003	14001	14005	15001
Description		Fill of post-hole 1 [13004]	Fill of post-hole 2 [13006]	Fill of post-hole 3 [13008]	Fill of post-hole 4 [13010]	Fill of post-hole 5 [13012]	Fill of post-hole 6 [13014]	Lower fill of post-hole 4 [13010]	Fill of linear feature [13017]	Fill of second cut of post-hole 3 [13008]	Topsoil	Fill of post hole [14004]	Fill of post hole [14006]	Burnt spread	Fill of post hole [14009]	Fill of post hole [15001]
	Vol charcoal >4mm	5ml	40ml	50ml	50ml	50ml	30ml	40ml	65ml	2.5ml	15ml	40ml	5ml	60ml	10ml	10ml
	% charcoal ID	100%	100%	50%	50%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal	**Common name**															
Alnus cf glutinosa	alder	-	-	-	-	-	-	-	-	-	-	-	-	-	5 (0.15g)	-
Betula spp	birch	24 (0.81g)	46 (3.63g)	56 (5.63g)	35 (3.93g)	69 (7.75g)	50 (4.26g)	34 (8.22g)	103 (6.47g)	9 (0.36g)	38 (2.27g)	46 (5.06g)	10 (0.52g)	98 (7.27g)	26 (0.33g)	1 (0.02g)
Corylus cf avellana	hazel	6 (0.27g)	9 (0.93g)	4 (0.22g)	8 (0.98g)	6 (0.34g)	3 (0.16g)	4 (0.28g)	25 (2.48gg)	-	16 (0.60g)	22 (2.28g)	5 (0.17g)	41 (4.22g)	13 (0.56g)	-
Quercus spp	oak	1 (0.11g)	46 (3.18g)	69 (4.32g)	2 (0.27g)	-	-	4 (0.19g)	23 (1.54gg)	17 (0.28g)	1 (0.02g)	2 (0.30g)	1 (0.07g)	1 (0.03g)	7 (0.18g)	5 (1.98g)
Salix spp	willow	1 (0.03g)	5 (0.44g)	9 (0.80g)	5 (0.55g)	5 (0.87g)	6 (0.59g)	4 (0.50g)	5 (0.14g)	-	1 (0.02g)	1 (0.10g)	-	16 (0.63g)	3 (0.09g)	-
Misc																
Bone	bone	2.5ml (1.69g)	5ml (2.15g)	15ml (10.11g)	15ml (11.05g)	30ml (26.78g)	25ml (15.76g)	5ml (2.76g)	30ml (21.98g)	<2.5ml (0.45g)	5ml (2.13g)	5ml (1.11g)	-	25ml (16.42g)	>2.5ml (2.12g)	2.5ml (1.31g)
Fucoid seaweed	seaweed	-	-	-	1 (0.04g)	-	-	-	-	-	-	-	-	-	-	-

Table 8.12
Botanical remains from Cairn More – Trenches 13, 14 and 15

Table 8.13

		Trench 16							Trench 17						
Context		16002	16004	16010	16010	16013	16020	16022	17001	17002	17003	17009	17014	17017	17023
Sample		1601	1602	1604	1605	1606	1609	1610	1718	1701	1703	1709	1712	1716	1717
Description		Middle palisade post-pipe fill	Wattle floor under outer bank	Middle palisade post-pipe fill	Fill of post hole	Outer bank post-hole fill	Lower fill of post pipe	Outer palisade post-hole fill	Floor of external house	Grey bone rich deposit	Lower post-pipe fill	Lower post-pipe fill	Fill of central hearth of external house	Outer palisade post-pipe fill	Floor of external house
Charcoal	**Common name**														
Alnus glutinosa	Alder					1				1					3
Betula	Birch	2	2	1		28	3	2	37	45	6	35	40	44	28
Corylus avellana	Hazel		46			5	33	3	6	1		2			5
Quercus	Oak	47		49	50	15	13	45	4		44	7	7		2
Salix/Populus	Willow/poplar		1			1				1				5	3

Table 8.13
Charcoal remains from Cairn More – Trenches 16 and 17

Table 8.14

	Trench 16										Trench 17				
Context	16002	1604	16005	16010	16013/14	16019	16020	16020	16022	16025	17001	17003	17003	17003	17006
Sample	1601	1605	1603	1604	1606	1607	1608	1609	1610	16012	1718	1702a	1702b	1703	1704
Description	MP post pipe	Fill of post hole	Post-hole fill	MP post-pipe	OP post-pipe		OP post-pipe	Lower fill of OP post-pipe	OP post hole	Feature fill	House floor	OP post-hole packing	OP post-hole packing	OP post-pipe fill	OP post-hole packing
Seeds (1mm)															
Brassica sp.	5		3		27	1	18	14	1	2				8	1
Brassica cf. *nigra*					14						5			1	
Brassica/Sinapis				3		5		9			1		8		
Carex sp.			2								1				
Carex cf. *buxbaumii*					2									1	
Carex cf. *pendula*				1							1				
Plantago lanceolata			4		1			2			2			1	
Poaceae type 1		4	1											1	
Poaceae type 2		3													
cf. *Poa*		1													
Rumex sp.			1		3										
Seeds (300 mic)															
Brassica sp.	8														
Brassica cf. *nigra*	32	16		40	32		24	16					8		
Carex sp.	8			8											

	Trench 17 (*continued*)										
Context	17007	17008	17009	17009	17014	17017	17017	17020	17024	17025	17031
Sample	1708	1706	1707	1709	1712	1714	1716	1715	1721	1722	1723
Description	OP post-pipe	OP post-hole packing		Lower post-pipe fill	Central hearth of external house	OP post-pipe	OP post-pipe	OP post-hole fill	MP post hole	Post-hole fill	Post-pipe fill
Seeds (1mm)											
Brassica	1		1	5			7	26	2	12	3
Brassica cf. *nigra*					5						
Brassica/Sinapis		1					3	4	2	3	5
Carex sp.				2				1			
Plantago lanceolata								1			
Poaceae type 1					2						
Rumex					1						
Seeds (300 mic)											
Brassica					16			48			
Brassica cf. *nigra*		24			16	8		8			8

Table 8.14
Macrobotanical remains from Cairn More – Trenches 16 and 17

Sample no	Context	Description	Radial cracks	Tyloses	Vitrification	Fungal hyphae	Insect damage	Bark	Pith
1601	**16002**	Post-pipe fill	32.00% (n=16)	28.00% (n=14)	12.00% (n=6)	-	2.00% (n=1)	-	-
1602	16004	Wattle panel	8.00% (n=4)	-	-	-	-	6.00% (n=3)	46.00% (n=23)
1604	**16010**	Post-pipe fill	10.00% (n=5)	42.00% (n=21)	12.00% (n=6)	6.00% (n=3)	-	-	-
1605	**16010**	Post-pipe fill	30.00% (n=15)	50.00% (n=25)	16.00% (n=8)	12.00% (n=6)	-	-	-
1606	**16013**	Post-hole fill	8.00% (n=4)	4.00% (n=2)	-	2.00% (n=1)	2.00% (=1)	-	2.00% (n=1)
1609	**16020**	Lower post-pipe fill	8.00% (n=4)	2.00% (n=1)	6.00% (n=3)	-	2.00% (n=1)	-	-
1610	**16022**	Post-hole fill	26.00% (n=13)	36.00% (n=18)	38.00% (n=19)	8.00% (n=4)	-	-	-
1701	17002	Old ground surface	8.00% (n=4)	2.00% (n=1)	-	8.00% (n=4)	-	2.00% (n=1)	-
1703	**17003**	Lower post-pipe fill	8.00% (n=4)	28.00% (n=14)	-	-	-	-	-
1709	17009	Lower post-pipe fill	-	2.00% (n=1)	-	2.00% (n=1)	-	-	-
1712	**17014**	Central hearth fill	20.00% (n=10)	2.00% (n=1)	6.00% (n=3)	4.00% (n=2)	4.00% (n=2)	-	2.00% (n=1)
1716	**17017**	Post-pipe fill	2.00% (n=1)	-	2.00% (n=1)	6.00% (n=3)	-	-	-
1717	**17023**	Fill of second hearth	32.00% (n=16)	-	8.00% (n=4)	2.00% (n=1)	6.00% (n=3)	-	-
1718	**17001**	Floor of external house	16.00% (n=8)	4.00% (n=2)	2.00% (n=1)	4.00% (n=2)	-	-	-

Table 8.15
Anthracological information recorded for samples from Cairn More – Trenches 16 and 17

Macrobotanical remains were completely absent. A greyish sandy silt (17002) was interpreted as an old ground surface, and produced a large concentration of birch, followed by only traces of willow/poplar, hazel and alder. This may represent original cleared vegetation. Fill (16025) of pre-hillfort shallow rock-cut feature [16024] was only analysed for the presence of macrobotanical remains, and contained two charred seeds from the cabbage genus *Brassica*.

Post holes

Three large post holes [9003], [9010] and [9012] were located at the edge of the inner bank, approximately 2 metres apart. The fills (9004), (9011) and (9013) all produced significant amounts of birch and hazel charcoal, with small amounts of willow and/or oak also present. These mixed fills are probably from hearth waste that either trickled down into the post-hole fills or was deliberately used as packing material for the posts, rather than evidence for posts burnt in situ. A charcoal deposit (9009) under the rampart stones produced a similar mixed assemblage dominated by birch charcoal but with alder, hazel and willow also present.

To the west of these post holes, a further six large post holes [13004], [13006], [13008], [13010], [13012] and [13014] were identified along the edge of the inner bank. The fills of post holes [13004], [13006], [13008] and [13010] produced very similar carbonised assemblages dominated by birch charcoal followed by smaller amounts of hazel, oak and willow, together with fragments of burnt bone. In addition, a single fragment of burnt seaweed was identified from the fill (13011) of post-hole [13010]. The significant amounts of charcoal found within these fills suggest that this hearth waste may have been deliberately used as packing around the posts. The upper fill (13021) of post-hole [13008] produced only traces of birch and oak charcoal with burnt bone. Fill (13011) of post-hole [13012] and fill (13013) of post-hole [13014] were also very similar, with birch, hazel and willow charcoal, together with fragments of burnt bone. These post-hole fills differed from the other four in not containing any

oak charcoal, perhaps suggesting that the charcoal from these fills came from a different episode of burning. The fill (13018) of linear feature [13017] produced a very similar carbonised assemblage to that recorded from the first four post holes, with birch dominating and smaller amounts of hazel, oak and willow also present, together with burnt bone.

Slightly further to the west, one large post hole [15001] was identified but was not excavated, although charcoal and bone were collected from the upper fill (15002) for analysis. While this fill produced more oak than birch charcoal, this does not imply that this constitutes the remains of an oak post since only selected fragments of charcoal were collected and so the sample may not be representative.

Two large post holes [14004] and [14006] were located to the east of post holes [9003], [9010], and [9012]. The fills (14005) and (14007) contained mixed charcoal assemblages, with birch, hazel and oak present in both fills, but additional traces of willow and bone identified in fill (14003). It may be that hearth waste was deliberately used as post-packing within the post holes. A burnt spread (14008) was located beneath the bank and may be related to its construction. The spread (14008) contained a charcoal assemblage that was very similar to that recorded from the post-hole fill, with birch and hazel dominating together with small amounts of oak, willow and burnt bone. The charcoal within the post holes may have originated from the burnt spread. The topsoil and overburden (14001) over the bank also produced a mixed charcoal assemblage that was similar in composition to that recorded from spread (14008) and so redeposition of material may have taken place. Directly beneath spread (14008) was a small post hole [14009], fill (14010), that contained a similar carbonised assemblage to that seen from the burnt spread, but with the addition of traces of alder charcoal. It is likely that the charcoal from this post-hole fill originated from the overlying spread. Post-pipe fills (17025) and (17031) from post holes [17026] and [17029] located to the south-east were analysed for the presence of macrobotanical remains only. Both fills contained small concentrations

of charred *Brassica* sp. and *Brassica/Sinapis* seeds, likely to represent the seeds of wild plants that were unintentionally burnt along with firewood.

Inner arc post holes

Fills (16002) and (16010) of two large post holes may represent burnt structural remains associated with timber framing for the ramparts. The features produced large concentrations of oak and traces of birch. The birch may in this case be explained by hearth-derived material mixing in with the burnt structural remains. The oak in both contexts exhibited frequent tyloses and weak ring curvature, as well as infrequent insect tunnelling, suggesting the presence of mature oak heartwood. This further supports the interpretation of the oak concentrations as posts burnt in situ. Both post-hole fills contained charred cabbage genus (*Brassica*) and sedge (*Carex*) seeds, most likely again representing wild plants from the surrounding natural environment.

Post-hole [17019] contained post-pipe fill (17020) and surrounding packing fill (17024), both of which were only investigated for the presence of charred macrobotanical remains. Fill (17024) contained seeds identified to the cabbage and cabbage or mustard genera (*Brassica* and *Brassica/Sinapis*), while in addition to *Brassica*, (17020) also produced a club sedge seed (C*arex cf buxbaumii*). Macrobotanical remains were also identified from fill (16006) of rock-cut post-hole [16005] situated between the inner and outer ramparts. The seeds of cabbages (*Brassica)*, docks (*Rumex)* and grasses (Poaceae) were present in small quantities, and are again likely to represent wild plants from the vicinity of the site.

Outer arc post holes

Fills (17003) and (16022) of two outer post holes [17005] and [16021] probably associated with the outer rampart produced heavily oak-dominated assemblages with only traces of other taxa present, and may represent the remains of burnt posts mixed with small amounts of hearth waste. Over 50% of the oak fragments in both contexts exhibited weak ring curvature, and together with the consistent presence of tyloses and absence of insect tunnelling this lends support to the wood deriving from mature heartwood. Charred cabbage genus (*Brassica)* seeds were found in both contexts, and (17003) additionally produced seeds of club sedge (*Carex cf buxbaumii)*, the grass family (Poaceae), and ribwort plantain (*Plantago lanceolata*).

The rest of the analysed outer arc post-hole fills include fill (16014) of post-hole [16013], post-pipe fill (16020) and packing fill (16019) of post-hole [16018], post-pipe fill (17009) and packing fill (17008) of post-hole [17015], and fill (17017) of post-hole [17018]. These fills are likely to represent mixed, displaced burning waste that was either deliberately dumped into post holes (possibly as packing material) or trickled from occupation surfaces. Charcoal was identified from all fills except (17008) and (16019), and the charcoal assemblages were consistently dominated by birch, except for the hazel-rich (16020), and contained smaller amounts of alder, hazel, willow/poplar and oak. Tyloses were rare, and growth rings mainly strong to moderate, suggesting the lack of mature heartwood and supporting the interpretation of the charcoal as hearth-derived material. Rectangular post-pipe fill (17017) stood out as having a particularly high concentration

of birch, and could represent a potential burnt post, though the clear prevalence of birch in firewood contexts across the site means that the charcoal could simply derive from hearth waste. Post-hole fill (16013) contained a variety of tree taxa mixed with the wild seeds of cabbages (*Brassica*), sedges (C*arex*) and docks (*Rumex* sp.). The macrobotanical remains of the remaining post-hole contexts mainly consisted of sedges (*Brassica* sp.) followed by occasional ribwort plantain (*Plantago lanceolata*). Charred macrobotanical remains were identified from packing fill (17006) and post-pipe fill (17007) of post-hole [17010]. Both contexts produced a single cabbage genus (*Brassica*) seed, and (17007) also contained two indeterminate, poorly preserved seeds.

Interior building and hearths

In the centre of the fort, a stone spread (7002) was located over the remains of a large hearth [7004]. Beneath (7002) was a clay silt deposit (7003) that appeared to be deposited within and around the hearth stones. The charcoal assemblage from (7003) comprised significant amounts of birch, hazel and willow, and traces of oak. Beneath (7003) was an earlier hearth deposit (7006) with a similar range of charcoal types present but with the addition of alder, heather type and a single fragment of hazel nutshell. These diverse charcoal assemblages are what would be expected from a domestic hearth with no deliberate selection of wood types for fuel. A post hole [7121] was located in the western section of the trench. The upper fill (7119) produced a mixed charcoal assemblage of birch, hazel, oak and willow, with a fragment of hazel nutshell. The fill of the post-pipe (7120) produced an assemblage of hazel, oak and willow. Both assemblages are consistent with hearth waste.

External building and hearths

House floor layer (17001) of an external building was dominated by birch with traces of alder, hazel, and willow/poplar also present, and the charcoal is likely to be scattered hearth waste. No macrobotanical remains were identified. The potential central hearth of the house was cut into the natural which was discoloured a dull reddish-pink, suggesting in situ burning. Its fill (17014) produced a concentration of birch, with oak also present, and is likely to represent the burnt remains of hearth fuel. The restricted range of taxa present in the hearth may be related to intentional fuel selection or suggest that the charcoal derives from the latest burning event rather than an accumulation of material over time. Macrobotanical remains in (17014) included the seeds of cabbages (*Brassica*), grasses (*Poaceae*) and docks (*Rumex*). Fill (17023) of the second hearth was similarly cut into discoloured natural, and contained a mix of charcoal dominated by birch and followed by hazel, alder and oak, while macrobotanical remains were completely absent. This mixed assemblage is typical of domestic firewood use that did not require selection for specific taxa.

Radial cracking was more common in the hearth deposits than the full assemblage, potentially indicating higher moisture content of the wood being burnt (Théry-Parisot & Henry 2012). Fungal hyphae and insect damage were rare, suggesting limited use of deadwood. The calibre of wood in the two hearths may differ, as the central hearth charcoal displayed mainly moderate to weak ring curvature, while over 60% of fragments in the second hearth had strong curvature, though the lack of pith and bark make it impossible to securely determine the original size of the wood.

8.3.6 Results: Tap o' Noth

The complete botanical results for Tap o' Noth are presented in Tables 8.16–8.20.

Natural peat and old ground surfaces

The earliest material excavated in Trench 1 in the vitrified fort was a thin layer of peat (1714), which overlay the bedrock. The only botanical remains recovered from this deposit were numerous fragments of carbonised heather type stems. This probably represents in situ burning of natural heather that was growing on the site prior to the period of occupation. Overlying the natural peat in places was a thin charcoal-rich lens (1710) that produced an assemblage of birch, alder, heather type and willow together with heather seeds and a single possible carbonised barley grain. The heather type stems and seeds may be from in situ burning of natural vegetation, and it is possible that birch and willow may have grown close by, but alder would be very unlikely on top of a hill like Tap o' Noth. The presence of the single carbonised cereal grain indicates human occupation on the site at this time and so the wood charcoal is more likely to represent hearth waste, presumably on an old ground surface. At the south-west end of the trench was a thin layer of silty soil (1712) that was interpreted as a possible degraded turf wall or turf component of a bank. However,

the carbonised assemblage comprised a diverse range of charcoal types including alder, birch, hazel, Scots pine type and oak representative of hearth waste.

Within Trenches 2, 3 and 4, the earliest layers identified during excavation were thin layers of peat (216, 304, 307 and 410), overlying the bedrock in most places. The carbonised assemblages from these peat layers produced charcoal of alder, birch, heather type, oak and willow together with occasional carbonised barley grains. Although heather type, birch and willow could have been growing locally, it is again unlikely that alder or oak would have been present on such thin soil on top of the hill. The presence of carbonised barley grains lends more weight to this material being the remains of hearth waste that was either dumped on the peat or from fires burnt nearby on old ground surfaces.

Within Trench 3 a thin layer of reddish-brown heat-affected silty material (306) was identified directly overlying the natural peat. The carbonised assemblage comprised charcoal of alder, birch, hazel, Scots pine type, oak and willow, with significant amounts of carbonised cereal grains. Barley was the only cereal type identified, with a few grains further identifiable as the hulled variety. It appears that this in situ burning was a result of either the preparation of cereals directly for food or drying of cereal grains prior to storage or grinding.

Context		1704	1708	1708	1708
Sample		1710	1715	1723	1729
Description		U-shaped bank	Deposit against inner wall	Deposit against inner wall	Deposit against inner wall
Vol charcoal >4mm			15ml	5ml	20ml	5ml
Charcoal	Common Name				
Alnus cf glutinosa	alder	-	-	2 (0.41g)	-
Betula spp	birch	107 (3.53g)	-	7 (0.40g)	8 (0.37g)
Corylus cf avellana	hazel	-	-	-	9 (0.20g)
Ericales	heather type	-	9 (0.67g)	-	1 (0.04g)
Pinus sylvestris type	Scots pine type	-	-	-	2 (0.08g)
Quercus spp	oak	-	-	74 (3.18g)	4 (0.07g)
Salix spp	willow	-	-	-	-
Cereals					
cf Hordeum vulgare sl	cf barley	-	-	-	-
Seeds					
Calluna vulgaris seeds	heather seeds	-	-	-	-
Corylus avellana nutshell	hazel nutshell	-	-	1 (0.04g)	-

Table 8.16
Botanical remains from Tap o' Noth 2017 excavations

Context		216	304	307	410
Sample		210	307	303	404
Description		Peat under bank	Peat under (306)	Peat under flat stones	Black peat over bedrock from base of outer wall
Total volume charcoal >4mm			5ml	15ml	15ml	2.5ml
Charcoal					
Alnus cf glutinosa	alder	-	-	6 (0.45g)	-
Betula spp	birch	6 (0.49g)	-	11 (0.83g)	3 (0.04g)
Corylus cf avellana	hazel	3 (0.19g)	-	4 (0.29g)	-
Pinus sylvestris type	Scots pine type	-	2 (0.02g)	-	-
Ericales	heather type	8 (0.10g)	-	-	9 (0.05g)
Quercus spp	oak	2 (0.20g)	-	15 (1.03g)	-
Salix spp	willow	1 (0.03g)	-	2 (0.06g)	-
Indet bark	indet bark	-	3 (3.69g)	-	-
Cereals					
Hordeum vulgare sl	barley	2	-	-	2
Hordeum vulgare sl	barley				
Cereal indet	indet cereal				
Cereal rachis frag	cereal rachis frag				
Carbonised seeds					
Calluna vulgaris seeds	heather seeds				
Corylus avellana nutshell	hazel nutshell				

Table 8.17
Botanical remains from Tap o' Noth 2018 excavations – Peat contexts

Context		205	205	209	209	210	210?	210?	212	215
Sample		**201**	**205**	**202**	**203**	**212**	**?**	**?**	**209**	**211**
Description		Top of charcoal spread (west)	Base of charcoal rich spread (west)	Top of charcoal spread (north)	Base of charcoal spread (north)	Charcoal from base of well	Basal well (recovered by conservator)	Basal well (dried bulk sample sieved by SR)	Lower well fill	Bank material
Total volume charcoal >4mm		200ml	30ml	500ml	150ml	5ml	5ml	15ml	30ml	10ml
% total charcoal identified		50%	100%	25%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	4 (0.28g)	-	21 (2.00g)	16 (1.11g)	-	2 (0.07g)	7 (0.31g)	-	5 (0.10g)
Betula spp	birch	4 (0.20g)	-	25 (1.11g)	16 (0.89g)	2 (0.09g)	4 (0.11g)	12 (0.37g)	10 (1.09g)	6 (0.18g)
Corylus cf avellana	hazel	43 (3.29g)	27 (1.41g)	15 (0.84g)	37 (1.79g)	6 (0.10g)	2 (0.11g)	14 (0.38g)	17 (1.89g)	8 (0.39g)
Ericales	heather type	13 (0.91g)	42 (2.14g)	138 (11.43g)	223 (11.65g)	6 (0.14g)	5 (0.16g)	32 (0.77g)	7 (0.52g)	-
Pinus sylvestris type	Scots pine type	43 (3.41g)	2 (0.08g)	81 (9.49g)	5 (1.78g)	2 (0.02g)	7 (0.26g)	7 (0.18g)	10 (0.82g)	-
Quercus spp	oak	46 (3.55g)	4 (0.07g)	11 (0.54g)	11 (0.59g)	11 (0.21g)	1 (0.04g)	10 (0.39g)	4 (0.68g)	-
Salix spp	willow	-	-	-	-	6 (0.26g)	-	4 (0.14g)	1 (0.10g)	3 (0.19g)
Burnt soil/peat	burnt soil/peat	-	5ml (1.68g)	-	-	-	-	-	-	-
Uncarbonised wood										
Betula spp twigs	birch twigs	-	-	-	-	-	++ up to 220mm x 5mm	-	-	-
Misc										
Monocot roots/stem bases	grass/sedge roots/stem bases	-	-	-	-	-	++++	-	-	-

Table 8.18
Botanical remains from Tap o' Noth 2018 excavations – Trench 2

Trench		Trench 3	Trench 4						
Context		**306**	**407**	**408**	**408**	**411**	**412**	**416**	**424**
Sample		**302**	**402**	**403**	**406**	**412**	**405**	**409**	**411**
Description		Charcoal under flat stones	Occupation layer	Clay within inner bank	Clay within inner bank, lower level	Compact blue clay floor (411)	Possible occupation layer on N side of inner bank	Fill of post hole [415]	Fill of beam slot
Total volume charcoal >4mm		30ml	100ml	40ml	75ml	2.5ml	10ml	30ml	5ml
% total charcoal identified		100%	100%	100%	100%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	4 (0.14g)	79 (5.07g)	73 (3.50g)	13 (1.09g)	4 (0.16g)	16 (0.28g)	25 (1.45g)	9 (0.22g)
Betula spp	birch	40 (2.05g)	53 (3.74g)	66 (3.57g)	27 (1.66g)	3 (0.14g)	19 (0.81g)	47 (1.75g)	2 (0.07g)
Corylus cf avellana	hazel	4 (0.27g)	-	-	-	-	3 (0.22g)	-	-
Pinus sylvestris type	Scots pine type	10 (0.42g)	7 (0.53g)	-	27 (10.29g)	-	1 (0.02g)	-	-
Quercus spp	oak	10 (0.56g)	2 (0.53g)	-	-	-	9 (0.26g)	-	-
Salix spp	willow	5 (0.20g)	-	-	-	-	-	-	-
Indet bark	indet bark	-	20 (3.46g)	-	-	-	-	-	-
Cereals									
Hordeum vulgare var vulgare	hulled barley	5	-	-	-	-	-	-	-
Hordeum vulgare sl	barley	69	-	1	-	-	14	-	-
Cereal indet	indet cereal	66	-	-	-	-	13	-	-
Cereal rachis frag	cereal rachis frag	1	-	-	-	-	-	-	-
Carbonised seeds									
Bromus spp	brome	1	-	-	-	-	-	-	-
Misc									
Bone	bone	-	4 (0.46g)	-	-	-	-	-	1 (0.06g)

Table 8.19
Botanical remains from Tap o' Noth 2018 excavations – Trenches 3 and 4

Trench	Trench 5	Trench 6					Trench 7			
Context	5004	6003	6004	6012	6014	6017	7006	7007	7011	7012
Sample	501	609	601	604	605	607	701	702	703	704
Description	Occupation layer	Upper floor layer	Fill of post hole [6005]	Upper fill of hearth 1	Fill of hearth 2	Lower fill of hearth 1	Basal layer under bank stones (7005)	Occupation deposit	Fill of palisade slot [7010]	Occupation layer under (7007)
Volume of charcoal >4mm	2.5ml	50ml	30ml	100ml	60ml	80ml	5ml	100ml	10ml	50ml
% charcoal >4mm identified	100%	100%	100%	50%	50%	50%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa alder	-	6 (0.38g)	6 (0.15g)	-	-	-	-	-	-	-
Betula spp birch	10 (0.13g)	75 (5.95g)	42 (3.47g)	92 (6.24g)	56 (3.31g)	80 (4.30g)	17 (0.58g)	52 (8.21g)	34 (1.45g)	87 (5.48g)
Corylus cf avellana hazel	7 (0.28g)	25 (1.32g)	24 (0.85g)	55 (3.41g)	24 (1.12g)	58 (2.62g)	5 (0.11g)	5 (0.31g)	14 (0.34g)	44 (2.20g)
Quercus spp oak	-	-	-	-	-	-	-	5 (0.53g)	2 (0.05g)	8 (0.77g)
Salix spp willow	-	3 (0.06g)	7 (0.51g)	11 (0.40g)	9 (0.29g)	10 (0.42g)	-	1 (0.28g)	1 (0.02g)	10 (0.54g)
Misc										
Bone bone	-	-	-	-	-	-	5 (0.43g)	-	-	-

Table 8.20
Charcoal remains from Tap o' Noth 2019 excavations – Trenches 5, 6 and 7

Rampart

A small area of the vitrified inner wall face [1713] was found intact in Trench 1. In front of the inner wall was a charcoal and bone-rich silty soil (1708) that appeared to have built up whilst the enclosure was in use. Three samples were analysed from context (1708), but each produced very different carbonised assemblages indicating that this is not a homogeneous deposit. Sample <7015> produced only small amounts of heather type charcoal, which could be from natural burning of onsite vegetation. Sample <1723> contained small amounts of alder, birch and hazel nutshell together with relatively large amounts of oak charcoal. This could just be the remains of hearth waste, but the oak could be evidence for the timbers that formed the timber lacing of the rampart. Sample <1729> produced a very diverse assemblage of birch, hazel, heather type, Scots pine type and oak, with none of the types present in particularly large amounts. This assemblage would seem to be the remains of hearth waste.

U-shaped banks

In the interior two U-shaped banks were identified. The charcoal assemblage from inner bank [1704] contained significant amounts of birch charcoal but nothing else. The outer bank [408] was investigated in most detail in Trench 4. The carbonised assemblage from the outer bank comprised significant amounts of alder and birch charcoal, with a single carbonised barley grain. The charcoal from within the bank may be the remains of a wooden palisade that was held up by a low stone bank before being burnt in situ. Although this is possible, neither birch nor alder are usually associated with palisade construction and the presence of a single cereal grain may suggest that this is hearth or midden waste that has been used as additional bank material.

The well

The well [204] was sub-circular with gradual sloping sides at the top, steepening to close to vertical towards the base. The well was initially cut through peat (216), then natural subsoil (207)

then into bedrock. The basal well deposits (210) contained a diverse range of charcoal types, including alder, birch, hazel, heather type, Scots pine, oak and willow, with no one type being overly dominant. This material probably represents hearth waste, either deliberately dumped into the well or a scatter from the around the well that fell down into the basal fills. The only identifiable uncarbonised plant material were birch twigs and the basal parts of either grass or sedge stems. The grass/sedge material could have grown in the base of the well once it went out of use. Birch twigs are very light and easily blow in the wind and so may have just blown into the well once it was abandoned. There do not appear to be high enough concentrations of birch twigs to suggest deliberate dumping of birch brushwood into the well.

A dark grey clayey silt (212) was identified on the southern edge of the well cut. This produced a very similar charcoal assemblage to that identified from the basal fills of the well and suggests that scattered hearth waste was present over much of this area of the site. Deposits (205) and (209) were noted as charcoal-rich soils on the upper lip of the north and west side of the well. The charcoal assemblages from these deposits were diverse with alder, birch, hazel, heather type, Scots pine type and oak all present. However, heather type stems make up 45% of the total charcoal from these two contexts, whilst Scots pine type accounts for 25% of the total.

Trench 4 Structure

A light blue clay floor layer (411) lay over the natural between the wall face (406) and the bank (408). This also contained small amounts of alder and birch charcoal like the U-shaped banks and so could have a similar source. In the field (411) was thought to represent a number of sequential floor layers with degraded wood separating these layers. A deposit of small stones, silt charcoal and animal bone (412) overlay floor layer (411) and was thought to represent a further occupation layer. The charcoal assemblage

comprised alder, birch hazel, Scots pine and oak together with some carbonised barley grains. This is the type of assemblage that would be expected from domestic hearth waste. A small post hole [415] was cut into clay floor layer (411) and a post pad was identified sitting on the peat layer at the base of the post hole. The fill (416) produced significant amounts of alder and birch charcoal, which are unlikely to represent the remains of a post burnt in situ and are more likely to represent scattered hearth waste as seen in the rest of this area.

A further deposit of silty clay (407), with charcoal and animal bone, also overlay the clay floor (411). This might be a destruction layer overlying the clay floor with a possible wicker- and post-defined structure. However, the charcoal assemblage was dominated by alder and birch charcoal, with smaller amounts of Scots pine, oak and indeterminate bark. This does not seem a particularly likely assemblage if a wattle and post structure had been destroyed by fire, since the commonest wattle woods, hazel and willow, are absent from the assemblage. From other carbonised assemblages on the site, it is clear that both hazel and willow were available in the local woodlands when the hillfort was occupied. A layer of collapsed stone (424) was present over most of the trench, and this also produced small amounts of alder and birch charcoal, suggesting this carbonised material was scattered over much of this trench.

8.3.7 Results: Lower fort

T5 HOUSE PLATFORM
Deposit (5004) lay across the platform and is thought to represent an occupation layer. However, only small amounts of birch and hazel charcoal were identified from this deposit, probably representing the remains of scattered hearth waste.

T6 HOUSE PLATFORM
An occupation floor layer (6003) produced a mixed charcoal assemblage dominated by birch but with hazel, alder and willow also present. In the central and northern side of the trench was a levelling deposit (6031), with a stone revetment (6030) on the northern side. The revetment corresponds with an arc of post holes. The fill (6004) of post-hole [6005] produced a charcoal assemblage that was very similar to that recorded from floor layer (6003), which suggests that hearth waste from the floor of the structure had trickled down into the post-hole fill.

Two stone-built hearths (Hearth 1 and Hearth 2) were located at the centre of the circular platform. Hearth 1 is the larger hearth and produced two distinct fills: upper fill (6012) and lower fill (6017). The upper fill was separated from the lower fill by a layer of heat-affected stones (6016). Although fills (6012) and (6017) were visually distinct during excavation, the charcoal assemblages were very similar with birch charcoal dominating, hazel also common and small amounts of willow present. Fragments of moulds and crucibles were recorded from the upper fill (6012), suggesting that this was a metalworking hearth, although it is more usual for the charcoal assemblages from metalworking hearths to be dominated by oak. Hearth 2 was located directly adjacent to Hearth 1 and produced a very similar charcoal assemblage to those recovered from Hearth 1.

ENTRANCEWAY AND OCCUPATION DEPOSITS
Bank [7005] had a line of large kerbstones [7015] and on the inside of this kerbline was a palisade slot [7010] that contained fill (7011). Fill (7011) contained small amounts of charcoal, with birch, hazel, oak and willow present. Between the back of the kerb and the palisade slot was a basal deposit (7006) that produced small amounts of birch and hazel charcoal, with burnt bone.

On the interior of the bank were a series of possible occupation deposits. The lowest of these deposits (7012) produced a charcoal assemblage of birch, hazel, oak and willow. Above (7012) was a further occupation deposit (7007), which produced an almost identical charcoal assemblage. These mixed assemblages are consistent with scattered domestic hearth waste.

8.3.8 Discussion

FIREWOOD
The majority of the charcoal from the three sites is best interpreted as hearth waste, either as evidence of in situ burning in hearths, or as intrusive burning waste in post holes, house floors and other features. There appears to be regional consistency in fuel selection patterns (or the lack thereof), as birch dominates in firewood assemblages across all sites, and a range of secondary taxa including hazel, willow/poplar, oak and alder were consistently present.

The mixed assemblages are consistent with domestic firewood use, where selection for specific taxa is unnecessary. Since metalworking appears to have taken place at all three sites, some level of specialised fuel selection might be expected, especially for oak, which is known to produce very high heat due to its density and to burn for longer with lower flames (Gale & Cutler 2000; Marston 2009). The apparent lack of firewood selection may partially be explained by the relative scarcity of oak: Jones et al's (2021) study (See also Jones below) notes that oak only makes up 0–3% of the land pollen count in the valley, implying that this high-quality fuel source would not have been readily available for collection. At Cairn More, ring curvature measurements suggest that one of the external hearths used wood of larger calibre, which may be linked to metalworking, since larger branches and trunks are often preferred for this process (Ludemann 2010). The lack of pith and bark in the analysed charcoal makes this a tentative suggestion, and additionally, hearths do not always replicate patterns of long-term fuel use: hearth waste is routinely cleaned and discarded, and there is no guarantee that the latest burning episode reflects longstanding patterns of size or species selection (Kabucku & Chabal 2021: 8).

The other taxa found in firewood contexts would have been more ubiquitously present in the Upper Strathbogie environs, though the prevalence of birch is somewhat surprising as it constitutes a fairly low percentage of the regional pollen signal (Jones et al 2021; Jones below). Perhaps birch was more common in the immediate vicinities of the three sites than it was in the valley as a whole, making it a low-effort source of firewood. Some indication of this is present in the Cairn More original ground surface, which produced a charcoal assemblage consisting nearly entirely of birch, which may represent cleared vegetation. Alternatively, the prevalence of birch could reflect intentional selection. Shackleton and Prins's (1992) model suggests that preferred species were

more likely to have been harvested when wood was plentiful, and this may have been the case in the valley since woodland was widely present in the area. Nonetheless, the burning properties of birch do not particularly differ from other taxa available in the valley, and it is more likely that its common use as fuel was influenced by local availability and ease of transport.

The anthracological information collected from the Cairn More charcoal provides further detail of firewood use at the site. There is little evidence for deadwood use in the form of fungal hyphae or insect damage, and this may suggest the harvesting of wood off of living trees, or the collection of recently dropped branches, as wood degradation may not be immediate (Moskal-del Hoyo et al 2010). The calorific value of wood is known to increase with its dryness (Chabal & Laubenheimer 1994; Théry-Parisot 2001), and if greenwood was indeed collected, it may have been left to dry before burning. This interpretation is supported by the generally infrequent radial cracking, as this phenomenon has been linked to the high moisture content of greenwood, though it is still uncertain how this would present in fragmented archaeological material (Théry-Parisot & Henry 2012).

Construction wood

The Craw Stane charred assemblages produced tentative evidence for burnt willow wattle and a possible oak post in the interior of the enclosure complex. However, these assemblages also contain additional charcoal types that probably represent scattered hearth waste and so can only tentatively be identified as the remains of structural components. Oak and alder planks were retrieved from Structure 3, and substantial quantities of oak timber from Structure 4 may represent the remains of the burnt superstructure of this building. Alder is recognised to be a less durable type of wood than oak (Deforce 2017), and its presence in structural components would not be preferred in a modern context but alder is known from buildings and rampart structures in prehistoric contexts. While the intentional selection of alder cannot be ruled out, the Craw Stane case may be linked to the scarcity of oak in the Upper Strathbogie valley. The difficulty to source oak could have resulted in occasional substitutions with other taxa, especially for components that were not essential for the building's structural integrity, such as internal plank fittings.

At Cairn More, convincing evidence is present for burnt hazel wattle made from branches or young trees. Additionally, the concentrations of oak retrieved from two outer palisade post holes are likely to represent burnt structural remains. The use of mature oak heartwood, as suggested by numerous tyloses combined with frequent weak ring curvature, would have contributed to the longevity of these posts and the site itself, as both xylophagus insects and fungus attacks struggle to penetrate tylosis-filled wood (Marguerie & Hunot 2007). The use of oak at both Cairn More and the Craw Stane complex shows an understanding of its strength and durability, and perhaps a willingness to source oak timber beyond its local natural availability.

The Tap o' Noth assemblages produced less convincing evidence of wooden structural remains. Within the vitrified walls of the upper fort were slots that are thought to be the remnants of the original timber lacing. However, the charcoal assemblages from the collapse of these walls were very diverse and did not show any obvious selection of specific types. It might be expected that wood for timber lacing would have been selected for specific reasons, depending on why the timber lacing was present. If increasing the strength and stability of the wall was the purpose of the timber lacing, durable oak might be expected to be the dominant type present. If the timber lacing were present to aid in deliberate vitrification, then again, oak might be the preferred timber because of its ability to produce very high temperatures when burnt (Gale & Cutler 2000). The carbonised assemblages from contexts associated with the walls appear to be the remains of hearth or midden waste rather than providing any evidence for the burning of the timber lacing within the walls.

The internal banks of the upper fort at Tap o' Noth showed some evidence for a dominance of birch charcoal, which could suggest some form of birch brushwood being used in the construction of the banks. However, birch is also common in the occupation layers and so it may just be one of the commonest types of wood available for collection for fuel and the charcoal from these features may be incidental, redeposited from elsewhere.

Crops and food plants

Evidence of food plants from the three sites is very limited, consisting of occasional finds of cereal grains and traces of hazelnut shell. The presence of hazelnut shells may be related to occasional foraging and consumption, though there are no indications of this being a major food source. Barley was the only cereal type identified at the Craw Stane, with a few grains further identifiable as the hulled variety. The quantity of cereal grain recovered from this site is relatively small considering its size, complexity and importance. This may simply be an artefact of sampling but could also indicate that cereal processing and, perhaps, some cooking activities were taking place elsewhere. It is interesting to note that more cereal grains were found in Structure 4 outside of the complex, suggesting that preparation or storage of cereals may have occurred outside of the enclosure complex interior. Evidence of off-site storage is lacking at contemporary sites in Scotland, but in early medieval Ireland granaries and drying kilns have been found outside the main structural areas of sites (Kerr et al 2012; McCormick 2014).

Cereals were completely absent at Cairn More and relatively scarce at Tap o' Noth, though a heat-affected patch of soil at the latter site did produce a significant number of carbonised cereal grains and suggests some form of food processing was occurring on the site. The dates from this context, however, are amongst the earlier from the sequence and could represent pre-fort activity. The only cereal type identified on the site was barley, with a few grains being further identifiable as the hulled variety.

Since barley pollen was present in the Upper Strathbogie valley, arable farming is likely to have taken place in the vicinity of the sites (Jones et al 2021: 907; Jones below). Barley is known to have been the most common cereal grown in Scotland until the medieval period, and is indeed found at several early medieval sites including Portmahomack (Carver et al 2016), Burghead (Ramsay 2018a; 2018b; 2019a; Niehaus 2022) Niehaus 2022), Lairg (McCullagh & Tipping 1998), and the Brough of Birsay (Donaldson 1982). The presence of this hardy and reliable crop at the Upper Strathbogie valley sites is thus not surprising.

Though technically not a plant, fucoid seaweed was a surprising find in ditch fills and a stone socket at the Craw Stane, and as a single piece in a post hole at Cairn More. This material must have been transported at least 50km from the coast onto the site. As both sites have evidence for metalworking activities, seaweed ash may have been used as a flux (a powder diminishing the formation of iron oxide and impurities) (Sebire 2013). Parallels are found at Dunadd in western Scotland, where metalworking evidence is present and seaweed was discovered in early medieval contexts (Lane & Campbell 2000: 223). Alternatively, seaweed may have been used as fertiliser in fields, as has been practised in coastal Scotland (McKenzie 2014).

8.3.9 Conclusions

The analysis of the charred assemblages from the Craw Stane complex, Cairn More and Tap o' Noth has provided information on firewood and construction wood use, as well as the utilisation of crops and wild plants. The three sites appear to have employed a very similar firewood strategy, with birch being the most common source of fuel, followed by a range of other deciduous trees that would have been available in the valley. While metalworking was clearly conducted at the sites, there is no indication of specialised fuel selection for this purpose. Both the Craw Stane complex and Cairn More presented evidence for the utilisation of oak for structural purposes, such as posts and planks. It is likely that oak was brought in from locations outside the valley, as it only makes up a small percentage of the local pollen count. There is some evidence for the limited use of other taxa in construction contexts: alder plank fragments were identified at the Craw Stane complex, and birch may have been utilised at Tap o' Noth and Cairn More. Barley grains were present in low numbers at the Craw Stane complex and Tap o' Noth, and the consumption of barley is in line with contemporary evidence from sites around Scotland. The off-site storage of grain is an intriguing possibility, as at the Craw Stane complex the main concentration of grain was recovered from a building outside the main enclosure, and at Cairn More no grain was identified. Finally, the unusual presence of fucoid seaweed at the Craw Stane complex and Cairn More may be related to specialised metalworking practices or the fertilisation of arable fields. These findings showcase a heavy reliance on local resources, ie the valley's wild woodland and most likely locally grown barley, but equally emphasise the sites' connectedness and willingness to source necessary materials from farther afield.

8.4 Palaeoenvironmental evidence from the Barflat/ Craw Stane complex and Tap o' Noth

Samantha E. Jones

8.4.1 Introduction

Between 2018 and 2020 high resolution pollen, non-pollen palynomorphs (NPP) and XRF was conducted on sediment samples extracted from a mire on Barflat farm, found just downslope from the Craw Stane complex and from a well at Tap o' Noth. The main objectives of the palaeoenvironmental analysis were to reconstruct the changes in vegetation and land-use surrounding the Craw Stane complex and Tap o' Noth but also to gain a better understanding of resource availability, land-use and the economies of both sites.

8.4.2 Site Location

A 1.86m core, sampled at 2cm intervals, was selected for analysis from a valley mire on Barflat farm around 300m southeast of the Craw Stane complex (57°19'26.3"N 2°49'59.3"W) and 900m south-east of the village of Rhynie (Illus 8.13). The main vegetation on the mire today is predominantly sedge (*Carex*) with some *Sphagnum* moss. Adjacent to the valley mire is grass dominated pastures, whilst along the Water of Bogie alder (*Alnus*) is present. The adjacent slopes are comprised of mainly gorse (*Ulex*) and pine (*Pinus*), with some birch (*Betula*), sedge (Cyperaceae) and grass (Poaceae).

Tap o' Noth lying at a height of 563m OD, is today covered with grassland and heather moorland (*Calluna vulgaris*) and wild blueberries (*Vaccinium*). At Tap o' Noth three samples were extracted from the lower sediments of the well excavated in 2018 (Chapter 2) (Illus 8.14). At the very base of the well a mat of organic material consisting of grass twigs and charcoal covering an area *c* 1m across and 0.1m thick was recorded (See Ramsay below). The in situ undisturbed deposits including at the base of the well were sampled in the field for pollen analysis.

8.4.3 Methods

Pollen and non-pollen palynomorphs were prepared using the conventional methods outlined in Moore et al (1991) including the additional step of density separation (Nakagawa et al 1998). A sum of 500 total land pollen (TLP) has been counted for all sub-samples where possible. At Tap o' Noth fewer pollen grains were counted due to poor preservation; however, a sum of 300 TLP was counted where possible. A count of 300 TLP is considered to give a representative picture of the past environment by Birks and Birks (1980).

Cereal-type pollen are classified as grains with a long diameter of 40ɥm + and an annulus diameter of 8ɥm +; most cereal-type pollen identified in this study were >40ɥm. Pollen counts are expressed as a percentage of the total land pollen (TLP), with spores and aquatic taxa excluded from the TLP sum. Non-pollen palynomorphs (NPPs) were also counted during routine pollen analysis and are expressed as concentrations. NPPs were identified using information from Bakker and van Smeerdijk (1982), van Geel (1976, 1978), van Geel et al (1981, 1983, 1986), Haaster (1984), Kuhry (1985, 1997), Pals et al (1980) and van der Wiel (1983). Rare types are indicated by a cross (+), where one cross is equal to one pollen grain or NPP. Pollen and NPPs were compiled and plotted using Tilia and TG View (Grimm 1991–2011). Zones were established using the constrained incremental sum of squares (CONISS) cluster analysis (Grimm 1987). Geochemical analysis (XRF) was also undertaken on the Craw Stane complex samples. This was conducted at RIAIDT (Infrastructure Network for the Support of Research and Technological Development) facility of the University of Santiago de Compostela (Spain). The methods and the results are discussed in more detail in Jones et al (2021).
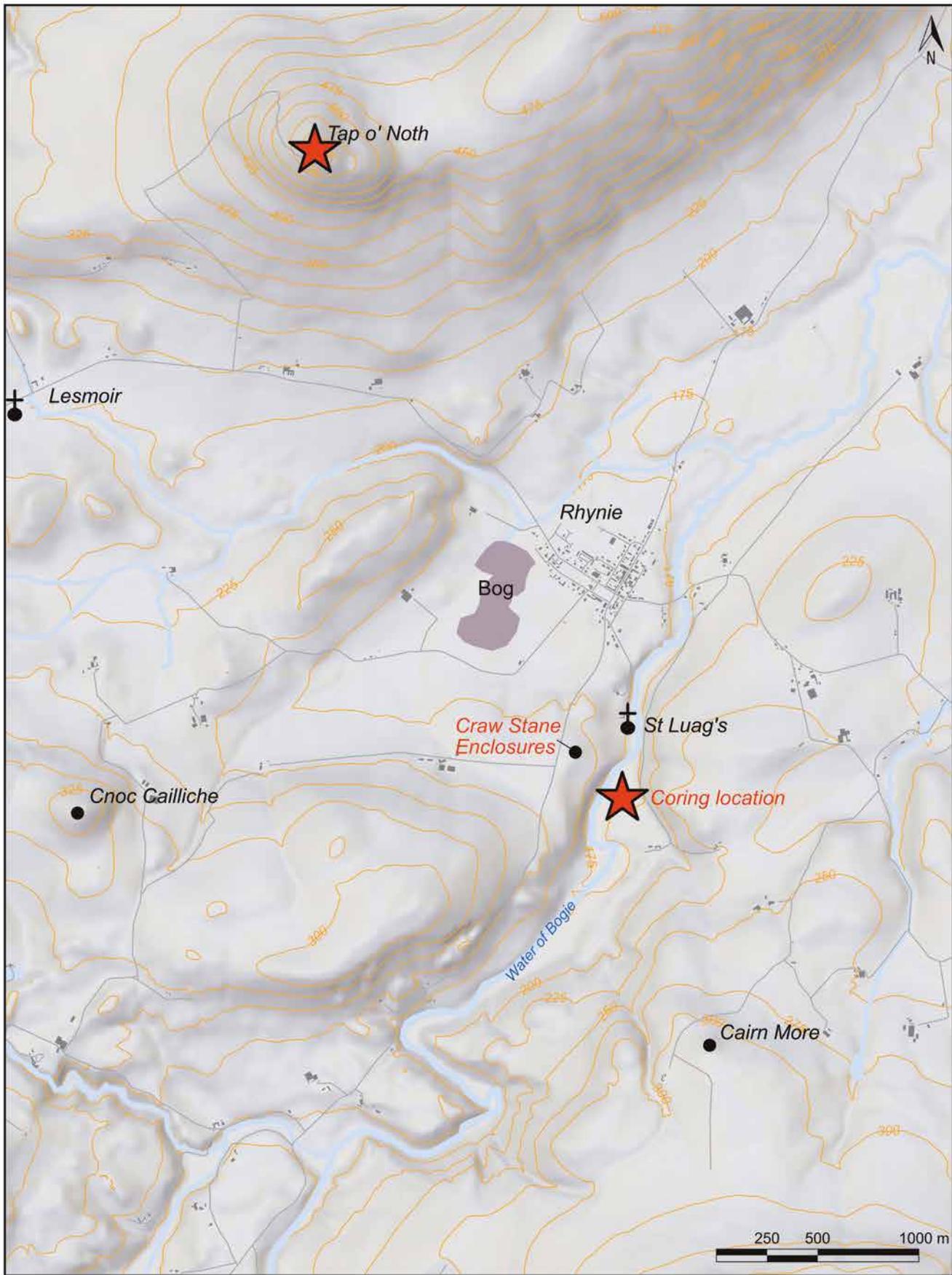
Illus 8.13
Rhynie – Barflat coring location
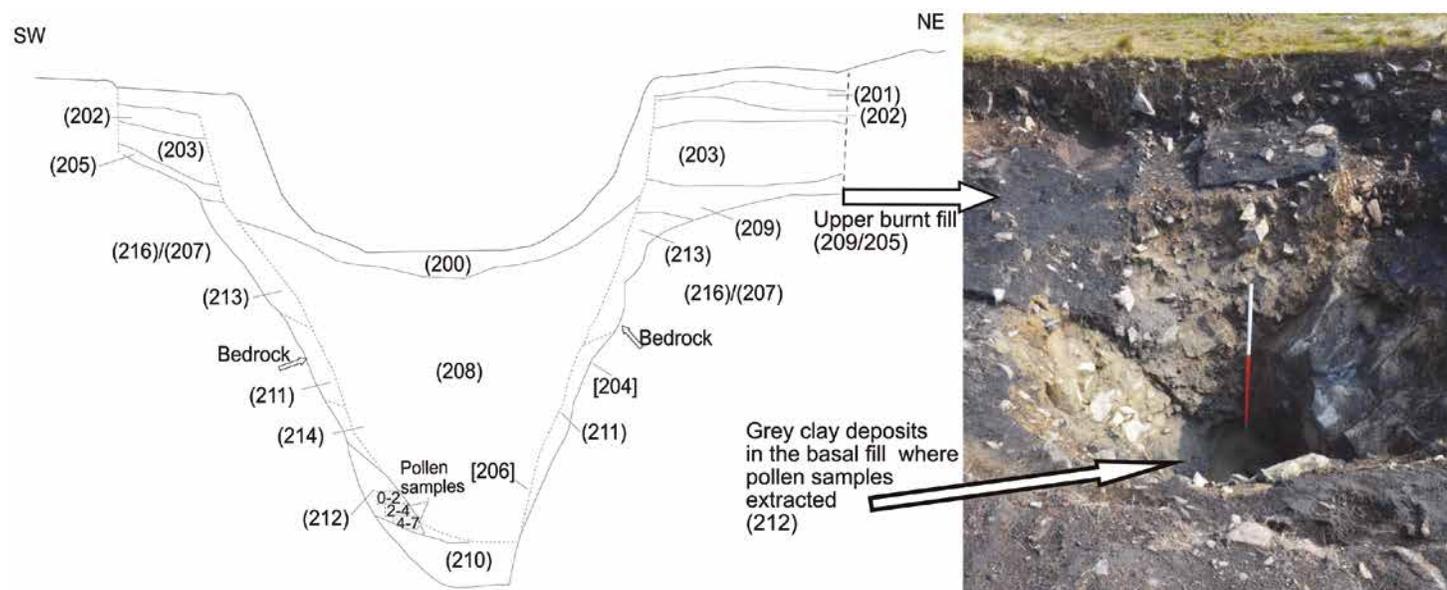
Illus 8.14
Tap o' Noth sediment profile and well deposits sampling location

8.4.4 Results

Eight samples from the Barflat valley mire core were submitted for ^{14}C analysis (Table 8.21). The bottom of the core produced an age range of AD 260–415 (95.4% confidence). An inverted age appears at 131cm and is believed to be an outlier possibly caused by the deposition of fluvial sediment carrying residual material during a flood (Jones et al 2021). All other radiocarbon ages are in chronological order.

POLLEN AND NPPS: TAP O' NOTH
Samples 0–2cm, 2–4cm and 4–7cm represent the lower sediments from the excavated well at Tap o' Noth and likely correspond to the period when the well was in use – these deposits have been dated to *c* 400–100 cal BC. The pollen preservation of the three samples investigated was generally quite poor. All identified grains were degraded, and less than 50 grains could be identified

from the bottom sample (4–7cm), which therefore should be interpreted with caution; however, a count of 300 grains excluding aquatics and spores has been achieved for the top two samples and is considered representative (Birks & Birks 1980). Results are presented in Illus 8.15. Herbaceous and heather pollen dominate all three samples investigated, notably Poaceae and *Calluna vulgaris* but also Cyperaceae, and pollen from plants often associated with pastures and/or disturbance such as Asteraceae, *Artemisia*, Caryophyllaceae, *Plantago* undiff., *Potentilla*, *Ranunculus* and *Rumex* (Brown et al 2007). Evidence of arable farming is potentially represented by the presence of cereal pollen types in the top two samples. Tree species tend to show a very low representation, apart from *Betula* and *Alnus*. Other trees present include *Pinus*, *Fraxinus*, *Quercus* and *Salix*. Other taxa represented in the pollen record include *Corylus/Myrica* and fungal spores

Lab code	Site	Material Type	Depth (cm)	Thickness (cm)	14C age	Error +/-	δ¹³C ‰	Calibrated Age AD (95.4 %)
SUERC-8041	Barflat	Peat humic acid	89–90	2	Fraction mod-ern:1.0931 ± 0.004	Modern	-30.6	1957–2003
SUERC-81223	Barflat	Peat-humic acid	110–11	2	593	21	-30.7	1303–1408
SUERC-82058	Barflat	Peat-humic acid	125	1	684	26	-30.2	1271–1387
SUERC-80414	Barflat	Peat-humic acid	131	1	1171	± 30	-29.5	770–960
SUERC-82062	Barflat	Peat-humic acid	145	1	944	26	-29.9	1028–1154
SUERC-81224	Barflat	Peat-humic acid	156	1	1092	24	-29.6 ‰	892–1011
SUERC-82063	Barflat	Peat-humic acid	167	1	1146	26	-29.2	777–92
SUERC-76891	Barflat	Peat-humic acid	181–2	2	1686	± 24	-25	260–415

Table 8.21
Barflat mire C¹⁴ ages (calibrated to 2σ; from Jones et al 2021)

233
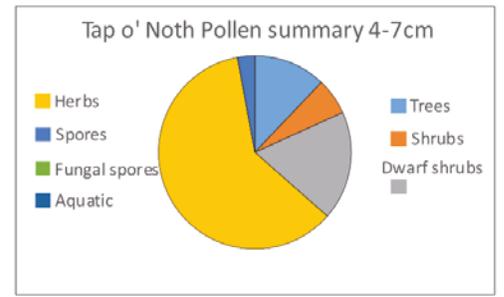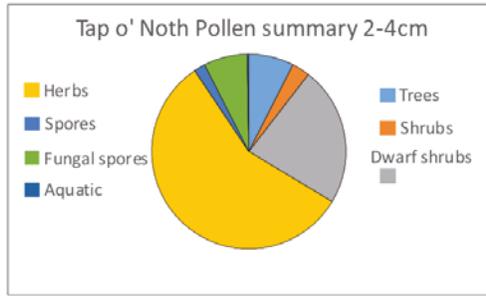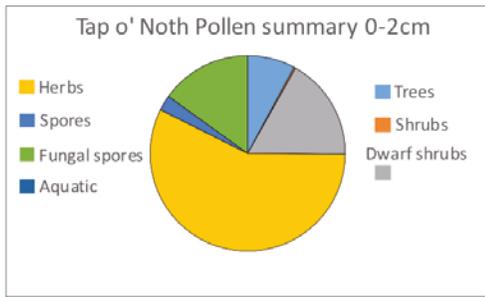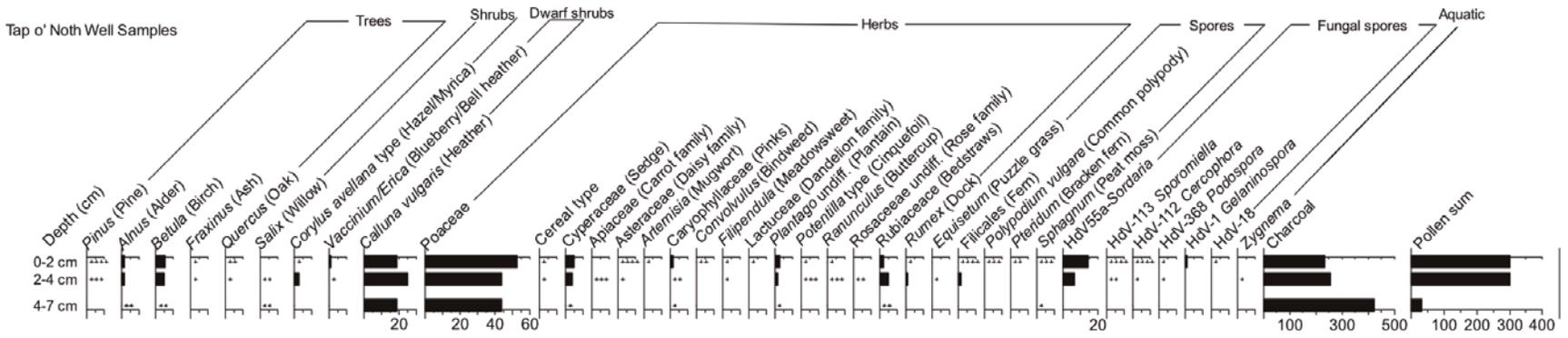
Illus 8.15
Tap o' Noth well sampling results
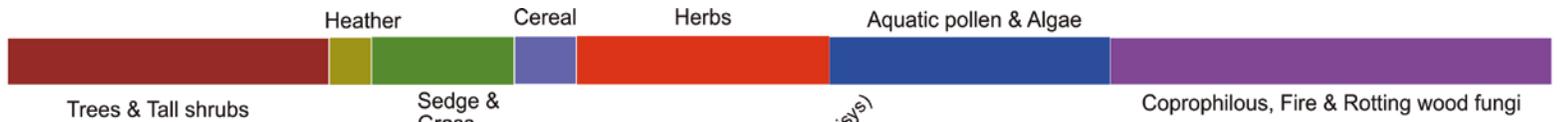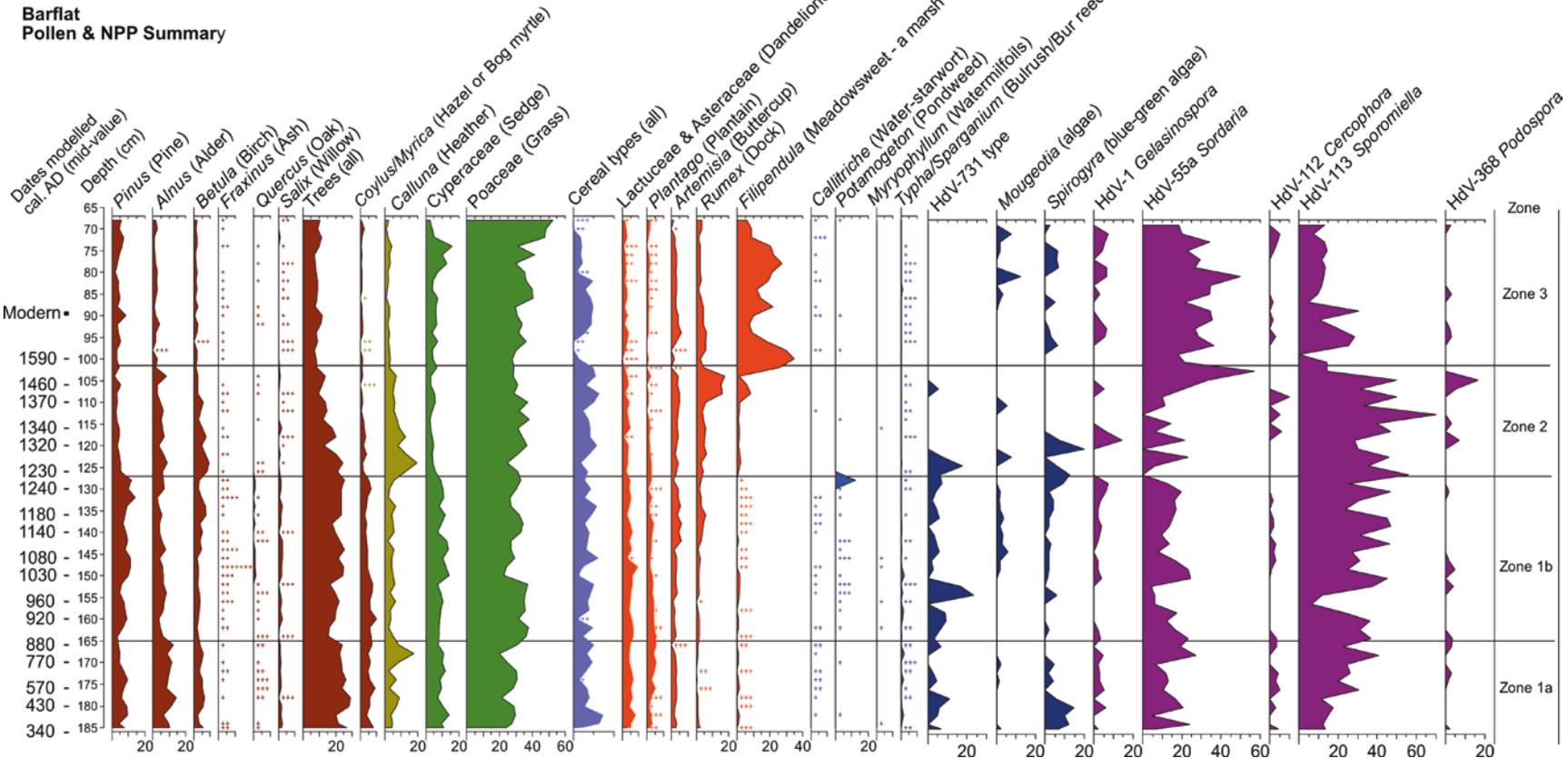
Illus 8.16
Summary Pollen and NPP results from Barflat

Zone	Depth (cm)	Age (cal AD)	Sediment	Dominant Taxa
Zone 1A	186--164	200–800	Grey-brown silty clay	**Woodland (20–30%):** *Pinus* (4–10%); *Betula* (2–7%), presence of: *Ulmus* (0–3%), *Quercus* (0–3%), some *Fraxinus, Abies* & *Picea*; *Corylus avellana* type (4–9.2%). **Heathland:** *Calluna vulgaris* (4–9.2%). **Wet woodland & mire:** *Alnus* (6–13%), *Salix* (1–3%); Cyperaceae (8–15%); *Pedicularis* & *Sphagnum*. **Aquatic:** Presence of *Callitriche, Typha* & the NPPs *Spirogyra, Mougeotia*, HdV-731. **Open ground, disturbance & pasture:** Poaceae (same as mire group); presence of Asteraceae, Lactuceae, *Plantago* undiff. *Rumex* spp., Ranunculaceae, *Plantago lanceolata*. Fungi associated with herbivore dung: HdV-368 *Podospora*, HdV-169 *Tripterospora*, HdV-112 *Cercophora*, HdV-113 *Sporormiella* & HdV-55A/B *Sordaria*. **Arable farming:** Cereal types (above 3%; between 184–82cm: 6.5–7.3%).
Zone 1B	164–128	800–1200	Grey-brown organic silty clay	**Woodland (wet & dry) decline to below 20% in the first half of this zone:** including *Alnus* & *Betula*. **Heathland:** is lower (2–7%). **Mire/Aquatic:** A rise in *Equisetum* above 150 cm, the presence of *Myriophyllum* between 165–45cm, a more consistent presence of *Potamogeton* above 155cm; A slight increase in *Sphagnum* (1–3%) and *Selaginella* (0–3%, > 146cm), Cyperaceae (78–14%). *Pedicularis* is absent. Fluctuations in the water table suggested by the presence/absence of aquatic algae *Mougeotia* & *Spirogyra*. HdV-207 Glomus chlamydospore might reflect erosion; HdV-1/2 Gelasinospora type, often associated with burning/drier conditions **Open ground, disturbance & pasture increase:** Poaceae increases slightly (same as mire); Brassicaceae, *Rumex* and Ranunculaceae increase slightly (to 3–4% above 142cm). Fungi associated with herbivore dung: HdV-368 *Podospora*, HdV-169 *Tripterospora*, HdV-112 *Cercophora*, HdV-113 *Sporormiella* & HdV-55A/B *Sordaria*. **Arable farming:** Cereal types consistent (>1.6%).
Zone 2	130–100	1200–1500	Dark brown, fibrous reed swamp peat	**Woodland:** *Pinus* declines from 12% to 2–9%. *Abies* & *Picea* disappear. Shrubs fall (below 20%). A prominent decline in Pteropsida (from 12% to 3–9% TLP). The spores *Botrychium* & *Dryopteris* disappear. *Betula* & *Alnus* however increase. **Mire & Aquatic:** Reduction in Cyperaceae, *Equisetum, Callitriche, Potamogeton*, HdV-731; but *Fillipendula* increases. **Heathland:** *Calluna vulgaris* initially increases (to 20%) but then decreases. **Disturbance, arable & pastoral:** Poaceae (35–55%); Brassicaceae (3–19%), *Rumex* (15–17%). Most coprophilous fungi types decline. Microscopic charcoal counts are also generally lower. **Arable farming:** Cereal types (2–6%)
Zone 3	100–68	Modern	Dark brown, very loose fibrous reed swamp peat	**Woodland:** Substantial decline in deciduous woodland (to below 20%), particularly *Betula* & *Alnus*. **Heathland:** *Calluna vulgaris* remains present, and the fungi *Meliola* type is well represented. **Mire/Aquatic:** Cyperaceae and *Equisetum* increase. Presence of *Valsaria* type & the aquatic *Callitriche*. **Open ground, disturbance & pasture:** Poaceae remains above 30%. *Filipendula*, Brassicaceae, *Rumex* and *Ranunculus* increase. Coprophilous fungi increase most notably *Sordaria* and *Sporormiella*, with *Cercophora, Podospora* & *Tripterospora* sporadically present. **Arable farming:** Cereal-type pollen fluctuates: Pronounced decrease between 103–96cm, a rise to 5% TLP, then a further fall after 82cm (1.4%).

Table 8.22
Summary of pollen and NPP results from Barflat

often associated with herbivores, particularly *Sordaria* but also *Sporomiella*, *Cercophora* and *Podospora* (van Geel et al 2003). All samples also contained high amounts of microcharcoal; above 400 counts at 4–7cm and above 200 counts (>5μm) in the top two samples.

Barflat

High resolution analysis was conducted on the Barflat core extracted *c* 300m south-east of the Craw Stane complex. The pollen and NPP diagram has been divided into three main zones based on CONISS. Zone 1 has been further divided into sub-zones 1a and 1b; 1b is a transitional zone between zones 1 and 2 (Table 8.22). Results are summarised in Illus 8.16 and Table 8.22 and are discussed in more detail in Jones et al (2021).

8.4.5 Discussion

Tap o' Noth

The well at Tap o' Noth dates to the Iron Age occupation of the site between the 4th and 1st century BC. In the three basal samples analysed (C212, Illus 8.14 and 8.15) elevated microcharcoal counts (200–400) were recorded. The macrofossil analysis (Niehaus & Ramsay this volume) identifies these as belonging to a diverse range of taxa including alder, birch, hazel, heather type, Scots pine, oak and willow and noted that no one type of taxa was overly dominant in the record, and thus probably represents hearth waste, either deliberately dumped into the well or from scatter located around the top of the well that had fallen down into the basal fills. Similarly, charcoal-rich deposits were also recorded towards the top of the well and represented mixed charcoal types from a variety of trees and heather, but predominantly from pine (25%) and heather type stems (45%).

Today grassland is the dominant vegetation found on the summit; it may also have been the dominant vegetation during the Iron Age occupation given the high representation of Poaceae pollen grains in the microfossil record. In terms of the economy of the site, cereal usage is evident in both the microfossil and macrofossil records. Low representation of cereal-type pollen is recorded in the two top samples of context 212, whilst in the macrofossil record significant amounts of carbonised barley grains were identified from a burnt occupation layer in the summit enclosure, with a few grains further identifiable as the hulled variety. The very low amounts of cereal pollen in the record may represent arable farming in the vicinity but not necessarily within the summit enclosure, and/or cereals that have been brought onto the site for processing. The latter seems to be supported by the macrofossil record, where Niehaus and Ramsay suggests in situ burnt grain, identified from a nearby occupation layer in trench 3 (306), was a result of either the preparation of cereals directly for food or drying of cereal grains prior to storage or grinding the

grains for flour or meal. However, the deposit from which the majority of the burnt grains were retrieved may date prior to the main phase of enclosure.

Besides arable farming there is some evidence of pastoral activities on site. The stalling of domesticated animals on the summit enclosure may be represented by the presence of herbaceous pollen such as *Plantago*, *Rumex*, *Artemisia*, *Filipendula*, Asteraceae and Lactuceae, often associated with disturbance or pasture (Brown et al 2007), and by a 7–15% representation of the coprophilous fungi *Sordaria* and sporadic representation of other coprophilous fungi (*Sporomiella, Podospora* and *Cercophora*) often associated with large herbivore dung (van Geel et al 2003). *Cercophora* and *Sordaria*, however, can also grow on rotting wood, whilst *Cercophora, Sordaria, Sporomiella* and *Podospora* can equally grow on non-domesticated animal dung (Perrotti & Van Aspern 2019) so some caution is needed when interpreting their presence. During extraction of the well samples it was noted that the site today is full of modern rabbit/hare droppings. However, modern contamination is unlikely as samples were extracted from a cleaned and uncontaminated section of the well. Hare droppings however could have impacted the record to some extent; hares were likely more common in Scotland during the Iron Age than rabbits, given the scarcity of rabbit bones in zooarchaeological assemblages. The brown hare is believed to have been introduced into the UK during the mid-Iron Age (Lauritsen et al 2018) but its distribution is predominantly in lowland areas of the UK. The native mountain hare, on the other hand, is found in upland heathland areas of northern England and Scotland and was likely more widespread in the past (Game and Wildlife Conservation Trust 2020). This species could have influenced the Tap o' Noth coprophilous record, though the presence of wild hare may be doubtful if the fort was in contemporary occupation. Indeed, robust evidence supporting the presence of domesticated animals at Tap o' Noth is present via the zooarchaeological record, where deposits of cattle teeth and bones have been identified, excavated from the inner face of the vitrified stone wall (See Mainland & Masson-MacLean below).

A wide range of wild foods, such as wild fruit, nuts, berries, and leafy plants, would have been seasonally available and probably formed an important subsistence resource during the Iron Age. At Tap o' Noth the pollen record shows that wild blueberries, which are packed with vitamins and fibre, were locally available during the Iron Age occupation of the site as they are today. Blueberries have previously been identified in Scottish archaeobotanical remains, including at an Iron Age Broch dating between 200 BC and AD 200 in Caithness (Dickson & Dickson 1984) and at Bearsden near Glasgow, in ditch deposits at a Roman fort on the Antonine Wall (Dickson & Dickson 2016). Blueberries have not been identified in the macrofossil results, but this may simply be because only charcoal and charred food remains have preserved. Ramsay did identify hazelnut shells, which does suggest people were supplementing their diets with some gathered wild foods.

In terms of natural vegetation likely growing on the summit of Tap o' Noth, sedge (Cyperaceae) has been identified in the pollen record; the dampness around the well likely providing an ideal environment for sedges to thrive. Several tree species were recorded in the Tap o' Noth pollen record including birch (*Betula*),

alder (*Alnus*), pine (*Pinus*), ash (*Fraxinus*), oak (*Quercus*) and willow (*Salix*). Tap o' Noth displays a similar representation of birch and alder pollen to the lowland coring site at Barflat but much lower pine and willow percentages. The sources are from different periods, but the cause of the difference is also probably due to both taphonomy and location. Taphonomy in that the small diameter of the well (eg van Amerongen 2020) and the height of Tap o' Noth have probably restricted regional pollen and pollen from lower altitudes from reaching the deposition site. The pollen representation at this site, therefore, is likely to be very localised.

The same woodland taxa, except ash, has been identified from the wood charcoal record. However, despite a diverse range of trees represented in the pollen record, tree percentage representation is very low, except for birch and alder. This would imply that most of the tree taxa identified were not growing locally on top of the hill. Thin soils may have been a contributing factor to this (Ramsay 2018c); however, given the diversity of charcoal types, woodland resources may have been plentiful in the wider landscape around Tap o' Noth, as represented in the Barflat record. It is quite likely most of the wood, particularly hardwoods, would have been sourced from the surrounding valleys below. Birch on the other hand seems to have been more locally and widely available displaying both a higher representation in the pollen record and is equally common in the macrofossil records.

Barflat

The Barflat core location in the mire below the Craw Stane complex is situated in a valley adjacent to the Water of Bogie river with a much wider pollen catchment area than the Tap o' Noth pollen source, encompassing both atmospheric and fluvial transported pollen from regional and local vegetation sources (eg Jacobson and Bradshaw 1981). The more sheltered location of the core location with its adjacent water course may also have supported more local woodland taxa compared to the summit of Tap o' Noth.

The pollen record comprises three main vegetation components: 1) Mire, 2) Woodland-Scrub-Heathland and 3) Anthropogenic. At the core location sedges, grasses, moss, alder, aquatic plants and algae formed part of the mire vegetation. The mire appears to have been considerably wetter between the 3rd and 14th centuries AD compared to after the 14th century. Minerogenic deposition, which has probably been deposited fluvially, is suggested by low organic and high silt content in the lithology and LOI results (see Jones et al 2021), whilst the presence of open water is represented by the presence of aquatic plants and algae such as *Callitriche*, *Potamogeton*, *Typha* & the NPPs *Spirogyra*, *Mougeotia*, and HdV-731. Outside of the mire, between the 3rd and 6th centuries AD, local communities would have had a wide variety of woodland resources available to them to use for construction, animal fodder and fuel. This is evidenced in the pollen record by the 20–30% arboreal representation, which constituted both wet and dry woodland (eg pine, alder, willow, some oak, some ash and birch). *Corylus/Myrica* type pollen are also well represented. The availability of hazel woodland/scrub would have been beneficial not only for construction or as a fuel resource, but also the seasonal availability of resources such as hazelnuts would have provided a valuable food supplement. These results are further supported by the archaeobotanical record which highlights a diverse usage of

plants at the Craw Stane enclosure complex. During excavations hazelnut shells were identified from a variety of contexts, as well as carbonised remains of Prunoideae (plum/cherry?) was also identified from a midden deposit. The identification of Prunoideae in the macrofossil record is interesting as it perhaps suggests the availability of wild cherries or plums. Wild cherries have been previously identified from early medieval contexts in Scotland. At Dundurn for example, human faeces contained over 24 cherry stones (Alcock et al 1989: 202). The genus *Prunus*, however, has not been identified in the pollen record. Besides the availability of wild plant resources, the inhabitants of the Craw Stane complex and surrounding settlements were likely practising both pastoral and arable farming. Pastoral farming is indicated by the strong presence of fungi commonly associated with herbivore dung such as: *Podospora*, *Tripterospora*, *Cercophora*, *Sporormiella* & *Sordaria*. Arable farming is suggested by the presence of cereal-type pollen which may belong to the *Hordeum* (Barley) family (see Jones et al 2021); the cultivation of which is again supported by the macrofossil analysis. Both arable and pastoral farming is further supported by herbs with cultural affinities (eg Asteraceae, Lactuceae, *Plantago* undiff. *Rumex* spp., Ranunculaceae, *Plantago lanceolata*). After the abandonment of the Craw Stane complex in the 6th century AD there is evidence to suggest continued exploitation of the land. Notwithstanding a brief decline in cereal percentages sometime around the 6th century AD (see Jones et al 2021) the local landscape does not appear to have been abandoned as cereal-type pollen continues to be recorded throughout the record. Pastoral indicators as well to some extent continue to be represented, with fluctuations in the coprophilous fungi record linked to erosional discharge (Jones et al 2021). Evidence of fire and erosion (represented in the geochemical record – see Jones et al 2021) are also recorded during and after the Barflat and Cairn More occupation periods, although these are most pronounced between AD 800 and AD 1200.

8.4.5 Conclusions

The main objectives of the environmental analysis have been to reconstruct the types of vegetation surrounding the early medieval settlement complex at the Craw Stane and the Iron Age fort at Tap o' Noth. This was undertaken to not only understand the differences in the environment that communities in the later prehistoric to early medieval periods lived within, but also to better understand resource availability and the economies of both sites. The summit at Tap o' Noth appears to have been more open than in the environs of the Craw Stane complex, mirroring the conditions of today. Subsistence economies at both sites would have been supported by subsistence farming with evidence for low-level use/availability of wild resources, such as blueberries and hazelnuts. Grass and herbaceous taxa appear to have dominated the environments of Tap o' Noth after the construction of the fort with evidence that the surrounding slopes supported heather and wild blueberries communities as it does today. The evidence for farming includes both arable farming (Barley) and pastoralism indicators; and the pollen and fungal spores associated with dung may indicate some domesticated livestock were kept within the summit enclosure. Woodland taxa were scare in the pollen record but may indicate the occasional alder and birch scrub (birch was

probably more locally and widely available). Woodland resources were probably more plentiful in the surrounding valleys below as indicated in the Barflat samples. During the 4th–6th centuries AD at Barflat woodland would have provided ample building material, fodder and fuel whilst the main economy centred around both pastoralism and arable farming. Cereal types are prominent in this record and represent predominantly *Hordeum* (Barley) types. Finally, despite abandonment of the Craw Stane enclosure complex and potentially a brief decline in cereal percentages in the 6th century AD, cereal pollen grains continue to be recorded throughout the record which suggests the locality was not abandoned with occupation at Cairn More and Tap o' Noth continuing to the 7th century AD.

8.5 Microbotanical Evidence from Pictland (Upper Strathbogie Valley): Phytoliths and Starch Grains

Shalen Prado

8.5.1 Introduction

Microbotanical residues, such as starch grains and phytoliths, retrieved from three Pictish sites in the Upper Strathbogie valley (Cairn More, Tap o' Noth and Rhynie) have provided either evidence of plants from Pictish settlements which only rarely preserve in the macrobotanical record or provide an alternative way of tracking plant use. These microscopic plant remains were extracted from soil samples and potsherds, and shed light on past architectural traditions, foodways, land-use and human–plant relationships in Pictland. Soil samples targeted intact floor layers from Tap o' Noth and Cairn More, while potsherd samples were limited to Rhynie. These two sampling strategies extracted variable quantities and types of microbotanical residues with phytoliths predominately retrieved from soil samples and starch grains from potsherd residues. The microbotanical results presented here are useful for comparison with the macrobotanical remains discussed by Niehaus and Ramsay (this chapter), and other environmental proxies such as pollen (Jones et al 2021; Jones this chapter). Overall, the phytolith and starch grain assemblages from the Upper Strathbogie valley point to the centrality of cereal production, the use of turf in upland architecture and human interaction with a spectrum of ecological niche zones.

8.5.2 Methods

Two sampling approaches were used to retrieve phytoliths and starch grains from Pictish archaeological sites: extraction from soil samples, and a three-wash process for extraction from artefact surfaces (Barton 2007: 1752; Hart 2011: 3246; Pearsall 2015: 360). Both approaches were successful in retrieving microbotanical specimens, with only one context considered as 'empty' (Rhynie Potsherd 2; Table 8.23). Laboratory procedures for microbotanical extraction from soil samples is detailed in Prado and Noble (2022). Soil samples were best suited for retrieving phytoliths and were not suitable for extracting starch grains which would have been burned up during chemical processing of the soil. The laboratory procedure for soil sampling was carried out at the McMaster Paleoethnobotanical Research Facility (MPERF) in Canada and

	Soil		Potsherds	
Site Name	# of samples	# of contexts	# of samples	# of contexts
		Context		
Cairn More (CM)	21	1		
		Floor		
Tap o' Noth (To'N)	14	2*		
		Hearth Floor		
Rhynie (REAP)			3	3
				Potsherd 1 *Potsherd 2* *Potsherd 3*
Total	35	3	3	3

Table 8.23
Phytolith sample contexts in this study. *Indicates neighbouring/embedded contexts which were located within the same horizon. For example, a hearth context within a floor layer context

broadly involved soil sterilisation, deflocculation, separating into soil fractions (A/B and S fraction), removing clay, chemical digestion and flotation. At Tap o' Noth and Cairn More, soil samples were taken using a horizontal 'blanket' sampling approach where a 1m x 1m grid delineated the sampling area (ie, house platform and in situ floor layer respectively). Composite 'pinch' samples were taken from each unit across the grid, sampling both feature (eg, hearths) and non-feature contexts (Prado & Noble 2022: 4). Horizontal blanket sampling is well suited in cases where researchers aim to collect a higher diversity of plants within a specific context (Lennstrom & Hastorf 1992: 206, 211; Pearsall 2015: 74).

The three-wash process used for sampling artefacts such as potsherds involves a dry wash, a wet wash and a sonicated wash to extract microbotanical specimens from the outermost to innermost layers of artefact surface residues. This process in non-destructive, cost-effective, time efficient and has been used in several archaeological investigations (Berubé et al 2020; Hart 2011: 3246; Morell-Hart 2015; Morell-Hart et al 2014, 2019; Pearsall 2015: 360; Pearsall et al 2004: 427; Prado 2023). The dry wash involves gently brushing the surface layer (often consisting of stuck-on soil) with your finger while wearing a nitrile glove. This wash is collected into a clean petri dish and transferred into

a labelled sample tube (eg, 2mL centrifuge tube). The wet wash involves the same gentle washing process with the addition of distilled or ultra-pure water. Again, this wash is collected into a petri dish and transferred to a labelled sampling tube using a clean pipette. The final sonicated wash gently dislodges stuck-on and trapped residues from the microscopic pores and crevices of artefacts by using a handheld sonicated device (in this case a Kinga Skin Scrubber KD-8020). Sonication lasts for five minutes to sufficiently dislodge the stuck-on residues (Pearsall 2015: 360), and like the other washes is transferred into a sample tube. Each sampling context (ie, artefact) took approximately 20 minutes to sample, and materials needed were minimal including glass petri dishes, ultra-pure water, pipettes, kim wipes, sample tubes, nitrile gloves and a handheld sonicator.

After extraction these samples were mounted onto glass microscope slides and identified using a transmitted light microscope (Zeiss Axiolab A.1) at 200x, 400x, and 630x magnification. Phytoliths were counted to a minimum of 200 morphotypes following established protocols (Albert et al 1999; Albert & Weiner 2001; Pearsall 2015) and were described using International Code for Phytolith Nomenclature (ICPN) 1.0 and 2.0 (Madella et al 2005; Neumann et al 2019). Artefact residues contained both starch grains and phytoliths (albeit a minimal quantity) as no chemical processing was necessary for these extractions. Starch grains required the use of cross polarised light filters to identify diagnostic features including the extinction cross, and these microbotanical structures were described using the author's reference collection of modern starch morphotypes (macmicrobot.omeka.net) and compared with Ahituv and Henry (2022), Piperno and Dillehay (2008), Torrence and Barton (2006), and Yang and Perry (2013).

Secondary analysis and tabulation were carried out using Excel using pivot tables. Each microbotanical specimen was described with morphological information including morphotype (eg, conical starch grain), size (eg, 10 microns), hilum (eg, centric), lamellae (eg, present), extinction cross (eg, bold – straight arms), surface texture (eg, smooth) and possible cooking damage (eg, blurred extinction cross). Secondary analysis predominantly focused on ubiquity (Table 8.24) which measures on the occurrence of specific plant taxa across sampling contexts. This is useful for understanding how pervasive a plant taxon is within a context and avoids over-representation of a plant's importance which can occur when using raw counts (eg, where a cache of a plant may overwhelm its representation).

	Aster.	Cyper.	Arund.	Panicoid.	Pooid.				Arbor.	Dicot.
					G	H	T	A		
CM	20/21	19/21	2/21	21/21	21/21	0/21	0/21	0/21	2/21	3/21
To'N	12/14	11/14	0/14	12/14	12/14	0/14	0/14	0/14	9/14	0/14
REAP	0/3	0/3	0/3	1/3	2/3	2/3	1/3	1/3	0/3	0/3

Table 8.24
Ubiquity of major plant taxa. Aster. = Asteraceae, Cyper. = Cyperaceae, Arund. = Arundinoideae, Panicoid. = Panicoideae, Pooid. = Pooideae (G = General Pooideae [species not identifiable], H = Hordeum sp., T = Triticum diccocoides, A= Avena sp.), Arbor. = Unidentified Arboreal, and Dicot. = Unidentified dicotyledonous taxa
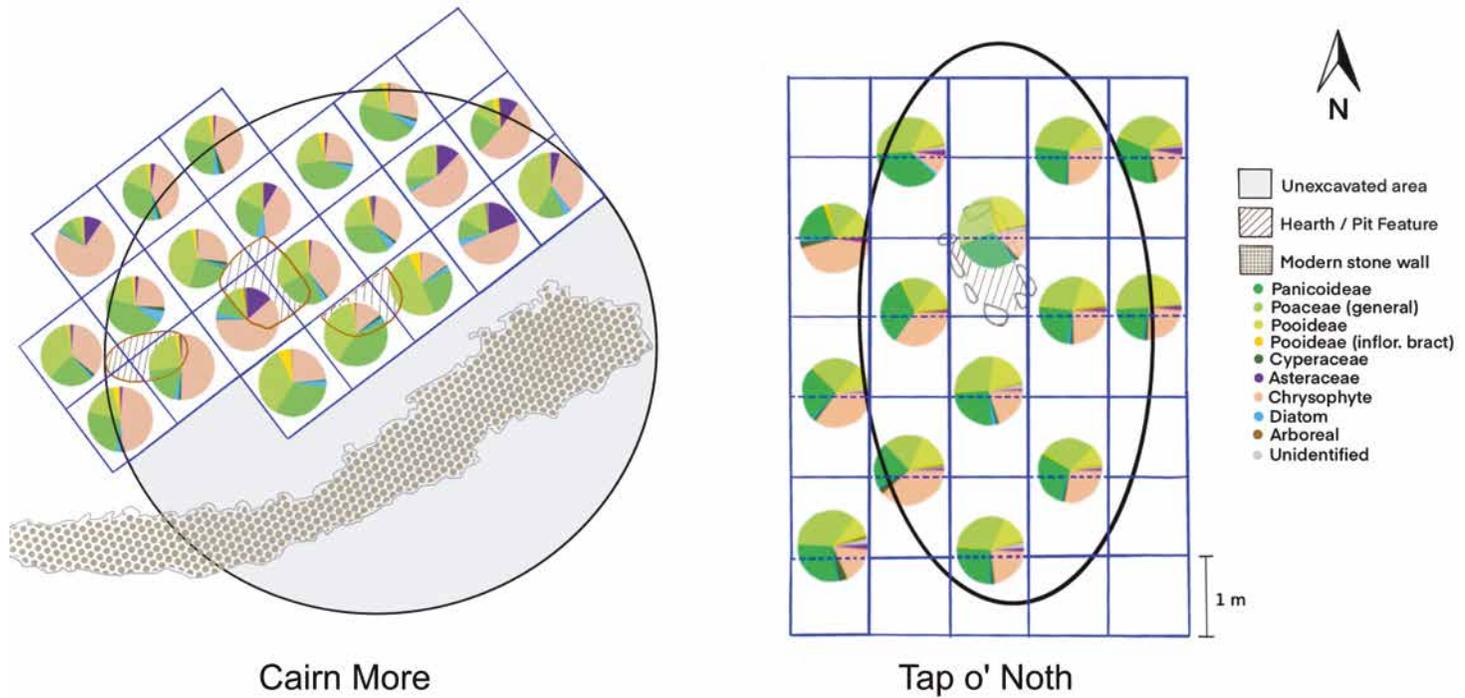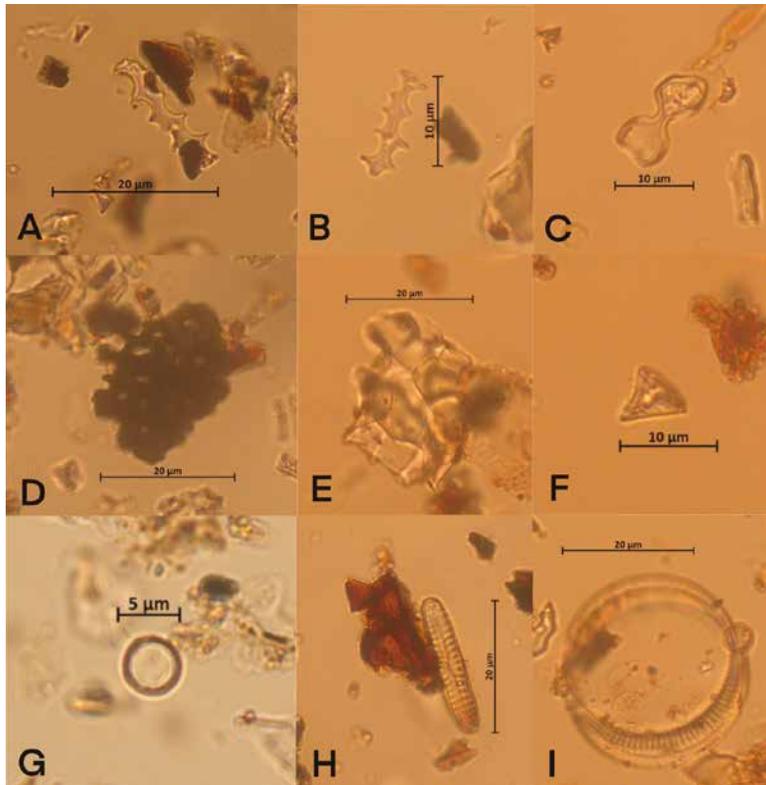
Illus 8.17
Microbotanical results from soil samples of excavated house floors at Cairn More and Tap o' Noth

8.5.3 Results

The microbotanical assemblages (Illus 8.17) are broadly reflective of the sampling strategy. Soil samples retrieved a broader spectrum of plant taxa, while the potsherd residue extraction had less diversity but were able to facilitate a more detailed identification of plant taxa (Table 8.25). As expected, grasses (Poaceae) were well represented, and this is unsurprising as grasses are one of the

Illus 8.18
Phytolith morphotypes extracted from Cairn More and Tap o' Noth samples viewed at 400. A–B elongate dendritic phytoliths (cereal inflorescence bracts), C – bilobate phytolith (Panicoideae), D – opaque perforate plate (Asteraceae), E – facetate phytolith (arboreal), F – sedge cone phytolith (Cyperaceae), G – Chrysophyte (micro-algae), H–I diatoms (micro-algae)
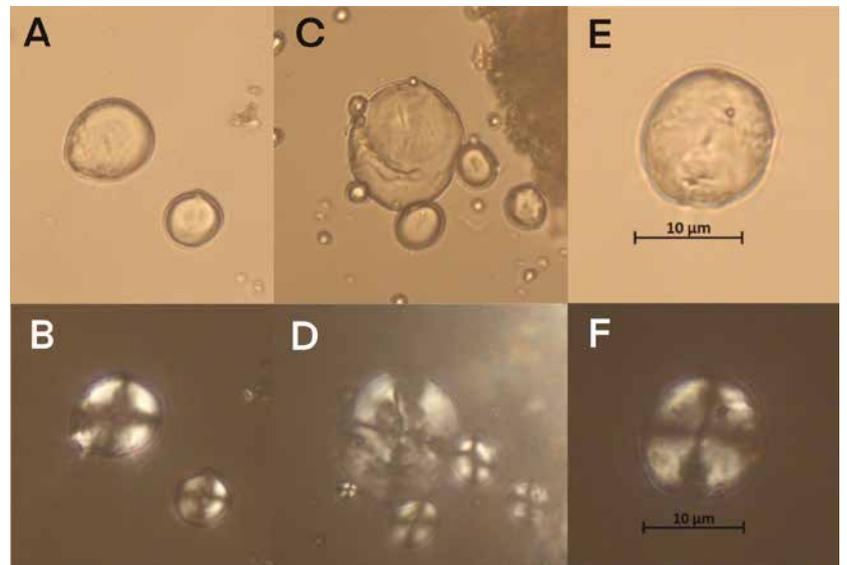
Illus 8.19
Lenticular cereal-type starch grains extracted from the Craw Stane complex potsherd surfaces (viewed at 200x – 400x). A–B Triticum dicoccum (emmer wheat) starch grain, with diagnostic dimpled surface. C–E Hordeum (barley) starch grains

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Site	Microremain	Plant Families Represented	Plant Taxa
Cairn More	Phytoliths	Asteraceae, Cyperaceae, cf Ericaceae, Poaceae (Arundinoideae, Panicoideae, Pooideae), Unidentified arboreal, Unidentified Dicot	Could not identify to genus level
Tap o' Noth	Phytoliths	Asteraceae, Cyperaceae, cf Ericaceae, Poaceae (Arundinoideae, Panicoideae, Pooideae) Unidentified arboreal	Could not identify to genus level
Craw Stane complex	Starch grains, Phytoliths	Poaceae (Panicoideae, Pooideae)	*Hordeum* sp., *Triticum diccocoides*, *Avena* sp.

Table 8.25
Plant microremains and taxa identified in study

highest producers of phytoliths (Delhon et al 2020: 231; Morell-Hart 2019: 236; Twiss 1992). Grass phytoliths from Arundinoideae (ie, reeds), Panicoideae (eg, needle grass) and Pooideae (eg, cereals) subfamilies were identified in soil samples from Cairn More and Tap o' Noth (Illus 8.18), while only Panicoideae and Pooideae were present in the Rhynie potsherd samples (Illus 8.19). These grasses were identified through grass short cell phytoliths which included elongate entire, cylindrical polylobate, bilobate, trapeziform sinuate, elongate echinate, trapeziform short cell, bulliform, papillae and elongate dendritic morphotypes. Cereal inflorescence bracts, the plant part that encapsulates the edible grain, were indicated through papillae and elongate dendritic morphotypes. Cereals were also evidenced in the study through the presence of lenticular starch grains within the Rhynie potsherd residues. Non-grass plants were also present and included asters (Asteraceae – opaque perforated plate phytoliths), cf. heather (Ericaceae – opaque perforate plate phytoliths), sedges (Cyperaceae – cone phytoliths), arboreal taxa (unidentified – faceted forms, conifer form phytoliths), and dicotyledonous plants (unidentified – hair cell base, stomata, jigsaw phytoliths). Overall, the results from the microbotanical analysis represent Pictish-plant interactions with heathlands, wetlands, grasslands and agricultural areas. To understand architectural traditions, foodways and land-use however, the results need to be discussed in regard to sampling strategy and spatial representation.

Cairn More

During excavations at Cairn More by the Northern Picts Project in 2020, an in situ roundhouse floor was identified under the collapse materials of the outermost rampart wall. The floor was truncated by a modern drystone wall, and therefore only half of the floor layer was accessible for microbotanical sampling. Twenty-one samples were taken across this floor layer using the 1m x 1m grid for blanket sampling (Illus 8.17). Twenty of these samples were taken directly from the stained floor layer, and an additional sample was taken just outside of the floor stain and was assumed to be a natural context. Radiocarbon dates from this floor layer suggest AD 5th- to 6th-century dates (Prado & Noble 2022: 3).

Grass (Poaceae) phytoliths were well represented in all samples. Of particular interest was the presence of elongate dendritic

phytoliths which are only produced in cereal inflorescence bracts. Although these phytolith morphotypes were only recovered in trace quantities, they confirmed the presence of cereal crops which were possibly processed (ie, threshed or winnowed) nearby to this roundhouse. Sedge (Cyperaceae) and aster (Asteraceae) phytoliths were occasionally identified through cone and opaque perforated plate morphotypes respectively. Some perforated plate phytoliths could be representative of heather (Ericaceae).

Micro-algae such as diatom frustules and chrysophycean cysts were frequently present throughout the roundhouse floor samples, and although these technically do not qualify as plant remains (algae belong to the Kingdom Protista rather than Plantae), micro-algae were tabulated alongside the microbotanical residues. Tentative identifications were assigned to these micro-algae and many appear to belong to freshwater species that live within terrestrial and subaerial environments such as peat bogs.

The microbotanical and micro-algae assemblage from Cairn More provided data to interpret architectural details of the roundhouse and to better understand human-plant relationships in Pictland. Wetland phytoliths (eg, sedge cones) and micro-algae were concentrated around the perimeter of the floor which suggests the use of wetland turf to build the outer walls of the structure. The roof was possibly constructed of mixed grass and heather thatching as Poaceae, Asteraceae and cf. Ericaceae morphotypes were present across the floor layer. Grasslands, heathlands and wetlands (eg, bogs) were represented through these micro-residues which suggests the Picts relied on and interacted with these ecological niche zones to create and sustain the upland settlement at Cairn More. The use of the roundhouse was unclear given the microbotanical evidence; however, the presence of the floor layer itself suggests repeated use of the structure. Furthermore, the presence of cereal inflorescence bract phytoliths confirms the presence of cereal agriculture and crop-processing activities at Cairn More, in this case just outside of the main ringfort enclosure, which mirrors the evidence from the Craw Stane complex (Niehaus & Ramsay this chapter).

Tap o' Noth

A series of house platforms were identified at Tap o' Noth within the lower citadel. These platforms were targeted for microbotanical sampling during excavations in 2022 to examine architectural details, use of space, activity areas and foodways. House 3 within Trench 16 was sampled following the blanket sampling strategy like the procedure at Cairn More and retrieved 14 samples. The T16 platform suggested an oval shaped structure and a single well-built rectangular hearth was located near the centre–west of the floor (Illus 8.17). Radiocarbon samples were taken from the floor layer of House 3 and returned AD 3rd –late 6th-/early 7th-century dates, the floor deposits presumably derive from towards the end of this occupation sequence. A small glass bead and burnt animal bone were retrieved during the excavation of the platform, suggesting that the building was likely a residence.

Across the floor layer from House 3, grasses (Poaceae), asters (Asteraceae), cf. heather (Ericaceae) and sedges (Cyperaceae) were represented. Wet environment indicators such as micro-algae and sedges were represented at higher quantities around the edge of the structure, and this is particularly clear toward the southern side of the floor layer. This suggests a probable concentration of

peat/turf around the outer edge of the platform. Given the absence of post holes and the higher-than-average retrieval of micro-algae and plant taxa that thrive in wet environments (eg, sedges), the microbotanical evidence suggests that House 3 was likely constructed of turf walls and a mixed thatch roof, like the structure at Cairn More. At both of these upland settlements the fortuitous retrieval of micro-algae (eg, chrysophytes and diatom frustules) alongside the microbotanical residues were important for understanding the architectural form of these Pictish buildings.

The microbotanical assemblage from Tap o' Noth suggests relationships between the Picts and several ecological niche zones including grassland, heathland, wetland and forest environments. Indicators of agricultural production were also present as evidenced by the recovery of cereal inflorescence bract phytoliths (ie, elongate dendritic morphotype) from the floor of House 3. However, the microbotanical assemblages from both Tap o' Noth and Cairn More house floors were not able to reflect the division of space for certain activities such as crop processing, sleeping/bedding or cooking. Such ephemeral floors can be challenging to interpret due to the cleaning habits of the inhabitants (eg, sweeping) which can remove activity area indicators or disperse them throughout the structure. Nonetheless, the presence of cereal inflorescence bract phytoliths from Cairn More and Tap o' Noth floors however indicates that crop processing such as the threshing or winnowing of cereal crops was carried out nearby these structures, and perhaps was tracked into the structure by its inhabitants providing some indication of the types of activities carried out in these structures.

RHYNIE

Microbotanical sampling at Rhynie was restricted to artefact residues as soil sampling strategies were not practised in collaboration with the Northern Picts Project until after the Rhynie Environs Project (REAP) was completed. Three potsherds retrieved from the Craw Stane complex were targeted for the three-wash sampling process. These potsherds were likely made by hand (ie, without a pottery wheel) and did not show any indication of cooking encrustations visible to the naked eye. Small assemblages of locally produced Pictish pottery are rarely recovered from Pictish archaeological sites (Noble & Evans 2022: 85) and this residue analysis suggests that such approaches are advantageous where

macroscopic food evidence is scarce because of preservation biases. It is important to note the possibility of contamination in starch research which has been discussed at length within the field (eg, Crowther et al 2014; Laurence et al 2011; Mercader et al 2017); however, no indication of contamination was present in these samples, such as the presence of unexpected residues (eg, maize starch grains).

Approximately 75 starch grains were retrieved from three Rhynie potsherds (Table 8.26). These sherds had already been gently cleaned after excavation and therefore a dry wash was not possible (ie, no dirt remained to brush off without water) although it was attempted. Two of the three sherds contained these starch grains, and one sherd (PS 2) was considered 'empty' as no identifiable residues were retrieved. Potsherd 1 (PS 1) only retrieved residues from the wet wash, and the sonicated wash was deemed 'empty'. Potsherd 3 contained the largest quantity of starch grains (n=70). The starch grain assemblage from Rhynie consisted of mostly lenticular morphotypes which are diagnostic of cereal grains; however, non-lenticular starch grains were also present including one spherical starch grain (cf transitory starch grain) and one other starch grain that could not be rotated to confirm the morphotype. Only one phytolith was retrieved from the potsherd surfaces, a grass type cylindrical polylobate phytolith (Panicoideae).

Starch grains from oat (*Avena* sp.), barley (*Hordeum* sp.), emmer wheat (*T. dicoccum*) and unidentified cereals (Pooideae) were recovered from two of the three potsherds from Rhynie. One sherd (PS 3) contained over 50 cereal starch grains which with most appearing raw and only some appeared cooked (eg, boiled). Several starches from Rhynie Potsherd 3 resembled emmer wheat and barley starch morphotypes (Illus 8.19). Cooking evidence can be determined by looking for cooking damage evidence of the starch grains; for example, blurred extinction crosses (Henry et al 2009). Both sherds had evidence of cooked and uncooked or 'raw' starch grains, which suggests that the Picts used handmade pottery for both cooking and raw storage. The quantity of starch grains from Potsherd 3 was surprising and perhaps suggests this sherd was mostly used as a cereal storage vessel because most of the grains appeared undamaged from cooking. Given the high status of the site, such vessels would not be surprising, and the presence of barley starch grains corroborates both

PS #	Wash	Morphotype	Plant taxon	#	Size	Lamellae	Hilum	Extinction cross	Surface
PS 1	W	Could not rotate	N/A	1	7μm	no	centric	blurry	smooth
PS 1	W	Lenticular – subcircular	*Hordeum* sp.	1	12μm	no	centric	blurry	dimpled
PS 1	W	Lenticular – subcircular	*Pooideae*	1	8μm	no	centric	bold	smooth
PS 1	W	Spherical	N/A	1	5μm	no	centric	bold	smooth
PS 3	W	Lenticular – polygonal	*Avena* sp.	1	8μm	no	centric	blurry	smooth
PS 3	W	Lenticular – subcircular	*Pooideae*	1	11μm	damaged	centric	blurry	smooth
PS 3	S	Lenticular –subcircular	*Pooideae*	1	11μm	no	centric	bold	smooth
PS 3	S	Lenticular – subcircular	*Pooideae*	1	7μm	no	centric	bold	smooth
PS 3	S	Lenticular – circular	*Hordeum* or *T. dicoccum*	60	5–22μm	faint	centric	bold	dimpled
PS 3	S	Lenticular – subcircular	*Hordeum* sp.	6	10μm	no	centric	bold	smooth

Table 8.26
Starch grains retrieved from Rhynie potsherds (PS) 1–3. Wet wash (W), Sonicated wash (S)

the macrobotanical and palynological evidence which also identified cereal residues within the Craw Stane complex (Jones et al 2021; Niehaus and Ramsay above).

8.5.4 Discussion

The microbotanical assemblages from this study suggest human–plant relationships in the Upper Strathbogie valley were consistent in regard to cereal production and upland architecture. Cereals were identified through various microbotanical residues (eg, elongate dendritic phytoliths and lenticular starch grains), which points to a consistent plant food production strategy by the Picts which centred around cereal agriculture. This is consistent with contemporaneous agricultural practices from medieval Ireland and Anglo-Saxon England (Banham 2010; Higham 2010: 20; McCormick 2014; McKerracher 2018; Monk 1986; O'Sullivan et al 2014: 75–6). Interestingly, other plant foods were not recovered as might be expected such as legumes (eg, beans and peas), geophytes (eg, roots and tubers) and nuts. Both legumes and geophytes have highly diagnostic starch grains, as do some nuts (eg, acorns). This absence could be indicative of an exclusive reliance on cereal plant foods; however, this study marks the beginning of such analyses, and a much larger sampling strategy would provide a clearer picture of past Pictish foodways.

The similarity between the microbotanical assemblages from the roundhouse at Cairn More and the house platform at Tap o' Noth suggest a shared approach to Pictish vernacular architecture. Although minor differences can be identified, for example the Asteraceae and Ericaceae signatures are more pronounced at Cairn More and more dispersed at Tap o' Noth, although these differences are minor. Overall, the structures were likely very similar in form, turf walled with mixed thatch roof, central hearths and likely flexible activity areas. The construction materials including peat turf, sedges, heath and asters were likely procured from wet upland zones such as blanket bogs and fens as evidenced by micro-algae, Asteraceae opaque perforated plate phytoliths and Cyperaceae cone phytoliths. Such materials were likely known to the Picts for the insulative and waterproof qualities. Similar construction traditions are known from other regions and time periods such as Iceland's Viking Age and historical turf structures (Bathurst et al 2010; van Hoof and van Dijken 2008).

Through this small study several details surrounding Pictish daily life have been uncovered; however, much is still ambiguous. The microbotanical assemblages from Cairn More, Tap o' Noth and Rhynie indeed point to shared traditions in regard to foodways and architectural form, yet it is unclear how these sites might have operated in relation to each other. Seasonality too is challenging to interpret based on this evidence. Potentially, the cereal evidence from upland sites indicates that cereal products were being transported to the upland settlements, as it is unlikely that cereal agriculture would thrive in the upland landscape in comparison to the fertile and sheltered lowland settlements (eg, Rhynie). However, the presence of the inflorescence bracts at Cairn More and Tap o' Noth is interesting as this indicates unprocessed cereals were taken to the upland settlements and processed there, instead of being processed first in the lowlands and transported later for consumption (eg, winter).

Further microbotanical analyses would certainly improve our understanding of daily life in Pictland including the use of space

and food traditions in Pictish settlements. Unfortunately, lowland settlements are often disturbed by historical and modern practices, including agricultural ploughing, and this inhibits the potential for microbotanical sampling of lowland settlement contexts (ie, sampling of floors). Pictish made pots are also rarely recovered in the archaeological record which limits the capacity for residue sampling. Imported pottery, which is slightly more common than locally made pottery, could present intriguing opportunities for understanding how the Picts interacted with cultural outsiders. Did the imported pots exclusively contain imported food and drink? Or were the pots reused? Hopefully future excavations of Pictish settlements uncover more opportunities for microbotanical analyses to investigate these and other questions on Pictish plant relationships, foodways, use of space, land-use and architecture.

8.5.5 Conclusion

Microbotanical analysis is useful in first-millennium AD contexts where macrobotanical evidence is often scarce in northern Britain. In this study, phytoliths and micro-algae were useful for identifying turf-walled architecture at settlements at Cairn More and Tap o' Noth. Starch grains were recovered from two of three Rhynie potsherds and the results suggest that locally made pottery was used for both storage and cooking of cereals at Rhynie. Cereals appeared to be the central plant derived food based on phytolith and starch grain evidence, as starch grains from legumes and geophytes were absent. Residue analysis was limited to a small sample size of three potsherds however, and an expanded analysis of other potsherds would greatly improve our understanding of Pictish plant food consumption. Such analyses are complimentary to pollen, wood charcoal and carbonised seed evidence and together archaeobotanical and paleoethnobotanical lines of evidence from Pictland are improving the resolution of daily life, seasonal tempos and Pictish environment relationships.

8.6 Faunal remains from the Tap o' Noth excavations

EDOUARD MASSON-MACLEAN

8.6.1 Introduction

The excavations at Tap o' Noth hillfort, Aberdeenshire, consisted of trenches targeting both the Iron Age oblong fort and a number of first-millennium AD dwelling platforms within the rampart of the lower fort. Due to soil acidity and unfavourable burial conditions for bone preservation, faunal assemblages are rare from these periods in mainland Scotland and Tap o' Noth is no exception. Excavations led by the University of Aberdeen since 2017 have yielded only small quantities of poorly preserved animal bone, including teeth with partial loss of dentine, and small calcined fragments comprising an assemblage of limited interpretative value.

The animal bone was recovered mainly by hand and no large bulk samples were taken for the recovery of animal bone. The assemblage was analysed following standard archaeozoological methods (Davis 1992; Dobney et al 1999) and taxonomic identifications were made using the comparative reference collection at the

University of Aberdeen Archaeology Department. The preservation condition and fragmentary nature of the teeth did not permit tooth wear analysis for age-at-death estimates due to loss of dentine and damaged occlusal surfaces or the use of the crown height method for horse (Levine 1982). Age-at-death based on long bone fusion followed Silver (1969).

8.6.2 Iron Age component

The animal bone from within the Iron Age oblong fort came from contexts (407) and (1708), deposits associated with middens and a possible structure up against the rampart of the fort interior. A poorly preserved assemblage of 202 bone specimens was recovered. Context (407) yielded 125 unidentifiable mammalian bone fragments, mainly small calcined fragments (<2cm), and 3 large mammal (cattle, horse or red deer size) vertebrae. Context (1708) yielded 74 bone pieces including 60 unidentifiable mammal, 8 long bone shaft fragments of large mammal and a vertebral fragment from a medium-sized mammal (sheep/goat, pig size). Four bones were identified as cattle including a right distal humerus, a right radius, a sacral fragment and a burnt centroquartale. The radius was complete with both epiphyses fused indicative of an animal which was at least 3.5/4 years old when slaughtered. Cut marks were observed on the distal humerus, indicating consumption, and was fused coming from an individual of at least 12–18 months old when killed. A pig lower third molar tooth was also recovered from (1708) and seemed to be in stage wear A or B (Grant 1982) suggesting the animal was slaughtered before reaching adulthood, possibly between 18–30 months, though in primitive breeds the eruption of the M3 could have occurred as late as three years of age (Lemoine et al 2014; Silver 1969; Bond et al 2015: 215). Cattle would probably have been a high-value multi-purpose commodity used as working animals, dairying, but also a source of food and raw materials (McCormick 2008: 1992), whilst pigs were raised primarily as a food item, but have also been considered to be high-status animals consumed by elites in the Iron Age (Smith 2000; Bond 2002).

8.6.3 The platform settlements

The animal bone from the lower fort comprised the degraded teeth and enamel fragments from context (16011), the foundation deposit for platform T16. At least one lower third molar and one upper molar of cattle could be identified and four horse upper cheek teeth, probably representing just a single individual for both species. The cattle teeth were too degraded to be aged. All horse teeth were in wear at the time of death indicating the individual or individuals were at least 5 to 6 years old (Levine 1982: 229). Horses, often associated with high-status activity, were mainly kept for warfare, transport or traction and may have been occasionally consumed at the end of their working life and also possibly in times of hardship (Foster 2014: 199; McCormick 2007: 92; Jaworski et al 2020; Cross 2011: 191).

Overall the faunal remains from Tap o' Noth are of limited interpretative value by the size of the assemblage and poor bone preservation. The limited data available does not suggest any clear divergence from patterns observed at other sites during the Iron Age and early medieval period.

8.7 Faunal remains from the Craw Stane complex, Rhynie

INGRID MAINLAND

8.7.1 Introduction

A mammal bone assemblage of 8,414 fragments was recovered from the Craw Stane complex, Rhynie, providing an opportunity to explore human-animal relationships at a Pictish royal centre during the 5th–6th centuries AD. This report aims to provide an overview of the assemblage focusing in particular on the spatial distribution of faunal material across the site, the species representation therein and the identification of taphonomic pathways for the assemblage. As the site is essentially single phase, no attempt was made to explore any changes in species representation through time. C201, a topsoil cleaning layer (n=47) and C15, associated with the 3rd to 4th cal BC century ring ditch (n=170: cattle =1%, Large ungulate = 29%, small ungulate = 3%, unidentified = 67%), were excluded from the analysis. Full data from these contexts is available in the archive.

8.7.2 Methods

All fragments were identified to species, anatomical element and body side whenever possible. Where species could not be ascertained fragments were assigned to one of the following size classes: L.ung (large ungulate – eg cattle, horse, red deer); S.ung (small ungulate – eg roe deer, pig, sheep/goat); S.mam (small mammal-sized – eg dog, otter, cat); UNM (unidentified) and MAM (indeterminate terrestrial mammal). Vertebrae and ribs were not identified to species or side and were grouped into one of the size classes above.

Mammalian species identification was achieved using the modern reference collection at the UHI Archaeology Institute, Orkney College UHI, and with reference to identification manuals such as Schmidt (1972). The presence of particular diagnostic zones on elements were noted, recording whether 50% or greater of the zone was present. All fragments identified to species were given an individual entry in the data record; fragments identified as L.ung, S.ung, etc only required an individual entry if they possessed a diagnostic zone or were considered special in some other manner.

Epiphyseal fusion was recorded for all bones identified to species. All fragments were examined for signs of pathology, butchery, recent breaks, erosion, weathering, burning or canid gnawing. The colour of burnt bones was noted using the following categories after Stiner et al (1995): 0 – not burned (cream/tan); 1 – Slightly burned; localised and less than half carbonised; 2 – Lightly burned; more than half carbonised; 3 – Fully carbonised (completely black); 4 – Localised half calcined (more black than white); 5 – more than half calcined (more white than black); 6 – Fully calcined (completely white).

8.7.3 The assemblage: taponomy and depositional trends

Bone was recovered by hand (n=3557) and through wet-sieving of soil samples (n=4640). Species representation in both fractions was similar with only four species identified, cattle (*Bos taurus*), sheep/
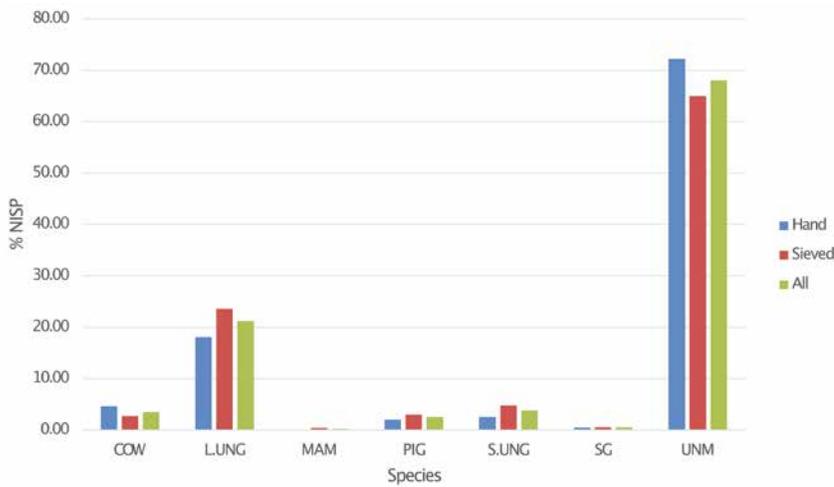
Illus 8.20
Species representation at the Craw Stane complex by recovery method: shows the relative frequency (% NISP) of fragments identified to species and to the taxonomic groupings

Species	Hand recovered		Wet-sieved		Total assemblage	
	n	%	n	%	n	%
CATTLE	164	5	127	3	291	4
SG	17	0	26	1	43	1
PIG	72	2	139	3	211	3
L.UNG	644	18	1095	24	1739	21
S.UNG	90	3	223	5	313	4
MAM	2	0	18	0	20	0
UNM	2568	72	3012	65	5580	68
Total	3557		4640		8197	

Table 8.27
Species representation at the Craw Stane complex by recovery method: shows the number of identified specimens (n, NISP) and relative frequency (%) of fragments identified to species and to the taxonomic groupings

Context type	Hand-collected		Wet-sieved		Total	
	n	%	n	%	n	%
Beam slot	18	0.51		0.00	18	0.22
Inner ditch	904	25.41	534	11.51	1438	17.54
Outer ditch	1374	38.63	2406	51.85	3780	46.11
Pit	0	0.00	10	0.22	10	0.12
Post hole	926	26.03	589	12.69	1515	18.48
Palisade trench	335	9.42	1101	23.73	1436	17.52
Total	3557		4640		8197	

Table 8.28
Bone deposition by context type: shows the number (n) and relative frequency (%) of bone fragments present in each context type by recovery method

goat (*Ovis aries/Capra hircus*) and pig (*Sus scrofa domesticus*) (Table 8.27, Illus 8.20). Hand recovery does not therefore seem to have biased representation in any significant way. Most of the bone was recovered from the enclosure ditches (inner ditch, n=1438; outer ditch, n=3780) and the palisade trench (n=1436) or were incorporated into post-hole fills (n=1515) with the latter particularly associated with two palisade post holes, features 236 and 164028 (n=1116 and 192 respectively) (Illus 8.21; Table 8.28). Broadly similar trends in bone representation by context type are evident in the wet-sieved and hand collected fraction indicating that this pattern of intra-site variability in bone deposition is not biased unduly by sampling strategy (where an emphasis on sampling of particular feature types may lead to an over-representation of bone in certain deposits).

The assemblage is characterised by a high degree of burning with 86% (n=7244) of fragments having been exposed to fire. The vast majority were either fully calcined (n= 6528, 90%) or more than half calcined (n=648, 9%) indicating combustion at high temperatures, likely in excess of 600°C (Stiner et al 1995). This calcined bone was highly fragmented, and a large proportion of fragments were not identifiable, either to element or species (n=5226, 72%). Some slight variation in relative frequency of burnt bone is evident by context type with very little unburnt bone present in deposits associated with the palisade ditch (Illus 8.22). The inner and outer ditches and post-hole deposits have a slightly higher representation of around 20% unburnt bone. None of the 10 fragments from pit 66 (C59) were burnt. However these are all unidentifiable fragments of mammal dentition and may well derive from one or two teeth. Intra-species variation is evident in the frequency of burning with cattle bone less likely to be burnt than pig (66% and 41% unburnt, respectively) (Illus 8.23). Only calcined fragments of sheep/goat were present (100% unburnt). Unburnt bone was typically in very poor condition, was highly fragmented, extensively abraded and/or weathered. This may account for the lack of butchery and any evidence of carnivore gnawing.
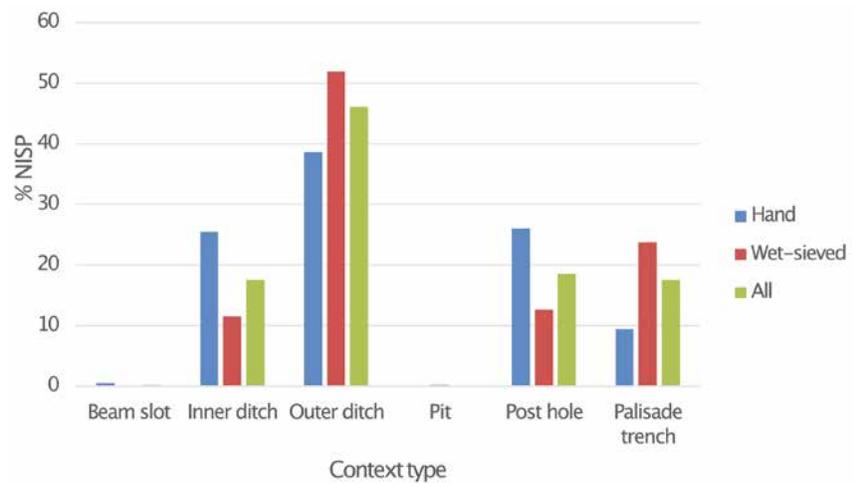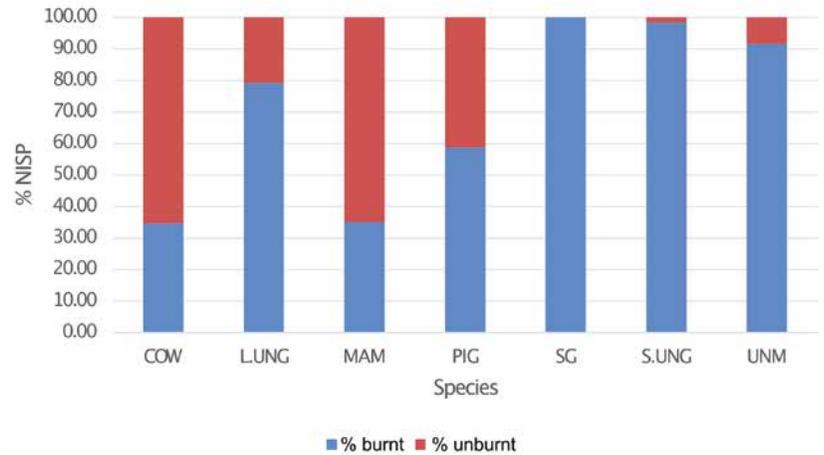

Illus 8.21
Bone deposition by context type: shows the relative frequency (%) of bone fragments present in each context type by recovery method (see Table 8.28 for NISP)
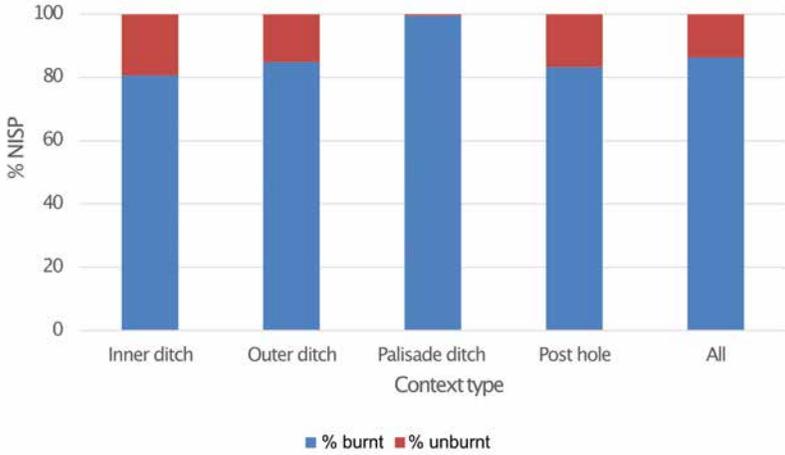
Illus 8.22
Proportion of burnt to unburnt bone by context type (context types with less than 100 fragments excluded; See Table 8.28 for NISP)

Illus 8.23
Proportion of burnt to unburnt bone by species (for NISP see Table 8.27)

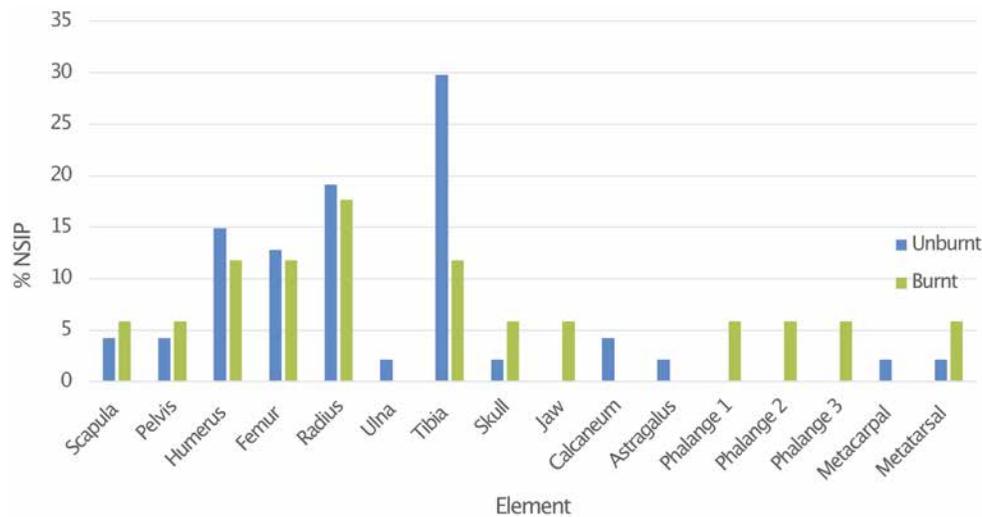### 8.7.4 Species and element representation

Species diversity was low with only cattle, sheep/goat and pig represented (Illus 8.20; Table 8.29). Cattle and pig are the dominant species for the assemblage as a whole with just over 54% and 39% of the fragments identifiable to species, respectively. Sheep/goat are relatively uncommon (8%). MNI suggests a greater emphasis on pig than cattle (cattle MNI=4, pig MNI=8, sheep/goat MNI=3) likely reflecting the greater potential for larger species to dominate highly fragmented assemblages due to the larger size/surface area of their bones. Nevertheless, cattle will have provided the bulk of the meat consumed at the Craw Stane complex.

Species	Inner ditch	Outer ditch	Palisade	Post hole	All	Inner ditch	Outer ditch	Palisade	Post hole	All
	n	n	n	n	n	%	%	%	%	%
CATTLE	58	106	60	67	291	56.31	40.15	67.42	76.14	53.39
PIG	35	134	22	19	211	33.98	50.76	24.72	21.59	38.72
SG	10	24	7	2	43	9.71	9.09	7.87	2.27	7.89
Total	103	264	89	88	545	100	100	100	100	100

Table 8.29
Species representation (NISP (n) and % NISP) for the Craw Stane assemblage as a whole and by context type

Illus 8.24
Cattle element representation for the Craw Stane complex assemblage: shows the relative representation of elements in the burnt (n=17) and unburnt (n=47) fractions for selected elements (phalanges are corrected to account for their greater frequency)

245
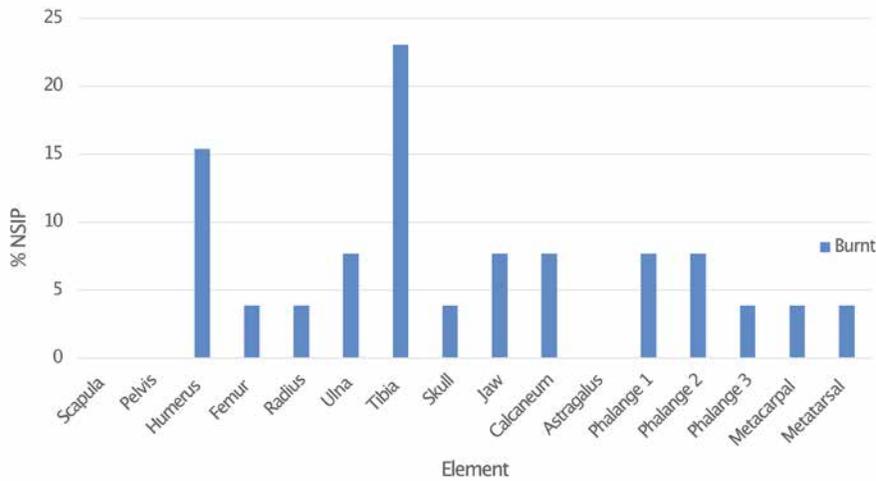
Illus 8.25
Pig element representation for the Craw Stane complex assemblage: shows the relative representation of elements in the burnt (n=24) fraction for selected elements (phalanges are corrected to account for their greater frequency)

Element representation for cattle indicates an emphasis on limb bone elements with very few phalanges and metapodials present, particularly in the unburnt fraction (Illus 8.24). These elements are not present in the large ungulate category either suggesting a real rather than taphonomic (eg through fragmentation) absence.

There were insufficient pig bones to allow assessment of element representation for the unburnt fraction. In the burnt bone most of the pig skeleton is represented with no particular emphasis on limb, feet or head elements (Illus 8.25). The higher frequency of tibia can be accounted for by the relative distinctiveness of this bone in burnt assemblage. The absence of scapula and pelvis may likewise be taphonomic, these elements being present in the small ungulate category. Only burnt sheep/goat bone was recovered. As with pig, element representation indicates the presence of cranial, limb and feet elements (Illus 8.26).
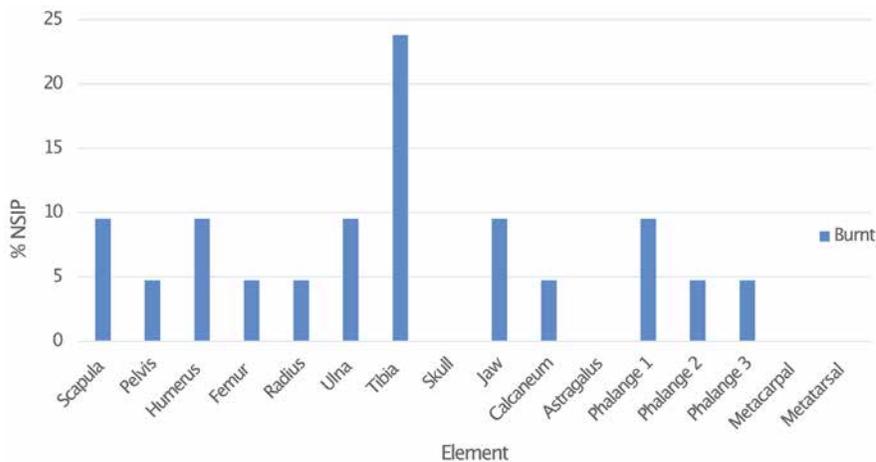
Illus 8.26
Sheep/goat element representation for the Craw Stane complex assemblage: shows the relative representation of elements in the burnt (n=21) fraction for selected elements (phalanges are corrected to account for their greater frequency)

8.7.5 Age-at-death

There were no intact mandibles were recovered from Craw Stane complex and hence age-at-death is reliant on loose teeth. The three cattle third molars (M3) recovered indicate animals which had died in young adulthood, *c* 18–30 months (n=2) and as adults (n=1) (Halstead 1985 age stages E and G, respectively). The slightly larger sample of pig third molars range in age from 16–20 months (Mainland et al 2019 stage D, n=9) to young adults (Mainland et al 2019 stage E, n=2) with the majority killed at 16–20 months (82%). There were no ageable sheep/goat teeth.

8.7.6 Intra-site variation in depositional practices associated with animal bone

Species representation varies with context type pointing to potential selective deposition and/or disposal practices for different animals. This applies in particular to pig and cattle with the former species more abundant in the outer ditch, whereas cattle occurred in higher numbers within the inner ditch, palisade and post-hole deposits. The latter largely comprise post holes associated with the timber structure(s) (features 29, 228, 230, 232, 15101, 15181, 234) or the palisade, again within the inner enclosure (features 235, 15079, 164020, 164022, 164028). A small assemblage of bone was also recovered from the fill of stone-setting 15359, located adjacent to the outer ditch and likely a setting for a standing stone (Noble et al 2015). Most of these post-hole features contain very little bone and may reflect little more than accidental inclusions or *ad hoc* use of midden material for packing material (Table 8.30). However three features, palisade post-hole 236, palisade post-hole 164028 and stone-setting 15359, contain larger assemblages and/or were noted on excavation to have what appeared to be associated bone groups. These are discussed separately below.

Stone-setting 15359
A small assemblage of animal bone was recovered from the base of stone-setting 15359, lying underneath the area of stone packing. During excavation it was noted that this included a cattle mandible; however by the post-excavation stage only a lower first or second molar (LHS) and *c* 20 highly fragmented pieces of cattle teeth were present. No enamel or dentine were retained in the cattle first/second molar indicating highly erosive soil conditions which likely contributed to the extreme fragility of the dentition. Age could not be assigned to this individual due to the absence of dentine/enamel. Associated with this was a pig third molar (LHS) and the fragmented remains of nine pig teeth, also representing teeth which had fragmented and were not identifiable as individual molars or premolars. The pig third molar was in reasonably good condition and could be aged with the absence of dentine wear (Grant (1982) wear stage 'a') indicating an individual aged around 16–20 months at death. None of the teeth recovered from stone-setting 15359 had been burnt prior to deposition. From the upper fill (C15022) of this feature 23 unidentifiable bone fragments were recovered, 17 of which were calcined.

Palisade post-hole 236
This feature forms one of a series of large post holes which would have supported upright timbers associated with the timber

Post-hole feature (context)	Cattle	Pig	Sheep/goat	Large Ungulate	Small ungulate	Indet mammal	Unidentified	Total
11(12)							2	2
29 (30)	1							1
52 (42)							11	11
64 (65)				4			11	15
229 (228, 229)				3			37	40
230 (230, 231)					2			2
233 (232, 233)					1	2		3
234 (234, 235)				8			6	14
236 (236, 237, 238)	35	9	2	196	37		833	1112
15079 (15080)				1			15	16
15101 (15102)							3	3
15155 (15156)							3	3
15181 (18182)							10	10
15359 (15022, 15359)	21	10					23	54
164020 (164021)				2	2		12	16
164022 (164023)	2			9	2		8	21
164028 (164029)	8			44	1		139	192
Total	**67**	**19**	**2**	**267**	**45**	**2**	**1113**	**1515**

Table 8.30
Bone distribution in post-hole/post-pit features (context numbers for fill deposits in brackets; palisade post holes are in bold)

palisade. On excavation it became clear that the post had been removed and the resulting void filled with burnt stone, animal bone and artefacts. This has been interpreted as a deliberate structured infilling, perhaps a decommissioning activity or ritualised destruction (Gondek & Noble 2012: 23).

An assemblage of 1,112 fragments were recovered from this infill deposit of which only 46 could be identified to species (Table 8.30). Most fragments were calcined (n=1059, 95%) and highly fragmented. The unburnt fraction was in very poor condition, fragmented and with very little original bone surface present. Where exterior surfaces were in situ weathering/exfoliation of the surface bone was apparent. This combination of taphonomic indicators suggests bone was exposed for some time prior to deposition and then affected by acidic soil conditions once in the ground. The unburnt fraction derives almost exclusively from cattle (n=34) or large ungulate (n=14). Most of the elements from cattle upper limbs were present and were largely from the left-hand-side of the body (Table 8.31). It is conceivable that these all derive from a single individual (MNI=1). If so, epiphysial fusion would suggest a young adult aged *c* 36–42 months. Elements of the feet (metapodials and phalanges) were not recovered. These are dense bones which usually tend to survive well and so their absence is unlikely to reflect preservation biases; rather what may be indicated a deliberate selection of the meat-bearing elements of the lower and upper limb for deposition with metapodials and feet being discarded elsewhere. A similar absence of foot and metapodials was noted for the structured cattle deposited associated with the human burial at Rosemarkie which also dates to the Pictish period and which was interpreted as a feasting deposit from the emphasis on meat-bearing elements (Kennedy

& Mainland in prep). The presence of unburnt cattle teeth and one large ungulate skull fragment do however suggest that cranial elements (MN1=1) were also being deposited in the post-pit. Pig is represented in the unburnt fraction by three bone fragments: a calcaneum, lower second premolar and a tooth fragment.

Fusion Age		Post-hole 236	Post-hole 164029
<1 month			
Astragalus		Fused (1R)	
7–10 months			
Scapula	Distal		Fused (1R)
12–18 months			
Humerus	Distal	Fused (1R)	Fused (1L)
Radius	Proximal	Fused (1L)	
24–36 months			
Tibia	Distal	Fused (1L)	Fused (1L)
36–42 months			
Calcaneum	Proximal		Fused (1L)
Femur	Distal	Unfused (1L)	
Tibia	Proximal	Unfused (1L)	Unfused (1R)
Ulna	Proximal	Fused (1L)	
Humerus	Proximal		Fusing (1L)

Table 8.31
Cattle bone fusion for palisade post-holes 236 and 164028

183 fragments of calcined bone from post-hole 236 were identified as cattle/large ungulate. These derive mainly from fragments of long bone undifferentiated to element (n=160) but a small number of ribs (n=16), cranial (n=4) and vertebrae fragments (n=3) were also present. Six calcined pig bones (3 tibia, 1 tarsal, 1 maxilla and a first phalange) and two calcined sheep/goat (1 scapula, 1 metapodial) were identified. The 37 calcined small ungulate fragments (rib =25, long bone =10, phalange =1, vertebrae = 1) may derive from either pig or sheep/goat.

PALISADE POST-HOLE 164028

The formation processes associated with this animal bone assemblage appear similar to palisade post-hole 236. The void associated with the removal of the palisade post had again been packed with animal bone and other organic material and likely reflects similar ritualised decommissioning/destructive activities (Noble et al 2016c: 30).

A smaller assemblage of 192 fragments was recovered of which the majority were unburnt (80%, n=153). Bone condition was poor however and both the burnt and unburnt fractions were highly fragmented with very few fragments identifiable to species (Table 8.29). In the unburnt fraction eight cattle limb bones were identified: calcaneum, humerus (2), scapula, tibia (3), upper third molar. A MNI of one is indicated with a possible young adult suggested, if it is assumed that these elements derive from one animal.

REPRESENTATION OF CRANIAL ELEMENTS AT THE CRAW STANE COMPLEX

No intact skulls or mandibles were recovered at the Craw Stane complex, reflecting the poor condition of the mammal bone. However loose mandibular/maxillary teeth and fragmentary remains of skull and mandibles can serve as a proxy for the presence of cranial elements. Cattle cranial elements were found in only 13 of the 75 bone bearing contexts with five context types represented (Table 8.32). Features 236 and 164028 are the palisade post-pits described above; 15359 is the stone setting also described above (Table 8.30). The palisade post-pit assemblages can be interpreted as the deliberate or structured internment of limb bone elements and skulls from at least two cattle (from the presence of two left distal tibias). Stone-setting 15359 is exclusively focused on cranial elements and probably also represents a structured deposit, here involving a single cattle mandible and a pig skull/mandible. Post-hole 29 is associated with the timber hall structure and just contains one fragment of bone, a lower cattle molar. This may represent further evidence for an association between the deposition of cattle and post holes, but equally could be a chance incorporation of debris within the fill.

A cattle maxillary first, second and third molar (LHS) was recovered from context 15005, the upper fill of the inner ditch. This was associated with a reasonably large assemblage of animal bone (n=1192) comprising a mixture of species and elements, both burnt and unburnt, and likely reflects generalised disposal of bone waste. A similar origin can be proposed for the cranial

Context type	Element										
Context	Mand	LM12	LM3	LP3	LT	MAX	SKULL	UM12	UM3	UP4	Grand Total
Inner ditch											
15005					38			1	1		40
150005					1						1
Outer ditch											
25		3	2	1			1	2		1	10
26			1			3					4
328	1				12						13
15192		2			20						22
161044					8						8
164042					5						5
Palisade ditch											
15007		1			44		1				46
Post hole											
30 (Post-hole 29)		1									1
237 (Post-hole 236)								1			1
238 (Post-hole 236)					25						25
15359 (Stone setting)		1			20						21
164029 (Post-hole 164028)								1			1
Total	1	8	3	1	173	3	2	4	2	1	198

Table 8.32

Distribution of cattle cranial elements at the Craw Stane complex by context and context type (mand = mandible, LM12 = lower molar, LM3 = lower third molar; LP3 = lower third premolar; LT = loose tooth, max = maxilla, UM12 – upper molar, UM3 = upper third molar, UP4 = upper fourth premolar)

elements recovered from the upper fills and middle fills of the outer ditch (C25, C26, C15192 and C161044) which are also associated with reasonably large assemblages of bone of mixed composition with no evidence for articulation or association. The fragmentary remains of cattle teeth (n=5) were the only mammal bone recovered from context 164042, the secondary basal fill of outer ditch 15004 formed after a period of natural infilling (Noble et al 2015: 24). Here, it is likely that this find represents accidental inclusion rather than a structured deposit.

8.7.7 Discussion

The assemblage of 8,414 fragments of mammal bone from the Craw Stane complex, Rhynie, provides an opportunity to explore human-animal relationships at this Pictish royal centre during the 5th–6th centuries AD. The taphonomic processes which have affected the assemblage do, however, place limits on interpretation. The vast majority of the bone recovered was calcined indicating combustion at high temperatures prior to deposition. Calcined bone is mineralised during the burning process and while more resistant to chemical and biological decay will typically exhibit higher degrees of fragmentation than unburnt bone due to dehydration and loss of organic content (Stiner et al 1995; Baker & Worley 2019). Settlement site assemblages which are dominated by calcined bone are often associated with acidic soils and will represent only the mineralised fraction of the original assemblage that has not been lost through diagenetic processes. At the Craw Stane complex, where unburnt bone does survive it is in poor condition, fragmented and with very little of the outer bone surface present. This again likely reflects the impact of acidic soils across most of the site, albeit with some potential micro-environments such as post holes and pit features in the inner and outer ditch where bone had preserved better. As a result of these taphonomic processes, the bone assemblage will probably only represent a fraction of the bone originally deposited. Moreover, differential fragmentation between species, which tends to increase representation of larger, complicates interpretation of species and anatomical representation both at an intra- and inter-site level. At the same time the low numbers of mandibles and the absence of butchery evidence means that little can be said regarding culling patterns, economic uses, carcass processing and/or culinary practices. Nevertheless, with these caveats in mind some general observations can be made on the nature of human-animal

relations at the Craw Stane complex, Rhynie, and how this compares with Pictish sites elsewhere in Scotland.

The low taxonomic richness evident at the Craw Stane complex is striking with only four species present: cattle, pig and sheep/goat. Other domesticates such as horse, dog or cat were not identified nor is there any evidence for the exploitation of wild terrestrial species such as red or roe deer or the use of marine resources. Birds are also notable by their absence. A similar restricted range of species is seen at Craig Rock and Mither Tap, also high-status Pictish sites in the north-east of Scotland (Masson-MacLean et al 2023) and may be a feature of these kinds of settlements, perhaps indicating specialised accumulation pathways deriving from particular food production and/or consumption activities rather than general household or settlement waste. Like other contemporary Pictish sites in mainland Scotland, cattle and pig are the dominant species at the Craw Stane complex while sheep/goat are. This contrasts with Late Iron Age and Pictish sites in the Scottish islands where sheep/goat and cattle are dominant, usually in that order (Mainland 2023).

Pig frequencies based on NISP are slightly higher at the Craw Stane complex than at other northern Pictish sites while MNI ratios suggest a significantly greater emphasis on pig at Rhynie (Tables 8.33 and 8.34). Pigs are widely associated with high-status sites and feasting activities during the first millennium AD in both Britian and Scandinavia (Masson-MacLean et al 2023; Mainland & Batey 2018; Madgwick et al 2019) and their greater relative importance at Rhynie may therefore indicate more emphasis on feasting than at contemporary sites in the region. Although age-at-death data is limited, the prevalence of pigs aged between 16–20 months, which provide both good quality, tender meat and a good carcass size, and the absence of very young piglets or very old adults is also consistent with consumption rather than subsistence production. Nevertheless, by virtue of their greater size cattle will still have provided the bulk of the meat consumed. Carcass utilisation models at the Craw Stane complex will be biased by bone preservation, fragmentation and small sample sizes and must be interpreted cautiously. However, the presence of most elements of the skeletons for each species does seem to indicate that some whole carcasses were deposited and that for pigs at least individual animals were being brought to the site on hoof rather than as joints of meat. This accords with trends at other sites in the region (Masson-MacLean et al 2023). Unfortunately, the limited dental and fusion data for cattle and sheep/goat makes it difficult to assess whether these species were being reared at Rhynie.

	Rhynie		Craig Rock		Burghead		Mither Tap		Rosemarkie cave	
	NISP		NISP		NISP		NISP		NISP	
	n	%	n	%	n	%	n	%	n	%
Cattle	291	53.39	93	49.47	951	66.69	81	52.26	347	91.56
Pig	211	38.72	65	34.57	241	16.90	50	32.26	10	2.64
Sheep/goat	43	7.89	30	15.96	234	16.41	24	15.48	22	5.80
Total	545	100.00	188	100.00	1426	100.00	155	100.00	379	100.00

Table 8.33
Comparing sheep, pig and cattle relative frequencies at Pictish sites in northern mainland Scotland based on NISP (data from Masson-MacLean et al 2023; Kennedy & Mainland in prep)

	Rhynie		Craig Rock		Burghead		Mither Tap		Rosemarkie cave	
	MNI		MNI		MNI		MNI		MNI	
	n	%	n	%	n	%	n	%	n	%
Cattle	4	26.67	7	50.00	16	53.33	3	37.50	7	70.00
Pig	8	53.33	4	28.57	12	40.00	3	37.50	1	10.00
Sheep/goat	3	20.00	3	21.43	2	6.67	2	25.00	2	20.00

Table 8.34
Comparing sheep, pig and cattle relative frequencies at Pictish sites in northern mainland Scotland based on MNI (data from Masson-MacLean et al 2023; Kennedy & Mainland in prep)

Intra-site variability in species representation and the presence of animal bone groups (ABGs) points to structured depositional practices involving cattle and potentially also pig bodies. The structured cattle deposits in the palisade post-pits, stone-setting 15359 and potentially post-hole 29 of the timber hall are also all located within the inner enclosure. These are partial rather than complete burials representing at least three, possibly four cattle crania and the post-cranial skeleton of at least two individuals though the second is represented only by a single tibia. A pig crania is also present in the stone-setting deposit. During the first millennium AD special deposits of mainly cattle crania found within post holes, ditches and pits and likely associated with foundation or decommissioning activities, are a common feature of sites across Europe including at Yeavering and Cowdery's Down (Hamerow 2006), site types for which parallels have been drawn with Rhynie (Noble et al 2016c). The structured deposits of cattle within the palisade post-pits and post hole associated with the timber hall at the Craw Stane complex would appear to be part of this wider first-millennium AD practice. There is also some indication that cattle bones were being preferentially deposited in the inner enclosure features and inner ditch whereas pig was more common in the outer ditch deposits suggesting other hitherto unrecognised structuring in the deposition of animal bodies within Pictish sites (Illus 8.27). Here, perhaps

the greater emphasis on cattle in proximity to the centre of elite activities at Rhynie reflects the significance placed on cattle in Pictish society (eg Masson-MacLean et al 2023).

The Craw Stane complex, Rhynie, assemblage thus provides further evidence for the importance of cattle and pig at mainland Scottish Pictish sites and for intra-regional variability in the extent to which elite sites engaged in animal rearing and production or consumption of animal products. More significantly it provides new evidence for the use of animal bodies in structured and potentially ritualised events at first-millennium AD elite sites in north-east Scotland.

8.8 An osteological assessment of the Rhynie Skeleton

ELLEN MCMANUS, ERMINE ROSHEM AND MARC F OXENHAM

8.8.1. Introduction

Human skeletal remains were excavated from a cist burial at the Pictish site of Rhynie, Aberdeenshire in the summer of 2013 and subsequently transported, within a container of local sandy soil, to the University of Aberdeen for analysis. As the quality of bone was very poor, with extensive flaking and exfoliation of the cortical bone, no attempt at washing was made. However, a soft brush was used to removed adhering soil where possible.

8.8.2. Preservation and completeness

The condition of preservation of the bones is very poor. Eleven fragmentary and incomplete skeletal elements were preserved: both femora, left patella (which is complete), right os coxa, right tibia, right humerus, right temporal and four vertebrae. The only dentition preserved was the enamel crown of the first left maxillary incisor. Element completeness ranges from <25% to ~75%. The texture of the bones is extremely friable and fragile while the majority of cortical bone is exfoliating from most elements. In addition to the elements recorded on the skeleton record sheet a quantity of small, unidentifiable fragments (<3cm diameter) were recovered.

8.8.3. Sex assessment

Two elements were preserved with the potential for sex determination: the os coxa, one fragment of which comprises part of the greater sciatic notch, and the left mastoid process. The angle of the greater sciatic notch can indicate skeletal sex; a larger, wider
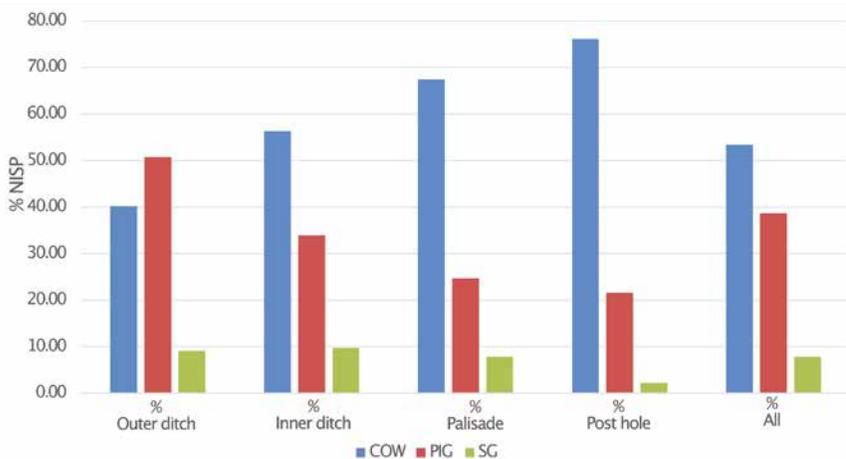
Illus 8.27
Species representation (% NISP) for the Craw Stane complex assemblage as a whole (all) and by context type (for NISP see Table 8.29)

angle is likely to be female whereas a smaller, narrower angle male (Walker 2005). In this instance the sciatic notch appears relatively wide, which is consistent with this individual being female. However, the entire contour of the sciatic notch has not been preserved and it is difficult to be certain of the original shape. It is therefore possible that the apparent wide angle of the curvature is an artefact of the way in which the bone has broken. The size of the mastoid process is another indication of skeletal sex; a large mastoid process is more likely to be male, a smaller one female (Walrath et al 2004). The mastoid process of the Rhynie skeleton is relatively small with an estimated limited ventral projection which suggests female. The Rhynie skeleton is provisionally determined to be female.

8.8.4. Stature assessment

The right femur is preserved in three sections, each of which conjoin to a greater of lesser degree. The estimated maximum length of the right femur is 435mm. While there are no available population specific (ie, early Pictish) stature models available, Walther (2017) has developed models for males and females that lived in Romano-British and early medieval English sites that have been used here. Table 8.35 provides estimates assuming this individual is male or female. If female (which seems more probable), the stature estimate is between 156.9cm and 159.3cm with a standard error of the estimate of approximately 2.3cm. If male, the stature estimate is between 161.7cm and 162.5cm with a standard error of the estimate of between 2.5 and 3.0cm.

	Romano-British Female	Romano-British Male	Early Medieval Female	Early Medieval Male
Stature	159.32 (5' 2.7")	161.74 (5' 3.7")	156.86 (5' 1.8")	162.53 (5' 4")
SEE	2.3 (0.91")	2.33 (0.92")	2.33 (0.92")	2.96 (1.17")

Table 8.35
Stature estimates (after Walther 2017)

8.8.5. Field Anthropology

A field anthropological assessment is best carried out in the field, or with the assistance of a comprehensive photographic record of the site and individual in question. In this case the burial was only assessed from a small number of images. Given the limited preservation, it is not possible to assess the burial in any detail. However, it is clear that this was an extended, supine burial with the lower limbs extended in a linear manner with no flexure at the knees or hips. The position of the patella in anatomical position (assuming it was not moved during excavation and preparation of the photos), in addition to the apparent articulation of the right femoral head and acetabulum, suggests an inhumation burial (grave immediately filled with soil after placement and positioning of the corpse) with no evidence for the maintenance of a void around the body during decomposition.

8.8.6. Further analysis

Unidentified bone fragments were radiocarbon dated to between AD 400 and 570 (SUERC-52935 1559±30, cal AD 420–570;

MAMS-21252 1602±21, cal AD 400–540, both 95% probability) (Noble et al 2019c). Further, unidentified bone fragments were taken for stable isotope analysis (see Britton below).

8.8.7 Summary

This skeleton was found in a Pictish cist burial. Sex assessment based on the morphology of the greater sciatic notch and the mastoid process is consistent with this individual being female. Age-at-death assessment based upon epiphyseal fusion indicates the individual is an adult, but age cannot be further refined. Assuming this is a female, stature is estimated to be approximately 157 to 159cm (+/-2cm). The position of the remains suggests an inhumation burial with the body in an extended supine position. The condition of the bones makes further information concerning stature, pathology or more precise age determination impossible to obtain.

8.9 Multi–isotope analysis of the inhumation at Rhynie

KATE BRITTON, WITH ORSOLYA CZÉRE, LUCY KOSTER AND JOVITA FAWCETT

8.9.1 Introduction

The isotope analysis of human remains is a powerful means of investigating past dietary habits, childhood origins and lifetime movements (see overviews in Bentley 2006; Britton 2017; Britton 2020; Makarewicz & Sealy 2015; Richards 2020). These approaches can be particularly fruitful in contexts where archaeological contextual information is sparse, or when considering the archaeological record of periods and places that are less well characterised via conventional means, as is the case with the burial at Rhynie and of the Picts more generally.

Based around the principal of 'you are what you eat' the carbon ($d^{13}C$) and nitrogen ($d^{15}N$) isotope analysis is employed in archaeological case studies to create archaeological foodwebs and to determine past human diets. The isotope ratios of foods consumed are passed onto animals and humans, resulting in characteristic 'signatures' in the isotope chemistry of their bodily tissues. This includes tissues that can be preserved in the archaeological record, such as collagen – a structural protein found in bone. The combination of $d^{13}C$ and $d^{15}N$ isotope ratios, in particular, are especially useful in indicating the main source of protein in the diet in the last decade or more of life, depending on bone sampled (DeNiro & Epstein 1978; DeNiro & Epstein 1981; Schoeninger & DeNiro 1984; Schoeninger et al 1983). Although there are few published studies, when applied to Pictish burials, these approaches have so far suggested a diet rich in terrestrial resources, and with little or no contribution of marine fish to the Pictish diet (Curtis-Summers et al 2020; Czére et al 2021). These approaches can be complemented with sulphur isotope analysis which, while also being useful in dietary reconstruction, is perhaps most useful as a geographical indicator in the years before death, particularly in the identification of residence in coastal areas owing to the sea-spray effect (Nehlich 2015; Zazzo et al 2011). Unlike carbon, nitrogen and sulphur, strontium ($^{87}Sr/^{86}Sr$) and oxygen ($d^{18}O$) isotope analyses are normally targeted at the

mineral phase of the skeleton, in particular tooth enamel which is densely crystalised, compact, and resistant to diagenetic alteration in the burial environment (Hoppe et al 2003; Zazzo et al 2004). Strontium isotope ratios in tooth enamel relate to the strontium isotope ratios of foods consumed, particularly strontium-rich plant foods, which in turn relate to the strontium isotope ratios of local soils (which themselves are a function of the age and type of underlying lithology). Oxygen isotope ratios of tooth enamel relate to that of what consumed. As the $d^{18}O$ of local environmental waters are a function of local climatic conditions, and can vary predictably across landscapes, strontium and oxygen isotope analyses can be used in tandem as geolocational tools in bio-archaeological studies. As teeth, even permanent dentition, form in childhood, these signatures are used to infer childhood place of residence rather than that occupied before death.

In 2013 two square barrows containing single inhumations were identified at Rhynie, just south of the fortified settlement. While one of these graves contained only a body stain, the other contained skeletal remains (REAP13 B01 560). Although fragmentary and poorly preserved, likely owing to local acidic soils, this individual was identified morphologically as an adult and possibly (but not unambiguously) a female. Radiocarbon dating yielded sufficient high-quality collagen for dating, suggesting sufficient preservation for further analyses, and confirming that the date of the burial (cal AD 400–570) was contemporaneous with the main settlement (Mitchell & Noble 2017). The goals of further research using isotope analyses were 1) to characterise the diet of the individual in the years before death and 2) to ascertain whether they are likely to have been raised locally, or whether they spent their childhood elsewhere.

8.9.2 Methods

A bone fragment from the pelvic area of the individual was selected for stable carbon, nitrogen and sulphur isotope analyses. Collagen was extracted using the Longin method (Longin 1971) with modifications (Brown et al 1988; Collins & Galley 1998) as detailed by Britton et al (2012), a technique that removes the mineral components of the bone using a weak acid. The resulting bone pseudomorph is then rinsed and heated in an acidic solution to hydrolyse the collagen. The collagen (which is at that point in solution) is then filtered, ultrafiltered and finally freeze-dried prior to analysis via mass spectrometry. Collagen was analysed at SUERC, East Kilbride, Scotland, on a Delta V Advantage continuous-flow isotope ratio mass spectrometer coupled via a ConfloIV to an IsoLink elemental analyser. Data were normalised to international and in house standards, and reproducibility was ±0.3‰ or better across all three isotopes.

For strontium and oxygen isotope analysis, the dental (enamel) cap of a premolar was selected for analysis. As with the bone, the enamel was manually abraided using a stainless-steel diamond coated dental burr in order to remove the surface areas that had been in contact with burial matrix prior to sample preparation and analysis. The enamel cap was then ultrasonicated in ultra-pure water and dried. Sample preparation included acid digestion and sample purification via anion exchange chemistry using a strontium-specific resin, as detailed in Britton et al (2009), a modification of the method of Deniel and Pin (2001) with

changes as detailed in Copeland et al (2008). Analysis was undertaken using a Thermo Fisher Neptune™ (MC–ICP-MS) at the Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. Repeat analysis of internationally available reference materials indicated analytical error was better than ±0.00005 and that Sr concentrations were accurate to within ±31ppm (calculated following the method described in Copeland et al 2008). Oxygen isotope ratios were determined from the phosphate moiety, which was isolated as silver phosphate using a rapid precipitation protocol following acid digestion, following the techniques described in Britton et al (2015), a modification of the methods described in Dettman et al (2001) and Tütken et al (2006). Silver phosphate was analysed in using a Finnigan TC-EA coupled via a Conflo III to a Micromass 100 GC-IRMS at the University of Mainz, Germany, calibrated and drift corrected to repeat measurements of an international standard (with a value of 21.7‰). Measurements were undertaken in triplicate and had a reproducibility of ±0.3‰ or better.

8.9.3 Results and data interpretation

The carbon, nitrogen and sulphur isotope ratios of the collagen extracted from the bone fragment from the skeleton excavated at Rhynie are shown in Table 8.36, along with associated elemental content data. The latter are consistent with the collagen being well preserved and therefore likely to be preserving *in vivo* isotopic signatures (Nehlich & Richards 2009; van Klinken 1999). The strontium and oxygen isotope data are shown in Table 8.37, along with strontium concentration data. Strontium concentration data are typical of human tooth enamel (Montgomery 2002).

| d¹³C	d¹⁵N	d³⁴S	%C	%N	%S	C:N	C:S	N:S
-21.1	11.8	15.8	42.1	15.6	0.25	3.1	456	145

Table 8.36
Stable carbon, nitrogen and sulphur isotope ratios measured in collagen extracted from the bone of the skeleton excavated at Rhynie (REAP13 B01 560)

| ⁸⁷Sr/⁸⁶Sr	Sr conc. (ppm)	d¹⁸O$_{v\text{-smow}}$
0.7107	81	17.1

Table 8.37
Strontium isotope ratio, strontium concentration and stable oxygen isotope ratio of dental enamel from a premolar of the skeleton excavated at Rhynie

In comparison to early medieval faunal data from across Pictland (Czére et al 2021), the carbon and nitrogen isotope ratios of the Rhynie individual are consistent with a diet based mostly on terrestrial resources, as implied by the low $d^{13}C$ values. This diet likely incorporated higher trophic level animal foods, however, such as pork, as indicated by the $d^{15}N$ which is elevated in comparison to cattle for example (see Illus 8.28). This would imply that while cattle-based dairying may have been practised, dietary protein also included considerable quantities of meat and that animal products such as pork may have been regularly consumed. These relatively elevated values may also be related to enrichment
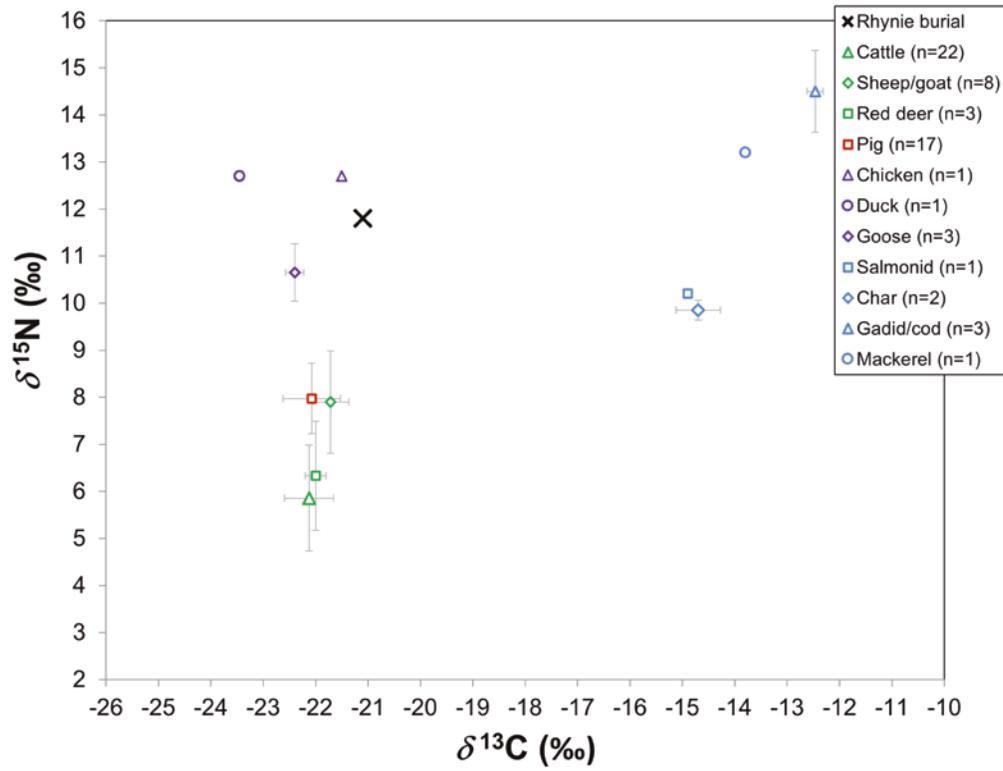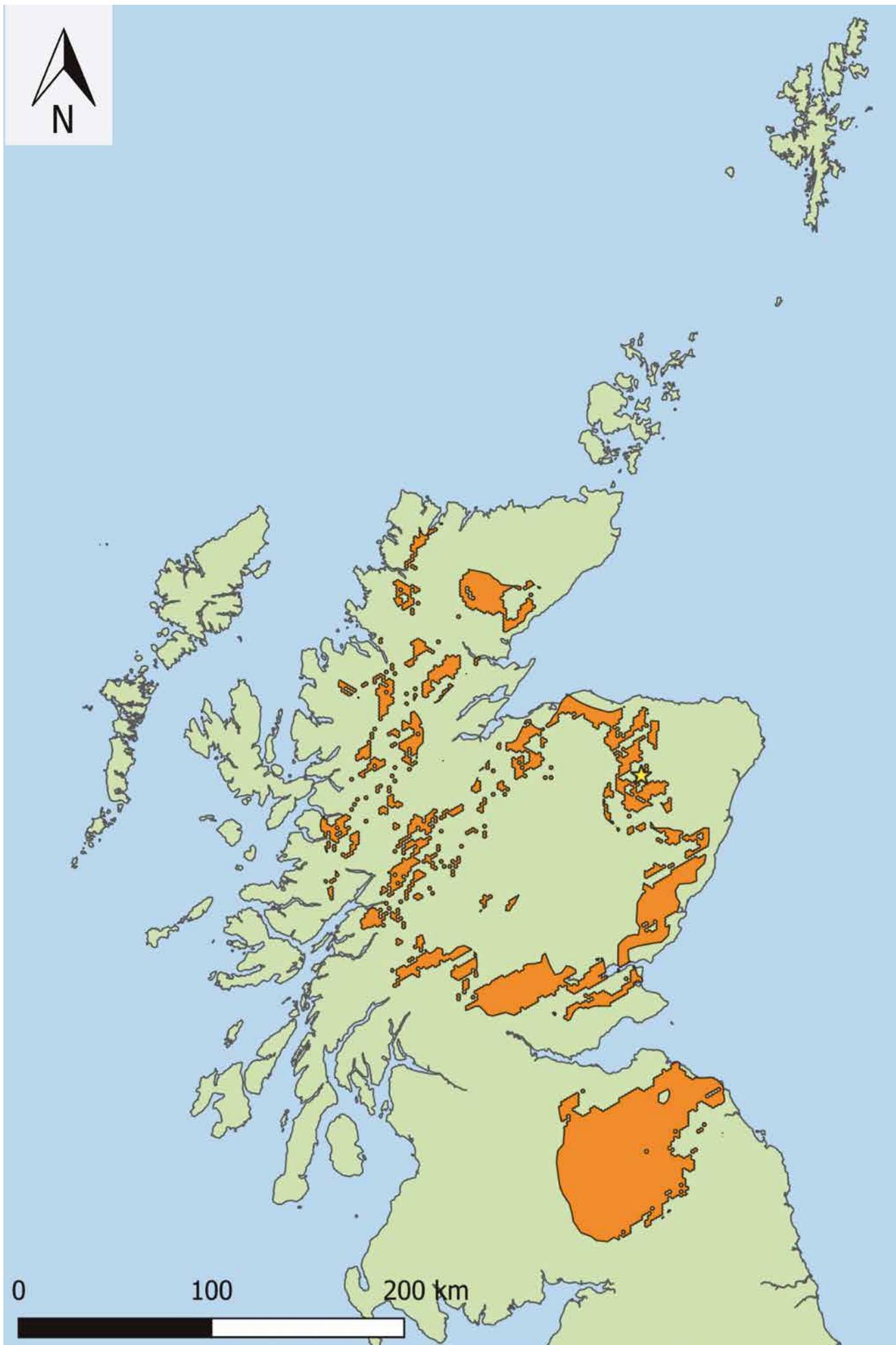
Illus 8.28
Stable carbon and nitrogen isotope data from the Rhynie burial in comparison to various animals measured from early medieval sites in north-east Scotland (Czére et al 2021)
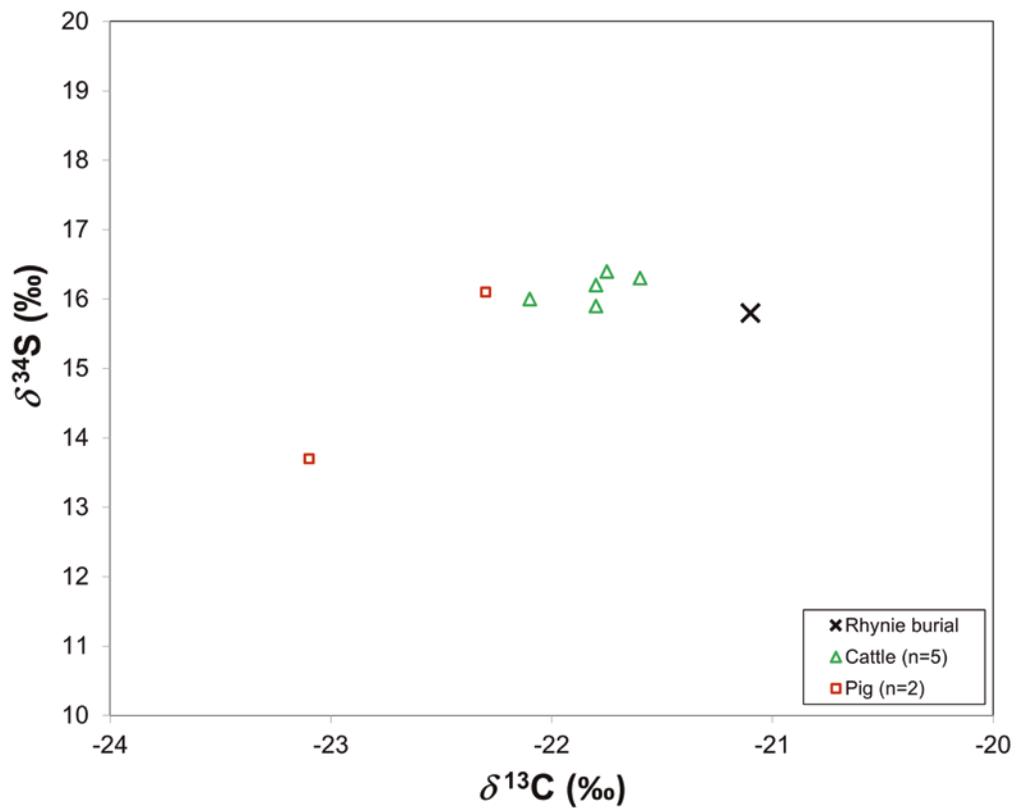
Illus 8.29
Stable carbon and sulphur isotope data from the Rhynie burial in comparison to that of cattle and pigs analysed from Rhynie (Britton, Czére and Fawcett, unpublished data)

Illus 8.30

Map of Scotland and northern England highlighting areas where bioavailable $^{87}Sr/^{86}Sr$ (Evans et al 2022) and drinking water $d^{18}O$ (Hoogewerff et al 2019) match those determined in the dental enamel of the Rhynie skeleton. Enamel $d^{18}O$ values were converted to estimated drinking water values using Daux et al (2008, equation 6). The location of Rhynie is indicated. Contains data from British Geological Survey materials © UKRI [2023] and Ordnance Survey data © Crown copyright and database right [2023], https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

or improvement of soils by manuring when growing crops such as grains, which can serve to increase $d^{15}N$ values in soils (and therefore in plants, and in the humans that consumed them). While contemporary soils across Scotland do, variably, demonstrate enrichment which could be consistent with such practices (past and present), the soils around Rhynie are not particularly enriched in ^{15}N, at least in the present day (Thornton et al 2015). The sulphur isotope values are relatively high. Although such values (>14‰) can imply a significant marine dietary input or (due to the sea-spray effect) coastal proximity, these elevated values are consistent with the majority of local fauna analyses (see Illus 8.29; Britton, Czére and Fawcett, unpublished data) that likely means these values instead reflect local lithology, which is also a dominant influence in past sulphur isoscape variability (Nehlich 2015).

The lithology surrounding Rhynie, however, is fairly complex including local Devonian chert, sandstones, shales and andesite along with Ordovician granite and norites (Parnell et al 2022), leading to a varied strontium isoscape found within close proximity of the site (Evans et al 2022; Evans et al 2010). As such, local bioavailable strontium could range from relatively low values (0.708–0.709) to more elevated values (0.712–0.713) (Evans et al 2010). The $^{87}Sr/^{86}Sr$ value determined in the tooth of the individual measured at Rhynie (0.7107) is therefore not inconsistent with that which could be anticipated for a local individual. According to predictive models of geographical variation in the $d^{18}O$ of human tooth enamel phosphate, individuals who spent their childhoods in the Rhynie area could be expected to have $d^{18}O$ values of 17.2 ‰ (Pellegrini et al 2016). It should be noted, however, that this combination of bioavailable strontium and predicted tooth phosphate value is found in other regions of Scotland, and

beyond. To further resolve this, the measured $d^{18}O$ value was converted to a predicted drinking water value (-7.39‰), calculated using published conversion equations (Daux et al 2008), and compared to $d^{18}O$ values of Scotland's freshwaters (Hoogewerff et al 2019). Considering predicted drinking water value alongside strontium isotope ratio, values measured in the Rhynie tooth enamel sample are again consistent with that expected for an individual who grew up locally (Illus 8.30).

8.10 Discussion and conclusions

The stable isotope data generated from the bone collagen and dental enamel of the skeleton excavated at Rhynie reveal insights not only into this individual's life, but also contribute to our wider knowledge of Pictish lifeways. Dietary data suggest a diet rich in pork and other ^{15}N-enriched foods, which could include poultry or wild fowl. This is consistent with the findings of other Highland individuals from early medieval Scotland, such as Blair Atholl man (Czére et al 2021). However, unlike Blair Atholl man or some of the early medieval individuals buried at Cramond (Czére et al 2022), the strontium and oxygen isotope data from the Rhynie individual suggest a childhood spent in the local area, and sulphur isotope ratios (in comparison to fauna from the site) suggest that this individual was also living in the area in the years before they died. While there are few published studies, this adds to our knowledge of wider early medieval mobility in Scotland (or the lack thereof). On a site-specific level, these data paint a picture of an individual, possibly a woman, with access to high-quality protein resources, who was raised locally and buried in a monument of noted location next to two square enclosures.