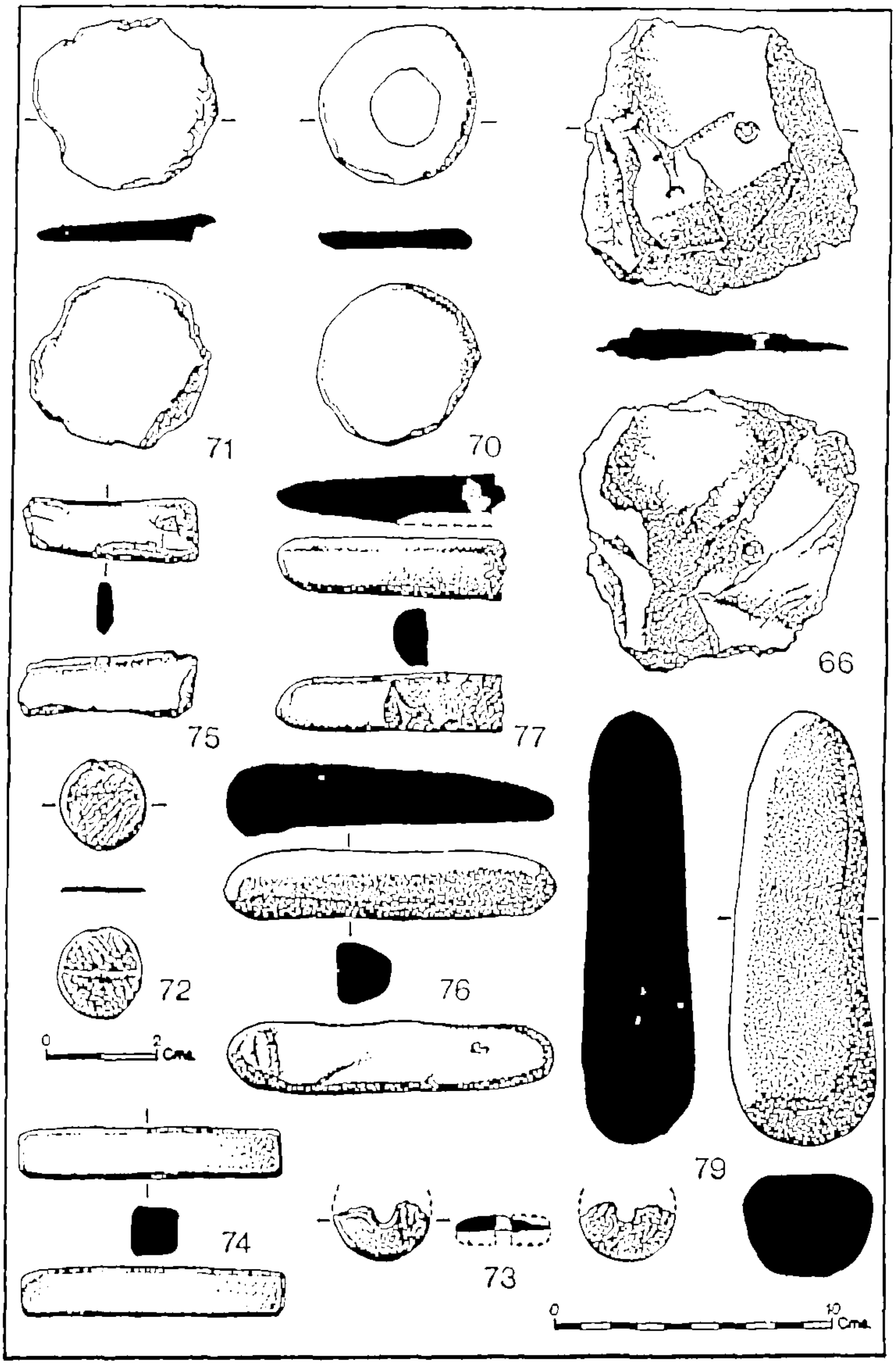


ILLUS 36 Stone disks and whetstones

depression is on the line of the break. These depressions may indicate that the discarded quern was reused as a door pivot or bearing. Original dimensions of quern D 320 mm, hole D 40 mm, thickness over 54 mm.

69.* DN205, SF131 Quern Stone. Slightly more than half of a reddish-grey garnet-schist upper stone. Heavily worn, snapped in two and very rotten. A great deal of the surface has flaked away, but some of the original grinding surface, indicated by garnets worn flat, still survives. Original D approximately 350 mm, hole D 50 mm, thickness over 60 mm.

70.* DN417, SF152 Stone Disk. Fine-grained blue-grey schist with a light polish shaped into rough disk. Edges are slightly rounded. A circle has been roughly inscribed D 26 mm on one side. Overall D 54-60 mm, W 7.5 mm.

71.* DN015, SF225 Stone Disk. Mica-schist roughly shaped into a disk. Edges have been ground smooth in places, but elsewhere chunks and flakes are missing from the edge. Top and bottom are fairly smooth, possibly deliberately polished. D 60 mm, W 8 mm.

72.* DN426, SF173 Gaming Piece? Small mica-schist disk highly polished and nearly perfectly circular, D 16 mm, W 2 mm.

73.* DN106, SF012 Spindle Whorl. Dark grey-black fine-grained sandstone, higly polished. Broken in half and one side has split away. Original D 35 mm, Hole D 8 mm, W perhaps 10 mm. Current dimensions 34 x 20 x 6 mm.

74.* DN106, SF016 Whetstone. Fine-grained, light grey schist, highly polished. Carefully shaped into a square sectioned hone with slightly rounded edges, standard of workmanship very high. Little sign of wear. 95 x 18 x 17 mm.

Probably post 800 AD.

75.* DN116, SF139 Whetstone. Fragment of dark grey shale two-sided flat rectangular hone. One end broken away, both sides well worn. Incised triangle and other marks on one side, perhaps a cross suggesting this was originally an amulet. 63 x 22 x 8 mm.

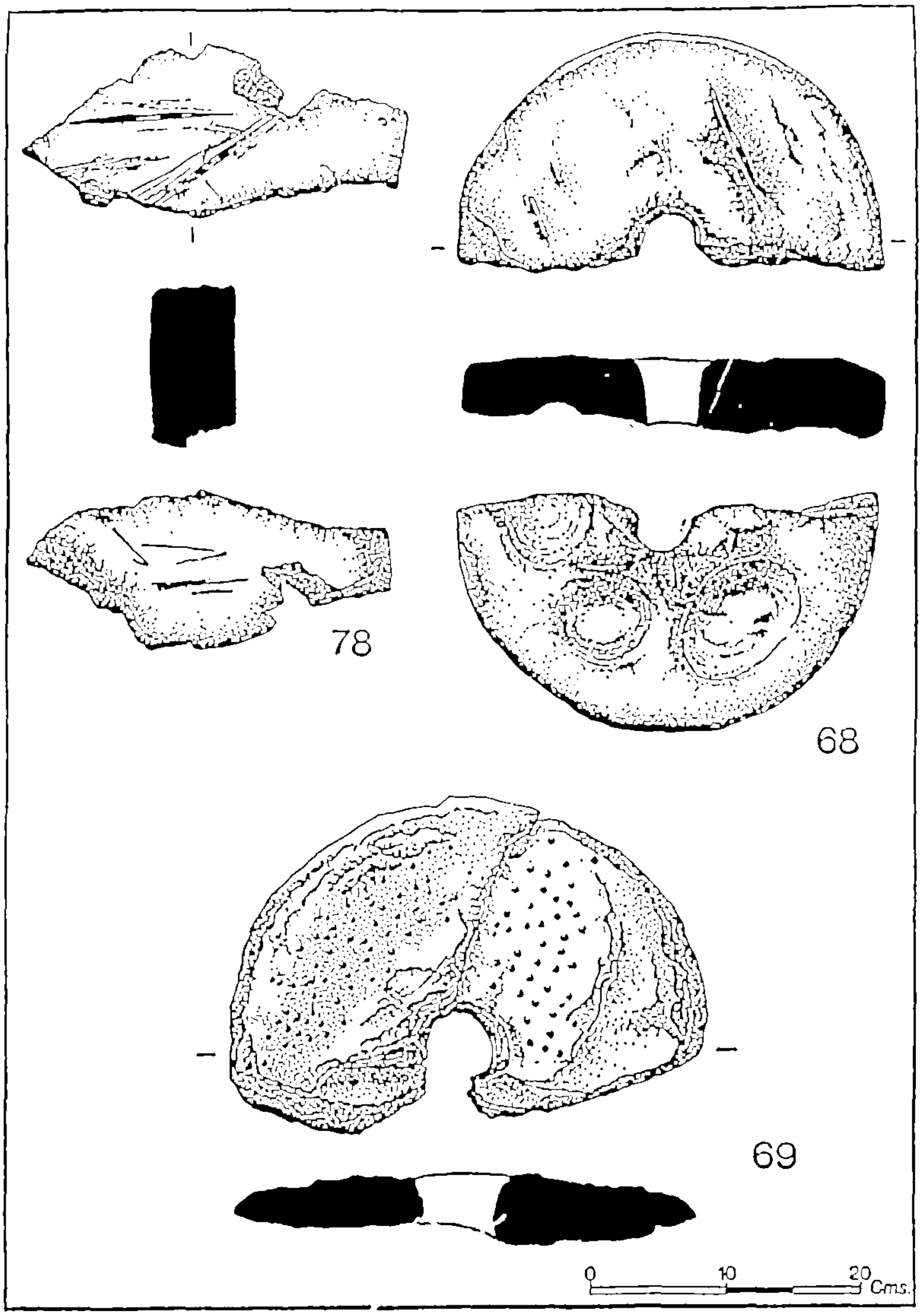
76.* DN116, SF145 Whetstone. Elongated pebble of blue-grey schist. One side has highly polished flat surface, otherwise unworked, 119 x 22 x 22 mm.

77.* DN154, SF150 Whetstone. Blue-green/grey schist worked into D-sectioned rod, with honing surface on flat side. Much of honing surface has flaked away and one end is broken off, 85 x 21 x 15 mm.

78.* DN106, SF138 Whetstone? Dressed slab of Old Red Sandstone, bearing many grooves, probably used as a hone and pin-sharpener. Now shattered and incomplete, but the two surviving edges were cut straight and square. One of the dressed edges features a 45 degree bevel. The two faces were ground very smooth and are parallel to one another. Both sides bear incised grooves which are deep in the middle and gradually become shallower at the ends, probably for sharpening the points of bronze or bone pins. To judge from the disposition of the broken incised grooves the stone was originally at least 400 x 200 mm. Surviving dimensions 290 x 130 x 76 mm.

79.* DN106, SF260 Hammer Stone/Rubber. Elongated pebble of granite or schist, probably too coarse for a whetstone. Unworked but comfortably held in one's hand. Both ends show signs of battering and one long surface has been ground flat through rubbing. 150 x 46 x 37 mm.

80. DN006, SF030 Tufa Slab. Roughly dressed slab of light grey-beige limestone with the impressions of plant remains in it. One side bears a patch of mortar about 100 x 60 mm containing crushed



ILLUS 37 Quernstones and rubbing-stone

brick or tile. Similar lumps of mortar were recoverd from molehills on the citadel summit. The mortar suggests that the stone was scavenged from a Roman military bath house. 225 x 204 x 66 mm.

81. DN603, SF178 Grave Stone? Fragment of headstone of Old Red Sandstone, with an incomplete inscription in a Copperplate hand which reads: P(?) Macgregor/saint F[illans]. 130 x 110 x 30 mm. 18th-19th cent.

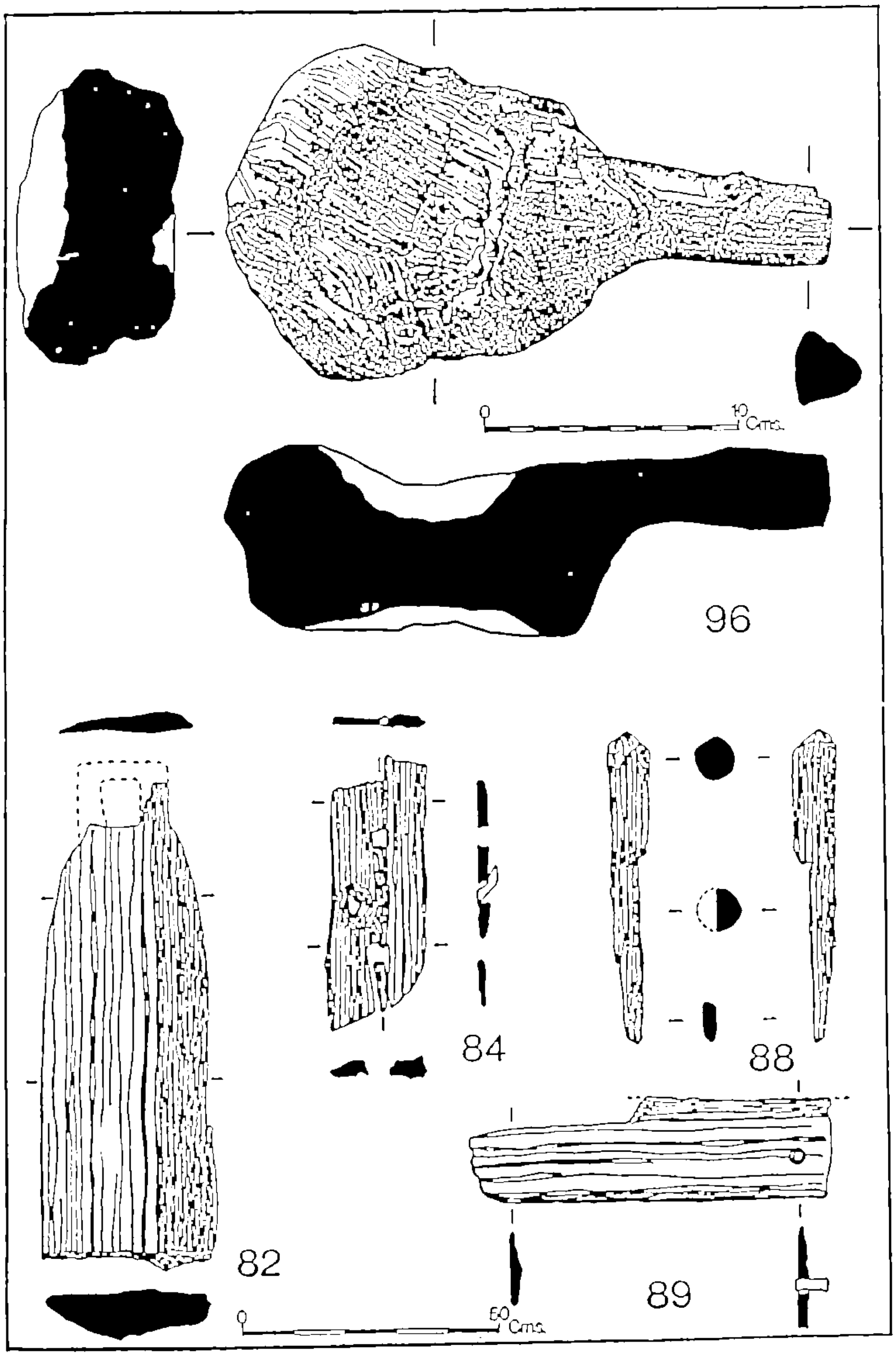
SLING STONES

From the upper levels of DN 101 - i.e. 101, 102, 103, 104 and 105 - came 36 ovoid pebbles, apparently of sandstone. Apart from two exceptions weighing respectively 117 and 125 gms, they range between 53 and 88 gms, the majority being 60-70 gms. They are most reasonably regarded as sling stones; but it is difficult to account for their occurrence in the dereliction levels of Dundurn.

WOOD (illus 38)

Wooden artefacts were preserved in good condition and in great numbers in the damp deposits of trench 100/400. Indeed such was the quality of preservation that it was not possible to record, let alone preserve, every worked fragment of wood. The major pieces are described below, but it should be borne in mind that a considerable quantity of wood shavings and chips indicative of wood-working was noted during the excavation. The identification of species was carried out by Dr. James H Dickson, Glasgow University Botany Department.

82.* DN426 Heavy Oak Plank of plano-convex section, with mortice hole. Split segmentally, so that curved surface corresponds to outer curve of the trunk (no bark was present and it is unclear



ILLUS 38 Objects of wood

whether any sapwood is present). Surface has been roughly dressed by an adze or similar tool. Shouldered tang or protrusion at one end suggests the presence of a squared hole, perhaps a mortice hole. Opposite end has been roughly chopped away in antiquity. 930 x 330 x 95 mm.

This timber provided the sample used in the combined radiocarbon and dendrochronological analysis, UB 1321-1325, to give a date of 608 - 30 + 15 AD.

83. DN426 Heavy Oak Plank of plano-convex section with curved end; split segmentally so that curved surface corresponds to curve of trunk; but no bark, no certain sapwood. Curved side dressed, plane side rough. One end has been gently rounded, the opposite end roughly broken away, perhaps through decay. 865 x 275 x 85 mm.

84.* DN426 Perforated (Oak?) Plank with peg. Probably split radially, surfaces very rough. One end of the plank appears to have been shaped in a curve, the opposite end was broken in antiquity. Three roughly square holes in a line down centre of plank, middle one still holds peg. Peg is angled in its hole and is flush with one surface. Peg: 60 x 15 x 15 mm; plank: 525 x 155 x 25 mm.

85. DN426 Oak Plank. Split radially, surfaces very uneven. One end has been snapped away in antiquity, the other has largely decayed, perhaps also in antiquity. 500 x 120 x 25.

86. DN122 (Oak?) Plank with two pegs. Probably split radially, but difficult to see since surfaces are very rough. Pegs are located side-by-side near one end, which although irregular may be original. Overall the plank tapers from the pegged end and while one edge may be more or less original the other has clearly flaked away. One of the pegs is about D 15 mm, it protrudes slightly from

the top surface and is flush with the reverse surface. The other peg is oval 15 x 12 mm, is recessed on the top side (it appears to have lost its head) and is flush with the other side. Overall dimensions: 635 x 225 x 35 mm.

87. DN426 (Oak?) Plank Fragment. Split radially, with only one original edge remaining. Neither original end remains: 560 x 100 x 35 mm.

88.* DN426 Stake. A limb with bark still attached trimmed to a blunt point at one end with an axe, and shaved to a finer flat point at the opposite end. L 600 mm D 75 mm.

89.* DN423 (Oak?) Plank with peg. Thin (25 mm) plank probably split radially. Peg located close to one roughly squared end, D 20 mm, flush with one side, protruding 35 mm from the other. Opposite end of the plank appears broken. Plank is 190 mm wide at peg end and appears to have been deliberately narrowed to about 150 mm at 240 mm from pegged end. L 700 mm.

90. DN426 (Oak?) Plank with peg. Very thin (6 mm) plank with remains of wooden peg in hole D 25 mm. No original edges preserved, only core of peg remains. 325 x 65 mm.

91. DN426 Incomplete stake. Pointed end with bark still in place on one edge, 175 x 45 mm.

92. DN426 Plank. Thin plank (13 mm) probably split radially. One end with original edge has been trimmed at an oblique angle, sides are original, opposite end was sawn to remove plank from trench, 450 x 125 mm.

93. DN426 Plank. Short length of plank split radially. Bark remains on one edge. Thickness varies from 35 mm at bark edge to 15 mm on opposite side. Neither end is quite square, both are original, 285 x 160 mm.

94. DN426 Stake? Probably broken end of sharpened stake. Width varies from 5-15 mm, 250 x 50 mm.

95. DN426 Plank. Short length of plank, somewhat decayed. The one original end is cut slightly concave, other end was cut to extract from trench. 410 x 20 x 20 mm.

96.* DN426, SF174. Crude handled bowl or ladle. Apparently hacked from the bole of a coppiced oak by utilizing one upstanding stem for the handle, breaking off an adjacent one, and chopping a lump out of the trunk to serve as the actual bowl. This is sub-circular in plan, overall D 120 mm, overall thickness 70 mm, with a slightly concave base, pitted perhaps by the tearing out of another stem. In the upper surface, a hollow up to 23 mm deep, 80 mm diameter, has been roughly scooped out; but its effective depth, for use as a ladle, has been diminished to no more than 15 mm by the scalloping of the rim on both sides. It has been suggested that this is a roughout for a more regularly-shaped ladle; but given its extreme crudity, together with the scars and pitting caused by the breaking off of unwanted stems, it is very doubtful if enough wood is left to yield a regularly-formed bowl.

RADIOCARBON DATES

Conventional radiocarbon age estimates were obtained from ten samples from various contexts utilizing charcoal, unburned wood and animal bone. In addition a single sample (no. 11) was subjected to combined radiometric and dendrochronological analysis using the technique known as 'wiggle-matching' (see Pearson et al 1983 for details of the method). This last date provides the most precise and accurate chronological assessment for a structural phase at Dundurn.

Table 2. Uncalibrated Radiocarbon Age-Estimates

Sample no.	Lab Ref.	Context and Composition	Radiocarbon Age in years BP	δC^{13}
01	HAR 2000	DN012 - Charcoal, hazel twigs, 59 g	1190 ±70	-26.6
02	HAR 2001	DN013, DN014, DN017a & DN 017b Charcoal twigs, 37g	1260 ±70	-26.9
03	HAR 2002	DN013 - Charcoal, oak beams 200 g	1310 ±70	-26.0
04	HAR 2003	DN106 - Charcoal twigs, 50g	1220 ±70	-27.2
05	HAR 2518	DN106 - Mixed charcoal, no visible twigs, 125g	1190 ±60	-26.2
06	HAR 2519	DN426 - Unburnt hazel twigs 330g sample divided between Harwell and Glasgow	1390 ±60	-28.9
07	GU 1040	DN406 - Mixed charcoal 75g, including 7g of twigs	1330 ±60	-25.7
08	GU 1041	DN415 - Mixed charcoal including twigs, 30g	1365 ±65	-26.1
09	GU 1042	DN426 - Unburnt hazel twigs 330g sample divided between Harwell and Glasgow	1510 ±60	-28.5
10	GU 1043	DN427 - Animal bones, 219g	1435 ±65	-22.2
11	UB 1321	DN122 Oak wiggle-matched	1502 ±15	-26.58
	UB 1322		1522 ±15	-25.87
	UB 1323		1574 ±15	-25.13
	UB 1324		1560 ±15	-24.99
	UB 1325		1588 ±15	-25.50

DATING THE SEQUENCE

Three types of evidence enable us to date the occupation of Dundurn and the sequence of its defences. (For some caveats on all three classes, see the initial paper in this series, Proc Soc Antiq Scot 116 (1986), 259-61).

(a) Historical Evidence

The Annals of Ulster record, s.a. AD 682, but recte AD 683.

Obsesio Duin Att & obsessio Duin Duirn

'Siege of Dunadd and siege of Dundurn'.

(MacAirt & MacNiocaill 1983)

This is likely to derive from an annal recorded contemporaneously at Iona, and is therefore highly reliable.

The Scottish Regnal Lists state, of Girg son of Dungal, mortuus est in Dundurn, 'he died in Dundurn'. From the reign-lengths given in the Lists, this event may be dated AD 889. Unlike the 683 annal, this is not a contemporary record in the form in which we have it, but it may none the less be based on an early written source (Anderson 1973; 1980).

(b) Artefactual evidence

With obvious exceptions, such as the modern coins and stoneware bottles from St Fillan's Well, and a few possibly mesolithic flints, none of the artefacts need fall outside the Early Historic period, with broad limits from the fifth or sixth to ninth or tenth centuries AD: limits which conform perfectly with the two historical dates. A dozen objects may be dated rather more precisely, and they are listed in chronological order:

Two glass beads (Cat nos 27 and 29) might be as early as the 2nd cent. AD, but could continue to the 7th cent. A glass beaker (Cat no 31) is likely to be late-5th to 7th cent. The silvered bronze dangle with a biting beast (Cat no 1) and the motif-piece with ribbon animals (Cat. no 42) can hardly be earlier than 625-650 AD. An E-ware vessel (Cat no 37) would belong in the 7th-8th cents., or a little earlier or later.

Towards the later part of the occupation, unlikely to be much, if any, earlier than AD 800, we should place the iron knife with strongly-angled back (Cat no 11); the glass boss with its spiral-ornamented protuberances (Cat no 26); the Carolingian sherd from the Rhineland (Cat no 36); and the well-formed whetstone with sharply squared cross-section (Cat no 74).

(c) Radiometric age-estimates

A total of 11 radiocarbon-derived age-estimates was obtained. (See above for Table 2, Uncalibrated Radiocarbon Age-Estimates). They are listed here (Table 3) in descending stratigraphical order, with calibrations to calendar years AD using the calibration tables of Klein et al 1982. (For the reasons for using this calibration throughout the present series of excavation reports, see Alcock et al 1986, 260-1). The bracket given for each date is at the 95% confidence level, with some rounding off to allow for the fact that the original laboratory errors are quoted at ±60, ±65 or ±70, whereas the Klein tables give the calibrations for ±50 or ± 100 years.

The overall range of the Dundurn dates is from 410-615 AD (Sample no 09) to 640-910 AD or a little later (Sample nos 05, 01). This range agrees well with the dates for the occupation of Dundurn derived from historical sources and artefactual evidence. Its great importance is that it makes it possible to dismiss the claim made by Feachem (1966, 85) about Dundurn and also Dunadd: 'the overwhelming probability must be that both are basically

Early Iron-Age hill-forts; re-used, - perhaps sporadically - ...until as late as the seventh century.'

Table 3. Calibrated C-14 Dates for Structures

Phase	Sample No	Feature No	Structural event	Calibrated Dates AD	Remarks
3B	05	106	Reinforcement of Terrace Wall	640 - 910	Derived from earlier features
	04	106		630 - 900	
	07	406		590 - 850	
3A			Rebuilding of Citadel defence Building of Terrace Wall		
HE 2	08	415	Destruction of Citadel 1	580 - 780	Derived
2B / 2A	01	012	Building of Citadel 1	640 - 910	Twigs
	02	013		615 - 885	Twigs
	03	013		600 - 865	Beam
HE 1	06	426	Laying of Wattle Floor and Demolition of Palisade 1	570 - 760	
	09	426		410 - 615	Twigs
1	10	427	Midden	455 - 645	Animal bones
	11	122	Palisade 1	578 - 623	Wiggle-matched

Notes: 1. Calibration after Klein et al 1982
2. HE = Horizon Event

The disproving of this claim is itself a considerable achievement for radiocarbon dating. It is more questionable, however, how far the method can help us to date the occupation and the sequence of defences with any greater precision. There are considerable problems about using the method in a historical period, for the probability statements which it provides are in no way comparable with the precise single-year dates which may be derived from a good historical source. It has been said of conventional (as opposed to high-precision) dates that 'it is normally beyond the scope of radiocarbon dating to define absolute archaeological time-scales to better than within several centuries.' (Campbell et al 1979, 37). The problem is brought into sharp focus at Dundurn by the age-estimates for a sample of 330 g of unburnt hazel twigs from DN426, divided equally between Harwell (Lab no 2519) and Glasgow (Lab no 1042). The laboratory estimates are respectively 1390 ± 60 and 1510 ± 60. These calibrate to 570-760 AD and 410-615 AD. In using these figures in a historical period, it does not help to draw attention to the statistical significance of the overlap between brackets. (For a fuller treatment of the problems of using radiocarbon dating in a historical period, Alcock in Kenyon & Avent 1987, 7-9).

One set of radiocarbon dates not hitherto considered is, however, of the greatest significance for dating the earliest known phase of the defences: namely the so-called 'wiggle-matched date' (Pearson et al 1983) obtained from a large oak beam believed to have come from the Phase 1 palisade. This was obtained from a series of 5 high-precision dates (UB 1321-5) which were calibrated using the beam itself. The resulting date is quoted as 608 + 15/-30 AD: i.e. 578-623 AD. This can be regarded as an accurate, and relatively precise date for the earliest element of the defence sequence as it is understood at present: the timber stockade of Phase 1.

In addition, at a rather coarser level, the dates for the structural timbers of Citadel 1 (DN 012, 013, 017; sample nos 01, 02, 03) do appear, as a group, later than the dates for the laying of the wattle floor DN 123 (Sample nos 06, 09). That floor marks a definite horizon in the stratigraphy of Cutting 100/400, Horizon Event 1; and as such it is taken to mark the end of Dundurn Phase 1. The subsequent Phase 2 was terminated by the destruction of Citadel 1, when the dragging down of burned material from the citadel itself into Cutting 100/400 is regarded as Horizon Event 2. The radiocarbon dates from the oak beams and hazel wattle of Citadel 1 show that it had not been built until some time after the floor of Horizon Event 1 had been laid. Phase 2 may therefore be sub-divided into 2A, before, and 2B after, the construction of Citadel 1. Unfortunately, that major structural event cannot itself be tied in to the stratified sequence in Cutting 100/400.

Horizon Event 2 was followed by the rebuilding of the citadel defence and by the erection of walling on the edge of the uppermost terrace of the Dundurn hill. These two structural events mark the beginning of Phase 3. If we are correct in assuming that the lower terraces were walled at the same time, this was when Dundurn became a classic example of a nuclear fort. Phase 3 is subdivided into 3A and 3B by the need to reinforce the rear of the terrace wall. Unfortunately, the radiocarbon dates for the destruction of the citadel, and for the reinforcement of the terrace wall, all come from charcoal which had been derived from earlier levels, as the dates for samples 04, 05, 07 and 08 clearly show.

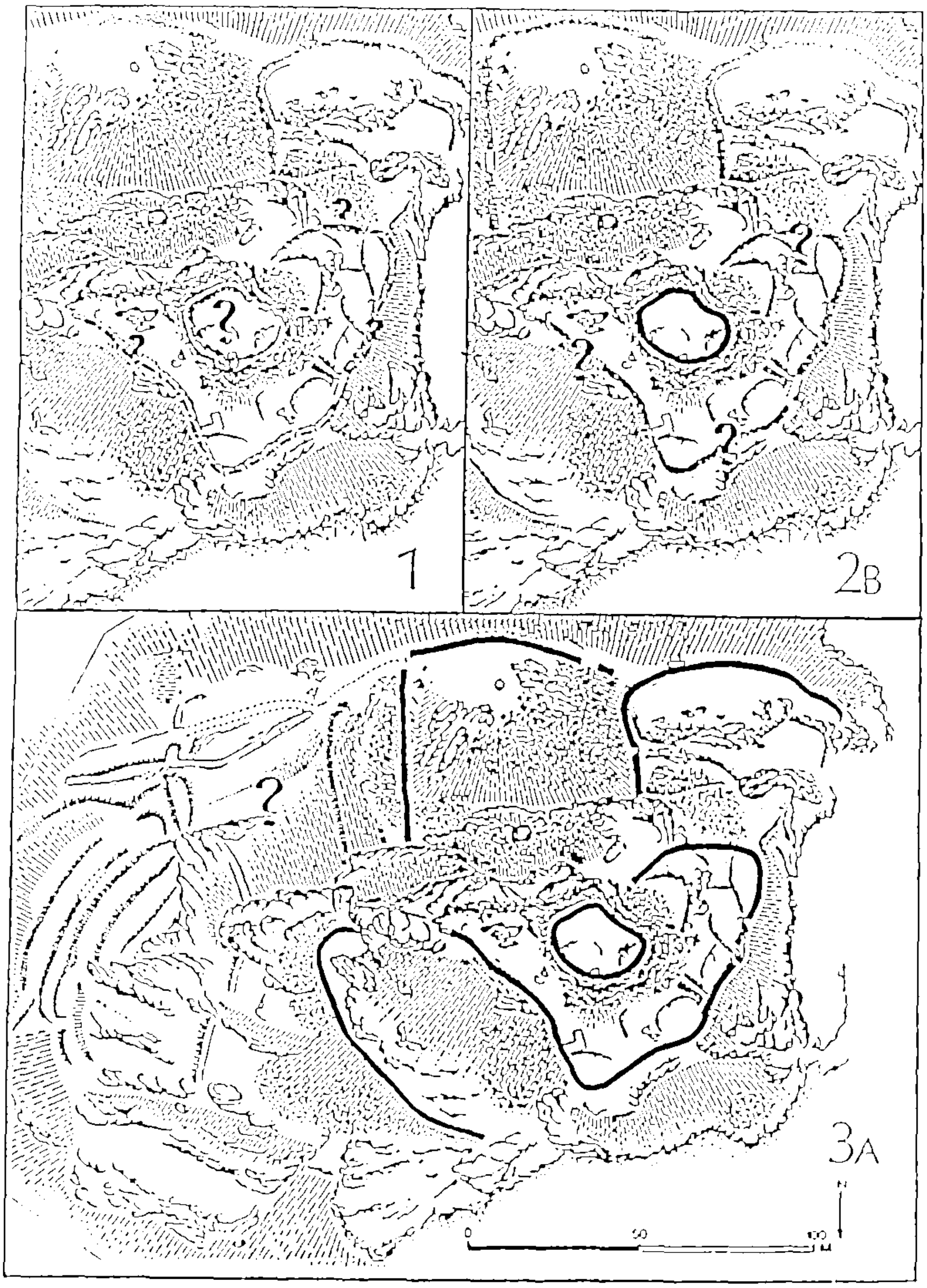
The stratification of datable finds conforms well to this scheme of structural phasing, and helps to supplement the radiometric dating. All those artefacts for which a date after AD 800 is suggested were recovered either from superficial layers, or from Phase 3B. They are the glass boss (cat no 26, DN 103); the

Rhenish/Carolingian sherd (cat no 36, DN 105); the fine whetstone (cat no 74, DN 106); and the angle-backed iron knife (cat no 11, DN 108).

The construction of Citadel 1 marks the start of Phase 2B. From its core (DN 013), and presumably lost during the building, comes the silvered bronze dangle (cat no 1), dated after 625-650 AD. The E-ware sherd (cat no 37), of the 7th-8th cents., came from a sandy floor (DN 120) deposited late in Phase 2A. The vegetable layer (DN 426) which began to accumulate at the start of Phase 2A produced the segmented blue glass bead (cat no 29), for which a date as late as the 7th cent. is acceptable; and more importantly, the motif-piece (cat no 42) with animal ornament which (like the silvered-bronze dangle) dates after 625-650 AD.

SUMMARY OF THE DEFENCE SEQUENCE (illus 39)

To summarize the defence-sequence: In Dundurn 1, around the beginning of the seventh century AD, the upper terrace of Dundurn was defended with a stout stockade, which may have enclosed a roughly diamond-shaped area, about 60 m along its longest side. Later in the century, in Dundurn 2A, the palisade was repaired or even dismantled, and the activities carried out behind it were diversified. Dundurn 2B saw the fortification, for the first time, of the summit boss or citadel with a nailed, timbered construction: radiometric age-estimates indicate that this did not occur until late in the seventh, or perhaps even into the eighth century. Historical probability suggests, however, that it was built before the annal-dated siege of AD 683. This phase ended with the burning and destruction of the citadel defence. In Dundurn 3A, the citadel was refortified, and an imposing rampart was built around the upper terrace, and presumably around the



ILLUS 39 Summary of structural phases

other terraces as well. Dundurn 3B saw a minor reinforcement of the terrace rampart. Probably the NW earthwork enclosure and embanked entrance passage should also be attributed to Dundurn 3A.

APPENDIX 1 : ANALYSIS OF FAUNAL REMAINS

Bone, including burnt bone, was present in many contexts but generally was in too poor condition or too fragmentary for this writer (STD) to analyse. The only contexts to produce quantities of bone were DN 426 and DN 427. Of the two, only DN 426 was extensively excavated. Although DN 427 was damp and rich in bone like DN 426, it was not fully excavated, and only enough bone for C-14 dating was removed. Only the collection from DN 426 is large enough to provide any information about diet and animal husbandry practices. For that reason, the DN 426 sample is the only one to be discussed in detail; the remaining material is described by contextual group. The sample from DN 427 should probably be grouped with that from DN 426 in so far as they seem closely contemporary (see discussion of trench 100/400 above). Here, however, no material from separate contexts has been combined.

DN 426

The bones from 426 suggest a virtually complete reliance upon domesticated livestock for meat. The three standard domesticates were all present: cattle bones were the most common, followed by pig and then sheep, which were there in small but noticeable numbers. Only 3 out of 727 identified bones were those of non-domesticated species: two of deer and one of wild fowl. The two deer tibia fragments (2 MNI) were those of juveniles, and the bird tibia was that of an unidentified wading bird (perhaps a heron). These do not suggest that wild fauna provided a significant component in the diet. In addition to the animal bones a single human bone was noted: the head of a femur.

The range and condition of the bone were consistent with the interpretation of this deposit as a domestic refuse midden (see above). There is certainly no indication that it represents a butchery deposit (i.e. there is no apparent over-representation of waste bone). Moreover it can be suggested with reasonable certainty that the bones are in their primary depositional context and have not suffered undue attrition from weathering. Obviously other taphonomic factors such as scavenging dogs can not be quantified - some gnawing was observed. In general the condition of the sample is good; the fragments are large and most breakages would seem to be due to ancient human activity. Very little of the bone has been burnt, perhaps less than 1%.

Methodology

The analysis of the DN 426 bones consisted of a fragment identification and raw count, an evaluation of minimum numbers of individuals, a note of the state of epiphyseal fusion and a programme of metrical measurement. 727 fragments from the total of 1395 were identified, which constitutes 52.1% of the sample. For the most part the unidentifiable bones were very small fragments accounting for only 19% of the sample by weight. It is however possible to suggest that the pig and perhaps the sheep/goat are under represented, because of the well-known tendency for cattle bones to survive better than those of pig or sheep/goat and also for cultural reasons (discussed below). The minimum number of individuals (MNI) was determined for each type of bone (where appropriate), and cumulative MNI values were derived for each species (Chaplin 1971, 70-5). The use of MNI complements raw fragment counts, but MNI is not without its problems (Grayson 1984, 27-84). However, in order to facilitate comparison between sites, especially those excavated some time ago, discussion here focusses on fragment counts despite their inherent biases. During the process of identification a note was made of the state of epiphyseal fusion and general conclusions were drawn as regards the age of death and the kill pattern. The small number of bones for which ageing information was available makes these age estimates tentative.

Measurements were taken of those bones which were sufficently complete. Angela von den Driesch's A Guide to the Measurement of Animal Bones from Archaeological Sites (1976) was followed. The abbreviations used in the metrical tables are hers. When a series of bones is measured, their values are listed in the same order for each measurement so that those from a single individual can be extracted.

The preliminary identification of this group was carried out under the supervision of Raymond Chaplin, who also contributed several suggestions which have been followed in preparing this report. In addition consultation with Peter Hill and Dr. Archibald Young has been most helpful.

Table 1. Fragment Count of Bones from DN426[1]

	Fragments	% of Total	% of Ident[2]	Weight
Cattle	439	31.5	60.4	
Pig	141	10.1	19.4	
Sheep/Goat	39	2.8	5.4	
Small Ungulate[3]	104	7.5	14.3	
Deer	2	0.1	0.3	
Bird	1	0.1	0.1	
Human	1	0.1	0.1	
Unidentified	668	48.1	-	3.56 Kg
Identified	727	52.1	-	15.17 Kg

[1] The fragment counts used for Table 1 are as follows: Cattle: 439=61%, Pig 222=31%, Sheep/Goat 62=8%. The additions to the Pig and Sheep/Goat counts were made by dividing the mixed small ungulate ribs and vertebrae in proportion to the relative frequency of the other Pig and Sheep/Goat identifications.
[2] Calculated with respect to the total of identified fragments.
[3] A mixture of ribs and vertebrae, which were not separated by species, but are probably those of pig and sheep/goat.

CATTLE

Cattle was by far the best represented animal at Dundurn, the 439 identified fragments constituting almost two-thirds of the identified total. Most of these bones were well broken up, and as a rule only ankle bones, scapulae and some ribs survive complete. Despite the modest sample size and broken condition, it is possible to estimate the size and age structure of the herd(s) represented by these bones. However, it was not possible to sex the bones or infer sex from their sizes, because of the condition and smallness of the sample.

The Dundurn cattle were small. Comparison with metrical data indicates that they fell within the lower end of the size ranges recovered from various Iron Age and Early Medieval sites (Clutton-Brock 1976, Higgs et al 1979, Maltby 1981, 1987). For instance the cattle from Danebury (Grant 1984, 510-14), Crosskirk broch (Macartney 1984, 145) and Anglo-Saxon Cheddar (Higgs et al 1979, 357) show that in every case the mean bone size was larger than at Dundurn. Only a single bone (a metacarpal) suitable for estimating height survives from Dundurn; it indicates that it came from a beast 1.07 m high at withers (Matolcsi 1971). This probably overestimates the average stature of the Dundurn herd, because the metacarpal in question is fairly large; larger, for instance, than the average Danebury metacarpal.

Three horn cores were recovered from DN 426, but only one was sufficently complete to merit detailed description along the lines suggested by Armitage and Clutton-Brock (1976). It is moderately long (147 mm), has a pointed tip and is both curved and twisted. The direction of its curvature and its overall proportions indicate that the horn came from a bull. All of the morphological traits are characteristic of Armitage and Clutton-Brock's Medium Horned group. However, except for descriptive precision the significance of their groupings is not entirely clear. They make no direct correlation between horn-type and breed nor do they attach any absolute chronological distinctions to horn-types.

Ageing was based entirely on epiphyseal fusion because no complete mandibles survived. Age identifications were made on 57 bone fragments of animals over six months old for which age-of-fusion correlations or other age estimates are available. These were exclusively limb bones; no cranial data were used.

Table 2. Cattle Age at Death Estimated from Epiphyseal Fusion

a. Age Estimates by Epiphyseal Fusion Group, N =total number of bones whose fusion is indicative of a specific age, n = number of unfused, i.e. under the age of fusion.

Age	N	n	% of group (n/N)	% of total (n/57)
	57	57	100	100
3½ yrs	20	6	30	11
2½ yrs	23	9	39	16
1½ yrs	6	1	17	2
10 mths	8	4	50	7

b. Cumulative Totals, N = number of unfused bones for each age level.

Age	N	%
3½ yrs	57	100
2½ yrs	16	28
1½ yrs	5	9

Given the small size of the sample it is best not to place too much significance on the absolute values of these statistics. They are, none the less, revealing about the kill-pattern or age structure of the herd. The cumulative attrition rates as derived from table 2b indicate that about three-quarters of the herd (72%) lived beyond age 2½ years and that just over half (52%) lived beyond 3½ years. This indicates a significant slaughter of juveniles and of recently mature beasts. Such a pattern of slaughter would be compatible with a regime primarily concerned with dairy production, in which surplus males and barren females were slaughtered upon achieving their maximum size. Unfortunately it was not possible to confirm this hypothesis by sexing specific anatomical elements or by searching for signs of sexual dimorphism represented in the size of bones. For instance, the metrical data from the cattle astragali (see Table 3) do show some minor peaks in the distribution; but these are not clearly enough defined to support meaningful inferences about the relative proportions of cows, oxen and bulls. The sample is simply too small.

Table 3. BOS from DN426

Bone	Frags (MNI)	Measurements: (mm)	Comments
Cranium	13 (-)	44: 150, 135 45: 54, 45 47: 150, -	Possibly under-represented.
Mandible	4 (-)		
Scapula	17 (8)	HS: 250,- ,- DHA: 210,- ,- Ld: 110,- ,- SLC: 35.5, 40.5,- GLP: 55.5, 56, 50 LG: 46, 49, 42 BG: 39, 38.5, 37.5	4 fused processes 1 unfused process Butchery: one e.g. of two parallel chops running lengthwise along exterior of the collum scapulae.
Humerus	11 (7)	BT: 61, 67, 68 BD: 68, 67, 73	5 distal fused 1 distal unfused Butchery: Outer condyle often split off. One e.g. has hack cut in articular surface.

Radius	6 (4)	BFp: 60, 61 Bp: 65, 67 BFd: 58, - Bd: 64, -	2 distal fused 2 distal unfused
Ulna	3 (2)		
Pelvis	8 (3)		Butchery: three have chops on exterior neck of ilium.
Femur	9 (4)	Bp:98 DC: 38	2 distal fused 2 proximal fused 2 proximal unfused
Tibia	14 (9)	fused; unfused Bp: -, 84, -, -; 78, - Bd: 51, 54, 54, 47; 51, 52 Dd: 37, 38, 37, 32; 36, 38.5	5 distal fused 5 proximal fused 3 distal unfused 1 proximal unfused
Astragalus	11, (7L, 4R)	GLl:61, 59, 54, 58, 60, 57, 55, 59, 56, 55, 41 GLm:55, 55, 51, 53, 54, 52, 50, 53, 52, 51, 39 Dl:32, 33, 30, 32, 32, 32, 31, 33, 31, 33, 23 Dm:33, 33, 30, 32, 33, 31, 32, 33, 30, 31, 21 Bd:37, 36.5, 32, 34, 37, 33, 34, 36, 34, 34, 26	Mean, std.dev.[1] 57.4, 2.2 52.6, 1.6 31.9, 0.9 31.8, 1.2 34.8, 1.7
Vertebra	54 (?)		Butchery: lateral condyle has often been struck off. None have been split medially.
Calcaneum	9 (6)	GL: 117, 113, 119 GB: 39, 33, 38	3 fused 2 unfused
Metapodials	16 (?)	GL:177,-, -, -,-, - SD: 28, -, -, -, -, 15 Bp: 50, -, -, 42, 39.5, 22 Bd: 52, 48.5, 51, -, -, -	3 distal fused 7 proximal fused 6 distal unfused
Phalanx No.1	17 (-)	Min. Max. GLpe: 49, 55 Bp: 26, 26 SD: 22, 23.5 Bd: 24.5, 25	
Phalanx No.2	9 (-)	Min. Max. GL: 35, 32 Bp: 26, 26.5 SD: 20.5, 20.5	

		Bd: 20, 23.5	
Phalanx No.3	16 (-)	Min. Max. DLS: 45, 73 Ld: 38, 53 MBS: 14, 22	Fine toed, fair range in size.

[1] Statistics calculated only for adult bones (i.e number 11 is omitted).

PIG

On the basis of raw fragment count, pigs were the second most common animal at Dundurn. 141 fragments are clearly porcine and a further 81 fragments of mixed small ungulate ribs and vertebrae have been assigned to pig (see Table 1, note 2). Pig thus constitutes 31% of the identified sample; however, there is reason to suspect that this figure is too low. A minimum of 10 individuals are represented by the pig mandibles, while the greatest MNI figure for cattle is 9 for the tibia. Likewise the MNI figure for pig scapulae (10) suggests that we may be missing a significant portion of the post-cranial skeleton. This may either be due to natural attrition of the more delicate pig skeleton in comparison with cattle, or more interestingly, it may reflect cultural practices. The differential deposition of certain parts of the skeleton could arise if hams were smoke- or salt-cured and consumed off-site, or if pork was roasted and dogs were allowed to chew the bones. In any event, a case could be made for arguing that the number of cattle and pigs consumed was roughly equal. In terms of contribution to meat supply there would of course be no comparison, especially as these were small pigs.

The mandibles also provide us with our best evidence for the age at slaughter of the pigs. Bearing in mind the sample size, the evidence strongly implies that the majority were slaughtered at the point of reaching full maturity. In dental terms this is the point at which the third molar is erupting (C (P_1) P_2 P_3 P_4 M_1 M_2 M_3 (erupting)). This dental pattern is present in ten out of twelve examples complete enough to age and represents eight out of a minimum of ten individuals. In addition the data below indicate that an appreciable number of very young pigs was also slaughtered.

Table 4. SUS from DN426

Bone	Frags (MNI)	Measurements: (mm)	Comments
Cranium	2 (-)		
Mandible	20 (10)	8 individuals with C (P_1) P_2 P_3 $_4P$ M_1 M_2 M_3(erupt) 6: 100, -, -, - 7a: 84, -, -, - 8: 98, -, -, - 9: 50, 58, 54, 55 11: 30, 40, -, 37 21: 11, 11, 11, 13	
1 piglet 1 adult		10: L: 34, 35 B: 15, 15.5	
Scapula	14 (10)	SLC: 23.5, 24.5, 15, 17, 19, 19, 21, 22, 20, 19, 17	
9 fused processes 3 piglets		GLP: 35, 37.5, -, 27, 29, 31, -, 32, 32, 30 LG: 27, 30, -, 24, 23, -, -, 27, 27, 23 BG: 23, 24, -, 19, 20, -, -, 24, 23, 19 DHA: 171, 155, -, -, -, -, -, -, -, - Ld: 106, -, -, -, -, -, -, -, -, - HS: 186, 164, -, -, -, -, -, -, -, -	
Humerus	5 (4)	BT: 30, 29 Bd: 41, 38	2 distal fused 1 distal unfused - piglet
Radius	2 (2)		
Ulna	4 (3)		2 distal unfused
Pelvis	25 (12)	LA: 33, 34, 31 LFo: 39, 42, -	3 fused 14 unfused - piglets 5 MNI piglets
Metacarpus	3 (1)		
Femur	5 (5)		2 unfused - piglet
Tibia	8 (6)		2 unfused - piglet

Fibula	3 (2)	
Calcaneum	1 (1)	
Metatarsus	7 (2)	B: 12, 11 GL: 77, 75 LeP: 74, 71 Bd: 15, 14
Astragalus	9 (-)	Mean, std.dev. GLi: 34.7, 3.7 GLm: 37.6, 4.1
Phalanxes	3 (-)	

SHEEP/GOAT

Only thirty-nine bones were unequivocably identified as being from sheep or goats (no attempt was made to distinguish between the two) and a further 23 of the mixed small ungulate ribs and vertebrae were attributed to sheep/goat (see Table 1. note 2). This represents 8% of the identified sample. Little can be said on the basis of so few bones other than that they appear to have been short, stocky animals which accounted for little of the meat consumed.

Table 5. Ovis/Capra from DN 426

Bone	Frags (MNI)	Measurements: (mm)	Comments
Cranium	3 (3)		
Scapula	3 (3)	SLC: 18, 18 GLP: 32	
Humerus	5 (4)	Bd: 28, -, -, - BT: 27, -, -, 26 SD: 14, 15, -, - Bp: -, -, -, 38	3 distal fused 1 distal unfused
Radius	1 (1)		1 proximal unfused
Ulna	3 (3)	-	
Pelvis	3 (3)	-	
Femur	3 (2)	Bd: 39	1 distal fused 1 distal unfused

Tibia	3 (2)	-	1 distal fused 1 proximal unfused
Metacarpus	7 (2)	Bd: 24, - SD: -, 15 Bp: -, 22 DD: 10, -	2 distal unfused
Calcaneum	3 (2)	GB: 20,20	
Astragalus	2	-	
Phalanx No.1	1 (1)	GL: 32 Bp: 12 SD: 9 Bd: 10	
Phalanx No. 2	1 (1)	GL: 22 Bp: 9 SD: 8 Bd: 5	
Phalanx No.3	1 (1)	DLS: 24 Ld: 21 MBS: 10	

REMAINING BONE-PRODUCING CONTEXTS

When possible bone fragments were identified by species and element.

DN 012

Small fragments, about 50% either burnt or calcined, 1230 gms. No teeth were observed.

Bos: 4 phalanges, 1 astragalus.

Sus: 1 humerus, 1 astragalus, 1 phalanx.

Ovis/Capra: 3 metapodials, 3 first phalanges and 2 second phalanges.

DN 020

Badly broken up and all fragments burnt or calcined, 350 gms.

Bos: 1 metapodial, 1 phalange, teeth.

Sus: 1 scapula, teeth.

DN 106

Small fragments, 100% burnt,no identifications, 300 gms.

DN 110

A collection of very small fragments about 50% of which are calcined, 35 gms. Only fragments of cattle teeth were recognized.

DN 118

Unidentifiable small, burnt fragments, 69 gms

DN 154

A dry and friable sample of which less than 1% was calcined, 395 gms

Bos: 1 Tibia, 1 humerus, 1 astragalus, 1 vertebra, teeth.

Sus: teeth Ovis/Capra: 1 scapula

Bird (wader ?): 1 femur

DN 201

20 gms of unidentifiable, very small calcined fragments.

DN 202

100 gms like DN 201.

DN 203

60 gms like DN 201.

DN 204

30 gms like DN 201.

DN 205

670 gms like DN 201 except bos teeth noticed.

DN 206

Very broken sample, about 50% burned or calcined, 630 gms.

Bos: 5 phalanges, 3 astragali, teeth.

Sus: teeth.

Ovis/Capra: phalange.

DN 207

Very broken, 20-30% burnt or calcined, 1700 gms.

Bos: 9 phalanges, 5 calcanea, 3 astragali, 2 scapulae, 1 mandible, 1 ulna, 1 femur, 1 metapodial.

Sus: 1 tibia, teeth.

DN 414

Badly weathered, small fragments, 50% burnt, 160 gms.

Bos: 1 metapodial, teeth.

Sus: teeth.

DN 415

Very worn and friable fragments, 105 gms. Bos: 1 radius.

DN 417

Medium to small fragments, badly weathered, about 20% calcined, 600 gms.

Bos: teeth.

DN 427

Sample analysed by Raymond Chaplin before being used for C-14 determination. Now destroyed. Total weight of sample 1962 gms. Weight of unidentified bone 112 gms or 6% of total.

Table 6. Bos from DN 427.

Bone	MNI	Measurements: (mm)	Comments
Cranium	1		Fragment with horn.
Mandible	1	3: 94 5: 223 6: 276 7: 133 8: 86 9: 49 10: 34 x 13 12: 140 13: 127 15a: 64 15b: 40 15c: 30	P_3 - M_3 slightly worn.
Scapula	1		

Femur	1		Unfused prox.
Tibia	2		2 unfused prox.
Tarsal joint	1		Including: metatarsal scarpho cuboid, cuneiform, astragalus.
Metatarsal	1		Unfused distal.

Total Bos Wt. = 1522 gms or 77.5% of total.

Table 7. Ovis/Capra from DN 427.

Bone	MNI	Measurements: mm	Comments
Horncore	1		Fragment.
Vertebra	1		
Humerus	1	GL: 139 BT: 29 SD: 14 Bd: 31	Fused prox. and distal.
Tibia	2		2 unfused prox.

Total Wt. Ovis/Capra =81 gms or 4% of total sample.

General Conclusions

These comments refer to the sample from DN 426, the only sample large enough to merit discussion. The inferences to be drawn from these bones have important implications for the understanding of dietary and animal husbandry practices at Dundurn and for the southern Pictish economy. It is in fact one of only two analysed faunal collections for the period from south of the Mounth, the other being from Clatchard Craig (Close-Brooks, 1986).

The condition and treatment of the bone provides some indication of dietary practice. It cannot, however, be easily quantified; hence these evaluations are subjective judgements based on observations. As a group the cattle bones are very broken. The only whole bones were the smaller lower limb bones and some few ribs and vertebrae. The butchery marks noted seem to relate either to dismembering the carcass or splitting the long bones to expose the marrow. The high degree of breakage may imply that beef was consumed in stews or soups. This dietary interpretation is supported by the near absence of burnt or scorched bone which might have been expected had the meat been roasted. The bones from DN 426 contrast sharply with those recovered from other contexts, which are mostly burned: but this reflects preservation conditions on the site rather than any culinary practices. Alternatively the bone from joints which had been roasted may have a different depositional history. Pig bones, on the other hand, are not so broken up and, as noted above, the post-cranial remains are scarce. This scarcity may be accounted for in a number of ways: the joints were consumed off-site, or pork was consumed on-site but in a different manner from beef, which was more destructive to the bone (e.g. allowing dogs to gnaw them). A factor contributing to off-site consumption may have been the curing of hams and bacon - items which travel well. It is not possible to select from these alternatives on present evidence. Suffice it to say that pork and beef were prepared differently and presumably thought of differently. Perhaps pork, because of its relative scarcity, was a more prized dish.

Following Chaplin's estimates for meat yiel: (1971, 134), it is clear that mutton was an insignificant part of the diet. On the basis of the DN426, sample it can have provided only about 1% of the meat. The most generous estimates of the pig population are derived from the MNI figures, which suggest that the number of pigs may have been about equal to cattle. Using the MNI estimates, pork can have contributed no more than 15% to the meat diet while beef accounted for about 85%. If the estimates of meat yields are based upon raw fragment counts, the bias in favour of beef grows to something over 90%. This further strengthens the suggestion that pork was treated differently to beef, if only because of the greater availability of beef. We know that in Ireland milk resources were considered seasonal (white foods being summer fare (Lucas 1960)); we should also expect that meat consumption was seasonal. If the slaughter took place when the animals were in their prime, say at the end of the summer, this would help to define which parts of the year were suitable for the social occasions which required meat. Against this in the case of pigs it must be recognized that their breeding pattern could produce two, or even three batches in prime condition at intervals over any one year.

A more intractable problem is to determine how important meat was in the overall diet, which also included barley, oats and presumably milk, butter and cheese. There is no satisfactory way of assessing the importance of animal products relative to cereal and other crop foods, but it may be possible to infer the relative importance of meat as compared with dairy products from the husbandry practices. It may be, for instance, that milk and cheese were more important sources of protein than was meat. McCormick argues that it is possible to distinguish dairy herds from beef herds in the faunal assemblages from early Christian sites in Ireland (1983). These assemblages include those from sites considered to have been royal, like Lagore (Henken 1950). McCormick follows Legge in noting the advantage of dairy cattle over beef cattle in terms of protein productivity: annually, dairy herds produce 115 kg/ha as compared to 27 kg/ha from beef cattle.

Unfortunately the evidence from Dundurn is not adequate to allow detailed reconstruction of the age and sex composition of the sample population. Consequently, it is not possible to determine whether it is consistent with a dairy regime on the Irish model, or whether it suggests a greater appreciation of roast beef. Equally, it is not possible to claim that it represents a working herd, rather than selected animals, or even joints, brought as food-rents or tribute to a royal centre.

Finally, it is of interest to compare, in Table 8, the relative frequencies of animals from selected excavations, principally of Early Historic or early medieval date, but also including the pre-Roman Iron age fort of Broxmouth, and the later medieval burgh of Perth. The character of the sites ranges through forts (nos 1, 2, 3, 5, 12), brochs (nos 10, 11) crannogs (no 8), and open sites of royal (no 9) or lesser (no 4) status to ecclesiastical sites (nos 6, 14) and a burgh (no 15). The table is limited in that it excludes age and sex, for which information is not always available. It does, however, show clear differences in the pastoral economy, or at least in dietary preferences, among the various sites.

Table 8. Comparison of Relative Percentages of Animals [1] from Selected Sites.

Site	Cattle%	Pig%	Sheep/Goat%
1. Dundurn DN 426	64	28	8
2. Clatchard Craig (Close-Brooks, 1986)	79	9	12
3. Dunadd[2] (A. Lane, pers. com.)	79	10	12
4. Buckquoy Ib (Ritchie 1977, 202)	54	23	23
5. Dinas Powys 4 (Alcock 1975, 19; 1987)	43	36	21
6. Iona[3] ditch 1 (Barber 1981, 313-6)	91	3	6
8. Lagore Ib (Henken 1950, 226)	71	14	15
9. Cheddar 1 (Rahtz 1979, 356)	43	26	31
10. Crosskirk Broch (Fairhurst 1984, 133)	66	18	16
11. Dun Mor Vaul (MacKie 1974, 188)	20	3	77
12. Broxmouth[4] (P. Hill, pers. com.)	59	8	37
13. Skeldergate,York[5] (O'Connor 1984, 12)	67	23	10
14. North Elmham[6] (Clutton-Brock 1976, 3[illegible])	20	29	51
15. Medieval Perth[7] (Hodgson 1983, 10)	65	8	27

[1] The percentages are of identified fragments and are for cattle, pig and sheep/goat only. In cases where other wild or domestic animals are present they have been excluded and the percentages recalculated in order to conform to a common format.

[2] Contextual control is poor.

[3] By the early middle ages there were no forests on Iona to support pigs.

[4] Global total of faunal remains (16,262 fragments) from Iron Age hillfort.

[5] 10th century.

[6] Middle Saxon.

[7] High Street site.

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APPENDIX 2

Botanical and biological report

by

J. H. DICKSON & D. W. BROUGH

1. INTRODUCTION

This account has been slightly condensed, largely by omitting archaeological details given in the main body of the Dundurn report, from Dickson & Brough, 'Biological studies of a Pictish midden', *Archäobotanik. Dissertationes Botanicae* 133 (Berlin-Stuttgart 1989), 155-166.

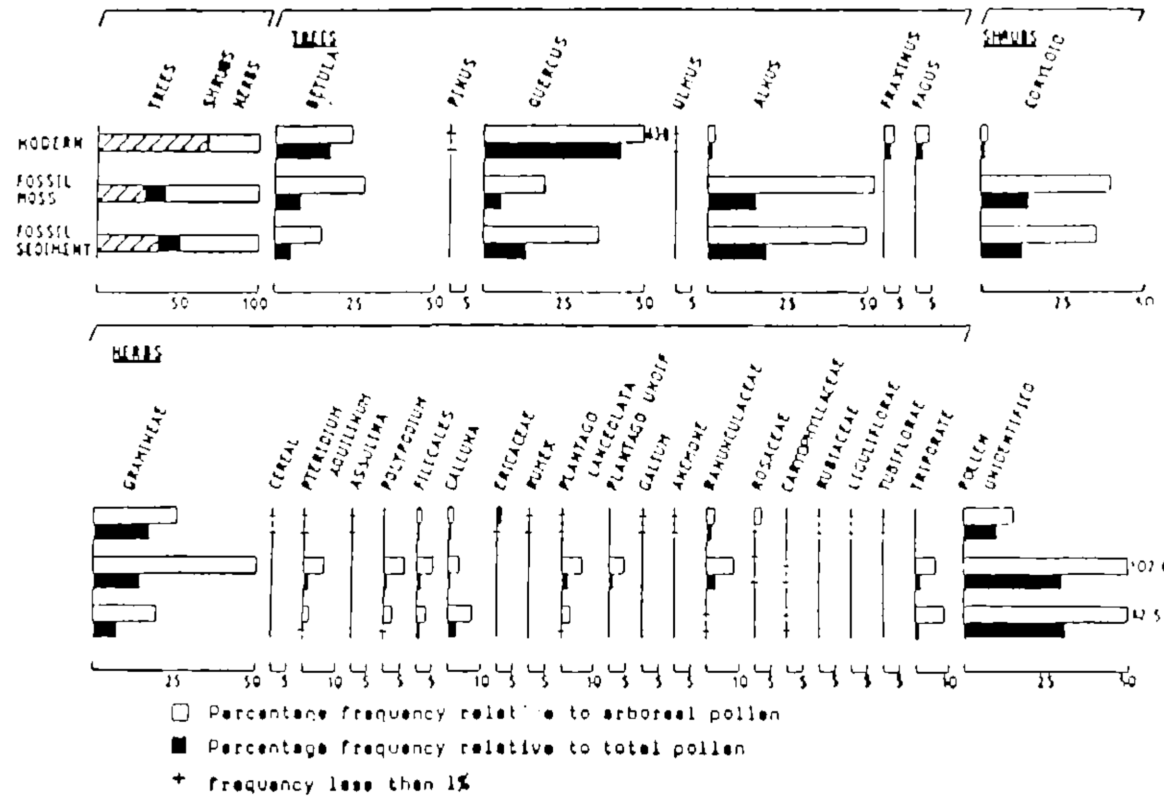
At present the upper parts of the knoll are grassy with large areas of Bracken as well as scattered trees and dwarf shrubs on the rocky outcrops. The lower parts are all more or less wooded with Ash, Beech, Downy Birch, Hazel, Pedunculate Oak, Rowan and Wych Elm. Pasture covers the flat ground by the River Earn with its small tributaries flowing north of the knoll, harbouring Pondweeds, Flotegrass and Reed Canary Grass. Alcock has pointed to the existence of former cultivation rigs, both on this flat ground and on the eastern spur of the hill itself.

2. INVESTIGATIONS OF LAYER DN426

Two pollen samples were taken from DN426, one from moss, the other from sediment. The modern pollen rain on Dundurn was removed from live mosses. Standard methods for extraction and identification were adopted for both pollen and macroscopic fossils, the latter were sieved from six samples, each of 250 gm. Biochemical tests were performed on seven samples. Full details are provided by Brough (1980).

2.1. POLLEN ANALYSIS

The results of pollen analyses are presented in Illus 40. Poor preservation accounts for the large proportions of unidentified pollen. From the modern rain 1188 grains were counted and from the DN426 moss 391 grains and from the DN426 sediment 427 grains.



ILLUS 40 Pollen frequencies from combined surface samples and DN 426

2.2. PLANT MACROFOSSILS

Fronds of Bracken (*Pteridium aquilinum*), well preserved in large compacted sheets formed at least 50% and up to 90% of five samples examined. Fragments of nuts of the Hazel (*Corylus avellana*) were the most numerous remains of the 14 taxa of flowering plants. We estimate that the fragments, irregularly broken by human hand, derive from up to 50 nuts; there was no sign of the splitting, neatly and equally in two, that results from germination, nor of animal gnawing. Remains of Downy Birch (*Betula pubescens*) and of Sedges (*Carex* spp) were recovered from five samples (Table 1).

TABLE 1: DN426 PLANT MACROFOSSILS

Species	Habitats	Remains	Sample No. 1 2 3 4 5 6
Alnus glutinosa (Alder)	AD	fr	+ - - - - -
Alopecurus sp (Foxtail)	B	ca	- - + - + -
Betula pubescens (Downy Birch)	D	cs,fr	+ - + + + -
Carex spp (Sedges)	A to E	n	+ + + + + -
Corylus avellana (Hazel)	D	nfr	+ + + + + -
Festuca spp (Fescue)	B	ca	+ - - - - -
Glyceria fluitans (Flote-grass)	AC	ca	- - + - - -
Juncus effusus (Soft-rush)	A	s	+ + + + + -
Phalaris arundinacea (Reed Canary Grass)	AC	ca	- + - - - -
Potamogeton polygonifolius (Bog Pondweed)	C	fst	- + - - - -
Prunus avium (Wild Cherry)	D	fst	- - - - + +
Ranunculus acris (Meadow Buttercup)	AB	a	- - - - + -
R. repens (Creeping Buttercup)	AB	a	+ - + - - -
Rubus idaeus (Raspberry)	D	fst	+ - - - + -
Pteridium aquilinum (Bracken)	D	fo	+ + + + + -
Mosses (all leafy stems)			
Calliergon cuspidatum	BC		+ - - - - -
C. cordifolium	C		- + - - - -
Dicranum scoparium	BDE		- + - - - -
Eurhynchium schleicheri	D		+ + - - + -
Hylocomium splendens	DE		+ - + + + -
Hypnum cupressiforme	BDE		- - + - + -
Isothecium myurum	DF		- - + - - -
Leucodon sciuroides	DF		- - + - - -
Plagiomnium cf. *affine*	D		+ - - - - -
Neckera complanata	DF		- - + - - -
N. crispa	DF		- - + + - -
Polytrichum commune	DE		- - + - - -
Pseudoscleropodium purum	B		- - + - - -
Rhytidiadelphus squarrosus	B		+ - - + + -
Thuidium tamariscinum	D		+ - + + + -

KEY

+	presence	a	achene
A	riversides and wet pastures	ca	caryopsis
B	grasslands/pastures	cs	catkin scale
C	semi-aquatic/aquatic habitats	fo	fronds
D	woodland	fr	fruit
E	heaths	fst	fruitstone
F	rocks	n	nutlet
		nfr	nut fragments
		s	seed

Wild cherry (*Prunus avium*) was found in two samples, one of which yielded an elongate clump (c. 7x5cm) of no less than 24 fruit stones, the products of several infructescences. All the other species of flowering plants extracted from the coarse fractions occurred in very low numbers and in only three or less of the samples. However, the fine fractions of all five samples produced many seeds of Soft-rush (*Juncus effusus*).

For the most part the mosses were also recovered in low numbers from few of the samples. Large, weft-forming species were found in greater abundance, notably *Thuidium tamariscinum* and *Hylocomium splendens*, the latter being the most frequently encountered moss in British archaeology.

The full list of plant macrofossils with broad ecological categorisation is given in Table 1. Nomenclature follows Clapham *et al.* (1981) and Smith (1978).

2.3. STEROL ANALYSES (Illus 41)

The use of sterols as indicators of faecal sewage has been demonstrated by Goodfellow *et al.* (1977) and applied to British archaeology by Knights *et al.* (1983). 5-dihydrosterols such as coprosterol are produced only in the mammalian gut by bacterial action. Their discovery in archaeological layers proves the presence of faeces which are so dispersed as to be unrecognisable as discrete lumps. The tests used by Knights *et al.* (1983) on samples from the Roman fort at Bearsden were applied to seven samples from DN 426. Coprosterol was discovered in five of the samples though in such very low levels as to be barely detectable in some except by selected current ion monitoring. The highest levels were in sample 1 which was the clump of Wild Cherry fruitstones of such a shape as to suggest a coprolite.

Table 2.

INVERTEBRATES; identified by Dr. R.M. Dobson

Lumbricid worm (cf. *Eisenia foetida*)	5 cocoons
Cyclorrhaphan fly (cf. Lonchaeidae)	3 puparia
Oribatid mite (Gymnonota)	1 1
Uropodoid mite	1

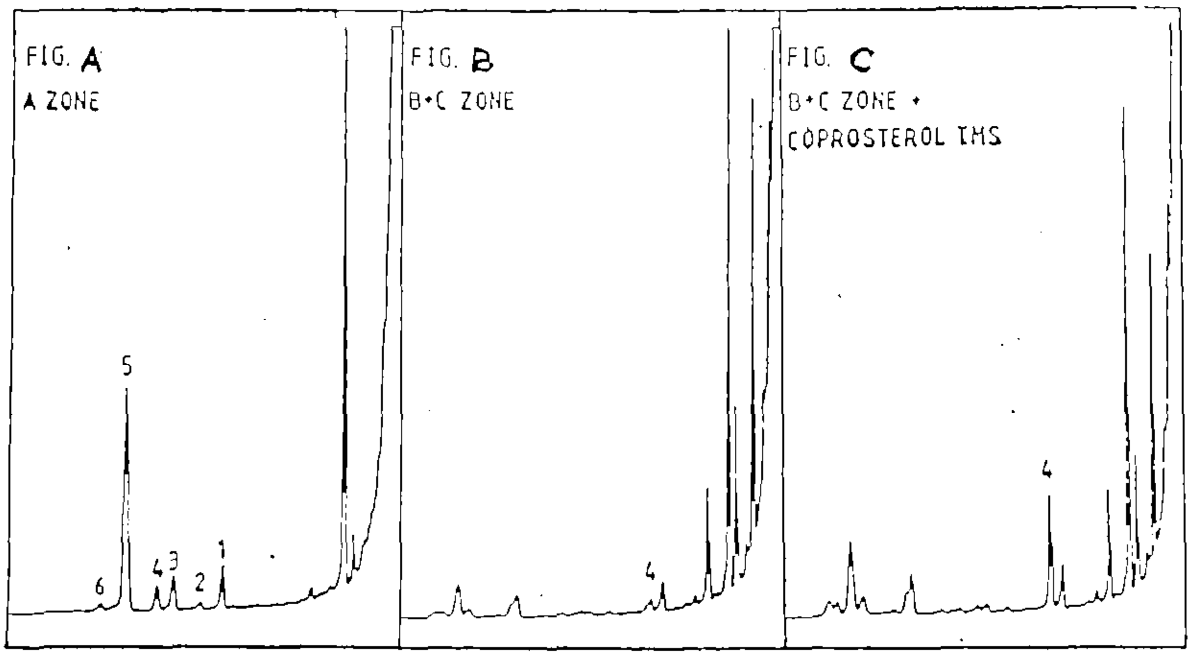


Fig. A A zone

Peak (1) Cholesterol
(2) Unidentified
(3) 24-methylcholesterol
(4) 22-ethyl-22-dehydrocholesterol
(5) 24-ethylcholesterol
(6) 24-ethylidenecholesterol (Δ^5-avenasterol)

Fig. B B and C zone

Peak (4) coprosterol

Fig. C B and C zone + COPROSTEROL T.M.S.

Peak (4) coprosterol

Illus 41. Gas liquid chromatographic analyses of non-saponifiable fraction of sample 1.

3. INTERPRETATION OF LAYER DN426

With the sole exception of the moss *Eurhynchium schleicheri*, all the plants listed in table 1 are known and are more or less common in Perthshire at present. They could have been gathered very locally, if not from the knoll itself, then from the immediate surroundings.

Bracken was deliberately collected in large quantities. Adhering to the fronds could well have been some or many of the minor components such as catkin scales of Downy Birch and caryopses of grasses (Foxtail and Fescue). Some, but by no means all, of the mosses may have been transported in that way. Species such as *Neckera* spp and *Leucodon sciuroides*, which grow on rocks and tree trunks are unlikely to have had such an arrival. Plants of wet pastures, riversides, semi-aquatic or aquatic habitats make up a large proportion of the list but are present in only very low numbers. Their origin may well have been the flat ground between Dundurn and the River Earn.

The modern pollen rain (Illus 40) reflects well the woodland cover of the lower slopes of Dundurn. 66% of the pollen comes from trees, notably oak. Very low values of Alder square with the very few Alder trees near Dundurn at present. However, the very low Coryloid values contrast with the good representation of Hazel bushes on the north slope of Dundurn.

The analyses from DN426 have much lower values of tree pollen (29% and 37%) but with Alder and Coryloid at much more substantial values. These reduced values of tree pollen may well imply that the surroundings of Pictish Dundurn were less wooded than now.

Hazel nuts are among the commonest food plants recorded from British archaeological layers from Mesolithic to Medieval. Raspberries, here represented by only 5 seeds, are also very commonly encountered.

The shape of the group of Wild Cherry stones combined with the sterol analysis prove that the object was excrement; *Prunus* stones are well-known from Medieval and earlier excavations (Fraser 1981, Hall *et al.* 1983) and have been reported from a "faecal mass" (Mitchell *et al.* 1987). At Dundurn, an inhabitant evidently ate Wild Cherries without spitting out the stones.

The assemblage of mosses is striking in its richness of 15 species. The great majority are robust species suitable for a variety of domestic purposes such as packing and wiping (Dickson 1973). Large mosses are now very familiar as part of the domestic economy of Medieval or earlier times in Europe (Fraser 1981, Hall and Kenward 1980, Rosch 1988, Van Ziest 1988). Their use as toilet paper has been discussed for Viking/Medieval Dublin (Dickson 1973, Mitchell *et al.* 1987) and Saxo-Norman Durham (Carver 1979). *Dicranum scoparium*, *Hylocomium splendens* and *Rhytidiadelphus squarrosus* occur at Dundurn, Dublin and Durham. The use of mosses as toilet paper is attested by adherent eggs of intestinal parasites, notably *Trichuris*. Such may well have been one of their uses at Dundurn but no parasite eggs were seen on the pollen slides.

However, the low levels and discontinuous presence of faecal steroids indicate that the deposit was not intentionally a cess pit. The absence of ground debris of cereals (bran) and other food plants, now known to be indicative of cess, supports that conclusion. Though sparse, the invertebrate remains are of species inhabiting rotting vegetation and two, the fly and the worm, have a strong preference for faecal material (Cernosvitov and Evans 1947).

Though now little more than an agricultural pest, in the past Bracken had a multitude of uses discussed by Rymer (1976). It is often encountered during excavations from the Neolithic midden at Skara Brae to Medieval towns. At Dundurn the Bracken may have been collected for use as bedding, flooring or thatch. Had the Bracken been flooring this would readily account for the foodstuffs, both plant and animal, and the fragment of fired clay.

Though Pictland was extensive, stretching from north of the Firth of Forth to the Northern Isles, there appear to have been no excavations until now on the Scottish Mainland which have thrown any bright light on the Pictish land-use and environment. Two pollen counts from Burghead Fort, Moray, have been published by Edwards and Ralston (1978). On Orkney there have been some excavations, but even there the botanical results are very minor, consisting of carbonised wood of trees or shrubs (Dickson 1983, Donaldson 1982). These discoveries are not comparable with the waterlogged Dundurn deposit, the first layer investigated archaeobiologically from southern Pictland.

The organic composition of the layer DN426 strongly resembles that of pre-Hadrianic deposits in buildings of the Roman Fort at Vindolanda, Northumberland (Seaward 1976 a and b). There the main component was Bracken, with mosses, especially *Hylocomium splendens*, straw, Hazel nuts, bones, faeces and puparia of the Stable Fly. For Vindolanda, the interpretation was the use of Bracken as winter bedding with the layers sealed by clay but without mucking out.

Unlike Vindolanda, however, the organic layer at Dundurn, though within the fort, is not inside a building. The biological investigations lead to the conclusion that DN426 was a midden upon which Bracken flooring (or bedding) together with other domestic refuse was dumped.

APPENDIX

Cereals from DN110

The only other plant remains identified from the Dundurn samples are four carbonised caryopses from Dundurn 110.

Mrs C.A. Dickson has recognised the following:
Hordeum vulgare L. emend. (Hulled Six-row Barley) 2 grains.
Hordeum vulgare cf. var. *nudum* (cf. Naked Six-row Barley) 1 grain.
Avena sp. (Wild or Cultivated Oats) 1 grain.

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