Excavation of Pictish and Viking-age farmsteads at Buckquoy, Orkney

by Anna Ritchie

INTRODUCTION

The promontory known as the Point of Buckquoy forms the N side of the Bay of Birsay, one of only three sheltered bays on the W coast of the mainland of Orkney (fig 1). The Point was named after a farm, Biggaquoy, which no longer exists, and the name was probably derived from Old Norse *bygg-kvt*, meaning bere quoy or barley enclosure (Marwick 1970, 60–1). By long tradition, the soils of Birsay are considered the most fertile of mainland Orkney, aided by the sand from the Bay of Birsay which, as it consists mainly of shell, is rich in calcium carbonate and is still used as a fertiliser on the fields. Oats and bere, a species of barley which used to be called 'big', were the most important crops grown locally in medieval and post-medieval times (Stat Acct 1795, xiv, 320). Until recent times, a fleet of fishing boats operated from the Bay of Birsay, and Castra Geo on the S side of the Point of Buckquoy is still the main landing-place for boats, although the fishing is no longer on a commercial or even a subsistence level. Skippie Geo (ON *skipa-gja*) on the N side of the Point may indicate another, formerly useful, landing-place.

The flat promontory of Buckquoy rises some 4–6 m above the foreshore. It consists of Lower Stromness flags of the Middle Old Red Sandstone, which are threaded with igneous dykes (mainly camptonite) and capped with boulder clay (Wilson *et al* 1935, 57, 63). The bedrock splits naturally into flat rectilinear slabs and consequently the beach below the Point of Buckquoy provides an almost inexhaustible source of superb building stone.

Until 1970–1, when an excavation was carried out over a total period of 10 weeks, a long low mound, truncated by the cliff-edge, existed on the S side of the Point of Buckquoy (NGR HY 243282). It had suffered considerable damage from coastal erosion and from traffic along a track leading across the site to the boat nausts or shelters at the head of Castra Geo and to the causeway at the tip of the promontory which gives access to the tidal island known as the Brough of Birsay. The continuing threat of this destruction prompted the Department of the Environment to sponsor a rescue excavation of the mound. Locally, the mound was known as Sinclair's Brae, but, as this name operated solely in oral tradition, it is proposed to call the archaeological site Buckquoy, after the promontory on which it stands. Before excavation, the mound survived to a length of 20 m and to a maximum height of approximately 0·5 m. Using initially the grid method and finally total area excavation, the mound was excavated down to the level of the natural subsoil with the consequent destruction of all archaeological features. From the layout of the structures which survived until then, it may be estimated that at least half of the original site had previously been destroyed by coastal erosion; of the remaining part, in most cases only the basal wall-courses survived, owing partly to the robbing of earlier buildings in order to construct new ones and partly to damage caused by modern ploughing. Little will be written in the description of

the excavation about soil stratigraphy because very little survived; the stratigraphy was essentially one of stonework, and the task was not so much one of distinguishing soil differences but one of disentangling building debris and tumbled stones from the remains of walls and paving, often only the basal wall-course. The crest of the mound, 0·5 m high, covered the superimposed remains of eight stone structures. Sections were recorded but they are not considered useful enough to be worthy of publication. Nevertheless, a process of successive rebuilding on the same spot allowed the recognition of an archaeological sequence spanning a period from the 7th to the 10th centuries AD.

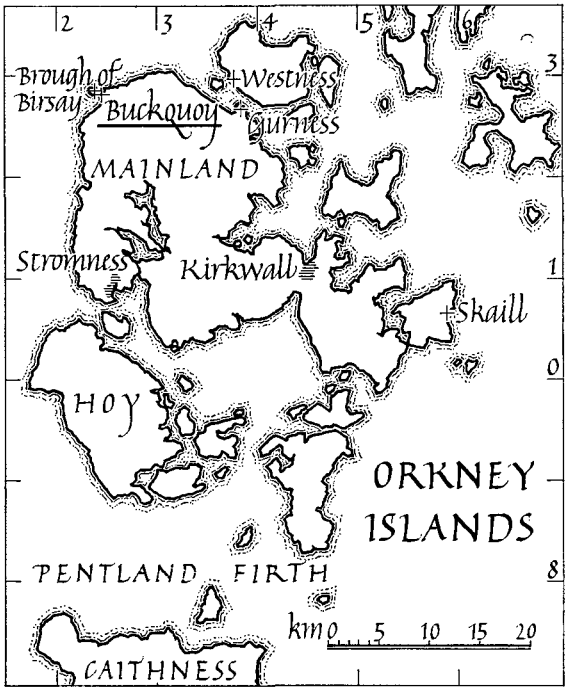

FIG 1 Buckquoy: location map

In summary, the site consisted of a series of farmsteads, one on top of the other, of which phases I and II were Pictish and phases III–V were Norse; a sixth and final phase of activity was represented by a Viking-age burial inserted into the ruins of the last farmstead.

EXCAVATION

Phase I: early Pictish farmstead (fig 2; pls 8, 9)

Phase Ia, house 6. The earliest surviving structure on the site consisted of part of a house characterised by rectilinear cells opening off a central chamber in which the hearth was situated. The walls showed the use of two building techniques: one employed upright slabs as the internal face at the base of the wall, with loose boulders behind as the basal wall filling, and the other used horizontal drystone masonry as the inner wall-face from ground level upwards (pl 8a). The external part of the wall in both cases is likely to have been built of turf, because no outer stone face had survived; where external paving existed to the N of the house, there was simply a gap between the edge of the paving and the back of the inner wall-face of the house. The latter survived to a height of only two courses.

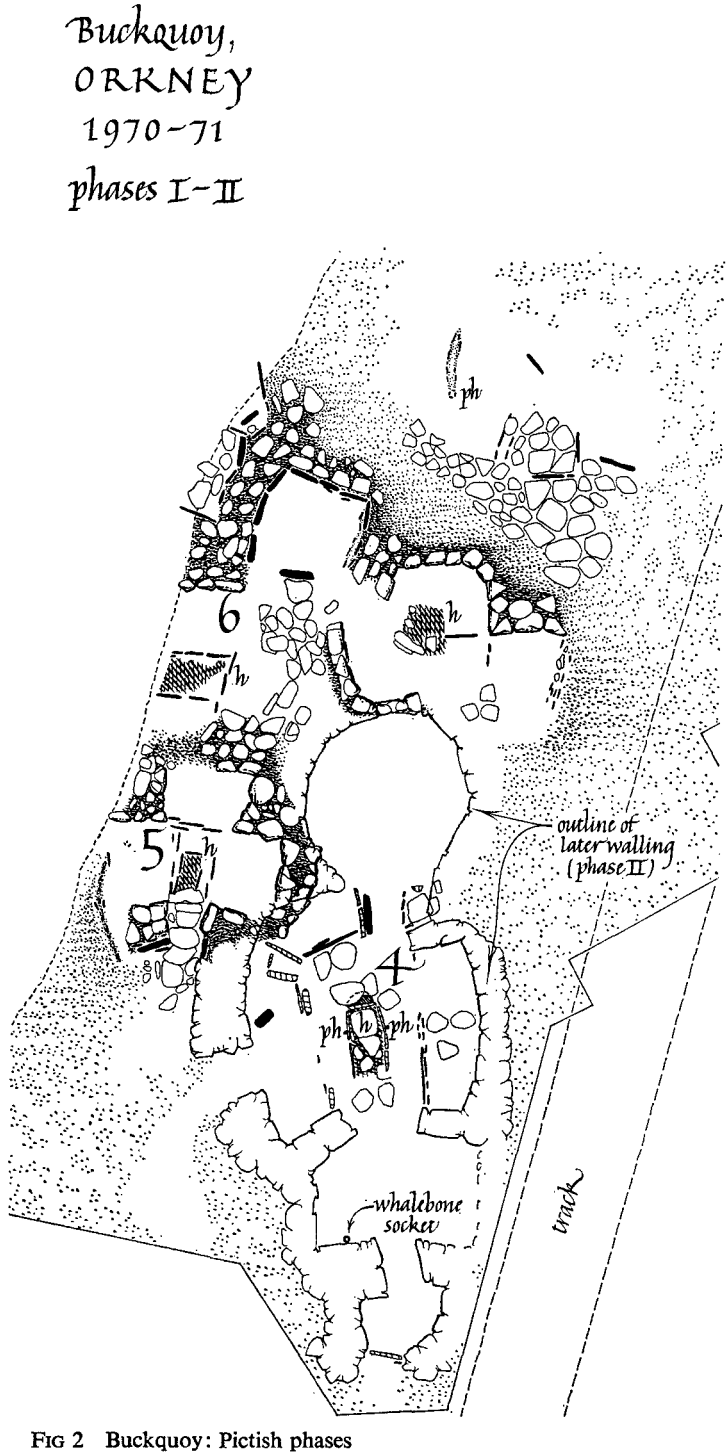

FIG 2 Buckquoy: Pictish phases

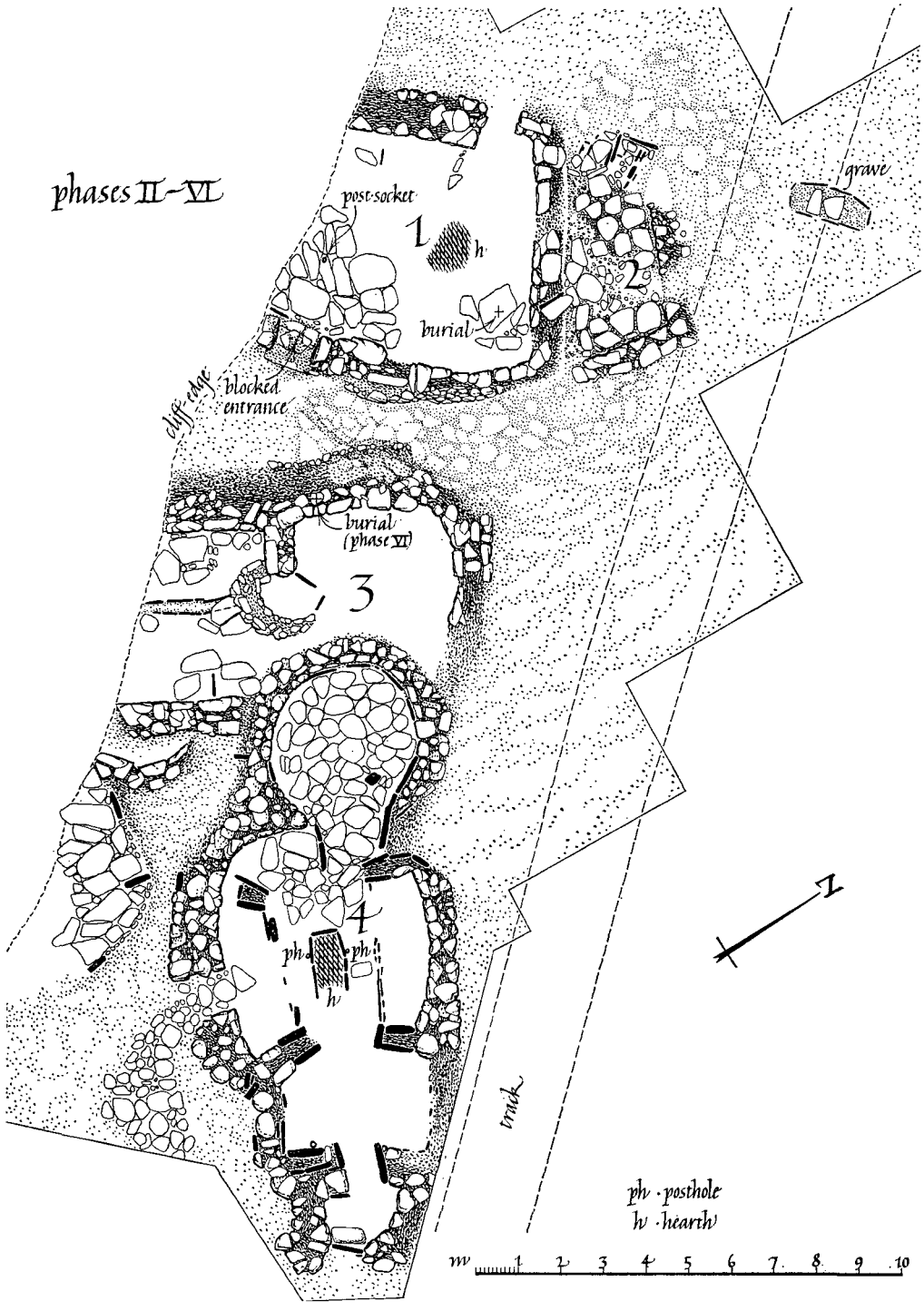

FIG 3 Buckquoy: late Pictish and Norse phases

One complete slab-lined cell measured 2 m by 1·5 m to 2 m in area; only one upright slab remained along its NE wall, but the former existence of others was indicated by the presence of their chocking stones. The total surviving internal length of the house was approximately 8 m. By analogy with a similar cellular house at Gurness in Orkney (the two house-plans are compared in Ritchie 1974, fig 1), it is likely that house 6 was roughly symmetrical to either side of the central chamber and therefore that its maximum internal width may have been about 9 m. The main hearth was rectilinear with a stone kerb but no formal paving, 0·85 m wide and an incomplete length of 1·25 m at the cliff edge; it contained peat ash and a little charcoal. A subsidiary open hearth lay partly within one of the cells towards the back of the house.

The only area within the house where the original floor deposit remained uncontaminated by Period Ib activities was within the slab-lined cell; this deposit yielded a perforated bone pin or needle (no. 1, see catalogue of finds).

Phase Ib, house 5. The SE half of house 6 was subsequently dismantled in order to build a smaller version of the same plan-form, house 5 (pl 9a). A curving portion of wall-face, two courses high, built across the central chamber of house 6 also belonged to this phase, but it was too fragmentary to allow further interpretation. The structures of phase Ib, like those of Ia, were built directly on the natural clay subsoil, and the stratigraphy of the two periods of building therefore depends upon the relationship of the stone walls rather than on soil levels. As a result, the artefacts from phases Ia and Ib must be considered inseparable, with the exception of the perforated pin (no. 1) mentioned above. The lack of soil stratigraphy should also imply that no great period of time lapsed between phases Ia and Ib.

House 5 was a compact and almost complete building of trefoil form, with three rectilinear cells surrounding a central hearth on the fourth (SE) side of which lay the entrance. Except at the entrance, where two upright stone slabs were used, the surviving walls were built of horizontal drystone masonry of which only one or occasionally two courses remained. An outer wall-face survived on the N side of the house, but, as with the earlier house 6, a wall-filling of earth or turf above the basal course should be inferred. Although the S wall of the house had been robbed entirely by later building activity, the line of its inner face was indicated by a very shallow groove filled with 'split peas'; this is interpreted as the effect of rainwater percolating down the inner face of the wall, part of which, judging by three surviving chocking-stones, may have been lined with upright slabs.

Internally, the house measured 2·75 m by 3·60 m, and the design of the three cells showed considerable symmetry with each containing a similar floor-area averaging 1·30 m by 1·60 m. The cells were divided from the central hearth area by low stone kerbs projecting only a few centimetres above the level of the floor. The rectilinear hearth, which occupied most of the central area, was kerbed on three sides and paved with stone slabs and measured 0·40 m by approximately 0·70 m. The open end of the hearth was sealed by a removable horizontal slab, which had notches carved to fit the side slabs (pl 9b). The hearth was filled with peat ash and some carbonised twigs of heather (calluna). Paving led from the hearth through the entrance to the house and extended some 1·30 m beyond. The entrance was 0·65 m wide at its outer end and 0·80 m wide at the inner end, where it was very close to the hearth; access into the house must have been past the NE side of the hearth.

Phase I artefact assemblage. Few artefacts were found in association with the structures of this phase. Apart from the perforated pin (no. 1) belonging to house 6, there are two simple bone skewer pins (nos 2, 3), an incomplete pin-shank (no. 27), a bone point (no. 36) and a perforated limpet shell (no. 93). The most distinctive artefacts were found amongst the wall-filling of the circular chamber of house 4 (phase II) where it overlay phase I structures; these are the bone

spoon (no. 43), a fragment of bone mount (no. 45) and a bone comb (no. 50). In assigning these three finds to phase I, it has been assumed that their provenance implies derivation from the early occupation rather than that they were lost during the construction of house 4; no other artefacts were found elsewhere in the walls of house 4.

None of these objects is closely datable but none would be inconsistent with a date in the 7th century AD, the period which will be argued for phase I on stratigraphical evidence. Bone and horn spoons with sloping shoulders characterising the shape of the bowl like no. 43 have been found in contexts dating to the early and mid-first millennium AD, e.g. Keiss and Skirza Head broch-complexes in Caithness (Anderson 1901, 122–7, 144–5; NMAS GA 463, 784), and Jarlshof, Shetland, from wheelhouse phase III (Hamilton 1956, 64, fig 29, 8). The closest parallels for comb no. 50 are those from the Broch of Burrian, N Ronaldsay (MacGregor 1974, no. 153, fig 11) and Buston Crannog, Ayrshire (Munro 1882, 219, fig 218). An unusual feature of this comb is the suspension hole at either end; one hole at one end is normal, designed to allow the comb to hang from a belt, perhaps with an iron ring as an intermediate fitting as found at Ihre, Gotland (Stenberger 1961, fig 50). The two holes on the Buckquoy comb may suggest that it hung horizontally, rather than vertically, possibly to avoid too much movement while hanging from the belt. The Broch of Burrian has also yielded two bone mounts (MacGregor 1974, nos 130, 131) closely comparable to mount no. 45 and to later mounts no. 46 (phase II) and no. 124 (phase VI); these mounts are likely to have strengthened the mouths of leather knife-sheaths (cf mounts still attached to sheaths from Lund, Sweden, Blomqvist *et al* 1963, figs 218–20).

Phase II: late Pictish farmstead, house 4 (figs 2, 3; pls 10, 11a)

The structures of phase Ib were dismantled virtually to floor level, leaving only one or two courses of walling in position, at the time when house 4 was built; this was done probably to obtain building stone as well as a measure to level the site because house 5 was dismantled even beyond the area required for house 4. The NW wall of house 4 was built immediately on top of the basal course of the E wall of house 5, utilising the upright slab on the E side of the house 5 entrance as part of the outer face of the new wall (fig 2; pl 9a). The circular chamber at the NW end of house 4 was semi-subterranean and had been dug into and below the earlier building-level; at the back of the chamber, the floor-level was some 0·36 m below the phase I ground-level. A natural rise in the level of the sub-soil beneath house 6 meant that, in order to achieve a level floor over the entire length of house 4, the floor of the circular chamber was dug into natural boulder clay. Its wall, which survived to a maximum height of 0·8 m, was revetted against both the subsoil and the overlying remains of phase I buildings by large upright slabs which were then backed at ground level by horizontal stonework. Above the upright slabs, the wall consisted of horizontal courses of stones which presented a smooth inner face but which lacked a formal outer face; up to six courses survived. Elsewhere the house wall consisted of a basal course of stones with both an inner and an outer face and occasional remains of up to four courses above. The SE part of the house had suffered considerable damage from ploughing and deep plough-scratches were visible on many stones.

The plan-form of house 4 consisted of four interconnecting rooms set in a line SE-NW (pl 10). There were two entrances, one set at the SE end of the house and another, served by a paved pathway leading into the house from the SE, set in the SW wall of the main living-hall. The SE entrance was 0·75 m wide and was furnished with a low sill-stone and, just inside the house, a horizontal pillow-shaped slab maintaining the height of the sill-stone. This entrance led into a small vestibule, 1·65 m by 1·25 m, which was unpaved. From the vestibule, entry was gained into a larger room, measuring 3·3 m by 2·2 m, which was again unpaved; a whalebone socket (no. 62)

found against the SE wall of this room (fig 2) may have functioned as part of the door furniture but, if so, it had probably been displaced from an original position rather closer to the doorway. This room was otherwise featureless and its function is therefore unknown.

The next room was the main living-hall, for it contained the hearth and possible traces of flanking benches. The second entrance to the house was set in the SW wall of this living-hall; it was 0·9 m wide and, although there was no sill-stone, the paving of the entrance extended some 0·6 m into the hall. The hearth was kerbed on three sides by low upright slabs, and its SE end was left open to facilitate the removal of ashes. When found, the hearth was filled with fine peat-ash, but beneath the ash was a stone-paved floor. A stone spindle-whorl (no. 83), affected by the heat of the fire, was found beneath the paving of the hearth. The hearth measured 0·7 m by 1·4 m, and the remains of a stone-lined post-hole were found on either side, probably representing the upright posts for a spit across the hearth. A fragment of bone mount (no. 46) was found in the S post-hole. An identical hearth with flanking post-holes belonged to the primary phase of the post-wheelhouse chamber 1 at Calf of Eday, Orkney (Calder 1939, 175, fig 1, pl LXVII, 2). At the NW end of the hearth was a shallow pit containing ash from the fire and part of an iron knife-blade (no. 97); the pit was later sealed by two paving-slabs.

The remains of low stone-kerbing on either long side of the hearth suggested that there may originally have been wooden benches or platforms lining the walls, but this can be no more than a very tentative interpretation: the kerbing may have functioned simply as minor sub-divisions of the floor-area as in house 5. An iron rivet (no. 111) was found within the kerbed area on the NE side of the hall.

At the NW end of the living-hall lay the entrance into a circular chamber, which measured 3·4 m in diameter. Initially, the entrance was only 0·65 m wide, between substantial upright slabs on the S side and the three small upright slabs on the N side which were all that survived of that side of the entrance slabs (shown in solid black on fig 2). At this stage, neither the circular chamber nor the living-hall was paved. After an interval of unknown duration, the circular chamber was paved with massive slabs (pl 11a) and the entrance was widened to 1·75 m by dismantling its original N side to floor level, swinging back the long slab which had formerly been part of the chamber wall to the position in which it was found when excavated, resting on the basal stones of the original wall-core, and paving over the area thus freed (fig 3). The paving extended over the small compartment which formerly lay to the S of the entrance into the circular chamber and into part of the living-hall (pl 11a). While there are obvious structural problems involved in thus widening the doorway, this interpretation seems to explain the surviving evidence best, particularly the free-standing condition of the long wall-slab.

Some subsidence occurred in the central area of the floor of the circular chamber, and an extra layer of slabs was laid down in order to maintain a level floor. The paving was separated overall from the original floor-level by a thin layer of brown sand, 0·04 m thick, and the paving thus provided a relative sequence of artefacts within the occupation of the house: the painted pebble (no. 87), pottery sherds (nos 64–7), and bone point (no. 38) were found in the primary occupation deposit, while two bone pins (nos 7 and 20), bone point (no. 39) and part of an iron knife-blade (no. 99) were found lying on the secondary paving.

The four rooms of house 4 were divided one from another by short cross-walls built in a particular and characteristic way. Only the basal course survived, and this consisted of substantial stone slabs set upright to form box-shaped wall-ends, with the tops of the slabs approximately level with one another. Upright slabs have been found as the footings of radial piers in wheel-houses and later related structures (e.g. at Jarlshof, Hamilton 1956, 67, pls Xb, XIId), usually in the form of a single slab incorporated into the inner face of the pier, and it is likely that the box-

ends in house 4 represent a development of the same building tradition. It is suggested that they acted as bases for piers of horizontally coursed drystone masonry.

After the abandonment of house 4, the circular chamber became filled with tumbled stones and earth up to a height of 0·6 m above floor level at the back of the chamber. The remains of a roughly constructed stone hearth, measuring approximately 0·9 m square, were found on top of the tumbled filling; there was no other structural evidence associated with this hearth, and it appeared to have been nothing more than a temporary camp-fire.

To the immediate S of house 4 were the remains of two structures which, on stratigraphic grounds, should be broadly contemporary with house 4. Both overlay the earlier house 5 and were built at the same level as house 4, but neither had any direct association with the latter. One was an incompletely surviving area of carefully laid paving, which had originally been bounded on its N and E sides by a wall or fence, because the small stones that had acted as fillers between the paving and its boundary were still in position. At its NW extremity on the cliff edge, the paving abutted the back of a short length of curving wall. This wall, of which only two to three courses survived, was built of horizontal drystone masonry with a smooth face to its inner curve and a rough outer face, and it had been truncated to the S by coastal erosion and to the N by the construction of house 3 in Norse times. The function of these two incomplete structures is unknown.

Phase II artefact assemblage. Apart from those artefacts already mentioned in the preceding section, bone pin no. 24 was also found inside house 4, in the SE corner of the main hall. The other artefacts associated with phase II were found outside and to the SW of the house, including the ogam-inscribed spindle-whorl (no. 84) which lay immediately outside the SW entrance into the main hall.

The bone pins include no. 7 with a flat ovoid head and straight shank; looking at the pins from the site as a whole on figs 4 and 5, it is noticeable that hipped shanks tend to be confined to the smaller pins where the risk of loss from clothing was perhaps higher. Pin no. 28 is an unfinished example of the same type of pin as no. 7, and it provides the clearest indication that some pin-making at least was carried out at Buckquoy. The animal-headed pin (no. 24) appears to represent a cat, and this possibility is supported by the presence of cat bones amongst the animal bone sample from this phase (Appendix 1). The fragment of bone mount (no. 46) has a slightly convex upper surface, unlike the flat fragment from phase I (no. 45), and there are two bone pegs still in position.

Relatively little pottery was recovered from the site as a whole, and all but six sherds were associated with phase II, mostly found on the floor of house 4. The fabric of the pottery is fine and well-fired with little grit, 6 mm–12 mm thick, and its outer surface is buff to red in colour, while the inner surface is black. None of the sherds provides enough information to allow the form of the vessel to be reconstructed; only wall-sherds and two flat-based sherds were recovered, apparently from large jars, and none is decorated. On the basis of the fabric, this pottery seems comparable with the wheelhouse wares, Hamilton's classes II and III, at Jarlshof in Shetland (Hamilton 1956, 64–6, 81–2), and with the late wheelhouse pottery from Clickhimin in Shetland (Hamilton 1968, 159–60), and it is likely that the form of the vessels was also similar.

Both of the spindle whorls belonging to phase II (nos 83 and 84) are made of chalk, probably derived as pebbles from local glacial deposits (Appendix 7) and presumably chosen for its creamy colour and tractable nature. Several other chalk whorls have been found in Orkney (MacGregor 1974, 92), including one from the Broch of Lingrow (NMAS GE 11) which is made from a very similar chalk to no. 84. One face of no. 84 has been carefully incised with an ogam inscription encircling the perforation (pl 13a); Professor Kenneth Jackson reports that the inscription is unintelligible and that the form of lettering suggests a date in the early 8th century (Appendix 6).

Two other ogam inscriptions on portable artefacts are known from Scotland, both knife handles, from pre-Norse contexts at Gurness in Orkney and Bac Mhic Connain on North Uist (Wainwright 1962, 96, 98), and neither contain late letter-forms (Padel 1972, 12). Whatever the meaning of the Buckquoy inscription, its presence on a spindle whorl would seem to imply that the whorl was special to its owner.

The ogam-inscribed spindle whorl is undoubtedly a Pictish artefact, and the same identification has been argued elsewhere for the painted pebble, no. 87 (Ritchie 1972, 298). A total of 19 painted pebbles have been found, all on domestic sites in the Northern Isles or in Caithness, and 15 of the pebbles can be dated to the period from about 200 AD to the 8th century, thus spanning the historical Pictish era. The painted designs are simple, mostly solid dots and wavy lines; the closest parallel to the Buckquoy example is one from Jarlshof (NMAS HSA 4108; Hamilton 1956, 77, fig 39) which has also been painted overall with small circles. The purpose of painted pebbles is unknown but, by analogy with later tradition, use as charm-stones for curing sick people and animals seems likely and is strengthened by the contemporary story about St Columba's holy pebble recorded by Adomnan (Anderson and Anderson 1961, 399–405; Ritchie 1972, 299).

Four fragments of iron knife-blades were found in phase II contexts (nos 97–100), one at least belonging to a single-edged blade with a curved back (no. 97).

PICTISH HOUSE-TYPES

Although it is not confined to this period, the use of horizontal masonry and upright slabs in combination as a wall-building technique is a characteristic feature of post-broch architecture in the Northern Isles and Caithness. It is a natural response to the type of building stone available, and can be found in structures of all periods from neolithic chambered tombs to the vernacular buildings of relatively recent times. Building technique alone is not, therefore, a diagnostic factor for dating purposes, but it can be useful in conjunction with specific house-types. It is possible to isolate plan-forms of houses which are confined to the middle centuries of the first millennium AD and which, more specifically, represent Pictish building tradition in N Scotland.

Houses 6 and 5 at Buckquoy belong to the *cellular type* of house. Unlike the amorphous housing complexes of the earlier iron age such as Howmae Brae, Orkney (RCAMS 1946, no. 195, pp 48–50, fig 93), the cellular house is a detached structure in which a central chamber is surrounded by rounded or rectilinear cells, the whole entered by a single entrance. The best surviving example elsewhere is the 'late dwelling' at Gurness, Orkney (RCAMS 1946, no. 263, p 78, fig 132), but others have been found in post-broch settlements such as Borwick, Orkney (Watt 1882; RCAMS 1946, no. 679, pp 252–3). No direct evidence has been found as to the form of roof used on these houses, but an advantage of the cellular design is that it reduces the span of the roof, with the protruding walling between the cells acting in effect as internal roof-support. A combination of partial corbelling over the cells and timber-framing over the central area of the house would seem to be the most likely solution to roofing. Using this method, the maximum length of ridge-timber necessary to roof house 5 would have been just under 2 m, spanning the area between the entrance and the walling on either side of the opposite cell, to form a hipped roof.

House 4 represents the most sophisticated example known to date of the *figure-of-eight type* of house. Simpler houses of this type have been found at the Udal, N Uist (Crawford 1973, 9; 1974, 9–11) and in the post-broch settlement at Yarrows, Caithness (Anderson 1873, 137, fig 1, F and G), and comparative plans of these structures drawn to the same scale may be seen in Ritchie 1974, 26, fig 1. The term 'figure-of-eight' is not ideal, but it serves to distinguish this type of house, where the cells are set in a linear plan, from the cellular type where the cells are arranged

roughly in a circle round the central area of the house. The structures at Yarrows are not closely datable but they are likely to be late in the post-broch sequence. The Udal houses belong to Crawford's phase XI.1, dated to the 7th to early 9th centuries AD (Crawford 1974, 9). As at Buckquoy, the figure-of-eight houses at the Udal were replaced in the early 9th century by a Norse settlement. Nothing is known of the detailed internal arrangements of the Yarrows houses, but the stone-built hearth and flanking platforms of Buckquoy house 4 are repeated at the Udal.

The circular cell at the NW end of house 4 was filled with large stones and it is likely that these represented a collapsed stone-corbelled roof; the diameter of the cell was well within the maximum figure of 4 m–4·5 m suitable for corbelling (Dunbar 1966, 233). A timber-framed hipped roof is envisaged over the rest of the house. The slab-built box-ends to the internal sub-dividing walls seem best interpreted as the bases for piers of drystone masonry, probably sharing a common ancestry in building tradition with the piers of wheelhouses; these piers would have risen to a greater height than the external house-wall and thus provided internal support for the central part of the roof, while the ends of the couples rested on the house-wall itself. The longest timbers required would have been the ridge-beams over the main living-hall which had to span a distance of 4 m. The external roof-covering of all three Pictish houses is most likely, on the analogy of the local vernacular tradition of later times, to have been turf or thatch, perhaps combined with flagstones at the wall-head (Dunbar 1966, 232).

Although the floor-area of house 4 is clearly far larger than that of house 5 and perhaps comparable with that of house 6, no real implications can be drawn about the respective social units involved because of the possibility that other houses or outbuildings belonging to each phase of occupation had already vanished over the cliff.

In view of the deliberate symmetry and possible anthropomorphic qualities of house 4, together with the Pictish love of symbols, a plan of the house was submitted for comments to a social anthropologist, Dr Anthony Jackson. He pointed out the similarity between the design of the N part of the house (circular chamber plus living-hall) and the symbol known as the 'circular disc and rectangle with square indentation', the distribution of which is confined to Orkney, Caithness and Sutherland, but he was sceptical of making this similarity into a firm identification. On the anthropomorphic appearance of the house, Dr Jackson drew attention to the ethnographic parallel provided by the African Dogon house (Forde 1954, 97–8, fig 5) and explained: 'The structure of houses all over the world often reflect men's religious views and are divided into sacred and profane areas. These divisions may or may not be paralleled with their cosmological views. In the case of the Dogon, the house structure mirrors their cosmology, as does their field system and ritual. The Dogon house represents a man.' Dr Jackson went on to suggest about the Picts: 'Their cosmology could be as intricate as the Dogon who, after all, are an isolated and primitive people. I do not think we should underestimate the possible complexity of their belief.' The 'circular disc and rectangle with square indentation' has been interpreted as the representation of a human figure (Thomas 1963, 60), and it is conceivable that this symbol and the design of house 4 derive from a common idea.

Long cist burial (fig 3; pl 11b, c)

To the N of the site, just beyond the area of the domestic settlement, lay a stone-built long cist containing an inhumation burial. The tops of the side slabs were immediately below the modern turf-line, and ploughing had chipped some of the slabs. The cist-pit had been dug through the contemporary topsoil and into the natural clay subsoil, and the excavated clay had been used to fill the cist after the burial had been made. The cist had been constructed by lining the slightly sloping sides of the pit with nine upright stone slabs, two at the head, one at the foot and three

slabs along each long side. The slabs measured 0·02–0·06 m in thickness and from 0·3 m by 0·3 m to 0·66 m by 0·47 m in area. The average depth of the cist from the tops of the side slabs was 0·44 m. The floor of the cist was unpaved and measured 1·7 m by 0·45 m at the head and 0·3 m at the foot; the corresponding measurements at the top of the cist were 1·85 m by 0·6 m by 0·45 m. The grave was aligned SW-NE, with the head to the SW.

The body had been laid on its back directly on the clay floor of the cist, with the head facing SE, arms at its side and both feet turned inwards so that the right foot overlay the left. The condition of the bones was poor, and parts of the hands and right foot were missing as a result of post-burial decay. The skeleton has been identified as that of a male aged between 25 and 30 years who was probably suffering from a tuberculous condition of the spine (Appendix 5). There were no grave-goods. The body had been covered, and the cist half-filled with natural clay subsoil, and two stone slabs had then been placed over the central part of the cist. When found, each slab had one end embedded in the cist-filling and the other resting against the inner face of the side slabs, and it is likely that this alternately sloping arrangement was original as neither slab was large enough adequately to span the top of the cist.

There was no evidence to associate this long-cist burial with any particular phase of occupation on the site, and it was felt that a radiocarbon date from bone collagen could not be sufficiently precise to answer the question of whether the burial was Pictish or Norse. Inhumation burial in long cists was practised at both periods in N Scotland, the closest examples in this case being the graves in the early Christian and Norse cemetery on the Brough of Birsay (Radford 1962, 168, 178). It is possible that the long cist at Buckquoy did not belong to the occupation of the site at all and that its presence there was fortuitous. Its location on the Point of Buckquoy rather than in the cemetery on the Brough of Birsay suggests that it ought to pre-date the latter.

Phase III: early Norse farmstead, house 3 (fig 3; pl 12a)

Norse farms are a considerably better known settlement type than are Pictish domestic sites, and the degree of erosion loss becomes very obvious from the plan of the surviving structural remains of the Viking-age settlement (fig 3). Each of the three buildings represents a stratigraphically and chronologically separate phase of the farmstead, and each must originally have been accompanied by at least one other building which has vanished into the sea. The only building which survives of the initial phase of Norse settlement is a byre (house 3), and the original dwelling house has been lost. The same or another dwelling house must have been in use contemporary with the barn (house 2, phase IV), while the dwelling house (house 1, phase V) lacks any surviving outbuildings.

The byre (house 3) was built partially overlapping the NW end of house 4; this section of the byre wall has been destroyed by ploughing in recent times, but there was no doubt about the stratigraphical relationship of the SE wall of house 3 to the underlying walling of house 4. Internally, the byre measured 4 m across, and it survived to a length of 8 m. The entrance must have been in a missing portion of the wall. The wall itself was built with a substantial inner face of drystone slabs, backed by turf; the latter was represented along the NW side of the house by a basal compacted sandy layer, bordered by a line of small stones which indicated that the original wall had been about 1·5 m thick (pl 12a). There is danger in assuming a turf backing when only the basal courses of a wall survive, but in this case the inner face survived to a maximum height of five courses, 0·6 m, and there was no reason why an outer face, if it had existed, should not have survived.

The byre was divided into two areas by a short cross-wall projecting, at right angles to the NE wall, about 0·7 m into the interior of the building. No features survived in the area to the N

of this partition to indicate its function, but, to the S of the cross-wall, a stone-lined drain ran down the central axis of the building. A sample of the silty material filling this drain was kindly examined by Dr S E Durno; phosphate analysis gave a figure of 660 mg (P_2O_5) per 100 g of the sample, a very high value which indicates animal life in the near vicinity and which supports interpretation of this part of the building as a byre. The sample also included plant cells resembling those from leaves of grasses, including Anthoxanthum odoratum (Sweet Vernal-grass), Cyanosurus cristatus (Crested Dog's Tail), Holcus lanatus (Yorkshire Fog) and Molinia caerulea (Purple Moor-grass). One of the stone slabs lining the drain was also part of the kerb of the underlying hearth of the phase I house 6, uncovered presumably during levelling operations when house 3 was built and utilised as a convenient slab for the byre drain. Remains of paving survived on either side of the drain.

At a later stage in the use of this building, the cross-wall was extended by 0·4 m by rough extra walling, which showed a straight joint with the original wall-end for the basal four courses and only above that level was roughly bonded in to the earlier wall. A lightly built arc of low walling was attached to the extended crosswall, open to the N where two low kerb-stones completed an oval area measuring 1 m by *c* 1·2 m. This is likely to have acted either as a storage compartment for fodder or as a setting to hold a water barrel or milk churn. Circular settings of upright slabs about 1·2 m in diameter were found at Jarlshof both in the early wheelhouse phase and in the Viking-age levels (Hamilton 1956, 61, pl IXb, 110, fig 53, 1A), and sunken settings or impressions for wooden barrels are a common feature of Icelandic Viking-age farms (Stenberger 1943, figs 35, 72; Eldjárn 1948, fig 7).

House 3 appears to have functioned as a combined byre and barn. Apart from the partial paving of the byre, the floor was earthen and showed patches of heavily burnt soil throughout the building, perhaps indicating that the roof had caught fire and collapsed. After its abandonment, the byre end was used as a convenient dumping place for a midden, which will be described under phase IV structures. A dense scatter of enigmatic tubular objects immediately beyond the NE wall proved to be the result of poor drainage; thin sections were examined by Mr J Romans, who kindly reported that the objects appear to be the 'iron stained pipes' which form around vertical root channels in very poorly drained soils. The site as a whole is extremely well drained, and the localised formation of these pipes is inexplicable, unless it occurred at a later date, during phase V, when this particular area was covered by several layers of paving.

Phase III artefact assemblage. This early Norse assemblage is very sparse owing to the difficulty of distinguishing its components with absolute certainty: as house 3 had been used as a midden, and there was no definite floor deposit, it was impossible to attribute finds from its interior to the period of its occupation. Finds that can be attributed certainly to this phase came from the area immediately to the NW of the house where they were sealed by later structures. They include simple bone pins and a point (nos 4, 5 and 40), two plates from double-sided composite bone combs (nos 51, 52), a single sherd of pottery (no. 76), fragments of single-edged iron knife-blades (nos 101, 102, 103), and part of an iron nail (no. 112). None of this undistinguished material is helpful for dating purposes.

Phase IV: middle Norse farmstead, house 2 (fig 3; pl 12b)

This phase was represented by a small rectangular building to the N of house 3; its associated external paving overlay the dismantled NW walling of house 3, and it was later overlain itself by house 1. Only the final yard-paving of phase V is indicated on fig 3; the earlier levels of paving were too numerous and fragmentary to include on the published plan. The basal course of stones along the SE and part of the N sides was all that survived of house 2, but it had been

built sufficiently carefully with straight wall-faces, angular internal corners and unusually fine paving that the line of the SW wall, of which nothing remained, was obvious from the edge of the internal paving (pl 12b). The building measured 2 m wide internally, and at least 3·65 m long, within a wall which, on the SE side, was 0·7 m wide. There was no surviving trace of an entrance. The floor was paved with large slabs and small pebbles filling the interstices between the slabs; a gap in the paving in the NE part of the building was caused by the secondary burial of an ox. There was no hearth. An upstanding box-like compartment formed by upright slabs was set into the wall in the probable NW corner of the building, perhaps for storage.

Unlike houses 3 and 1, whose axes lay NE-SW, house 2 was aligned NW-SE, crosswise to the locally prevailing wind. This fact, together with the size of the building and the carefully paved floor, suggests that this may have been a threshing barn. No other evidence of arable agriculture had survived, but it is unlikely that none was practised. It is also possible that it functioned as a stable.

The building was deliberately dismantled to floor level when house 1 was built, and it was overlain both by the NE wall of the latter and by its associated paved yard.

Phase IV artefact assemblage. Finds attributable to this phase came mostly from the midden in house 3; others were stratified between the layers of paving belonging to phases IV and V, and one (pin fragment no. 29) came from the floor of house 2 itself.

The bone pins (nos 8–11, 14, 16, 18, 19, 21, 29) are all common types (Stevenson 1955), with the exception of no. 9 with its decorated flat oval top, and can be matched from most post-Roman Scottish sites where pins have been found in any numbers. The Buckquoy range of pins in general is marked by fine craftsmanship, best seen perhaps on the decorated examples, especially the thistle-headed pin (no. 16). The design of a band of cross-hatching on the stem occurs also on a pin of essentially similar form from Buston Crannog (Munro 1882, fig 212), and on a pin from Freswick (NMAS HR 1002). The bone implement (no. 42) may be an unfinished pin but it would be unusually large in this assemblage of pins, and a function as some sort of pounding implement is more likely.

No precise parallels have been found for the decorated bone handle (no. 44), but it is a simple form and bone handles were widely used in post-Roman and Viking-age contexts.

One complete comb (no. 53) and one fragment (no. 54) belong to this phase. Both are double-sided composite bone combs of native rather than Norse form. Incised linear decoration involving various groupings of oblique lines as on no. 53 and on no. 55 from phase V is quite a common alternative to ring-and-dot decoration on combs from Scottish, Irish and Manx sites, and its occurrence in the 9th century at Buckquoy reinforces Alcock's assessment of it as a predominantly late motif, based on 10th-century Irish examples (1963, 159). This style of decoration may also be found on Norse comb-types; the three-stroke saltires on no. 53 were executed in exactly the same way as the four-stroke saltires on a single-sided Norse comb from Sanday, Orkney (Greig 1940, fig 68), so that one set of strokes appears to overlie the other, creating an impression of interlace. The shaped end-plates of no. 53 are unusual on this type of comb, but the fragmentary comb from A Cheardach Mhor, S Uist, with simple incised cross decoration, shows a similar interest in the detail of the end-plate, here decorated with oblique grooves along the edge (Young and Richardson 1960, fig 15, 51).

One small base-sherd (no. 77) and two wall-sherds (nos 78, 79) were found in phase IV levels. The fabric and style of these sherds is identical to those from pre-Norse levels, as is the one sherd (no. 80) from phase V and the sherd (no. 76) from Phase III; with only five sherds involved, which may have been derived from earlier pre-Norse levels, Viking-age Buckquoy may have been aceramic. No pottery was found in the first phase of Norse occupation at Jarlshof, but its place

was taken by steatite. Buckquoy lacks steatite in any form, but vessels of wood and leather, of which nothing has survived, may have been an important part of the domestic equipment (cf Addyman 1976, 320–1); the organic material that survived at Sandnes in Greenland (Roussell 1936) and more recently at Trondheim in Norway (Long 1975, 21, 23) and Dublin in Ireland (Ó Ríordáin 1971, 77) provides a tantalising glimpse of what may have been lost elsewhere. Highlighting the absence of native pottery from most of early historic Ireland, Ryan suggested that the alternatives to making pottery might be more efficient: imported pottery or containers of other materials (1973, 632), and this consideration could explain the virtual absence of pottery from Viking-age Buckquoy.

One of the gaming-boards, no. 90, was found in the midden in house 3. The other two boards, nos 91 and 92, were discovered on the excavation stone pile after heavy rain had washed them, but it is likely, to judge from the stage of the excavation at that time, that they too originated in the Norse levels. All three boards consist of undressed stone slabs which have been lightly incised with the same design of intersecting lines forming 36 cells or, more importantly, 49 intersections, with the central intersection emphasised by a circle. This is essentially the same design as that on the wooden board from Ballinderry in Ireland (Kendrick 1933), which is formed by peg-holes instead of line-intersections; a double incised circle surrounds the central peg-hole, and incised arcs emphasise each of the corner holes.

M. Claude Sterckx (Dept of Celtic Studies, Université de Haute Bretagne) agreed very kindly to comment on the nature and significance of the three gaming-boards, and his report has been published in full elsewhere (Sterckx 1973a). He recognised that board no. 92 does in fact bear the same pattern of 49 intersections with a circle round the central intersection as the other two boards, and that here the pattern has been cancelled by the addition of extra lines and circles forming no regular or coherent design (fig 10; Sterckx 1973a, figs 1 and 2).

The game represented by the boards is a battle game between two players, and it was common to both Celtic and Scandinavian tradition (Sterckx 1970). This was the *hnefatafl* of Icelandic sagas (Murray 1952, 55–8), and similar games were played in Ireland as *brandubh* and in Wales as *tawlbwrdd* (Sterckx 1973b). The Ballinderry board is considered to have been used for *brandubh* (Sterckx 1973b, 741), whereas the Buckquoy boards belong to a Norse cultural assemblage and are most likely to have been used for *hnefatafl*; the similarity between the Ballinderry and Buckquoy boards underlines the common tradition behind these board-games.

No playing pieces were found at Buckquoy and it is likely, given the informality of the boards themselves, that small pebbles or shells were used rather than specially manufactured pieces. Bone playing pieces have been found in Norse contexts in Scotland at the Brough of Birsay, Orkney, Jarlshof, Shetland (Hamilton 1956, pl XXXVII, 8), and Drimore, S Uist (MacLaren 1974, 17, no. 37, fig 2), mostly with basal peg-sockets for use on peg-hole boards of Ballinderry type; together with the Buckquoy boards and fragments of boards from the Brough of Birsay, and Underhoull in Shetland (Small 1966, 244, fig 16), and the possible miniature board from Jarlshof (Hamilton 1956, 145, pl XXXI, 1), these indicate the contemporary popularity of board games.

Phase V: late Norse farmstead, house 1 (fig 3; pl 12c, d)

The latest surviving building was house 1, an incomplete dwelling house measuring internally *c* 4·5 m–5 m wide and a truncated 6 m in length. Its walls were built with an inner stone face, surviving to a maximum of four courses, and presumably an earth and turf backing of which no trace survived. The NW wall was represented only by a basal course of stones, but an outer face survived to show that the wall had been *c* 1 m wide. The NE end of the house was squared in

plan, and the end-wall was built with markedly more substantial stone blocks than were the rest of the walls, suggesting that it was a gable wall. There were two entrances, one 0·75 m wide in the NW wall close to the gable and the other in the SE wall. This latter entrance had been 1 m wide and paved, but, at a secondary period in the use of the house, it had been blocked up by two massive stones (pl 12d). The floor-area inside this entrance was paved, unlike the rest of the house which had an earthen floor. This sensible precaution against the heavy wear suffered in an entrance area can be matched elsewhere, for instance at Isleifsstaðir and Skallakot in Iceland (Stenberger 1943, figs 97, 104, 23). A shallow but distinct circular socket had been cut into one of the paving stones (fig 3, pl 12d), and it seems likely that this was the base for one of the timber posts providing roof-support. It lay at a point one-third of the width of the house, suggesting that two aisles of posts were involved. No post-holes were found, and the rest of the posts must also have been carried on pad-stones.

A small hearth represented only by a heavily burnt patch in the earthen floor lay on the long axis of the house. A large stone slab in the NE corner covered the disarticulated skeleton of a newborn infant (Appendix 5); individual bones of babies were found elsewhere on the site, perhaps betraying a hardline philosophy towards infant mortality, although the infant burial in house 1 could be interpreted as a founding ritual rather than a simple convenience.

Faint traces of possible benches along the sides of the house were provided by the alignments of two stones on the SE and four stones on the NW; if, however, one were not expecting to find traces of benches, it is doubtful whether this evidence would even be considered.

The area immediately outside the house on the NE and SE was paved, with evidence of more than one renewal on the SE leading to the entrance that was later blocked. A short stretch of roughly built walling bordered the paving leading to this entrance (this wall and the paving are indicated by stippling on fig 3; both overlay the earlier wall of the byre, house 3, as well as the paving associated with the barn, house 2) (pl 12c).

Phase V artefact assemblage. The horizontal distribution of most finds from this final phase of Norse occupation was misleading in the sense that successive ploughing had scattered them and certainly levelled out any large midden deposits.

Among the bone pins, no. 22 has a cylindrical head similar to one found at Sìthean a Phiobaire, S Uist (Lethbridge 1952, fig 5, 8). Of the two animal-headed pins, no. 25 is a remarkably delicate piece of craftsmanship, very much in the native manner of animal-headed pins such as no. 24 from phase II, the double-headed pin from the Broch of Burrian (MacGregor 1974, fig 6, no. 39) and an unpublished pin from the Brough of Birsay. These small pins with the animal heads set at right angles to the shank are quite unlike Scandinavian zoomorphic pins, which are twice the size, with the animal heads carved along the axis of the pin and a totally different art-style (e.g. Jarlshof, Hamilton 1956, fig 58; York, Waterman 1959, 105, fig 25–7). If no. 33 is accepted as an unfinished pin, it becomes evidence for local pin-production.

One almost complete comb (no. 47) and two plates representing two other combs (nos 48, 49) belong to a single-sided type of composite comb with an arched back. Nos 47 and 48 are decorated with incised ring-and-dot motifs. This distinctive type of comb has been found on three other sites in Orkney: the Broch of Burrian, N Ronaldsay (MacGegor 1974, fig 11, nos 149, 150), the Broch of Borwick (Anderson 1883, fig 213) and the Brough of Birsay. It would appear to have been a local Orcadian fashion, most probably among the Pictish population, and does not appear to have been found outside Orkney (thus militating against MacGregor's suggestion (1974, 80) that the form may have been derived from one-piece combs found in S Scotland). The other comb-fragments from this phase belong to the more common double-sided composite type, again of native origin; nos 55 and 56 show linear incised decoration. The best parallels for the alternating

groups of oblique lines on no. 55 are from Cahercommaun (Hencken 1938, fig 26, 10) and Lagore (Hencken 1950, fig 97, 1283) in Ireland.

Stone artefacts are represented only by two spindle-whorls (nos 85, 86) and a pebble whetstone (no. 88). Two dark blue beads (nos 84, 85) are the only artefacts made of glass, and they are among the few objects likely to have been imported from outside Orkney. Another is the lead weight (no. 96); at 9·1 g, this is likely to have been a balance-weight representing 1 ertog (one-third of an øre), for Viking-age weights were rarely precise (Eldjárn 1956, 355–7; Skaare 1976, 50, table 13).

NORSE HOUSE-TYPES

The partial remains of three Norse buildings survived at Buckquoy: a byre, a barn and a dwelling-house. All three were rectilinear in plan-form but otherwise were quite different, and their differences appeared to reflect their functions. The byre, house 3, was subdivided internally into two, the byre proper and a storage area, and the rounded end that survived implies that the roof was hipped. No direct evidence of roof-type or material was found in any Norse level, but a basic form involving timber-frame and turf covering seems most likely. Both the barn, house 2, and the dwelling-house, house 1, had straight squared ends and may have been gabled; the small floor-area of house 2 and the massive end-wall of house 1 support the idea of gabled roofs. The SE side-wall of house 1 showed an irregular curve, but the opposite wall was straight, and the plan-form is essentially that of a simple hall-house. It has been argued elsewhere that the houses claimed to be boat-shaped at Jarlshof and Underhoull in Shetland are in fact similarly irregular hall-houses, and that the true boat-shaped house as seen in Iceland and the Faroes does not exist in Scotland (Ritchie 1974, 33).

There are currently nine excavated Norse settlements in Scotland datable to the period from the 9th to the 12th centuries (an amazingly small body of evidence for such a major phase of Scotland's history): Birsay (Cruden 1965), Westness (Kaland 1973), Skaill and Buckquoy in Orkney, Jarlshof (Hamilton 1956) and Underhoull (Small 1966) in Shetland, Freswick in Caithness (Curle 1939) and the Udal (Crawford 1974) and Drimore (MacLaren 1974) in the Outer Hebrides. There is insufficient evidence to include the structures at Gurness and Orphir in Orkney (RCAMS 1946, no. 263, pp 78–9, no. 485, p 175) among this list of known Norse settlements. All but three of these Norse sites (Westness, Freswick and Drimore) were established literally on top of earlier settlements, some of which had been occupied as late as the 8th century AD. Beneath the houses at Freswick was found tantalising evidence for a wattle and daub structure built on a foundation layer of clay (Curle 1939, 94); its plan and date are unknown, but it seems most likely to have been a primary and perhaps very temporary Norse structure. There would appear to have been a distinct preference on the part of Norse immigrants for settling on old occupation sites; since there was no shortage of good agricultural land in the areas involved, the preference may reflect an innate Norse habit of land conservation, very necessary in parts of the Norwegian homeland (Munch 1966).

At Jarlshof, the main lines of development in the Norse farmstead were two-roomed dwelling-houses with separate outbuildings during the 9th to 11th centuries, followed at the end of the 11th or early 12th centuries by the attachment of a byre to one end of the dwelling-house, and finally, in the 12th and 13th centuries, dwelling-houses became elongated and porches and small outhouses were attached to their side-walls (Hamilton 1956, 93–189). This broad pattern of development is supported by the evidence from other Scottish sites, and it compares well with the typology of house-forms in other Norse colonial areas; the site at L'Anse aux Meadows in

Newfoundland is particularly useful, because a linear sequence of farmstead types is there supported by a series of radiocarbon dates (Ingstad 1970). The Norse phases at Buckquoy belong to the first stage of the development: dwelling-houses with separate outbuildings.

In terms of size, Scottish Norse houses fall into two groups: the first averages 15 m in internal length and 5–6 m in width, with an average floor area of 70 sq m, and the second averages 10·5 m by 4 m–4·5 m in width, with an average floor space of 45 sq m. Anthropological data for societies practising mixed farming suggests that an average of 10 sq m should be allowed for each person (Naroll 1962, 187-9), which would indicate units of seven and four to five people occupying the two size-groups of Norse houses. Such figures would be consistent with the impression of single-family farmsteads given by the sagas.

Phase VI: 10th-century Norse grave (figs 3, 11)

Before excavation began, there was a slight hump on the crest of the mound; immediately below the turf was an inhumation burial, and it was the minor disturbance of the ruined debris of phase V in order to insert this burial that had caused the hump. The grave was a simple shallow pit, and no attempt had been made to utilise the disturbed stones to make any sort of formal grave setting or mound. The burial itself had suffered some disturbance from ploughing, and the bones were in poor condition (Appendix 5). The shattered skull lay on top of the pelvis, and the body appeared to have been buried in a crouched position on its right side, facing SE, aligned S-N with the feet to the N. The silver penny (no. 119), knife (no. 121), whetstone (no. 122), bone mount (no. 124) and buckle (no. 125) were all found close together at the waist of the skeleton, apparently *in situ* on its right side, while the ring-pin (no. 120) lay across the lower vertebrae and the spearhead (no. 123) was disturbed beside the upper part of the body, on its right. The skeleton has been identified as that of a male, probably more than 40 years old (Appendix 5).

Simple unprotected graves are a common form of Viking-age burial, and a crouched position for the body, though not the most common position, is not unique in N Scotland; several skeletons in the Pierowall cemetery on Westray had their knees drawn up (Thorsteinsson 1965, 165), and at Reay, in Caithness, the body was described as 'possibly in a doubled-up position' (Curle, J 1914, 295). Insertion of the burial into an existing mound is a common economy, often in Orkney into the mounds of ruined settlements (Thorsteinsson 1965, 163; Charleson 1904, 562, 565).

As a group, the grave-goods are most closely matched in N Scotland with those associated with an inhumation in a long cist at Skaill, Sandwick, Orkney, where a perforated whetstone, an iron knife with the remains of a handle and a large iron spearhead were found together with a comb and comb-case and an iron arrowhead (Watt 1888).

The coin (no. 119) was kindly identified by Mr R B K Stevenson as half (deliberately cut) of a silver penny of Eadmund (AD 940–6). Although other Anglo-Saxon coins have been found in Orkney, this is the first occurrence of a coin of Eadmund; the only other coins of Eadmund in Scotland are those from Islay and Iona (Stevenson 1951, 173). Its owner must have regarded it either as bullion or as a luck token, certainly not as currency. The coin shows little wear and its date, together with the dating in the first half of the 10th century of the ring-pin, ought to imply a date for the burial within the third quarter of the 10th century. The bronze ring-pin (no. 120) was kindly examined by Mr Thomas Fanning, whose report forms Appendix 8. The pin is in excellent condition and belongs to a type of Hiberno-Norse ring-pin with polyhedral head and plain ring which has been dated elsewhere to the first half of the 10th century AD. The silver hoard from Skaill, Orkney, contains a very similar ring-pin and was probably buried *c* AD 950 (Graham-Campbell 1976, 120).

The general form of the knife-blade (no. 121) is very common at this period, characterised

by marked shoulders, thick curving back and substantial tang. The length and curve of the tang are perhaps less common features, but this may reflect nothing more than the preference of the smith or the owner (Alcock 1963, 113). The bone mount (no. 124) may have strengthened the sheath for the knife, particularly necessary if it covered the long handle as well as the blade. The latter appears to be much worn by whetting, and the whetstone (no. 122) has certainly been well used. The iron buckle (no. 125) may have fastened the knife to the belt rather than fastened the belt itself, for its diameter at 27 mm is narrow for a belt. The spearhead (no. 123) might perhaps be better described as a javelin head, for it is smaller than most Viking-age spearheads but too substantial to be an arrowhead. A spearhead closely matching the Buckquoy example was found in a grave at Lyking on mainland Orkney (Grieg 1940, 80).

ECONOMY

Any assessment of the economic life of the site in terms of food resources must be limited even more by the conditions of partial recovery than is cultural assessment; complete middens may have been lost as a result of coastal erosion. With the exception of the phase IV Norse midden that accumulated in the ruins of house 3, there were no distinct midden horizons, and food debris as well as artefactual debris appeared to have been scattered at random over the site. Miss B Noddle, who identified the animal bones, has drawn attention to some of the additional hazards of survival peculiar to food debris in her report (Appendix 1).

Based on a sample of about 7,000 bones overall, it would seem that there was little difference in the animal bones between Pictish and Norse periods. All animal bones were recovered and identified from the area excavated, but it is possible, for example, that the phase II collection is more complete than that from any Norse phase, simply because the excavated area may have contained a more complete sample of the phase II settlement. As it survives, the proportion throughout the occupation of the site was about 50% cattle, 30% sheep and 20% pig. About one-third of the animals in all genera died in their first year of life, indicating that the main function of the livestock was the provision of hides and meat. In view of the unlikelihood that the sheep were truly wool-bearing, the fact that only five spindle-whorls were found from all levels becomes less surprising; the importance of bone pins amongst the other artefacts does, however, suggest that clothes were made of textiles rather than leather.

Examination of the bird bones by Mr D Bramwell led to the identification of 54 species (Appendix 2); most were wild, and domestic geese and fowl appear to have been insignificant in Norse times and irrelevant in the pre-Norse economy. Bird meat does not appear to have played an important part in the diet in any phase.

Fish appear to have been more important as a source of food in Norse times than in Pictish times. Identification of the fish bones by Mr A Wheeler implies that, although line-fishing from boats must have occurred in the Pictish period, deep-water line-fishing was far more frequent in Norse times (Appendix 3). Even allowing for the possibility that, without the use of sieving techniques, only the bones of the larger fish species were recovered, it does not seem likely that fishes were ever a dominant element in the diet.

Marine mollusca, identified by Dr J G Evans (Appendix 4), were represented most predominantly by limpets and winkles, but neither, in terms of meat weight, can have contributed to any significant extent as food sources in Pictish or Norse times. A decrease in the size of limpets from Pictish to Norse times may indicate the effects of localised over-collection. There is no means of determining whether limpets were collected as food for human consumption or as fish-bait.

CONCLUSIONS

The mound at Buckquoy covered the remains of five distinct phases of domestic occupation. The house-types and artefacts from phases I and II indicate a date of occupation in the middle centuries of the first millennium AD; the ogam-inscribed whorl associated with phase II suggests a date in the first half of the 8th century and, since there was no great time-lapse between phases I and II, a date in the 7th century seems likely for phase I. Both phases fall into the historical Pictish period, and the ogam-inscribed whorl and the painted pebble can be seen as specifically Pictish artefacts. The distinctive plan-forms of the houses, especially house 4, should help in the future identification of Pictish settlements. Despite the lack of diagnostically Scandinavian artefacts, the house-plans of phases III, IV and V indicate Norse occupation; dating evidence is provided by the 10th-century burial of phase VI. The ruins of house 1 had become a mound of earth and rubble by the time that the burial was made in the third quarter of the 10th century, and there was no trace of deliberate destruction. Allowing an interval of about 40 years after the abandonment of house 1 for the mound to form, and estimating backwards from the date of the burial, phase V must have come to an end around AD 900. The initial establishment of the norse farmstead is unlikely to have taken place much before about AD 800, and therefore all three Norse phases should be contained within the 9th century. It has been argued elsewhere (Ritchie 1974) that there is evidence for considerable integration between native Picts and incoming Norsemen in Orkney during this initial settlement period. This integration is highlighted at Buckquoy by the fact that the artefact assemblage from the Norse levels is dominated by native products. It is clear that the absence of imported artefacts is a common situation on Norse colonial sites (e.g. L'Anse aux Meadows, Newfoundland (Ingstad 1970), where the only foreign objects were an Icelandic stone lamp and a Hiberno-Scottish ring-pin), but the explanation can vary from area to area in conjunction with other factors. Megaw has drawn attention to the lack of 9th-century Norse women's graves in the Isle of Man as an argument for 'continuity on the distaff side at the critical settlement-stage' (1976, 25). In Orkney, where there were 9th-century female Norse burials, the explanation must be more complex, but there can be no doubt that some form of social integration between Pict and Norseman existed at least in the 9th century and probably into the 10th century.

CATALOGUE

The finds have been deposited in Tankerness House Museum, Kirkwall, Orkney; museum registration numbers are given in brackets (THM).

Bone pins (figs 4, 5)

1 Perforated bone pin, flat section, 85 mm long, phase I (THM 1976.40).
2 Bone skewer pin, 94 mm long, phase I (THM 1976.86).
3 Bone skewer pin, 69 mm long, phase I (THM 1976.44).
4 Bone skewer pin, 91 mm long (incomplete at tip), phase III (THM 1976.70).
5 Bone pin, flat triangular head, 50 mm long (incomplete shank), phase III (THM 1976.71).
6 Bone pin, flat triangular head, hipped shank, 29 mm long (incomplete at tip), phase IV (THM 1976.78).
7 Bone pin, flat ovoid head, 70 mm long, phase II (THM 1976.37).
8 Bone pin, flat fan-shaped head, 47 mm long, phase IV (THM 1976.85).
9 Bone pin, expanded flat-topped head, oval in section with two decorative oval dots, 40 mm long, phase IV (THM 1976.80).
10 Ball-headed bone pin, hipped shank, 29 mm long, phase IV (THM 1976.76).
11 Ball-headed bone pin, head decorated overall with dots, hipped shank, 40 mm long, phase IV (THM 1976.81).

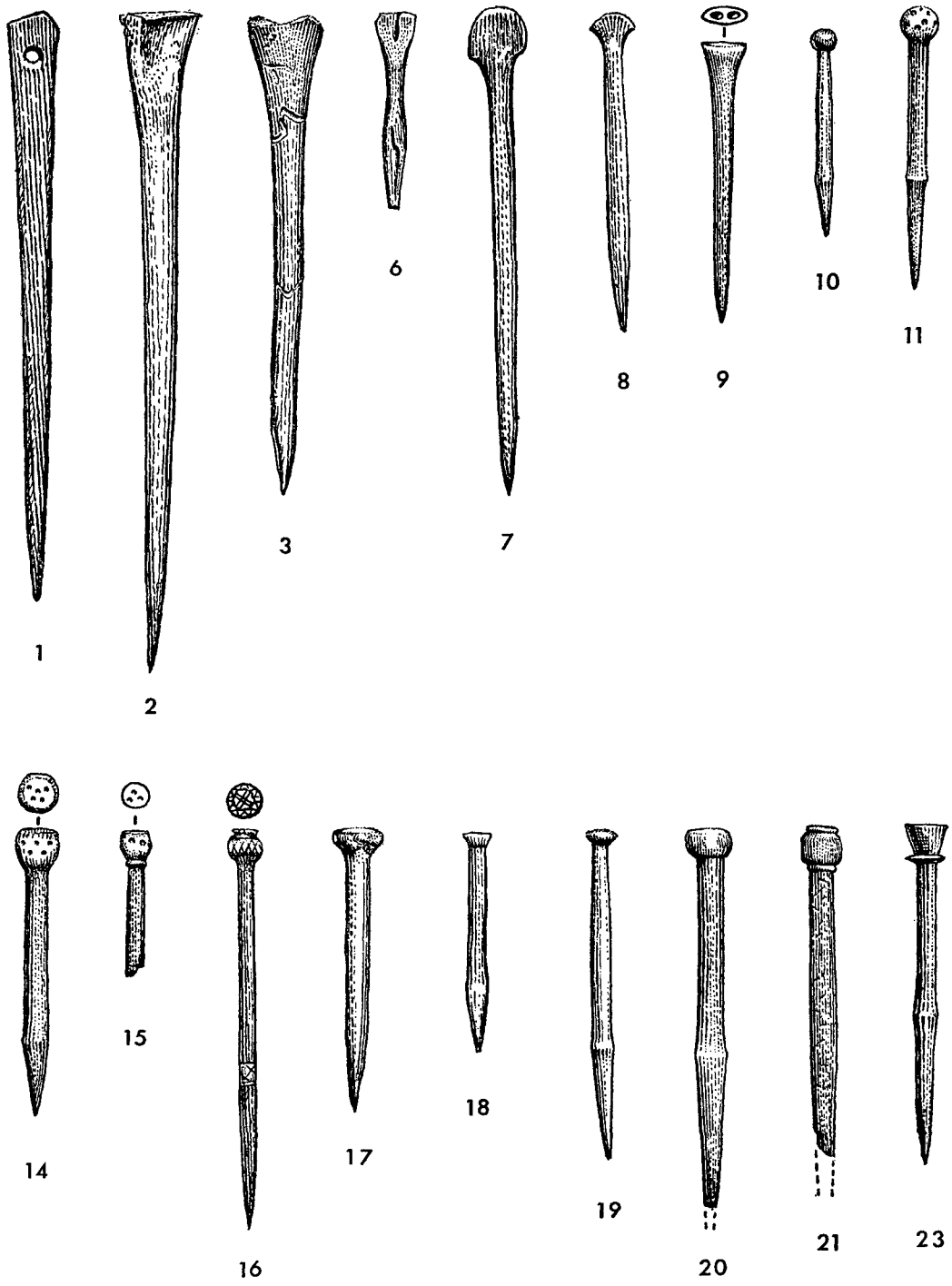

FIG 4 Buckquoy: bone pins (scale 1 : 1)

12 Ball-headed bone pin, 32 mm long (incomplete shank), phase V (THM 1976.96).
13 Bone pin, broken ball-head, hipped shank, 40 mm long, phase III (THM 1976.72).
14 Bone pin, flat-topped ball-head decorated overall with dots, hipped shank, 41 mm long, phase IV (THM 1976.88).
15 Bone pin, flat-topped ball-head decorated overall with dots, collar between head and shank, 20 mm long (incomplete shank), phase V (THM 1976.89).
16 Thistle-headed bone pin, bands of cross-hatched decoration on head and lower shank, decoration on flat top of head, 57 mm long, phase IV (THM 1976.83).
17 Nail-headed bone pin, 40 mm long, phase III (THM 1976.69).
18 Nail-headed bone pin, hipped shank, 33 mm long, phase IV (THM 1976.84).
19 Nail-headed bone pin, hipped shank, 48 mm long, phase IV (THM 1976.77).
20 Bone pin, squat cylindrical head, hipped shank, 55 mm long (incomplete shank), phase II (THM 1976.39).
21 Bone pin, cylindrical head with collars at top and base, 48 mm long (incomplete shank), phase IV (THM 1976.82).
22 Bone pin, cylindrical head, 30 mm long (incomplete shank), phase V (THM 1976.98).
23 Bone pin, flat-topped circular head, collar between head and shank, hipped shank, 50 mm long, phase II (THM 1976.45).
24 Animal-headed bone pin, carved animal's head set on small ball-head, facing at right angle to shank, 37 mm long, phase II (THM 1976.38).
25 Animal-headed bone pin, animal's head set at right angle to shank, four bands of cross-hatched decoration incised on shank, 47 mm long, phase V (THM 1976.99).
26 Animal-headed bone pin, carved animal's head set on collar, facing at right angle to shank, 20 mm long (incomplete shank), phase V (THM 1976.95).
27 Lower part of shank of bone pin, 26 mm long, phase I (THM 1976.36).
28 Unfinished head and upper part of shank of bone pin, flat ovoid head, 21 mm long, phase II (THM 1976.75).
29 Shank of bone pin, indications of a flat ovoid head, 41 mm long, phase IV (THM 1976.74).
30 Lower part of shank of bone pin, 18 mm long, phase V (THM 1976.92).
31 Central part of hipped shank of bone pin, 39 mm long, phase V (THM 1976.93).
32 Lower part of hipped shank of bone pin, 38 mm long, phase V (THM 1976.94).
33 Upper part of ?unfinished bone pin, 39 mm long, phase V, (THM 1976.90).

Bone implements (figs 5, 6)

34 Bone pin or awl, cleft head, 47 mm long, phase IV (THM 1976.79).
35 Double-ended bone implement, awl or fish-gorge, 48 mm long, phase V (THM 1976.97).
36 Bone point, 105 mm long, phase I (THM 1976.46).
37 Bone point, 113 mm long, phase II (THM 1976.43).
38 Bone point, rounded tip, 53 mm long, phase II (THM 1976.42).
39 Bone point, 94 mm long, phase II (THM 1976.41).
40 Bone point, rounded tip, 95 mm long, phase III (THM 1976.73).
41 Bone point, 75 mm long (incomplete), phase V (THM 1976.91).
42 Bone implement, broad rounded tip, cylindrical head, 96 mm long, phase IV (THM 1976.87).
43 Bone spoon, pointed stem, shallow bowl, 152 mm long, phase I (THM 1976. 103).
44 Bone handle, socket 32 mm deep, decorated with three concentric incised lines round end of handle, 92 mm long, phase IV (THM 1976.48).
45 Bone mount, incomplete remains of two peg-holes, 59 mm long (incomplete), phase I (THM 1976.47).
46 Bone mount, two peg-holes retaining bone pegs and one incomplete peg-hole, 58 mm long (incomplete), phase II (THM 1976.51).

Bone combs (fig 7)

47 Single-edged composite bone comb, four plates, three iron rivets, two suspension holes, double-ring-and-dot decoration, 70 mm long, phase V (THM 1976.108) (pl 13b).
48 End-plate from single-edged composite bone comb, one iron rivet, ring-and-dot decoration, 23 mm long, phase V (THM 1976.107).

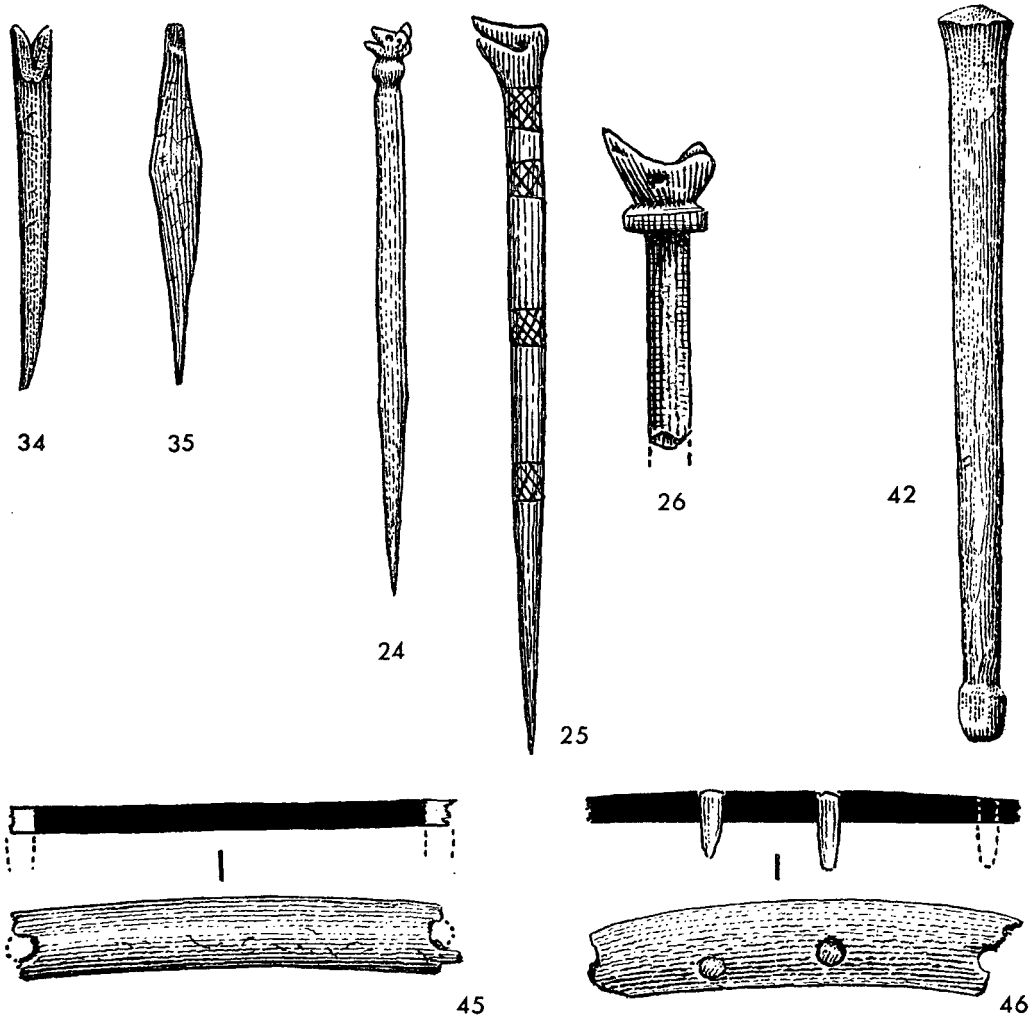

FIG 5 Buckquoy: bone artefacts (scale 1 : 1 except nos 24–6 at 2 : 1)

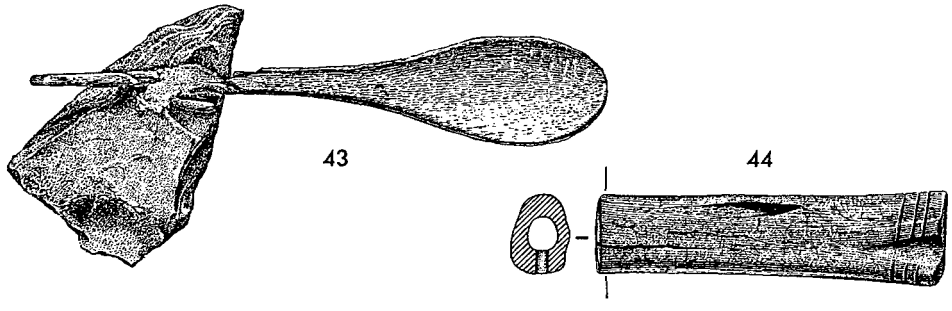

FIG 6 Buckquoy: bone spoon (no. 43) as found with handle crushed on to stone, and bone handle (no. 44) (scale 1 : 2)

49 End-plate from single-edged composite bone comb, one iron rivet, 20 mm long, phase V (THM 1976.114).
50 Double-edged composite bone comb, three plates, three iron rivets, two suspension holes, ribs decorated with incised outline and dots, 74 mm long, phase I (THM 1976.49).
51 End-plate from double-edged composite bone comb, incomplete rivet-hole, 19 mm long, phase III (THM 1976.102).
52 Plate from double-edged composite bone comb, iron rivet retaining fragment of rib, 44 mm long, phase III (THM 1976.100).
53 Double-edged composite bone comb, six plates, one suspension hole, four iron rivets, ribs decorated with incised crosses, end-plates shaped, 116 mm long, phase IV (THM 1976.104).
54 Plate from double-edged composite bone comb, one rivet-hole, 17 mm long, phase IV (THM 1976.105).
55 Double-edged composite bone comb, one end-plate and one central plate missing, ribs incised with pairs of diagonal lines, 95 mm long (incomplete), phase V (THM 1976.120).
56 Two end-plates from double-edged composite bone comb, one iron rivet, one plate retaining fragment of rib decorated with two incised diagonal lines, 21 mm and 23 mm long respectively, phase V (THM 1976.116).
57 End-plate from double-edged composite bone comb, one iron rivet, 20 mm long, phase V (THM 1976.111).
58 Plate from double-edged composite bone comb, one rivet-hole, 9 mm long (incomplete), phase V THM 1976.110).
59 Plate from double-edged composite bone comb, 21 mm long (incomplete), phase V (THM 1976.110).
60 Rib fragment from composite bone comb, one rivet-hole, ring-and-dot decoration, 44 mm long (incomplete), phase V (THM 1976.112).
61 Rib fragment from composite bone comb, incomplete rivet-hole, ring-and-dot decoration, 22 mm long (incomplete), phase V (THM 1976.113).

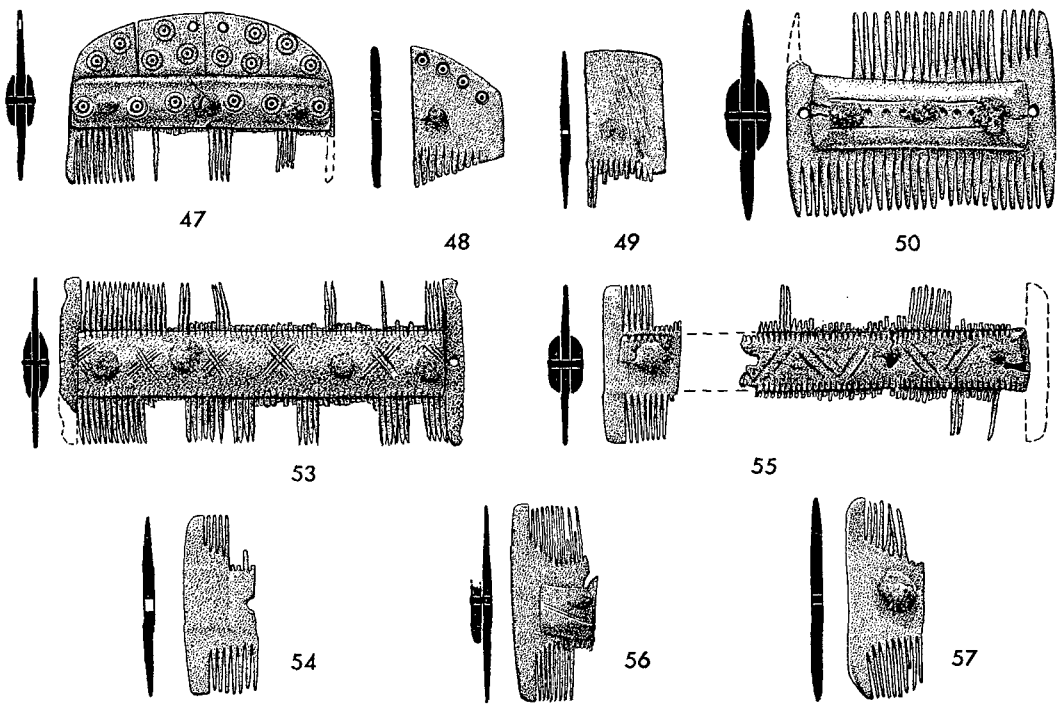

FIG 7 Buckquoy: composite bone combs (scale 1 : 2)

Cetacean bone

62 Squared block of cetacean bone with concave upper surface, 142 mm by 125 mm, 31 mm thick, phase II (THM 1976.50).

Human bone (fig 8)

63 Spindle-whorl made from human femur-head, 36 mm diameter, unstratified (THM 1976.174).

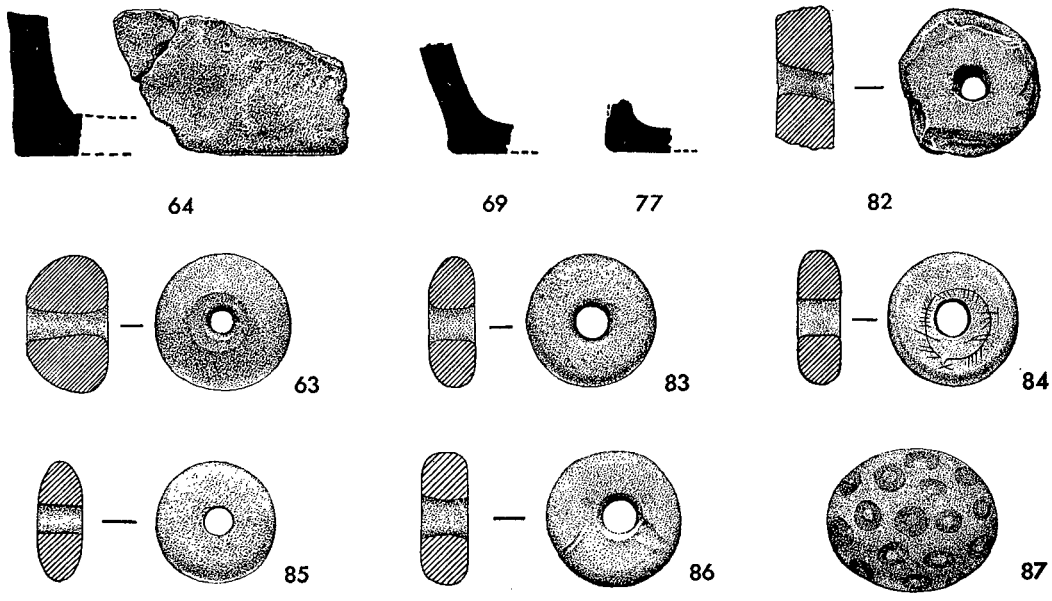

FIG 8 Buckquoy: pottery, spindle whorls and painted pebble (scale 1 : 2)

Pottery (fig 8)

All sherds have a fine sandy fabric containing mica and a little small stone grit: outer surfaces are buff to red in colour, inner surfaces black.

64 Four wall-sherds and one flat-based sherd (base diameter *c* 150 mm), 9–10 mm thick, phase II (THM 1976.60).
65 Two wall-sherds, 9 mm thick, phase II (THM 1976.61).
66 Wall sherd, 10–12 mm thick, phase II (THM 1976.62).
67 Wall sherd, 9 mm thick, phase II (THM 1976.130).
68 Wall sherd, 6 mm thick, phase II (THM 1976.130).
69 Wall sherd and flat-based sherd (base diameter *c* 70 mm), 6–9 mm thick, phase II (THM 1976.131).
70 Two wall-sherds, 7–9 mm thick, phase II (THM 1976.132).
71 Two wall-sherds, 7 mm thick, phase II (THM 1976.129).
72 Wall sherd, 6 mm thick, phase II (THM 1976.127).
73 Wall sherd, 9 mm thick, phase II (THM 1976.126).
74 Sixteen wall-sherds, 7 mm thick, phase II (THM 1976.125).
75 Wall sherd, 7 mm thick, phase II (THM 1976.124).
76 Wall sherd, 9 mm thick, phase III (THM 1976.121).
77 Flat-based sherd (base diameter *c* 50 mm), 7 mm thick, phase IV (THM 1976.59).
78 Wall sherd, 5 mm thick, phase IV (THM 1976.123).
79 Wall sherd, 6 mm thick, phase IV (THM 1976.128).
80 Wall sherd, 9 mm thick, phase V (THM 1976.133).
81 Wall sherd, 7 mm thick, unstratified (THM 1976.175).
82 Spindle-whorl, roughly made from pottery sherd, 35 mm diameter, phase IV (THM 1976.122).

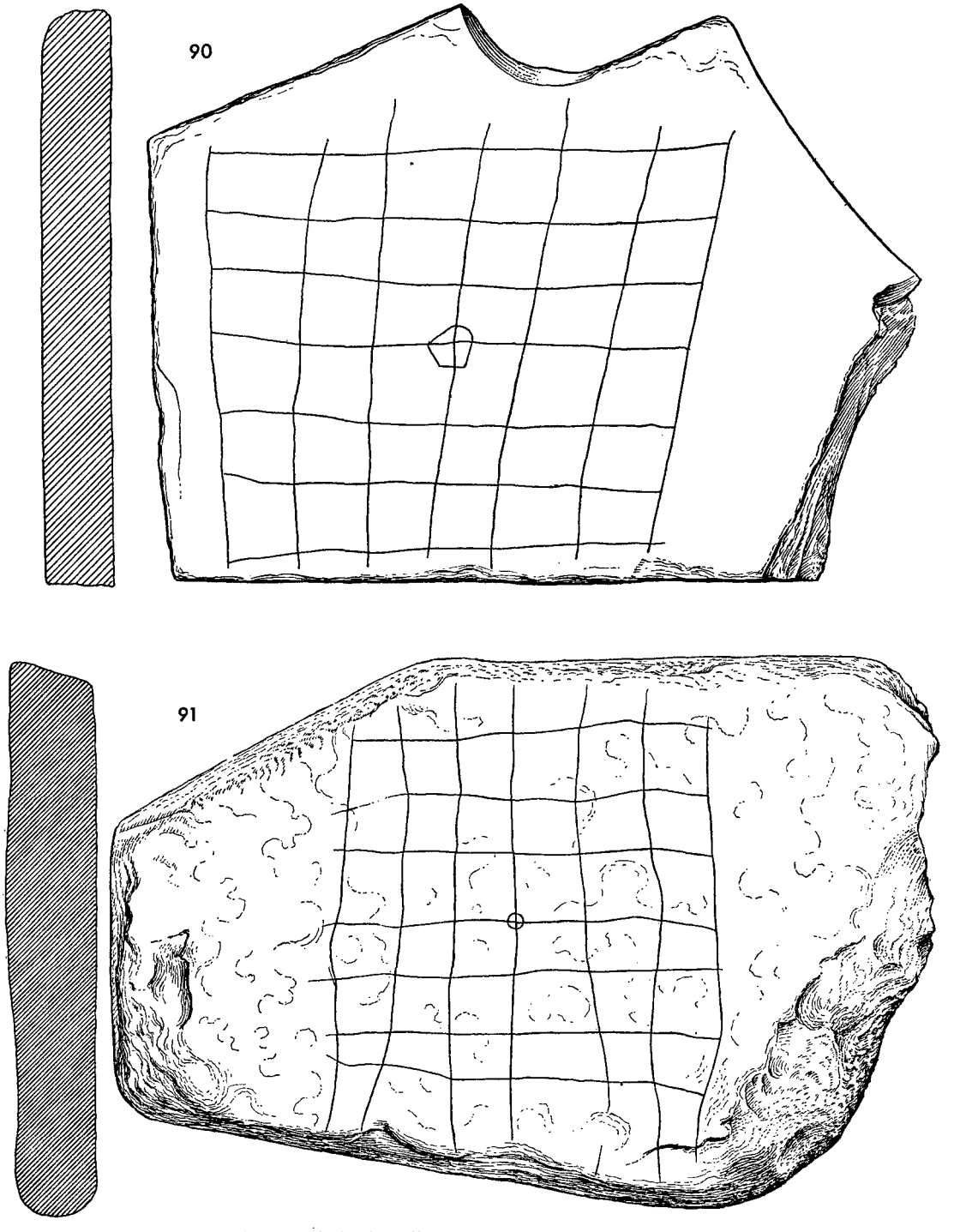

FIG 9 Buckquoy: stone gaming boards (scale 1:2)

Stone (figs 8, 9, 10)

83 Limestone spindle-whorl, 34 mm diameter, phase II (THM 1976.57).
84 Limestone spindle-whorl, ogam inscription incised round perforation on one face, 36 mm diameter, phase II (THM 1976.56) (pl 13a).
85 Limestone spindle-whorl, 31 mm diameter, phase V (THM 1976.162).
86 Haematite-stained siltstone spindle-whorl, 35 mm diameter, phase V (THM 1976.161).
87 Quartzite pebble, painted overall with small circles in brown pigment, 40 mm by 35 mm, 25 mm thick, phase II (THM 1976.58).

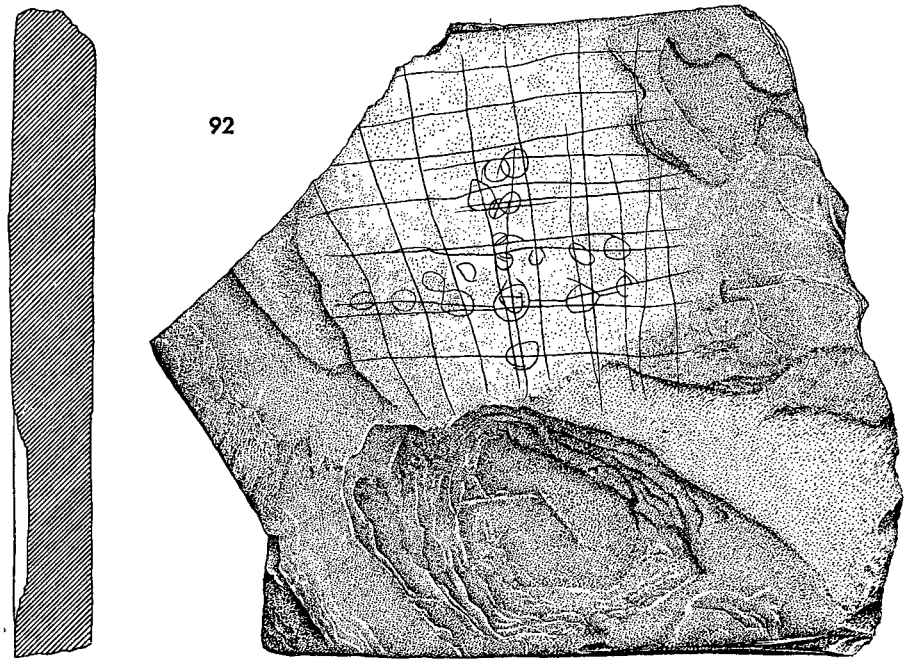

FIG 10 Buckquoy: stone gaming board (scale 1 : 2)

88 Siltstone whetstone, worn on both sides, 83 mm by 30 mm, 15 mm thick, phase V (THM 1976.159).
89 Siltstone pebble, polished face on one side, 56 mm diameter, 15 mm thick, phase IV (THM 1976.157).
90 Flagstone gaming-board, incised with 36 cells, circle incised round central intersection, 235 mm by 175 mm, phase IV (THM 1976.158) (pl 13c).
91 Sandstone gaming-board, incised with 36 cells, circle incised round central intersection, 253 mm by 172 mm, unstratified (THM 1976.177).
92 Flagstone gaming-board, lightly incised with 36 cells and circle at central intersection, overlain by incoherent lines and circles, 190 mm by 170 mm, unstratified (THM 1976.176).

Shell

93 Limpet, two perforations at apex, 55 mm diameter, phase I (THM 1976.55).

Glass

94 Fragment of blue glass bead, 7 mm diameter, 4 mm long, phase V (THM 1976.163).
95 Blue glass bead, 7 mm diameter, 3 mm long, phase V (THM 1976.184).

Lead (fig 11)

96 Lead weight, base diameter 12 mm, weight 9·1 g, phase V (THM 1976.154).

Iron (fig 11)

97 Fragment of single-edged knife-blade, 70 mm long (incomplete), phase II (THM 1976.67).
98 Knife-blade, 76 mm long, phase II (THM 1976.65).
99 Fragment of knife-blade, 45 mm long (incomplete), phase II (THM 1976.66).
100 Fragment of knife-blade, 31 mm long (incomplete), phase II (THM 1976.144).
101 Two fragments of single-edged knife-blade with part of tang, together 62 mm long (incomplete), phase III (THM 1976.137).
102 Fragment of knife-blade, 66 mm long (incomplete), phase III (THM 1976.136).
103 Fragment of small single-edged knife-blade, 40 mm long (incomplete), phase III (THM 1976.135).
104 Fragment of knife-blade, 78 mm long (incomplete), phase IV (THM 1976.138).
105 Two fragments of single-edged knife blade, together 55 mm long (incomplete), phase IV (THM 1976. 139).
106 Four small fragments of knife-blade, phase IV (THM 1976.140).
107 Two fragments of single-edged knife-blade, together 70 mm long (incomplete), phase V (THM 1976.151).
108 Two fragments of knife-blade, together 73 mm long (incomplete), phase V (THM 1976.146).
109 Fragment of knife-tang, rectangular section, 33 mm long (incomplete), phase V (THM 1976.153).
110 Fragment of iron strip, one iron rivet, 35 mm by 13 mm (incomplete), phase V (THM 1976).
111 Iron double-headed rivet, 18 mm long, phase II (THM 1976.68).
112 Nail fragment, 22 mm long, phase III (THM 1976.134).
113 Nail, 40 mm long, phase IV (THM 1976.143).
114 Nail fragment, 34 mm long, phase IV (THM 1976.141).
115 Nail fragment, 17 mm long, phase IV (THM 1976.145).

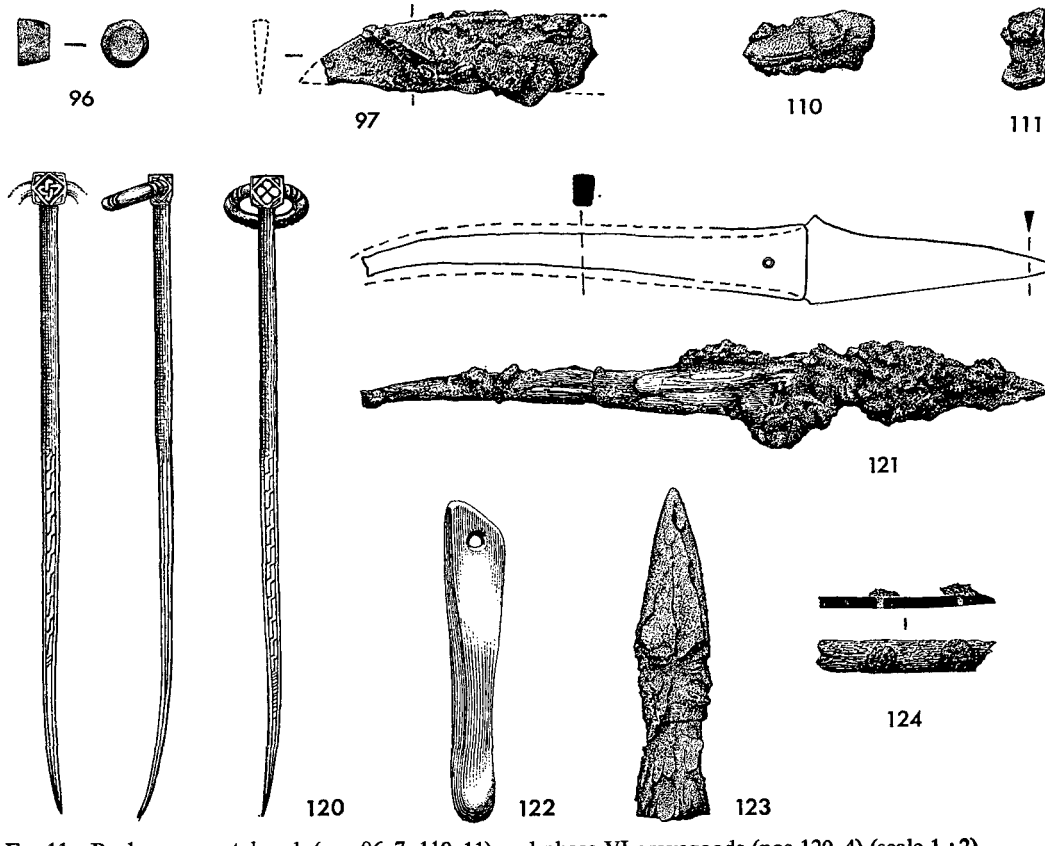

FIG 11 Buckquoy: metalwork (nos 96–7, 110–11) and phase VI gravegoods (nos 120–4) (scale 1 : 2)

116 Two nail-fragments, rectangular section, phase V (THM 1976.149).
117 Nail fragment, 42 mm long, phase V (THM 1976.150).
118 Nail fragment, 67 mm long, phase V (THM 1976.148).

Grave-goods associated with phase VI burial (fig 11)

119 Half of silver penny of Eadmund, deliberately cut (THM 1976.166).
120 Bronze ring-pin, Hiberno-Norse type, decorated on shank, head and ring, 166 mm long from tip to head (THM 1976.165).
121 Single-edged iron knife with tang, fragments of bone handle adhering to tang, 120 mm long (THM 1976.167).
122 Black shale whetstone, much worn, perforated at one end, 85 mm long (THM 1976.172).
123 Small iron spearhead, leaf-shaped, socketed, 87 mm long (THM 1976.169).
124 Fragment of bone mount, 2 iron rivets, 45 mm long (incomplete) (THM 1976.171).
125 Fragment of iron buckle, max diameter 27 mm (THM 1976.170).

APPENDIX 1

The animal bones from Buckquoy, Orkney

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There are essential limitations inherent in any assessment of excavated faunal remains. This material derives almost entirely from waste middens, and these structures have a natural history of their own depending on their content and their rate of accumulation. Isaac (1971) showed that under African conditions considerably less than 50% of a pile of bones could be recovered after 6 months, and that some bones are more readily destroyed than others. A midden may be protected from scavengers by the rapid accumulation of non-edible material, or it may be removed entirely by its builders as an aesthetic or a space-occupying nuisance. This may account for periods in the excavation in which bones were fewer than others or entirely lacking, and it may not be a result of changes in agricultural practice or diet. Also the material in a midden may be rendered unrecognisable by the mechanical forces of later inhabitants carrying out their lives on top of it; from the bone point of view this results in a large number of durable loose teeth which survive after the fragmentation of other bones, and this was sometimes the case at Buckquoy; indeed, so great had been the wear that some of these teeth were sand-polished.

The bones from Buckquoy were in an excellent state of preservation, as frequently occurs in Orkney, and, although fragmentary, about 80% were identifiable. The material from the different genera was analysed in several ways, where the number of fragments justified this (in the case of the main domestic genera, cattle, sheep and pig). In the following tables the material will be considered under these headings: number of identifiable fragments, minimum number of individuals, number of fragments per minimum individual, anatomical analysis of the different bones present where numbers warrant, and age-range of the individual where possible. The bones were measured whenever suitable; dimensions of complete bones will be presented as tables (and frequently occurring measurements of bone widths are available as archive material) in an effort to determine whether there was any change of type of animal between the two cultures represented during the period of the excavation. This method of presentation is adopted from that of Chaplin (1971) who discusses the validity of the statistics employed. The item number of fragments per individual has not been widely used previously, but seems particularly useful for this site where it seems that the bones from whole carcasses (comprising some 140 identifiable bones excluding ribs) were originally placed on the midden, with certain exceptions deduced from the anatomical analysis; the number of fragments per individual then gives some idea of how much material has been lost, for the reasons discussed above. The ages of the animals are given in groups to allow easier presentation than exact chronological ages; the 'text-book' data usually employed (Silver 1963) is derived from improved animals of the 18th century and later, and is not thought to be applicable to these animals of a considerably earlier date and living in a less favourable environment.

In all, some 7,000 bone-fragments were identified. These are grouped under the headings of cattle, sheep, pig and 'others'; this last group comprises goat, horse, deer, seal, dog, cat and rodent, and a few fragments from non-mammals, amphibian and crab are also included. Table I is a summary table showing the distribution of the different genera in the different periods, both from the point of view of numbers of

identified fragments and minimum number of individuals. This last is derived from the most frequently occurring fragment, combined with the age-range and the measurements of the fragments. It is assumed that the different layers contained separate groups of individuals.

From Table 1 it can be seen that the number of bone-fragments from the different periods varied widely. The numbers were highest in the ploughsoil, Norse V and Pre-Norse Ib, and lowest in Norse III and Pre-Norse IIii, which may have obscured some small differences due to the cultural change, and also

TABLE 1

Proportions of bone-fragments and individuals for the different periods. The first figure is the number of identified bone-fragments, followed by the %. The second is the minimum number of individuals, followed by the %. The third is the number of fragments per individual.

Period		Cattle	Sheep	Pig	Other
Topsoil	(1)	833 (45%)	611 (33%)	297 (15%)	97 (7%)
	(2)	21 (42%)	17 (34%)	12 (24%)	—
	(3)	39	32	20	—
Norse V	(1)	973 (44%)	672 (31%)	382 (17%)	168 (8%)
	(2)	28 (47%)	19 (31%)	13 (22%)	—
	(3)	35	29	27	—
Norse IV	(1)	303 (62%)	112 (23%)	47 (10%)	26 (5%)
	(2)	16 (55%)	8 (27%)	5 (9%)	—
	(3)	19	13	9	—
Norse III	(1)	120 (47%)	84 (33%)	37 (12%)	21 (8%)
	(2)	6 (29%)	10 (50%)	5 (21%)	—
	(3)	20	9	8	—
Pre-Norse IIii	(1)	150 (38%)	135 (34%)	92 (23%)	28 (5%)
	(2)	5 (22%)	10 (44%)	8 (32%)	—
	(3)	30	12	10	—
Pre-Norse IIib	(1)	201 (53%)	95 (25%)	70 (19%)	9 (3%)
	(2)	10 (42%)	9 (37%)	5 (21%)	—
	(3)	20	9	13	—
Pre-Norse IIia	(1)	14 (56%)	11 (44%)	Nil	Nil
	(2)	5 (50%)	5 (50%)	—	—
	(3)	3	2	—	—
Pre-Norse Ib	(1)	672 (50%)	285 (21%)	296 (22%)	20 (7%)
	(2)	26 (50%)	7 (13%)	20 (37%)	—
	(3)	26	14	13	—
Pre-Norse Ia	(1)	112 (62%)	26 (14%)	28 (16%)	12 (7%)
	(2)	6 (46%)	3 (23%)	4 (31%)	—
	(3)	19	9	7	—

low in Pre-Norse IIia and I a. By whatever criterion is adopted, the bulk of the material derives from cattle. The proportion is highest in Norse IV (62% fragments, 55% individuals) and lowest in Pre-Norse IIii (38% fragments, 22% individuals). Sheep comes second, ranging from Pre-Norse IIii (34% fragments, 44% individuals) to Pre-Norse Ib (21: in fragments, 13% individuals), and pig third ranging from Pre-Norse Ib (22% fragments, 37% individuals) to Norse IV (10% fragments, 17% individuals) and none in Pre-Norse IIia.

However, there is little overall variation, and it seems likely that the availability of livestock was dictated by the environment rather than by direct choice. There is one difference which might have significance, and that is the change in number of bones per individual amongst the smaller genera, which increases after Norse III, whereas the number of fragments per individual amongst cattle remains much the same throughout. A variety of reasons for this may be suggested:

TABLE 3: Sheep bones – Anatomical distribution

No. layer	Total			Skull		Mandible			Vertebrae	Scapula			Humerus			Radius			Pelvis	Femur			Tibia			Calcaneum			Astragalus		Carp/Tars	Metapodials			Phalanges		Loose teeth		
	No.	Ind.	Ages	%	Ind.	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	%	%	Ind.	Ages	%	Ind.	%	Ind.	Ages
Topsoil	611	17	NW 2J 5I 5M 2E	4·4	3	4·1	4	W 2I E	12·4	2·9	3	N W J	4·4	10	N W J I M	3·6	5	N W 2I M	2·6	5·2	12	N W 5I 5M	6·2	12	N 2W 5I 4M	1·8	7	J 4I 2M	3·1	10	1·5	6·5	7	N 2W J 2I M	2·3	6	2·7	10	3I 3M 2E
V	664	16	N 3N 2J 4I 3M P E	3·8	4	5·6	7	2J 3I M E	12·1	3·9	6	N W 2J	6·3	11	2W 2J 2I M	4·8	9	N 3W J 3I	4·2	4·8	9	2W 2J 2I 3M	8	13	N W 2J 4I 5M	1·9	8	J 4I 3M	3·3	12	2·4	9·6	10	2N W 5I 2M	6·6	3	18·5	7	N 2I 2M P E
IV	101	6	N W J 2I M	3	1	4	1	I	11	7	2	—	2	7	I	4	2	I M	6	12	3	J 2I	5	2	I M	4	2	I M	5	3	1	11	3	N W I	9	2	12	2	J I
III	57	5	J 2I 2M	7	2	1·8	1	J	18	1·8	1	A	1·4	1	M	3·6	5	2N 2I M	5·3	10·6	2	I M	7	1	—	1·8	1	J	1·8	1	—	53	3	J 2I	3·6	1	19·2	2	M
IIii	135	10	3N W 2J 2I M E	5·9	3	5·1	3	J I E	19·2	0·7	1	—	4·4	4	2N	5·9	3	N 2I	3·7	7·4	4	N I 2M	3·7	3	N I M	3·7	4	N W J M	5·9	5	3·7	11·8	7	3N W 2I M	4·4	1	8·8	3	I M E
IIib	84	8	N W J 3I M P	4·7	2	5·9	3	I M P	10·7	9·5	3	W J	5·9	3	W J	13	4	3I M	8·3	5·9	3	2I M	5·9	3	I 2M	2·4	2	I M	1·2	—	3·6	7·2	3	N W I	2·4	—	7·2	2	N P
Ib (25)	55	4	N J 2I M	3·6	1	3·6	1	W	5·4	3·6	1	—	—	—	—	2	1	—	7·2	—	—	—	5·4	2	I	1·8	1	I	3·6	2	1·8	16·4	3	N M	30·9	2	9·1	1	—
Ib (29)	96	4	W 2I M	—	—	5·2	3	J I	17·7	6·3	3	—	4·2	3	J	3·1	1	I	7·3	4·2	2	2I	6·3	2	I M	4·2	2	I M	2·1	—	—	13·5	4	N I	5·2	1	19·8	2	I
Ib (31)	125	5	W J 2I M	3·2	—	3·2	2	J I	13·6	4·8	4	J	8·8	4	J 2I M	4·0	3	I M	3·2	8	3	2I M	7·2	4	W J I M	2·4	2	2I	6·4	5	—	13·6	4	J 2I M	8·8	2	6·4	2	I M

TABLE 4: Pig bones – Anatomical distribution

No. layer	Total			Skull			Mandible			Vertebrae	Scapula			Humerus			Radius			Ciena			Pelvis	Femur			Tibia			Tarsals/ Carpals	Metapodials			Phalanges			Loose teeth		
	No.	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages
Topsoil	291	10	N WJ 4I M A E	3·1	3	J M	4·1	5	N 3I A E	8·9	2·1	3	4·5	4	N J I M	3·1	2	2I	3·4	4	J 2I M	2·1	3·4	4	N J I M	5·2	5	J 3I M	7·6	11	4	N J 3 I	14·8	4	2I 2M	21	5	J 2I 2M
V	377	11	N W 3J 3I 2M E	2·1	2	—	4·8	3	J I M	13·5	2·7	6	4·5	6	W J 3I	3·2	6	2J 3I M	1·9	4	N J 2I	2·4	5·0	7	N 3J 2I M	6·4	8	N WJ 3I 2M	7·1	13·1	5	W J 2I M	12·4	2	I M	16·2	5	2I 2M E
IIii	92	8	2N W 2J 2I M	3·3	1	—	9·9	5	N W 2J I	6·6	1·1	1	4·4	2	N J	5·5	4	N	5·5	4	2N W 2J	4·4	7·7	4	N W 2I	7·7	4	N J I M	8·8	13	3	N W I	11	2	I M	7·7	1	I
IIib	66	4	N J I M	3·0	1	—	1·5	1	J	12·1	3·0	2	1·5	1	—	3·0	2	NI	3·0	2	I M	1·5	9·0	3	N I M	6·0	2	N I	9·1	17	3	J I M	90	2	I M	4·5	1	—
Ib (29)	129	5	N J 2I M	3·9	—	—	1·6	2	J E	17·8	1·6	1	3·9	3	N J I	4·7	3	2I M	1·6	1	M	5·4	5·4	4	N 2I M	5·4	2	2I	12·6	16	3	J I	17·1	2	I M	6·4	1	—
Ib (31)	101	5	N J 2I M	—	—	—	3	1	I	11	4	1	8	3	J I M	3	2	J I	7	3	J 2I	4	5	3	2I M	5	3	N J I	6	11	2	2I	10	2	I M	8	1	—

TABLE 2: Cattle bones – Anatomical distribution

No. layer	Total			Skull		Mandible			Horn core	Vertebrae	Scapula		Humerus			Radius			Pelvis	Femur			Tibia			Calcaneum			Astragalus		Carpals/ other Tarsals	Matapodials			Phalanges		Sesamoids	Sternal elements	Loose teeth		
	No.	Ind.	Ages	%	Ind.	%	Ind.	Ages	%	%	%	Ind.	%	Ind.	Ages	%	Ind.	Ages	%	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	Ages	%	Ind.	%	%	Ind.	Ages	%	Ind.	%	%	%	Ind.	Ages
Topsoil	797	18	3N 2W 2J 3IM P 6E	2·7	4	3	3	N W J M	1·3	12	4	7	3	4	N W 2I M	4	5	W	4	3	6	2, 2W I, 4M	1	7	W I 4M	2	6	2N W 2I M	4	10	5	9	13	N 2W 2J 3I 5M	15	11	2·5	1·5	19	13	3W, W I M P 6E
V	221	24	2N 2D 2J 4I 3M P 6E	2	4	4	9	2N J 2I M 3E	0·6	15	4	7	3·5	7	N 2J 2I M	3	4	N W 2I M	4	3	8	2M 3I 2M	3	10	N J 4I 4M	3	10	N W I 7M	4	14	7	9	14	3N 2b J, I 4M	18	11	3	3	21	14	2N 4I M P 3E
IV	210	9	N 2W J I M P 2E	2·8	2	2·8	3	N	0·5	18	3·8	2	3·8	2	N I	2·8	2	I M	3·3	1	2	I M	5	4	N W J I	0·5	1	I	5	5	7	7·6	4	W I 2M	13	3	1	1	21	6	N I M P 2E
IIii	150	5	N W J I M	3	3	4	2	J	—	18	3	1	1·5	2	N	4	2	J I	10	0·6	1	J	0 6	1	N	1·5	1	N	3	3	8	6	4	J I M	22	4	6	0·6	7	2	M
IIib	188	8	2N W J I 2M	5	2	4	3	N	0·5	10·6	6	3	6	1	—	0·5	1	M	1·5	2·1	1	N	1·5	1	J I M	0·5	4	N	3·1	4	6·2	9·5	4	J I 2M	19·6	4	5·8	1	12·4	—	N I 2M
Ib (25)	127	7	2N 2W J I M	6	3	0·7	—	—	—	4·7	6	2	1·6	1	N	2·4	2	N M	6	1·6	1	N	11·8	4	2N J M	3·2	3	2N J	3·9	3	8·7	10·2	4	N 2W	16·5	3	2·3	—	11	2	I M
Ib (29)	476	10	N J 4I P 3M	5·2	4	3·9	3	J I E	1·8	10	4·4	5	2·3	4	J I 2M	4·8	6	N 4I M	4·2	1·6	3	N I M	3·6	4	J I M	2·0	5	2I M	2·1	6	10	8·8	5	N I 2M	20·1	6	4·6	0·8	14·4	—	I 3M
Ib (31)	477	9	N W J I M P 3E	1·8	1	2·7	3	E	1·4	15·7	5·4	6	3·4	3	J I M	3·5	3	N 2M	6·5	2·5	5	N I 3M	5·0	4	N I 2M	2·7	4	I 3M	2·5	7	6·1	4·6	4	W I M	16	3	4·8	4·8	12	7	2J I M P 3E
Ia	112	6	N W J I M E	2·6	1	6·2	2	M E	0·8	9·8	7·1	—	3·5	3	N J	4·5	2	I	6·2	4·5	3	J 2M	2·7	3	N W	2·7	2	N I J	2·7	2	6·2	4·5	1	—	8	2	6·2	3·5	6·2	—	1E

a. before this period the midden was being used for butchering-waste only, and the larger cattle were boned out at the point of slaughter, whereas this was not always practised with the smaller genera (as happens in the modern butcher's shop);
b. the smaller bones were removed extensively for working, though pig-bone is not very often employed for this purpose;
c. the smaller bones were more vulnerable to the mechanical forces exerted upon them by overlying occupation, but this is not borne out by the numbers of loose teeth;
d. the small bones were removed by scavengers which had become scarcer by the later periods.

Tables 2, 3 and 4 comprise an anatomical analysis of the bone-fragments for cattle, sheep and pig respectively, where there were sufficient numbers of fragments in the layer to warrant this (over 50). These tables also include the minimum number of individuals estimated for each fragment, and an estimation of the age-range for each fragment where suitable for such deductions. The analysis has been carried out on skull and mandible fragments, horn cores (not of course in the pig), vertebrae, most of the bones of the limbs, including the ulna in the pig only, where this bone is separate from the radius. Carpals and tarsals have been included, as far more of these bones were found in this excavation than any other in the writer's experience. Sessimoid bones and sternebrae are included for cattle, as they were again unusually frequent. There is also a column for loose teeth. The age-ranges comprise newborn (N), weanling (W), juvenile (up to about 1 year by modern standards) (J), immature (up to the epiphyseal closure of the latest maturing bones, about 4 years by modern standards (I), and mature (M). It is possible to assess two further categories on the evidence of dental-wear, post-mature (P) and elderly (E). No chronological age can be suggested for these last two as they depend so much upon environmental conditions. No pig bones were identified in the period Pre-Norse IIia, but since so few bones were recovered from this period as a whole, it is probable that pigs were kept.

Among all the genera, the highest proportion of any bones found was that of the phalanx, though of course there are a large number of these bones (24) in each animal. The bone present in the highest proportion might be expected to be the vertebrae, but these bones are largely cancellous and more readily destroyed than the compact long bone. Among the cattle bones, the proportion of pelvic fragments is variable, the proportion of radial fragments comparatively low in IIib, and femoral fragments low in IIii. The proportion of metapodial fragments is low in the early Pre-Norse periods. The differences in the long bones might be explained by the use of different long bones for bone-working at the different periods.

When the individuals represented by the different bones are considered, it is obvious that many adult individuals are not represented by long bones; this may be explained by the fact that once a bone reaches adult size (that is immature or older), it is not possible to age a shaft fragment. These individuals are represented by the tarsal bones. A few adult animals are only represented by teeth, and this, coupled with the occurrence of long bones only as fragments, does suggest that adult bone was extensively used as an industrial material, or that adult bones were broken up more than younger ones by natural forces, for processing for glue or for other purposes. The high proportions of the tarsal bones also suggests that the carcass was suspended for butchering by the hamstring tendon, a technique that is still employed today, and that when butchering was complete the hock bones were discarded intact. The character of the metapodial fragments suggests that many of these bones were in fact worked, and that many of those found were discarded after unsuccessful splitting.

Amongst sheep, the proportion of phalanges and carpal/tarsal bones found was lower than that of cattle. These bones are much smaller in this genus, which might account for their loss. Far more individuals are represented by the long bones, in particular the tibia, in the latest periods of topsoil and Norse V. Again changes in raw material for bone working might be invoked, but another explanation might be changes in cooking method; a stew prepared in a small vessel might result in bones being broken into less recognisable fragments than one prepared in a large vessel or a joint prepared by roasting. It may be noted that in Norse III there is a low proportion of metapodials, in Pre-Norse IIii few scapulae and tibiae, and in Pre-Norse IIib many radii but few phalanges. The proportions of the pig bones are fairly consistent throughout.

The anatomical data has been summarised in Table 5, and compared with the proportions of each bone in the whole skeleton. The purpose of this is to provide a comparison for other sites, although at the moment it is not possible to distinguish between changes in midden content due to 'input', and those due to subsequent events. The table includes the proportions of the different skeletal elements in the whole animal. It is assumed that the skull normally breaks up into eight identifiable fragments, and, for this particular site, where preservation is so good, all the coccygeal vertebrae are included. The shorter tail of

TABLE 5

Average anatomical distribution of animal bones

	% In intact animal	Cattle %	Sheep %	Pig %	Recovery goat in Africa (Isaac 1971)
Skull	5·7	3·7	4	2·6	—
Mandible	1·4	3·5	4·3	4·2	—
Vertebrae	33	10·7	13·3	11·7	0·7
Scapula	1·4	4·7	5·2	2·4	—
Humerus	1·4	3·2	4·2	4·5	100 (distal)
Radius	1·4	3·3	4·9	3·7	23
Ulna	1·4	—	—	3·4	76
Pelvis	1·4	4·1	5·3	3·3	—
Femus	1·4	2·2	5·9	5·9	22 (proximal)
Tibia	1·4	2·9	6·1	6·0	88 (distal)
Calcaneum	1·4	2·0	2·7	—	—
Astragalus	1·4	3·5	3·7	—	—
Carpals/tarsals	5·7	7·1	1·6	8·5	—
Metapodials	2·8	7·7	10·5	10·9	33 (proximal)
Phalanges	17	16·3	9·0	12·5	—
Loose teeth	23	13·7	14·2	7·1	—

TABLE 6

Percentage of individuals in different age groups found at different periods

Period	Animal	Age code NWJ	Age code 1	Age code M and older
Topsoil	Cattle	42	16	42
	Sheep	30	30	40
	Pig	33	33	33
V	Cattle	33	19	48
	Sheep	35	30	35
	Pig	46	30	24
IV	Cattle	50	10	40
	Sheep	50	37	13
	Pig	20	40	40
III	Cattle	57	14	29
	Sheep	30	30	40
	Pig	44	40	20
IIii	Cattle	60	20	20
	Sheep	60	20	20
	Pig	62	25	13
IIib	Cattle	50	20	30
	Sheep	33	44	23
	Pig	40	40	20
IIia	Cattle	25	25	50
	Sheep	20	40	40
	Pig	Nil		
Ib	Cattle	37	25	38
	Sheep	37	44	19
	Pig	42	42	16
Ia	Cattle	50	17	33
	Sheep	33	33	33
	Pig	50	25	25

the pig is offset by its possession of twice as many metapodials and phalanges as the cattle and sheep. The data of Isaac (1971) is also included as the only comparative material available, although it refers to conditions in Hottentot villages of the present day.

Part of the difference between the % found and the % in the intact animal will of course be due to the fact that most bones are found broken, but it is thought that any bone will break into two or at the most three identifiable fragments. Phalanges are usually found intact. The pattern of recovery was very different from that found in the African experiment.

Tables 2, 3 and 4 include data on the age-ranges of the animals found, but this material is more comprehensible when presented along, as it is in Table 6. The age at which an animal died or was killed gives some indication of the sort of environment which it inhabited and the economic use to which it was put. Thus, if an animal is killed in the first year of its life, the economic return from it is only the hide and the carcass not yet fully grown. It has consumed less than an older animal but there is also the return on its parents' keep to be taken into consideration. Older animals may also have contributed their wool, labour of offspring according to genus; the pig alone has no other economic possibilities other than its carcass. It is not necessary for the animals to have reached the 'mature' stage before breeding, although it is

TABLE 7

Bones from animals other than cattle sheep and pig

Period	Goat	Horse	Dog	Cat	Deer	Seal	Whale	Otter	Rabbit	Mouse	Vole	Toad	Rat	Crab	Total
Topsoil	7 (2)	36 (5)	3 (2)	7 (2)	Red 5 (1)	2 (1)	—	—	8 (2)	2 (1)	10 (2)	—	7 (1)	4	97
V	30 (4)	45 (4)	4 (1)	34 (5)	Red 8 (2)	10 (2)	7	—	2 (1)	1 (1)	15 (3)	1	2 (1)	7	165
IV	—	18 (2)	—	—	Roe 1 (1)	4 (1)	1	—	—	—	—	—	—	2	26
III	6 (1)	4 (2)	—	—	—	—	—	—	—	1 (1)	—	—	2 (1)	—	12
IIii	1 (1)	6 (2)	2 (1)	13 (1)	Red 1 (1)	1 (1)	1	—	3 (1)	—	—	—	1 (1)	—	29
IIib	—	6 (2)	—	—	—	1 (1)	1	—	—	—	—	—	1 (1)	—	9
IIia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Ib	—	50 (5)	—	1 (1)	Red 11 (5)	8 (1)	1	3 (1)	3 (2)	—	—	1	1 (1)	1	80
Ia	—	10 (1)	—	1 (1)	—	2 (1)	—	—	—	—	—	—	—	—	12

The figure in brackets is the minimum number of individuals present.

considered unlikely that cattle would breed much earlier at this period. The primitive Soay sheep will breed young, however, and although ewe lambs at the present day in the St Kilda islands (Boyd *et al* 1964) achieve little success, 2-year-old animals succeed. Table 6 shows that a very high proportion of the animals died young; as a generalisation, about a third of all genera were dead by the time they were a year old, about one-third were killed between the ages of 1 and 4 years, and about one-third lived longer.

There is thus little evidence of any economic function for the animals other than the provision of meat and hides, although the proportion reaching mature years amongst the sheep and cattle is rising in the later periods. Nevertheless, over half the animals were being kept for at least one winter, and though there was no doubt considerable killing in the autumn, Childe's concept (Childe 1931) of only a nucleus of breeding stock being retained is again refuted, and some winter fodder must have been available for the majority of animals. This concept has also been discussed by Higgs and Waite (1963). There is, however, little evidence for cattle being kept extensively as working animals.

The number of bones derived from 'other species', that is wild species, carnivores and horses, has been summarised in Table 4. Further details of these animals are presented in Table 7. The small number of confirmed goat bones is also included here. The problem of separating sheep from goats is notoriously difficult, particularly when the sheep is of the primitive type found in this excavation, and the number of goat presented here is doubtless an underestimate, but it is not likely that the goat made up more than a small proportion of the small ruminants. There was an appreciable proportion of horse bones throughout. Hunting of mammals seems to have played little part in the economy, although both red and roe deer were found, and a few seal bones. Dog and cat were scanty, and there were few rodents. Crab claws were found, particularly from the later periods, and two specimens of toad. Rabbit bones are included in this table, but the modern rabbit is of course capable of inserting itself into any part of the deposit. The whale bones probably came from washed-up specimens; the flesh of these animals might have been used more widely than appears here, as it seems likely that the carcass of such a large animal would be fleshed where it was found.

This completes the economic part of the report. The rest of the material covers the size and type of the animals involved. This is confined to the sheep and cattle, as there were too few mature pig bones to afford sufficient data. However, the pigs were very small compared with modern specimens and they had the slender bones of the 'wild boar' type of animal which was the only domestic pig occurring outside the

Orient until recent times. There are two lines of evidence available for the study of the animal type. The most important is the measurement of bone-sizes, and, since whole bones were so few in the excavation, the bulk of the data comes from measurements of bone width. (The few whole bones are listed in separate tables, Tables 8 and 9). Some evidence is available for the estimation of body weight from some of these measurements in the case of cattle (Noddle 1973).

The other source of information regarding type of animal (breed is far too precise a term to be used for this early livestock) is the fragments of skull and horn-core. It must always be borne in mind that the size of an animal is not only a function of its genetic potential, but also depends upon whether it received sufficient nutrition during its period of growth to achieve that potential; thus variations in size may be the result of periodic weather-changes and not the development of new stock-types.

The measurements of the whole cattle bones are given in Table 8.

TABLE 8

Dimensions of whole cattle bones (measurements in mm)

Period	Bone	Length	Proximal width	Distal width	Midshaft width
Topsoil	Metatarsal	201	42	45	22
V	Metacarpal	170	47	—	25
	Metatarsal	197	41	48·5	223
Ib	Metacarpal	172	52	—	26
	Metacarpal	172	—	53	27·5
	Metacarpal	178	—	53	26
	Metacarpal	177	52	—	26
	Metacarpal	172	49	48	28
	Metatarsal	197	40	47	22
	Metatarsal	205	39·5	48	22
	Metatarsal	200	43	46·5	23
	Metatarsal	207	40	44	23
	Radius	247	68	61	42 (level of nutrient foramen)
	Scapula	258	125	62	42 (minimum neck width)

Histograms were made (and deposited with the archive material) of the bone measurements obtained most frequently. They comprise minimal width scapula neck, humerus width distal condyles, radius maximum proximal width, tibia maximum distal width, metacarpal maximum proximal and distal width (taken at epiphyseal line), metatarsal as metacarpal and maximum length first phalanx. The changes in size which can be determined are not large, but there does seem to be an increase in size of scapula neck and width of metacarpal, and length of first phalanx. There is no discernible change in distal tibia or metatarsal, and both distal humerus and proximal radius seem bigger in the Pre-Norse period. Therefore no conclusion can be reached about the change in type of animal for this evidence. It was noted that the anterior posterior dimension of the metatarsal midshaft was always greater than the width; this factor is variable in modern animals, but the significance is not yet known.

Approximate body weights have been obtained in terms of modern animals from measurements on the astragalus. These range from about 133 kg to about 230 kg, and there are no definite distinctions visible between the different periods. The few heavy specimens occurring in all those periods where there were large concentrations of bone were probably bulls; sexual dimorphism is far greater in primitive breeds of cattle than in modern (Walker 1964). If these are indeed entire males, it follows that the majority of male animals were either castrated so that their remains become difficult to distinguish from the female or the majority of males were killed young.

Very few large skull fragments or complete horn cores were recovered. Polled skulls are not likely to have survived, judging by the condition of the other bone fragments. There is a strong tradition that the Norse kept polled cattle (Wilson 1910), but it is based on the polled Galloway breed of Scotland in which the polled condition was deliberately encouraged to facilitate rail transport south during the 19th century; however, this mutation occurs consistently about once in every odd 50,000 births, and, once having

occurred, it tends to be dominant. The specimens found comprise a large, presumably male specimen from ploughsoil level and a much smaller presumably female specimen from Norse V; both are curved, the male one forward and downward, but the direction cannot be determined in the female. From the early Pre-Norse period derives a short, young (based on texture) specimen, attached to a large portion of the frontal bone. There is a round hole in the parietal bone about 50 mm in from the horn core; similar lesions have been observed in medieval animals (Highworth, Wilts; Noddle unpublished) and possibly result from the stunning procedure adopted in slaughtering. The second Pre-Norse specimen is smooth textured and curved. It is believed to derive from a female and is much larger than the Norse

TABLE 9

Dimensions of complete sheep bones (in mm)

Period	Bone	Length	Proximal width	Distal width	Midshaft width
Topsoil	Radius	132	26	26	16
	Metatarsal	124	19	21	—
	Metatarsal	133	19	22	12·5
Norse V	Humerus	130	33	26	15
	Humerus	134	22	26	15·5
	Humerus	117	28	23	12·5
	Metacarpal	124	19·8	23	12
	Metatarsal	127	—	21	10·5
	Metatarsal	134	18	22	10·5
III	Radius	136	27	26	15
IIii	Radius	130	28	27	15·5
	Metatarsal	127	18	22	11
IIib	Metacarpal	117	20·5	22	12
Ib	Radius	147	29	27	15·5
	Metacarpal	125	21	23	12·5
	Metacarpal	113	—	22	12
	Metatarsal	137	19	21·5	11
	Metatarsal	116	20	22	12
	Metatarsal	124	17	21	—
Ia	Radius	142	29	27	17
	Metatarsal	127	18	20	11·5
	Humerus	143	36	25	1·5
	Radius	150	28	26	15
Mouflon (Modern)	Metacarpal	125	21	23	11·5
	Metatarsal	137	19	22	10·5
Soay (Modern)	Humerus	129	35·5	24·8	—
	Radius	137	27	25	14
	Metacarpal	119	19·7	22	12
	Metatarsal	131	17·5	20·4	9·8

specimen, but the amount of information about 'breeds' which can be derived from the horn shape is arguable. The young Pre-Norse specimen is somewhat similar to that illustrated by Platt in her report on the animal bones from Midhowe Broch (Grant and Callander 1934, 515), and the variability is paralleled by her finding on the Norse Jarlshof cattle (Hamilton 1956, 212–15).

In the case of the sheep, the same data of bone measurements and horn cores is available for analysis, but because of the survival of both wild and primitive breeds of domestic sheep to the present day much better comparative material is available. Collections of bones from mouflon are available from zoological gardens and museums, Soay sheep derived from the feral island population of St Kilda and its descendants from recently imported specimens on the mainland, and Orkney sheep from the islands of N Ronaldsay have been used to provide not only straight measurements but also proportions. Table 9 lists all whole bones found in the excavations with representative samples from the comparative animals. The bone measurements indicate a sheep small by modern standards, slightly larger than the Soay and thus weighing rather more than the 20 kg Soay average. There is a slight decrease with the passage of time,

which could be attributed to decrease in nutrition coupled with increasing exploitation of the environment rather than any genetic change. There is no distinct difference between Norse and Pre-Norse animals. In the case of the first phalanx, there is an abrupt reduction of length in the mixed material of topsoil, although long specimens still persist. When the proportions of this bone are examined, there is a gradual transition from something similar to the wild mouflon form to an animal more like the present-day Soay. The proportions of the scapula neck show the same tendency, but the picture is less obvious because the change in shape is from mouflon proportions to the extremely long narrow Soay form and then back again to the shorter Orkney (modern long-tailed sheep have a very short thick scapula neck). However, the changes are not very great, and the data for all the animals overlaps in part of its range. Horn core evidence is not very helpful. Firstly only one good specimen of sheep horn core was obtained from the excavations; secondly, all the comparative breeds of sheep have similar horns in the male and very variable horns in the female, except that the Soay cross section tends to be more oval than the others. A few oval horn tops were found.

The evidence can be summarised as follows. The sheep stock at the earliest stages of the excavations was of a very primitive type not far removed from the wild. Nevertheless, it must have been an imported form originally, as wild sheep are not believed to have occurred in the British Isles. The animals were subjected to pressures which selected a type more similar to the Soay. Eventually, by topsoil, appears a form indistinguishable from the Soay from the limited material available. It is not possible to say whether this was newly introduced or whether there is a long time-lag in this mixed layer during which the sheep continued to change elsewhere but were not deposited at this site. As the Soay sheep is generally considered to be a Norse type, the appearance of this animal at Buckquoy is surprisingly late. Platt records the presence of two breeds of sheep during the Norse period at Jarlshof, distinguished by their horn cores and some very long bones of a possible third type which she described as deerlike, but which would also be agreeable with a mouflon type (Hamilton 1956, 214). Ryder has inferred the presence of a primitive pre-Soay type of sheep from fleece evidence (Ryder and Stephenson 1968). It is thought that this animal would not possess wool, but a hair coat. The age of the animals at death would suggest that they were not kept for wool production.

One specimen is of considerable interest; it comprises part of the frontal bone and one horn core of a young polycerate specimen, and the broken-off horn core of at least one other horn, probably two horns. The polycerate habit crops up sporadically in domestic sheep from time to time, and has been recorded in very early specimens from both Catal Huyuk and early Egypt (Epstein 1971). Elwes (1912) suggests that the majority of medieval sheep in N Scotland had four horns and both the sheep skulls found during the excavations in Lund were polycerate (Bergquist and Lepsikaar 1957). The recently extinct Hebridean breed was frequently polycerate (Low 1846) and the habit survives in the present day Manx Loughton and the St Kilda Black; this last breed is the only one which seems to have more than four horns with any frequency, and it is believed to originate from Skye (Ryder 1968). The habit has not been recorded in present day Soay sheep, but up until the first world war a number of Shetland sheep in the western parts of the islands were polycerate.

Two pathological specimens were found, a mandible exhibiting paradontal disease and an abcess cavity of such proportions that it had broken out of bone in two places (topsoil), and a humerus with a cauliflower-like exostosis on the lateral distal portion, probably the result of continued trauma such as is encountered by the modern Orkney sheep feeding on the rocky shores of N Ronaldsay.

SUMMARY

Some 7,000 mammal bones were recovered from the site. The bulk of them originated from the topsoil and the periods Norse V and Pre-Norse Ib. There was little variation in the proportions of the genera throughout, in the anatomical distribution of the remains, or in the size and age range of the animals. The proportion throughout was about 50% cattle, about 30% sheep, about 20% pig and about 5% other genera. There were no pigs in Pre-Norse IIia. About one-third of the animals died in their first year of life amongst all genera, indicating that the main function of the livestock was the provision of hides and meat. Amongst the other genera the most frequent was horse, but there were also a few goat and deer bones. Dog was rare, and cat (large wild cat) more frequent. A few crab claws were also identified. The cattle were small, about 180–200 kg live weight, about half the size of modern beasts but rather larger than the medieval English animal. The sheep were of a short-tailed very primitive race, in many respects more like the mouflon than the Soay. It is unlikely that they were wool-bearing. During the period covered

by the excavation there seems to be a gradual change towards the Soay type, and in the uppermost layers it is possible that the Soay appears. A possible polycerate specimen was found. There are no great differences from the bones described from the Norse period at Jarlshof by Platt (Hamilton 1956, 214–5) and no marked differences between Norse and Pre-Norse livestock.

APPENDIX 2

Bird and vole bones from Buckquoy, Orkney

by D Bramwell, Fulwood, Baslow Road, Bakewell, Derbyshire

Identification of birds

From the table overleaf it can be seen that by far the greatest concentration of bird bones is from the topsoil; although this material is evidently an unstratified layer, the variety of species is very similar to the other Norse layers and so may be regarded as being the refuse left by those people. A striking fact about this assemblage is the small part played in the economy by poultry, with very few geese and domestic fowl and no sign of domestic ducks at all, while the odd fowl bone from the Pictish levels can probably be dismissed as intrusive, due to rabbit burrowing. It suggests very strongly that the Pictish people did not have any domestic birds at all. By far the greatest amount of bird meat was provided by the wild birds which these people, Norse and Picts, found in their environment, which provided a rich and varied fare though many of the species would not be relished today, e.g. gulls, cormorant and shag. Present habits of the birds show four main environments where hunting must have taken place: (a) moorland, cliffs and scrubland; (b) meadow, marsh and freshwater; (c) sea shore and mud flats; (d) the open sea.

These divisions apply to the places where the birds may be found ouside the breeding season. The sea birds, of course, must come ashore to breed and so would at that season utilise cliffs, turfy places and fresh-water lochs. It is likely that most of the pursuit of these species would be carried out at this season. Gannet, guillemot, cormorant and razorbill, for example, are very approachable when nesting on the cliff ledges. The largest seabird in this list is the now extinct great auk, but its sparing remains seem to indicate that it was not particularly common even at this early date, though it continued to breed on Orkney till 1812 (Lea and Bourne 1975, 100–2). Another large bird in the list which no longer breeds anywhere in the British Isles is the common crane, an inhabitant of wild and secluded marshy places. In northern Europe today this bird is a summer visitor but other species in this list are autumn and winter visitors, e.g. knot, jacksnipe and turnstone, showing that wild fowling was spread largely over the whole year. Osprey is represented by a large femur. The presence of black grouse is of some interest to ornithology, as bones also turned up at the Skaill excavations of Norse age in Deerness, Orkney. This is a sedentary species though nesting does not yet seem to have been recorded on Orkney.

The few bones of domestic goose belong to the normal early domesticated form of grey-lag, that is a bird almost identical in size with the wild grey-lag. A few measurements of the Buckquoy birds are given:

Left tarsometatarsus, 78·7 mm long, 17·8 mm prox width, 6·7 mm least width of shaft, 18·0 mm distal width.

An incomplete tarsometatarsus, 18·5 distal width.

An incomplete humerus, 25·0 distal width.

The thicker shaft to the complete tarsometatarsus quoted above is the reason for regarding it as a domestic bird, following studies on medieval geese bones from King's Lynn (Bramwell 1977).

The domestic fowl bones from Buckquoy are from the usual small variety which is widely found from Roman to quite recent times, with little sign of selective breeding. There is however an incomplete humerus in this collection which betrays a sturdier variety, though still only a small bird. Odd specimens of this nature may not necessarily denote selective breeding but are probably a feature which appears by chance from time to time. The following fowl bones were complete: humerus, 63 mm and 69 mm; femur, 69 mm and 79 mm; tarsus, 61·5 mm and 71·5 mm; coracoid, a pair at 48 mm.

The Orkney vole, Microtus arvalis orcadensis

Of considerable zoological interest are a few skulls of this vole, from the topsoil and Viking V. Normally the remains of burrowing animals are suspect in archaeological digs, but in this case the state of preservation agreed with the other Norse material. The point of interest is that zoologists are still not agreed as to how the Scottish islands acquired their faunas following the sterility of the Ice Age. Some

TABLE 10

No. of bones

		Norse			Pictish			
	Topsoil	V	IV	III	IIii	IIib	IIia	I
Great northern diver	3	3	1	1	5	1	—	3
Fulmar	2	—	3	—	1	—	—	5
Manx shearwater	8	6	4	1	—	—	—	3
Gannet	23	39	8	1	8	3	—	16
Cormorant	4	1	—	1	1	—	—	—
Shag	6	7	—	—	—	—	—	—
Mute swan	1	—	—	—	—	—	—	—
Whooper swan	1	3	—	—	—	—	—	—
Goose, domestic	8	12	1	—	—	—	—	—
Shelduck	—	2	2	—	—	—	—	—
Mallard	1	—	—	—	—	—	—	—
Teal	3	—	—	—	—	—	—	—
Wigeon	—	1	—	—	—	—	—	1
Shoveler	2	—	—	—	—	—	—	—
Eider	2	—	—	—	—	—	—	—
Common scoter	1	—	—	—	—	—	—	—
Golden eye	1	—	—	—	—	—	—	—
Small duck species	1	2	—	—	—	—	—	—
Osprey	—	—	—	—	—	—	—	1
Merlin	1	—	—	—	—	—	—	—
Kestrel	1	—	—	—	—	—	—	—
Red grouse	2	—	—	—	—	—	—	—
Black grouse	2	—	—	—	—	—	—	—
Fowl, domestic	32	9	1	1	—	—	—	1
Crane	1	—	—	—	—	—	—	—
Water rail	1	—	—	—	—	—	—	—
Corncrake	1	—	—	—	—	—	—	—
Oyster catcher	1	—	—	—	—	—	—	—
Golden plover	1	—	—	—	—	—	—	—
Turnstone	—	—	—	—	—	1	—	1
Dunlin	1	1	—	—	—	—	—	—
Knot	—	1	—	—	—	—	—	—
Greenshank	—	1	—	—	—	—	—	—
Curlew	8	—	—	—	4	—	—	4
Whimbrel	2	—	—	—	—	—	—	—
Jacksnipe	2	—	—	—	—	—	—	—
Phalarope, ?grey	—	1	—	—	—	—	—	—
Skua, ?pomarine	1	1	—	—	—	—	—	—
Black-headed gull	1	—	—	—	1	—	—	—
Lesser black-backed or herring gull	—	3	—	—	—	—	—	—
Glaucus gull or greater black-backed gull	12	2	—	1	—	—	—	1
Gulls, small species	1	—	—	1	—	—	—	1
Little auk	3	3	—	—	—	—	1	—
Razor bill	10	2	—	—	—	—	—	—
Great auk	2	—	—	—	1	—	—	—
Common guillemot	9	5	1	—	—	—	—	7
Black guillemot	—	—	—	—	—	1	—	—
Puffin	5	1	1	1	—	—	2	3
Rock dove	1	2	1	—	—	—	—	—
Ring ousel or blackbird	4	—	—	—	—	—	—	—
Redwing or song thrush	1	1	—	—	—	—	—	1
Starling	7	2	—	—	—	1	—	—
Rook or crow	6	7	1	—	—	—	—	—
Raven	2	—	—	1	—	—	—	—
indeterminate	18	7	3	—	—	—	—	2

TABLE 11

The species arranged under habitats:

(a)	(b)	(c)	(d)
Merlin	Swans	Oyster catcher	G.N. diver
Kestrel	Mallard	Turnstone	Fulmar
Red grouse	Teal	Dunlin	Manx shearwater
Rock dove	Wigeon	Knot	Gannet
Osprey	Shoveler	Curlew	Cormorant
Ring ousel or	Goldeneye	Whimbrel	Shag
Blackbird	Small ducks	Gulls	Shelduck
Redwing or thrush	Crane		Eider
Starling	Water rail		C. scoter
Rook or crow	Corncrake		Skua
Raven	Golden plover		Little auk
	Greenshank		Razorbill
	Jacksnipe		Great auk
	Phalarope		Guillemot
			Puffin

support a 'relict' theory and postulate 'land bridges' from various directions, thus enabling the islands to be repopulated by certain species, but more recently Corbet (1961) has dismissed the land bridge theory in view of the depth of the channel surrounding Orkney. He regards the vole as of accidental human introduction, possibly in cattle fodder or turf, by some immigrant people, at any time from the mesolithic to Viking age, and since the arvalis species is otherwise a continental mammal, it might be thought that a Viking origin could be within reason. Now the variety orcadensis is considerably larger than its continental counterpart, in other words it is a specialised island form which must have required many generations to develop, but the Buckquoy skulls are already large, so the origin of Orkney voles must be sought further back in prehistory. A bone of the common toad (phase V) merits similar consideration.

Acknowledgment

The writer is grateful to Mr G S Cowles of the Dept of Ornithology, British Museum (Natural History), for his help in identifying the osprey.

APPENDIX 3

The fish bones from Buckquoy, Orkney

by Alwyne Wheeler, British Museum (Natural History)

INTRODUCTION

The remains of fishes recovered from the excavation of the Pictish and Norse homesteads at Buckquoy, Birsay, amounted to a considerable quantity of bones. These were in most cases in broken condition, some even fragmentary, and many were not identifiable even to family. No scales, otoliths, or teeth were contained in the samples examined. This was probably because recovery was by hand-picking of excavated material and no sieving was attempted; comparisons of recovered fish remains from sieving and hand-picked medieval sites at Great Yarmouth (Wheeler and Jones 1976), and elsewhere, has shown that the former method of recovery produces a very different fauna list, enhanced in particular by small species. The interpretation of the Buckquoy fish bones is therefore dependent on the supposition that they represent only the larger species of fishes caught and consumed at the site.

The samples were sorted first so that vertebral centra (which dominated all samples in number and quantity) were segregated from bones from the jaws and cranium, and also from the fragments which would prove to be unidentifiable. The jaw bones, principally dentary and premaxillary bones are mostly very characteristic and form a firm basis for identification. From the preliminary species list formed in this way the vertebral centra and other complete or characteristic bones were identified. Only bones positively

identified to genus or species are included in this report. Where, because of their fragmentary nature or lack of distinguishing features, identification was doubtful these bones were not further considered, it being felt that the species list would not be constructively increased by their inclusion and the interpretation of the results might be materially affected.

RESULTS

A summary of the results is given in tabular form (Table 12), and further notes are given on the bones identified, the estimated sizes of the fish concerned where a comparison is possible, and some notes on the biology of the species with references to potential fishing methods. Biological details are from Wheeler (*1969*).

TABLE 12

Species or groups of fishes represented in the Buckquoy material. Minimum numbers of each species are given; presence (P) is indicated for the groups not identified to generic level

	Pictish			Norse		
Phase	I	IIa	IIb	III	IV	V
Species or group						
Elasmobranch	—	—	—	—	P	P
Conger eel	1	1	—	—	2	1
Trout	—	—	—	—	—	1
Cod	—	—	—	—	6	2
Saithe?	2	—	—	—	10	3
Haddock	—	—	—	—	—	2
Ling	—	—	1	—	4	5
Cod-family indet.	—	P	P	—	P	P
Hake	1	—	—	—	—	—
Red seabream	—	—	—	1	1	2
Ballan wrasse	1	—	—	—	2	1
Mackerel	—	—	—	—	1	1
Grey gurnard	—	—	—	—	1	1

Elasmobranch – shark or ray. Because these fishes lack bones, their skeleton being composed of calcified cartilage, skeletal remains are few. They are represented by vertebral centra at two periods (IV and V) of the Norse levels. Vertebral centra are featureless and it is not possible to identify these remains further. Their size, however, suggests that the fishes were moderately small; if sharks, less than 1 m in length, and if rays less than 0·75 m in length. Sharks of this size in the area of the Orkneys are the dogfishes (*Scyliorhinus* spp.) and the spurdog (*Squalus acanthias*), all common species; several kinds of ray or skate (*Raja* spp.) could be involved. The sample from period V contained nine centra; those from the other periods were each a single centrum.

Conger conger – conger eel. Identified from two Pictish periods (I – a right dentary from a fish *c* 1·7 m long; II a – anterior part of premaxillary from a fish *c* 1·4 m long), and three Norse periods (IV – five vertebral centra, one right dentary from a fish *c* 1·5 m long, one premaxillary from a fish *c* 1·3 m long; V – six vertebral centra from a fish at least 1·4 m long). The conger eel is a large fish which occurs in inshore waters from the intertidal zone to 150 m depth on rocky grounds. Its habit of living amongst rocks and in wrecked ships results in it mainly being captured on baited lines, and by chance in crab or lobster pots; it is very rarely caught in trawls.

Salmo trutta – trout. Identified from one Norse period (V – one left dentary from a fish of *c* 0·25 m length). The trout occurs naturally in several of the larger lochs of the Mainland (Orkney) as well as in streams and in the sea, as sea trout. The relatively small size of this specimen suggests that it may have been caught in freshwater. The trout is well known as an anglers' fish and although it can also be caught in nets its capture on a baited hook or with a lure of some kind is more likely.

Gadus morhua – cod. Aparently present only in the Norse levels whence it was identified from three periods (IV – three right and one left premaxillary bones from fish estimated to be 0·40 m, 0·75 m, 0·78 m,

0·86 m in length (2–5·6 kg gutted weight), two vomers, one left premaxillary from a fish estimated at 0·66 m and 2·5 kg, two right dentaries one from a fish estimated to be 0·70 m and 3 kg, two left maxillaries in fragmentary condition; V – two right premaxillaries from fish estimated to be 0·80 m (4·5 kg), and one right maxillary).

The cod is a well-known food fish which is common off Orkney. Small specimens can be captured close inshore, but larger fish (above *c* 6 kg) are usually captured in deeper water. It will take a baited hook readily and is captured today in large numbers in trawls and seine nets. It lives in schools close to, but not on, the sea bed.

Pollachius sp. – saithe or pollack. The remains identifiable to these species are not sufficiently complete to allow precise determination. *Pollachius* is represented in only one Pictish period (I – two parasphenoids of small fishes) but is present in several Norse periods and represented by numerous bones. The Norse periods are (IV – four parasphenoids of two large and two small fishes, three vomers, three right maxillaries, two left premaxillaries of large fish, and eight right and three left dentaries representing three large, three medium and four small fishes; V – one parasphenoid, three basioccipitals, two left, two right maxillaries, two right and two left premaxillaries all from large fishes, one right and two left dentaries all moderately large fishes).

Due to lack of comparative material of known lengths it is not possible to estimate the lengths or weights of the fishes involved; small fish are probably less than 0·45 m, large ones *c* 0·90 m.

Saithe and pollack are similar in external appearance and are closely related. Both species occur in the seas around the Orkneys but the saithe is the more common and is abundant inshore when young. It is thus likely that these fish were saithe. Young fish tend to be found in schools close to rocks, although the larger fish inhabit more open sea beds; at all stages they are easily captured on baited hooks or lures, although the modern fishery for saithe is prosecuted mainly by trawling.

Melanogrammus aeglefinus – haddock. Identified from two periods of the Norse levels, (IV – one cleithrum from a fish of *c* 0·45 m; V – one cleithrum, two parasphenoids of fishes *c* 0·50 m and 0·70 m). These lengths represent weights of 0·90, 1·01, and 2·75 kg respectively. The haddock is a bottom-living species which occurs in schools over open ground; it is today usually caught in trawls but can be captured on hooks provided they are fished on the sea bed. It is not usually found close enough inshore to be captured from the shore.

Molva molva – ling. Present as numerous remains from both Pictish and Norse levels although more abundant in the latter period. Ling bones have been identified in the Pictish period IIb (one left premaxillary from a moderately large fish, one left dentary, three large anterior abdominal vertebral centra; all these bones could have originated from a single fish). In the Norse period (IV – one cleithrum, two caudal vertebral centra, two vomers, three parasphenoids, two right dentaries from fish of *c* 1·20 m, two left premaxillaries from fish of *c* 1 m and 1·40 m, 13 vertebral centra; V – two vomers, three parasphenoids, two basioccipitals, one left and one right premaxillary both fragmentary, three right dentaries (all fragmentary) two of fish *c* 1·50 m length, one of a 0·50 m fish, and two left dentaries both from fish *c* 1 m, nine anterior vertebral centra).

The ling is a large member of the cod family which attains a length of 2 m and a weight in excess of 35 kg. It is relatively common in the vicinity of Orkney in depths of 50 m and more; only small fish occur in shallower water. Large specimens such as are mostly represented in the Norse material tend to frequent rocky grounds and are mostly captured on baited hooks.

Merluccius merluccius – hake. Identified only in Pictish period I (one right dentary from a specimen of *c* 1 m, five vertebral centra). Possibly all these bones came from a single fish.

The hake is a relatively deep-water fish; today specimens of this size are rarely found and then only in water of at least 165 m depth. However, hake migrate into shallower water in summer and it may be before the stocks were over-fished (as they are today in the NE Atlantic) that large hake could be caught inshore. Although commercial fisheries for hake are by trawling, this fish can be caught on hooks.

Pagellus bogaraveo – red seabream. Present only in the Norse levels and represented by very few bones. Found in periods (III – one abdominal centrum of a fish *c* 0·45 m length; IV – three caudal centra of fish *c* 0·40 m length; V – one left dentary of a fish *c* 0·37 m, three abdominal centra of at least two fish one *c* 0·45 m, the other smaller, possibly 0·37 m).

The red seabream is an uncommon fish north of the Irish Sea today although it has been reported off Orkney. Its presence in these Norse remains might indicate that it was more common there at that period than today suggesting possibly a rather warmer climate. It grows to a maximum length of 0·51 m and a weight of *c* 4 kg; it is today caught in trawls occasionally and also on hooks.

Labrus bergylta – ballan wrasse. Identified in one Pictish level and three Norse levels. Pictish period (I – first anal pterygiophores and articulated spines). Norse period (IV – first anal pterygiophores and articulated spines, three caudal vertebral centra from fish *c* 0·30 m long; V – one left dentary, one lower pharyngeal bone, pair of upper pharyngeal bones).

The ballan wrasse is a rock-haunting species which can normally only be captured on hooks or in baited pots. It is uncommon today in the vicinity of the Orkneys but is reported from time to time. The remains identified suggest that it may have been more common in the 7th to 9th centuries than it is today, but are too sparse to be more closely analysed.

Scomber scombrus – mackerel. Represented only from two levels in the Norse period (IV – one vertebral centrum; V – three centra, one abdominal and two caudal).

The mackerel is a well-known food fish which is largely pelagic in its life-style living in schools near the surface and coming close inshore in summer. It is easily captured on hook and line, although today taken by a variety of other methods. From the material recovered it was not an important food fish.

Eutrigla gurnardus – grey gurnard. Identified from Norse levels in period IV (dorsal fin spine) and V (one right opercular spine, one dorsal fin spine). This material is not sufficient to permit assessment of the length of the specimens involved. The grey gurnard is a common sea fish around the British Isles, most common in 20–40 m although occasionally captured in shallower water. It is entirely a bottom-living species found on sandy or muddy bottoms and vulnerable to capture by line and in trawls.

DISCUSSION

Some interest centres on the comparison to be made between the species recognised in the Pictish and those in the Norse levels which can be seen in Table 12. The relative abundance of fish bones is much greater in the Norse levels than in the Pictish suggesting a greater reliance on fish in the diet and improved fishing techniques, although it is possible that the greater age of the latter occupation could have accounted for such a difference, as also could different-sized populations on the site. The list of species in Pictish remains contains three types of fish which could be caught in shallow inshore waters. Ballan wrasse, conger eel, and saithe or pollack are all rock-haunting fish relatively easy to catch on hook and line when fishing from the shore as for example the craig fishing as described by Fenton (1973). The use of a poke net (a large circular net, baited and drawn swiftly to the surface) would also be a possible means of capturing these fish and as the saithe caught in this way would mainly be small, as were the Pictish fish, this is a viable alternative. Two other species out of the five determined (ling and hake) are, however, exceptions, both are relatively deep-water in their life-style and are more likely to have been caught on lines fished from boats at sea (not necessarily far offshore).

The fishes identified from Norse remains are more numerous. Again, conger eel, saithe and ballan wrasse could be captured by craig fishing, as could mackerel on occasions in summer. Cod, the large saithe or pollack, haddock, ling, and gurnard are more likely to have been caught on long lines set in deep water. Cod, saithe, and ling are mid-water or near-bottom fish such as might be captured on the middle hooks of a line, while haddock and gurnard are bottom-living fish which would take a bait from a sunken line. Many elasmobranchs (e.g. the rays and dogfishes) are also bottom-living. Both red seabream and mackerel could be caught in mid-water on such a line. These notes suggest that during the Norse period fishing was prosecuted in deeper water using many-hooked lines, requirements of which would have been a larger, more sea-worthy fishing boat than close inshore fishing needed.

One of the species identified is also of interest. The red seabream is rare today in the region of the Orkneys yet it is represented in three periods of the Norse occupation which suggests that it may have been more common then than it is today. This may be due to a less favourable climate today (it is a warm-water fish found in the Mediterranean), but in view of the limited material available and sparsity of supporting evidence amongst the fish species (the ballan wrasse remains are less positively capable of the same explanation), this interesting suggestion is not further pursued. Additionally, it is interesting that several of the fishes, notably the hake, ling and haddock for which length estimates are possible, are considerably larger than would be captured today in inshore waters. This suggests that larger fish may have been found in shallow water in the 7th to 9th centuries than today. A possible explanation for this is that fishing pressures on these species may have reduced the stock of large fish close to the shore. In other words the present-day distribution of these (and other species) of small specimens inshore and large ones in deeper water may be a result of exploitation rather than of selection of habitat by the fish.

APPENDIX 4

The mollusca and environment, Buckquoy, Orkney

by J G Evans and Penny Spencer, Department of Archaeology, University College, Cardiff

Marine mollusca

All large shells of marine molluscs were collected during the excavation. They came from eight phases of Norse and Pre-Norse occupation; in addition, shells from the topsoil were collected thus making a total of nine samples. The shells were identified and counted (Table 13), and the results presented as a graph showing changes of relative abundance through the deposit (fig 12); all species are considered to be human food debris.

TABLE 13

Buckquoy, Orkney. Invertebrate fauna, largely human food debris from the Pre-Norse and Norse middens. + = present but not counted; cf = probable; ? = possible.

	Phase								
	Pre-Norse					Norse			
	Ia	Ib	IIia	IIib	IIii	III	IV	V	Top-soil
Patella vulgata Linné	1130	2728	35	284	516	431	6834	22543	5480
Patella aspera Lamarck	—	—	—	—	—	—	—	—	1
Patina pellucida (Linné)	—	—	—	—	—	—	—	—	3
Gibbula cineraria (Linné)	2	4	—	5	1	—	3	56	72
Calliostoma zizyphinum (Linné)	4	14	—	3	—	—	—	28	1
Littorina littoralis (Linné)	27	128	12	17	26	10	45	406	559
Littorina littorea (Linné)	542	2364	36	785	1400	651	5401	26854	17748
Trivia cf *arctica* (Montagu)	4	—	—	—	—	—	—	—	—
Nucella lapillus (Linné)	70	410	19	56	99	226	109	1414	456
Buccinum undatum Linné	—	—	—	—	—	—	—	—	2
Cepaea hortensis (Müller)	—	2	—	—	—	1	—	—	—
Mytilus edulis Linné	2	7	—	1	—	+	—	—	—
cf *Modiolus modiolus* (Linné)	—	—	—	—	—	—	—	—	+
Ostrea edulis Linné	—	—	—	—	—	1	1	—	—
Pecten maximus (Linné)	—	+	—	—	—	+	+	—	—
? *Lima hians* (Gmelin)	—	—	—	+	—	—	—	—	—
cf *Cardium edule* Linné	—	—	—	—	—	—	—	+	—
Cancer pagurus	—	—	—	—	—	—	+	—	—
Spirorbis borealis	+	+	+	+	+	+	+	+	+
? *Flustrella hispida*	—	—	—	—	—	—	—	—	+

Limpets (*Patella vulgata*) and winkles (*Littorina littorea*) predominate with dog whelks (*Nucella lapillus*) and flat winkles (*Littorina littoralis*) as constant, but subordinate, elements. Top shells (*Gibbula cineraria* and *Calliostoma zizyphinum*) and mussels (*Mytilus edulis*) are sporadic, while all other food species are represented by one or two occurrences only. The species are all characteristic of rocky shores being common in the intertidal zone, and there is no reason to suppose that they were collected from other than the immediate vicinity of the site. There is virtually no suggestion of sandy-shore or mud-flat species – e.g. *Cardium* and other burrowing bivalves (cf the list in Coles 1971, 354).

The histogram (fig 12) shows that during the Pre-Norse phases limpets gradually gave way to winkles as the most important species eaten. During the Norse period this trend is reversed, while in the topsoil, winkles once more assume dominance.

To estimate the weight of meat represented, a modern limpet sample was measured – 100 limpets from Lavernock, Glamorgan, were collected and weighed as follows:

	Weight (kg)
Shells	0·66
Flesh, raw	0·31
Flesh, boiled in water for 5 min	0·18
Flesh, boiled in water for 20 min	0·15

Using the figure of 0·15 kg/100 limpets, the meat weights of the Buckquoy samples were estimated, and are listed in fig 12. The total is 58·3 kg, which, applying the data of Shawcross (1967) of 650 calories/kg, and 2700 calories per man per day, is sufficient meat on its own to support one man for 10 days. Although clearly a rough calculation, side-stepping many sources of error (such as the differences between the modern and ancient limpet populations), it nevertheless serves to demonstrate the wholly subsidiary nature of shellfish in the diet.

In order to trace changes of size in the limpet population through time, a sample of 100 shells from each phase (excluding C) was measured, the measurements taken being the external length, breadth and height. Plots of length against breadth yielded straight-line graphs with a slope of 45°. Either of these two measurements can thus be used as an index of size (height not controlling the meat content to any great extent, most of which is in the ventral part of the animal). Distribution curves for length were plotted, showing that the limpets in phases E, D and B are larger than those in phases A, III, II and I. The shells

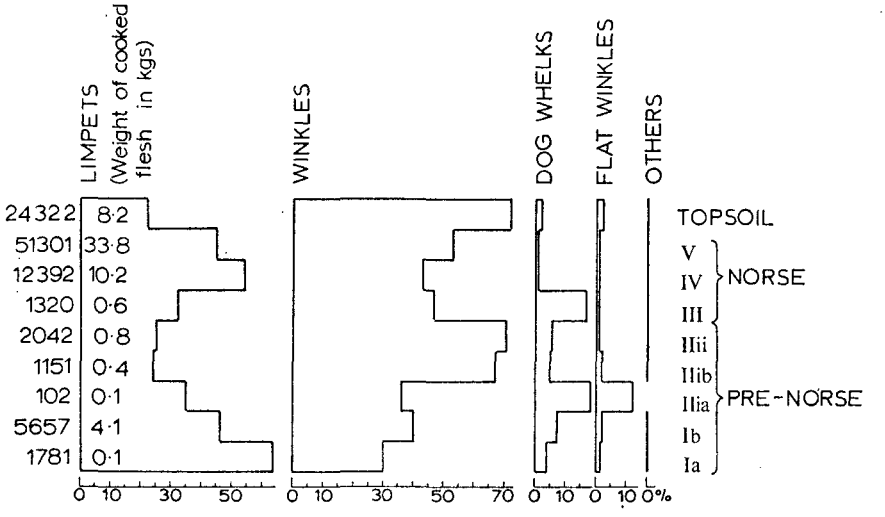

FIG 12 Buckquoy: changes of relative abundance of shellfish (percentages of total fauna)

in the topsoil are intermediate between the two groups. This diminution in size may be due to intensive collection by man. A similar phenomenon, possibly attributable to a similar cause, has been recognised in the Danish kitchen-midden sites (Brothwell and Brothwell 1969, 64).

Plots of height against length showed that the majority of the limpets were of normal profile, i.e. they were neither excessively flattened nor excessively conical (cf the modern population from Lavernock which is composed largely of markedly conical individuals). The significance of this is that the Buckquoy shells were collected throughout the intertidal zone, and not from either close to high-water-mark or low-water-mark exclusively, for limpets in the upper part of the intertidal zone are generally conical (Lavernock sample), those from near low-water-mark, flattened.

Notes on certain species

Patina pellucida (Blue-rayed limpet). This species lives on the sea-weed, *Laminaria*, and the few examples from the topsoil may derive from sea-weed spread on to the land as manure.

Littorina littorea (Edible winkle). A few small examples may be the closely related *Littorina saxatilis*, but their degree of preservation made certain identification impossible.

Trivia arctica. The four shells of this species were identified on the basis of their size and the absence of dark spots. However, these may be lost in the fossil state, and it is therefore possible that the shells are *Trivia monacha* (da Costa).

Nucella lapillus (Dog whelk). The shells of this species varied considerably, and one or two giant specimens were recorded. All, however, were clearly referable to the one species.

Cepaea hortensis. A land snail, which may have been used for food, but which may equally have been part of the land-snail fauna living on the site.

Cancer pagurus (Edible crab). One small claw fragment (dactylopodite), possibly of this species, was recovered.

Spirorbis borealis. This species is a small tube-worm (Annelida, Serpulidae) which secretes a calcareous tube rolled in a spiral (diameter of spiral, 2–4 mm), and which often occurs attached to stones, seaweed, etc, in the intertidal zone. A few specimens were found encrusting limpets and, on at least one shell, were on the inside, indicating it to have been collected dead. The occurrence of this species in the midden is, of course, incidental.

Flustrella hispida. A small compound animal (Polyzoa) which secretes a calcareous skeleton and lives on sea-weed, rocks, etc. One colony, possibly of this species, was found on one of the shells of *Patina pellucida.*

THE ENVIRONMENT

A cliff section, 200 m to the N of the archaeological site, was sampled for land snails in the hope that these might give some clue to the recent environment of the area, and in particular, its reaction to human occupation.

The section showed the following stratigraphy (fig 13):

Depth below surface (cm)

0–20 Topsoil. Dark, sandy loam. Modern vegetation consists of unkempt grass and weeds.

20–45 Midden. Compact, sandy loam with numerous stones, bone fragments and marine shells, the latter mainly limpets and edible winkles.

45–62 Pale, orange-brown sand; very compact. Calcareous.

62–67 Top of buried soil. Dark-brown clay loam with intermixed shell sand.

67–75 Base of buried soil. Non-calcareous, dark-brown clay-loam free of shell sand.

75+ Solifluxion debris. Pale yellow-brown stony loam with large angular stones pitched in all directions; stones in the upper part (75–90 cm) relatively horizontal.

Five samples through this section were analysed for land snails using the method described by Evans (1972). The results (Table 14) have been presented as a histogram of relative abundance (fig 13). The snail species have been grouped into three broad ecological categories – woodland, intermediate and grassland. *Lauria cylindracea* is often put with the woodland species, particularly in the S of Britain, but in the W and N it is more sensibly included with the intermediate or even open-country species. In the Orkneys today it is often extraordinarily prolific in dry, open sand-dune and fixed-dune pasture habitats.

A consideration of the stratigraphy of the section described, together with the results of snail analysis, enables the following tentative sequence to be put forward.

There was first a phase of solifluxion, indicating a cold climate and open, treeless landscape, which probably relates to the closing stages of the Last Glaciation.

A period of soil formation then ensued under the milder, temperate conditions of the Post-glacial. The parent material is non-calcareous and the soil is thus devoid of land snails, at any rate in its lower levels. But the upper few centimetres of the buried soil contain fragments of shell sand derived ultimately from the sea by wind transport (Evans 1972). The incorporation of this material probably took place by earthworm mixing when the cover of blown sand was minimal. A similar phenomenon occurs at Skara Brae in Orkney and at a number of places along the N coast of Cornwall (Perranporth, Newquay and Daymer Bay), and the latter site I have discussed with Mr Keith Valentine (Dept of Soil Science, Reading University) who agrees that deposition of a thin layer of wind-blown sand followed by earthworm mixing are the most likely mechanisms involved.

The land snail fauna from the buried soil (62–67 cm) is unequivocably a woodland one and closely similar (in the abundance of *Discus, Carychium* and the Zonitidae) to woodland faunas from southern Britain.

In the shell sand above (45–62 cm), the grassland species, *Vallonia excentrica,* appears, suggesting a degree of deforestation. Whether this is a natural process brought about by the overwhelming action of the wind-blown sand or whether it is in part or wholly of man-made origin is not clear, but it should be pointed out that marine shells, presumably human food debris, were present at the base of this horizon (*c* 62 cm) indicating the presence of man at an early stage in the clearance process. The significance of the marked increase of *Clausilia bidentata* in the blown sand is uncertain.

A sample from the midden (20–45 cm) was too poor in land snails for a count to be made, but the

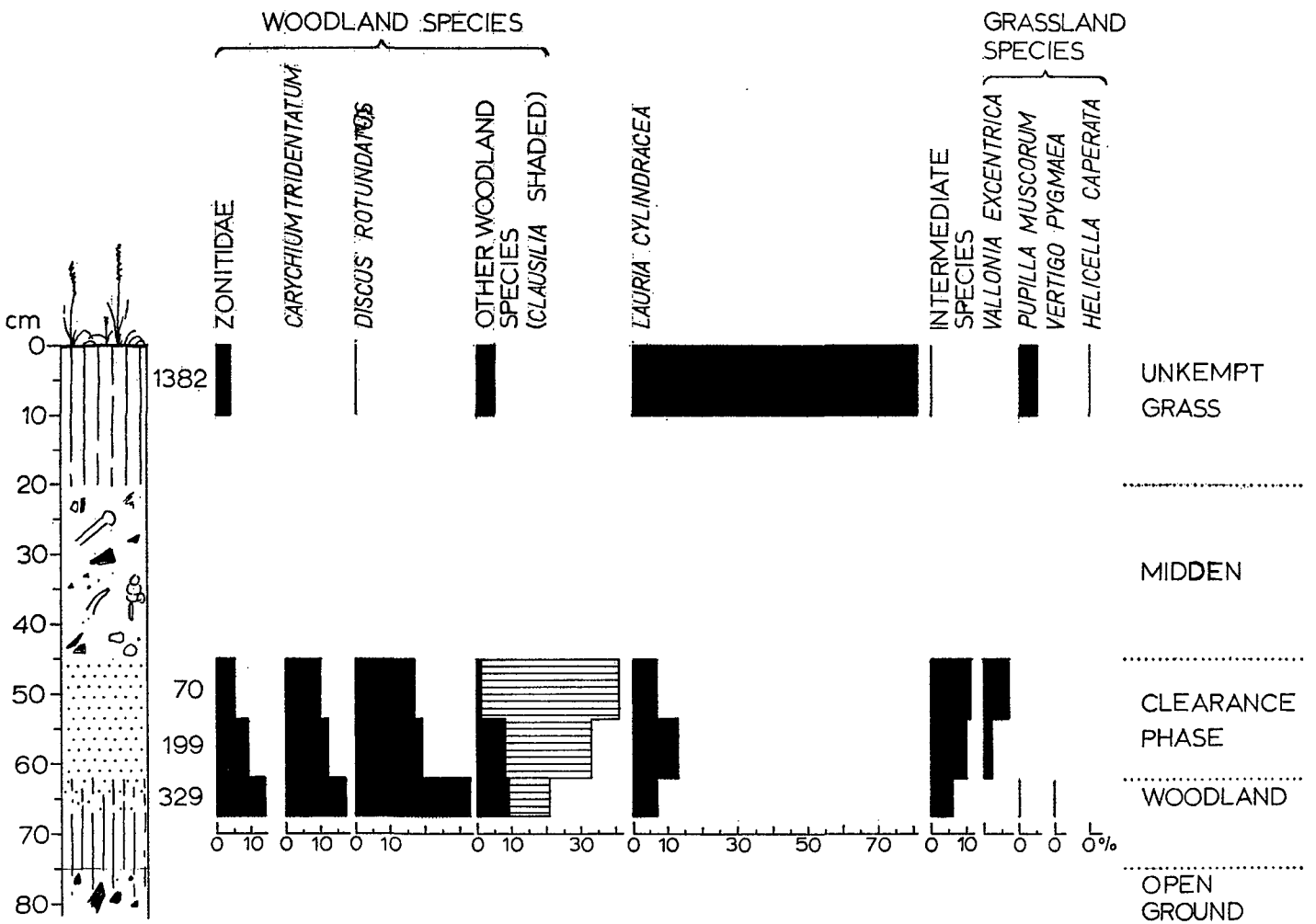

FIG 13 Buckquoy: land snail diagram from cliff section 200 m N of archaeological site

few shells which were extracted (*Clausilia*, 5; *Cochlicopa lubrica*, 1; *Vallonia*, 1) suggest it to be related to the layers below rather than to the top soil.

The topsoil is characterised by the predominance of *Lauria cylindracea*, a reflection, perhaps, of the somewhat more specialised environment of the present day – particularly the absence of woody vegetation – by contrast with that which obtained in the past.

The age of the midden in this section is uncertain, and it is not possible to tie in this sequence with that from the Pre-Norse and Norse archaeological site, though the close proximity of the two suggests that we are dealing with one and the same site. Moreover, a small collection of land snails from Norse phase III (taken from the earth within the limpets and winkles) suggested affinities with the fauna in the blown sand (45–62 cm) rather than with the topsoil (Table 14).

TABLE 14

Buckquoy. Land Mollusca. Norse III is a small sample of earth from marine shells in the archaeological site. All samples, except Norse III, weighed 1·0 kg air dry. + = non-apical fragment; cf. = uncertain identification.

	cm				Norse
	62–67·5	53·5–62	45–53·5	0–10	III
Carychium tridentatum (Risso)	58	25	7	—	—
Cochlicopa lubrica (Müller)	4	4	5	—	—
Cochlicopa lubricella (Porro)	—	5	1	—	—
Cochlicopa spp.	14	9	2	1	—
Columella edentula (Draparnaud)	cf. 2	—	—	—	—
Vertigo pusilla Müller	2	1	—	—	—
Vertigo substriata (Jeffreys)	8	1	—	—	—
Vertigo pygmaea (Draparnaud)	1	—	—	—	—
Pupilla muscorum (Linné)	1	—	—	77	—
Lauria cylindracea (da Costa)	23	26	5	1163	1
Lauria anglica (Wood)	cf. 2	—	—	—	—
Acanthinula aculeata (Müller)	4	+	—	—	—
Vallonia excentrica Sterki	—	4	5	—	—
Clausilia bidentata (Ström)	46	51	28	4	—
Cepaea hortensis (Müller)	1	+	—	—	—
Helicella caperata (Montagu)	—	—	—	1	—
Punctum pygmaeum (Draparnaud)	5	6	—	22	—
Discus rotundatus (Müller)	110	39	12	1	2
Euconulus fulvus (Müller)	1	—	—	—	—
Vitrea contracta (Westerlund)	3	4	—	—	5
Oxychilus alliarius (Miller)	11	5	1	64	5
Retinella pura (Alder)	21	4	3	—	—
Retinella nitidula (Draparnaud)	11	5	—	—	—
Vitrina pellucida (Müller)	1	9	1	49	—
Limacidae	—	1	—	—	—

SUMMARY

The shell-fish debris indicates total dependence on rocky shore species. The limpets were collected throughout the intertidal zone. There is a decrease in the size of the limpets from the Pre-Norse to Norse phases of occupation, possibly due to over-collecting. The quantity of shell-fish is insignificant in terms of bulk in the diet of the occupiers of the site.

Land snails indicate a formerly woodland landscape, with a subsequent phase of deforestation possibly to be associated with early human settlement in the area.

APPENDIX 5

The human bones from Buckquoy, Orkney

by J Hillsdon Smith, Department of Forensic Medicine, University of Edinburgh

LONG CIST BURIAL

This skeleton was poorly preserved and showed disintegration and disappearance of some of the bones comprising the right wrist and hand, right foot and left hand.

Age All the available long bone epiphyses were fully united. The third molar teeth were present on both sides of the upper jaw and on the right side of the lower jaw. The sternum was not fused to the manubrium. There was no lipping of the glenoid cavity. The symphysis pubic characteristics, together with the above findings, suggested an age range of *25–30 years.*

Sex On the basis of pelvic characteristics and the shape and formation of the frontal bones, mastoid processes and orbits of the skull, the skeleton was assessed as being *male.*

Build This was assessed as being *'average'.*

Stature The only intact bone present was the left tibia and its overall length applied to Trotter and Gleser's equations gave a living height of *67–68 inches.*

Teeth These were all healthy and showed only slight wear on their occlusal surfaces.

Other characteristics

Lumbar vertebrae 4 and 5 There was collapse and splitting of the bodies of these vertebrae with consequent 'splaying' of the spine at this level. Lumbar 5 was rotated on 4 and the right side of the body of 5 was eroded.

Right femur The anterior surface of the upper end of this bone bore three, what appeared to be, sinuses. These were (i) on a level with the greater trochanter; (ii) 20 mm below (i); and (iii) in the lower part of the neck of the bone. The edges of these 'sinuses' were smooth and rounded, and the lower part of this portion of the bone (which was separate from the shaft) was also rounded and smooth. The mid-shaft was missing.

Tarsal bones There was marked asymmetry between the tarsal bones of the right and left feet, the former being smaller, distorted and, when re-assembled, giving the appearance of a hyperextension (equinus) deformity.

These characteristics, together, indicate a septic condition of the spine, probably tuberculous in nature, giving rise to a psoas ('cold') abscess and subsequent osteomyelitis of the femur with foot deformity.

The right hand, right foot and left hand There was no feature present to indicate that any of these joints had been amputated. The features were those of soil erosion of bone and natural decay.

Cause of death The likely cause of death at this age, assuming the interpretation of a tuberculous disease is correct, is generalised or miliary tuberculosis with wasting and toxic anaemia.

VIKING-AGE BURIAL, PHASE VI

This was a poorly preserved partial skeleton.

Age All epiphyses of the long bones were united. There was insufficient skull, dental or pelvic material present to enable an age estimate to be made. However, the presence of osteoarthritic 'lipping' of the thoracic vertebrae bodies and the frank osteophytes of the lumbar vertebrae suggest an age in *excess of 40 years.*

Sex On the basis of the shape of the obturator foramen of the pelvis, the digastric groove of the skull and the general bony configuration, the indications are that this is a *male skeleton.*

Stature Measurements of the left ulna, left radius and right humerus, using Trotter and Gleser's formulae give a living height of *5 ft 9 in to 5 ft 11 in.*

Cause of death The fragmentation and decay of the bones of the skull make it difficult to assess the possibility of head injury. However, examination of these fragments showed no clear evidence that there had been any such injury. The findings were more consistent with collapse of the skull due to pressure and decay after burial.

INFANT BURIAL IN HOUSE 1, PHASE 5

The appearances and measurements of these bones are consistent with them being those of a newborn or neonate infant of undetermined sex. The cause of death was not apparent.

MISCELLANEOUS INFANT BONES

The following bones, initially collected together with animal bones from the midden deposits, have been identified by Dr C Oyler (29 Church Road, Longlevens, Gloucester).

Phase V Fragment of an infant's cranium, newborn or earlier; long bone, probably tibia, from newborn or earlier infant; fragments of humerus and probable femur from infant, newborn or earlier.

Phase IV Infant clavicle.

Phase IIib Part of infant's humerus, newborn or earlier.

APPENDIX 6

The ogam inscription on the spindle whorl from Buckquoy, Orkney

by K H Jackson, Department of Celtic, University of Edinburgh

Instead of the normal straight base-line, this feature is engraved as a crude circle, roughly concentric with the central hole. The only other circular ogam inscription known to the writer is that on the symbol stone in the grounds of Logie House, Aberdeenshire, in which case there is no such rational explanation for the circle. Apart from the M, which is clearly diagonal to the base-line, the other strokes are evidently all intended to be at right-angles to it, and therefore to belong to the H, B, or A groups (*aicmi*) of letters. Most are in fact more or less at right-angles to the point where they reach the line, but some are more sloping, as at Logie, due partly to the fact that their direction is related to a circle, not to a straight line; but in no case is there any doubt which *aicme* they belong to. Almost every stroke is quite clearly made out when the whorl is held to a strong light at an angle and examined with a magnifying glass.

Since the base-line is a circle, it is impossible to say where the inscription is supposed to begin, or whether we are to read it from the inside or the outside. However, the x mark described below may be intended as the 'feather-symbol', particularly as there is a slight break in the base-line here, and one end of it curves towards the x. Beginning therefore at this point, and assuming that we are to read from the inside, the following is the transliteration:

1 A small x above the level of the base-line, whose left-hand end before the slight break curves up almost to touch the x. Either the feather-symbol, or the *forfid* for E.

2 Three strokes of the H *aicme*, sloping very diagonally down to the base-line but not crossing it; the gap between the first and second strokes being slightly larger than that between the second and third. Probably T rather than HD.

3 A long, clear stroke passing diagonally down from right to left, clear across the base-line. Unquestionably M.

4 Five strokes at right angles to the base-line and clearly crossing it. Certainly I.

5 Five strokes above the base-line but not crossing it, all very diagonal, the first three close together, the last two further apart at the top but converging in a V on the base-line at the bottom; the first stroke of the five does not reach the base-line but ends up against the upper part of the last stroke of the preceding I. Probably a letter of five strokes, therefore Q, rather than three and two (which would be TD).

6 A single stroke right across the base-line, sloping down diagonally from left to right; the direction of the slope shows it cannot be M, and it must therefore be A.

7 Three strokes below the line but not crossing it, therefore belonging to the B *aicme*; the first sloping extremely upwards diagonally towards the left, the others doing the same but in decreasing order as to slope. This must be V.

8 Four clear strokes in the same position and of the same type and slope, but all parallel and sloping about as much as the third stroke of the preceding letter. The third stroke slightly crosses the base-line. An S.

9 A very clear upright stroke crossing the base-line at right angles, therefore A. It has a sort of long serif at its upper end; compare the similar 'serif' on an A in the inscriptions at Aboyne, Golspie, and Latheron.

10 Two strokes below the line but not crossing it, sloping upwards diagonally towards the left; L.

11 Two more of the same, rather closer together and sloping less, converging slightly towards the bottom but not joining. There is a line running diagonally down from the bottom of the first stroke which/seems to join the two and continues well beyond, but this is apparently a fortuitous scratch. Another L.

12 Four, or perhaps five, strokes above the line but not crossing it, sloping downwards towards the left; the doubtful fifth at a slightly greater angle. Either C or Q.

After this there is a gap with room for one letter of five strokes, before the x is reached again. This gap further supports the view that the inscription begins with the x.

The whole inscription is therefore either TMIQAVSALLC (or TMIQAVSALLQ) or ETMIQAVSALLC (or ETMIQAVSALLQ). Alternatively, if we read the inscription the other way on, looking at it from outside the circle and not from inside, we shall have SDDACTANIMV (or NDDACTANIMV) or ESDDACTANIMV (or ENDDACTANIMV).

The dating of Pictish ogams unaccompanied by decorative motifs is always difficult, but this one has none of the peculiarities such as 'bind-ogams' or fanciful letter-forms which characterise late inscriptions in Scotland, and an 8th-century date, perhaps early rather than late in that century, seems probable. The A with serif would be in keeping with this.

All the readings are wholly unintelligible and cannot be Celtic, but this is of course perfectly familiar in the ogam inscriptions of Pictland, and ours must be simply one more of the fairly numerous ogams in the unidentifiable language used by the Picts for this purpose (Jackson 1955, 138–42, 152–5). In case anyone is tempted to suggest that the possible ETMIQ consists of Latin *et* 'and' and the genitive of the Gaelic word *maq* 'son', the following considerations should be held in mind. First, such an inscription would not begin with 'And'; nor is the presence of a Latin word probable in an inscription on a spindle whorl. By reading something like *Allc et miq Avsa* and assuming that *miq* does mean 'of the son', we might get something like '(of) Allc and of the son of Avsa' (i.e. belonging to these two people with wholly unknown names). But this is pretty nonsensical, nor is a spindle whorl likely to announce that it belongs to a man, even if 'Allc' were his wife. In any case *miq* cannot be the genitive of *maq*. It is true that this Gaelic word does seem to occur, in the form *maqq* or *meqq*, in five other Pictish inscriptions (Jackson 1955, 140), and though the *q* for the *c* expected at this date is very archaic this can probably not be held to be an objection, since it could well be due to deliberate archaisation on the part of the engravers. The objection is of a different kind, and it is insuperable: the genitive of *mac* 'son' was *maic* in Old Irish, sometimes *meic* or *mec*, and *meic* or *mec* in early Middle Irish. The still later form *mic*, which is also the modern one in Irish and Scottish Gaelic, did not appear until the late 11th century at the earliest; and moreover it was apparently unknown in Scotland till even later, since the Gaelic texts in the Book of Deer, hailing from Buchan in the middle of the 12th century, have exclusively *meic* or *mec*, never *mic*. We must be content to write off this inscription as unintelligible, like all the other 'Pictish' inscriptions.

APPENDIX 7

Chalk spindle-whorls from Buckquoy, Orkney

by G H Collins, Institute of Geological Sciences, Edinburgh

Three spindle-whorls were identified by macroscopic examination:

No. 83 A fine-grained cream coloured limestone, weathering white and powdery. It contains broken fossil shell fragments, unidentifiable, but almost certainly from lamellibranchs.

No. 84 A fine-grained cream coloured sandy limestone, with quartz grains up to 0·5 mm in diameter.

No. 85 A fine-grained cream coloured limestone with a few rounded quartz grains, about 0·25 mm in diameter.

The three spindle-whorls are made from a closely similar rock type, varying only in detail. This rock-type is not to be found *in situ* in Orkney, but it can be reasonably well matched with chalk erratics to be found in the boulder clay of both Orkney and the mainland of Scotland. We have a specimen from South Ronaldsay (MC 3285), reputedly of Cretaceous chalk, which matches your specimens 84 and 85 quite well. We also have a specimen from Moreseat Farm, southwest of Peterhead (MC 3286) which is a shelly cream coloured limestone comparing favourably with no. 83.

It has long been believed that Mesozoic rocks are to be found in the Moray Firth and in the North Sea south of Orkney. Recently our Continental Shelf Unit obtained samples of chalk from the Moray Firth. These are cream coloured fine-grained limestones, with occasional quartz grains. One specimen is quite sandy, having quartz grains up to 2 mm diameter. In addition, I have compared the spindle-whorls

with specimens from the Daneian chalk in the Royal Scottish Museum. The Daneian chalk does not occur in the British Isles, and is the uppermost part of the chalk. Your specimens compare favourably with the matrix of two fossil specimens (RSM cat nos 1911.5.12894, and 1911.5.12919) from Faxe, Denmark. However, from my inspection of the chalk specimens mentioned above, I believe that the spindle-whorls could well have been made from chalk pebbles, obtained from local glacial deposits.

APPENDIX 8

The bronze ringed pin from Buckquoy, Orkney

by Thomas Fanning, National Parks and Monuments Branch, Office of Public Works, Dublin

The pin is a fine well-preserved specimen, the upper shank circular in cross-section, the lower shank assuming a rectangular cross-section and tapering to a point which is slightly curved. This portion is decorated on its broad faces with an incised step pattern delimited by two vertical lines and on the minor faces with a double vertical line. The polyhedral head has outlined lozenge-shaped panels ornamented with a simple interlaced knot on one side and a saltire motif on the other. It is pierced to take the narrow grooved terminals of the circular-sectioned ring which also bears light grooving at two places along its circumference. The ring is now fixed in the pin-head through corrosion but originally it would have swivelled freely. Length 171 mm; thickness of shank 5 mm; width of head 9 mm; thickness of head 6·4 mm; external diameter of ring 2·05 mm; thickness of ring 5 mm.

The Buckquoy pin belongs to a type of dress-fastener usually referred to as a ringed pin or ring-pin, which can be divided into a number of classes and subdivisions on the basis of the ring and pin-head form (Fanning 1969; 1975). This specimen clearly belongs to the plain-ringed, polyhedral-headed variety which have a relatively long pin with a small close-fitting ring held in a facetted head. Ornamentation, when present, is typified by the example under discussion – the interlaced knot and saltire motif on the pin-head and the step-pattern on the lower shank. Also characteristic is the grooving on the ring, particularly where it enters the pin-head giving it a slight zoomorphic appearance.

Although this type of ringed pin is of frequent occurrence in the areas settled by the Vikings of Norse origin the majority of the Irish examples and a number of the Scottish pins were recovered from native Celtic sites. Close parallels for both the form and ornament of the Buckquoy pin can be cited from Lochlee crannog, Ayrshire (Munro 1882, 131, fig 144) and Lagore crannog, Co Meath (Hencken 1950, 72, fig 14, 1430). Both these pins have small close-fitting rings with outer surfaces slightly grooved. The Lochlee specimen is decorated with the three motifs found on the Buckquoy pin – the angular interlaced knot, outlined saltire and step-pattern – while the Lagore pin has the interlaced knot design. Unfortunately, neither pin can provide any help as to dating, lacking as they do associations and stratification. Two further parallels, in Limerick City Museum, although unprovenanced, are also worthy of mention as they share the same decorative designs as the Buckquoy pin (Fanning 1969, 10, fig 1, 3, 4). However, a small polyhedral-headed pin from a ringfort at Lissue, Co. Antrim, was found in a level dated by the excavator to the 10th century, largely on the evidence of a slate trial-piece which contained, amongst other designs, a number of attempts at an interlaced knot (Bersu 1947, 50, fig 10, no. 1, fig 11, pl 1).

Comparative examples from Viking sites are more helpful with regard to dating. The Skaill hoard, Orkney, deposited *c* AD 950, contains a silver pin of this type decorated with a lightly incised step-pattern. This pin has been incorrectly listed as a fish-hook (Grieg 1940, 129, no. 49, fig 59; *Proc Soc Antiq Scot*, 3 (1857–60), 249, no. 49). Another, undecorated, bronze pin from Jarlshof, Shetland, was found in a midden dated by the excavator to 10th-century Viking levels (Hamilton 1956, 152, no. 35, pl XXIX, 4). A number of male Viking graves provide us with similar dating, in particular, three burials from the Isle of Man each of which contained a ringed pin in fragmentary condition but undoubtedly of this form. These graves are dated to within the century AD 850 to 950 (Bersu and Wilson 1966, 43, 62, 79, 87, pls VIII, e, XII, d, XIV, c). A floruit, therefore, in the 10th century is acceptable for this type and is strengthened by the association with the Buckquoy pin of a silver penny of Eadmund I (940–6). In at least two of the Manx graves there was clear evidence to indicate that the pin had been used to fasten the woollen cloak in which the man's body had been dressed and it is reasonable to suppose that such also was the case at Buckquoy (Bersu and Wilson 1966, 50, 68).

The Viking settlements in the Faeroes, Iceland and indeed North America have yielded pins of this

type. The majority of the Icelandic pins are polyhedral-headed (Eldjàrn 1956, fig 140) and the pin discovered in the excavations at L'Anse aux Meadows, Newfoundland, is an undecorated example of this form with a small worn pin-head (Ingstad 1970, 134, 135, fig 29). Probably one of the best parallels for the Buckquoy pin comes from a female grave in a Viking burial mound at Tjørnuvik in the Faroes. This pin is decorated with an interlaced knot motif and still retains a portion of the cord used to secure the fastening (Dahl and Rasmussen 1956, figs 6–8). Its occurrence here in the Faroes and the examples from Iceland may possibly represent a link with settlers of Hiberno-Norse origin, or, more likely, Viking trade along the Atlantic sea-route from centres such as Dublin (Ó Ríordáin 1971, 76). The absence of this form from the Scandinavian homelands highlights the Hiberno-Scottish associations and this assumes additional importance when one considers the evidence of the 10th-century Hiberno-Norse coin hoards which indicates that the Vikings in Ireland, by that century, looked no further than Scotland and the Western Isles for support in their campaigns (Dolley 1966, 18).

Finally, the origin of the plain-ringed polyhedral-headed form is bound up with the development of the ringed pin series as a whole. In Ireland, a number have been found on sites dated to pre-Viking times and it would seem likely, therefore, that the type was adopted by the Vikings, probably during the second half of the 9th century. The form became increasingly popular as new markets opened up and the employment of designs such as the interlaced knot and step-pattern probably sprang from this exchange and contact between Irish, Viking and perhaps late Saxon workshops (Bersu 1947, 50).

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REFERENCES

Addyman, P 1976 'Archaeology and Anglo-Saxon society', *in* Sieveking, G de G, Longworth, I H and Wilson, K E (eds), *Problems in economic and social archaeology*, London, 309–22.

Anderson, J 1873 'Notice of the excavation of the brochs of Yarhouse – in Caithness', *Archaeol Scot*, VI (1873), 131–98.

Anderson, J 1883 *Scotland in Pagan Times: Iron Age*. Edinburgh.

Anderson, J 1901 'Notices of nine brochs along the Caithness coast from Keiss Bay to Skirza Head excavated by Sir Francis Tress Barry', *Proc Soc Antiq Scot*, 35 (1900–1), 112–48.
Anderson, A O and Anderson, M O (eds) 1961 *Adomnan's Life of Columba.*
Alcock, L 1963 *Dinas Powys.* Cardiff.
Almqvist, B O and Greene, David (eds) *Proceedings of the Seventh Viking Congress, Dublin, 15–21 August 1973.* Dublin.
Bergquist, H and Lepiksaar, J 1957 *Medieval animal bones found in Lund.* Lund.
Bersu, G 1947 'Excavations at Lissue', *Ulster J Archaeol*, 10 (1947), 30–58.
Bersu, G and Wilson, D M 1966 *Three Viking Graves in the Isle of Man.* London.
Blomqvist, R and Martensson, A W 1963 'Thulegravningen 1961'. *Archaeologica Lundensia*, II (1963). Lund.
Boyd, J M, Doney, J M, Gunn, R G and Jewell, P A 1964 'The Soay sheep of the island of Hirta, St Kilda. A study of a feral population', *Proc Zool Soc Lond*, 142 (1964), 129–63.
Bramwell, D 1977 'Bird bone', *in* Clarke, H and Carter, A, *Excavations in King's Lynn, 1963-70*, London, 399-402.
Brothwell, D and Brothwell, P 1969 *Food in Antiquity.* London.
Calder, C S T 1939 'Excavations of iron age dwellings on the Calf of Eday, Orkney', *Proc Soc Antiq Scot*, 73 (1938–9), 167–85.
Chaplin, R E 1971 *The study of animal bones from archaeological sites.* London.
Charleson, M M 1904 'Notice of some ancient burials in Orkney', *Proc Soc Antiq Scot*, 38 (1903–4), 559–66.
Childe, V G 1931 *Skara Brae.* London.
Coles, J M 1971 'The early settlement of Scotland: excavations at Morton, Fife', *Proc Prehist Soc*, 37 (1971), 284–366.
Corbet, O 1961 'Origin of the British insular races of small mammals and of the 'Lusitanian' fauna', *Nature*, 191 (1961), 1037-40.
Crawford, I A 1973 *Excavations at Coileagean an Udail (The Udal), N Uist*, 10th interim report. Christ's College, Cambridge.
Crawford, I A 1974 'Scot (?), Norseman and Gael', *Scot Archaeol Forum*, 6 (1974), 1–16.
Cruden, S 1965 'Excavations at Birsay, Orkney', *in* Small, A (ed), *Fourth Viking Congress*, 22–31.
Curle, A O 1939 'A Viking settlement at Freswick, Caithness', *Proc Soc Antiq Scot*, 73 (1938–9), 71–110.
Dolley, R H M 1966 *The Hiberno Norse Coins in the British Museum.* London.
Dunbar, J G 1966 *The historic architecture of Scotland.* London.
Eldjárn, K 1948 'Eyðibyggð a Hrunamannaa fretti', *Arbok hins islenzka fornleifafelags*, (1943–8), 1–43.
Eldjárn, K 1956 *Kuml og Haugfe ur heidenum sio a Islandi.* Reykjavik.
Elwes, J 1912 'Notes on primitive breeds of sheep in Scotland', *Scottish Naturalist*, (1912), 1.
Epstein, H 1971 *Origins of the domestic animals of Africa.* London.
Evans, J G 1972 *Land snails in Archaeology.* London.
Ewart, J C 1913 'Domestic sheep and their wild ancestors', *Trans Highland Scot Agric Soc*, 25 (1913), 160.
Fanning, Thomas 1969 'The bronze ringed pins in the Limerick City Museum', *North Munster Antiq J*, 12 (1969), 6–11.
Fanning, Thomas 1975 'Some bronze ringed pins from the Irish Midlands', *J Old Athlone Soc*, 1 (4) (1974–5), 211–17.
Fenton, A 1973 'Craig-fishing in the northern isles of Scotland', *Scot Stud*, 17 (1973), 71–80.
Forde, D 1954 *African Worlds.* Oxford.
Graham-Campbell, J A 1976 'The Viking-age silver and gold hoards of Scandinavian character from Scotland', *Proc Soc Antiq Scot*, 107 (1975–6), 114–35.
Grant, W G and Callander, J G 1934 'The broch of Midhowe, *Proc Soc Antiq Scot*, 68 (1933–4), 444.
Grieg, S 1940 'Viking antiquities in Scotland', *in* Shetelig, H (ed), *Viking Antiquities in Great Britain and Ireland*, Oslo, vol II.
Goodier, R (ed) 1975 *The Natural environment of Orkney.* Edinburgh.
Hamilton, J R C 1956 *Excavations at Jarlshof, Shetland.* Edinburgh.
Hamilton, J R C 1968 *Excavations at Clickhimin, Shetland.* Edinburgh.
Hencken, H O'N 1938 *Cahercommann: A stone fort in County Clare.* Dublin.

Hencken, H O'Neill 1950 'Lagore Crannog: an Irish royal residence of the 7th to 10th centuries A.D.', *Proc Roy Irish Acad*, 53c (1950), 1–247.

Higgs, E S and Waite, J P 1963 'Autumn killing', *Antiquity*, 37 (1963), 274.

Ingstad, A S 1970 'The Norse settlement at L'Anse aux Meadows, Newfoundland. A preliminary report from the excavations 1961–8', *Acta Archaeol*, 41 (1970), 109–54.

Isaac, G 1971 'Diet of early man: aspects of archaeological evidence from Lower and Middle Pleistocene sites in Africa', *World Archaeol*, 2 (1971), 278.

Jackson, K H 1955 'The Pictish language', *in* Wainwright, F T (ed), *The Problem of the Picts*, Edinburgh, 129–60.

Jones, A M 1975 'The marine environment of Orkney', *in* Goodier 1975, 85–94.

Kaland, S H H 1973 'Westnessutgravningene pa Ronsay, Orknøyene', *Viking*, 37 (1973), 77–102.

Kendrick, T D 1933 'A gaming board of the Viking period found in Ireland', *Acta Archaeol*, 4 (1933), 85.

Lea, David and Bourne, W R P 1975 'The birds of Orkney', *in* Goodier 1975, 98–121.

Lethbridge, T C 1952 'Excavations at Kilphedir, South Uist, and the problem of brochs and wheel-houses', *Proc Prehist Soc*, 18 2 (1952), 176–93.

Long, C 1975 'Excavations in the medieval city of Trondheim, Norway', *Medieval Archaeol*, 19 (1975), 1–32.

Low, D M 1846 *On the domestic animals of the British Isles*. London.

MacGregor, A 1974 'The Broch of Burrian, North Ronaldsay, Orkney', *Proc Soc Antiq Scot*, 105 (1972–4), 63–118.

MacLaren, A 1974 'A Norse house on Drimore Machair, South Uist', *Glasgow Archaeol J*, 3 (1974), 9–18.

Marwick, H 1970 *The place-names of Birsay*. Aberdeen.

Megaw, Basil 1976 'Norseman and native in the Kingdom of the Isles. A reassessment of the Manx evidence', *Scot Stud*, 20 (1976), 1–44.

Munch, G S 1966 'Gardshanger i Nord-Norge', *Viking*, 30 (1966), 25–59.

Munro, R 1882 *Ancient Scottish Lake Dwellings or Crannogs*. Edinburgh.

Naroll, R 1962 'Floor area and settlement population', *American Antiquity*, 27, 4 (1962), 587–9.

Nicolaisen, W F H 1969 'Norse settlement in the Northern and Western Isles', *Scot Hist Rev*, 48 (1969), 6–17.

Noddle, B A 1973 'Determination of the body weights of cattle from bone measurements', *in* Matolcsi, J (ed), *Domestikationsforschung und Geschichte der Haustiere*, Budapest, 377–89.

Ó Ríordáin, Breandan 1971 'Excavations at High Street and Winetavern Street, Dublin', *Medieval Archaeol*, 15 (1971), 73–85.

Padel, O J 1972 *Inscriptions of Pictland*. Unpubl thesis, University of Edinburgh.

Radford, C A R 1962 'Art and architecture: Celtic and Norse', *in* Wainwright, F T (ed), *The Northern Isles*, Edinburgh, 163–87.

Ritchie, A 1972 'Painted pebbles in early Scotland', *Proc Soc Antiq Scot*, 104 (1971–2), 297–301.

Ritchie, A 1974 'Pict and Norseman in Northern Scotland', *Scot Archaeol Forum*, 6 (1974), 23–36.

Roussell, A 1936 'Sandnes and the neighbouring farms', *Meddelelser om Grønland*, 88, 2 (1936).

RCAMS 1946 Royal Commission on the Ancient and Historical Monuments of Scotland, *Inventory of the Ancient Monuments of Orkney and Shetland*. Edinburgh.

Ryan, M 1973 'Native pottery in early historic Ireland', *Proc Roy Irish Acad*, 73, c, 11, (1973), 619–45.

Ryder, M L 1968 'Evolution of Scottish breeds of sheep', *Scot Stud*, 12 (1968),

Ryder, M L and Stephenson, S K 1968 *Wool Growth*. London.

Shawcross, W 1967 'An investigation of prehistoric diet and economy on a coastal site at Galatea Bay, New Zealand', *Proc Prehist Soc*, 33 (1967), 107–31.

Silver, I A 1963 'The aging of domestic animals', *in* Brothwell, D and Higgs, E (eds), *Science in Archaeology*, London, 250–68.

Skaare, K 1976 *Coins and Coinage in Viking-age Norway*. Oslo.

Small, A 1966 'Underhoull, Unst, Shetland', *Proc Soc Antiq Scot*, 98 (1964–6), 225–48.

Spencer, P J 1975 'Habitat change in sand-dune areas', *in* Evans, J G, Limbrey, Susan and Cleere, Henry (eds), *The effect of man on the landscape: the Highland zone*, London (CBA Research Report no. 11), 96–103.

Stenberger, M 1943 *Forntida Gardar i Island*. Copenhagen.

Stenberger, M 1961 'Das graberfeld bei Ihre im Kirchspiel Hellvi auf Gotland', *Acta Archaeol*, 32 (1961), 1–134.
Sterckx, C 1970 'Les jeux de damiers celtiques', *Annales de Bretagne*, 77 (1970), 597–609.
Sterckx, C 1973a 'Les trois damiers de Buckquoy (Orcades)', *Annales de Bretagne*, 80 (1973), 675–89.
Sterckx, C 1973b 'Les jeux de damier celtiques', *Etudes Celtiques*, 13 (1973), 733–49.
Stevenson, R B K 1951 'A hoard of Anglo-Saxon coins found at Iona Abbey', *Proc Soc Antiq Scot*, 85 (1950–1), 170–5.
Stevenson, R B K 1955 'Pins and the chronology of the brochs', *Proc Prehist Soc*, 21 (1955), 282–7.
Thomas, C 1963 'The interpretation of the Pictish symbols', *Archaeol J*, 120 (1963), 31–97.
Wainwright, F T 1962 'Picts and Scots', *in* Wainwright, F T (ed), *The Northern Isles*, Edinburgh, 91–116.
Walker, C 1964 'Growth and development of meat qualities in Angoni cattle', *J Agric Sci Camb*, 63 (1964), 155.
Waterman, D M 1959 'Late Saxon, Viking and early medieval finds from York', *Archaeologia*, 97 (1959), 59–105.
Watt, W G T 1882 'Notice of the broch known as Burwick or Borwick – Orkney', *Proc Soc Antiq Scot*, 16 (1881–2), 442–50.
Watt, W G T 1888 'Notice of the discovery of a stone cist – at Skaill Bay', *Proc Soc Antiq Scot*, 22 (1887–8), 283–5.
Wheeler, A 1969 *The fishes of the British Isles and north-west Europe*. London.
Wheeler, A and Jones, A 1976 'Fish remains', *in* Rogerson, A 'Excavations on Fuller's Hill, Great Yarmouth', *East Anglian Archaeol*, report no. 2, Norfolk, 208-24.
Wilson, D M 1971 'The Norsemen', *in* Menzies, G (ed), *Who are the Scots*? London, 103–13.
Wilson, G V, Edwards, W, Knox, J, Jones, R C B and Stephens, J V 1935 *The Geology of the Orkneys*. Mem Geol Survey Great Britain, Edinburgh.
Wilson, J 1910 *Evolution of British Cattle and the formation of breeds*. London.
Young, A and Richardson, K M 1960 'A Cheardach Mhor, Drimore, South Uist', *Proc Soc Antiq Scot*, 93 (1959–60), 135–73.

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a Cells of house 6

b House 6

a House 5, partially overlain by house 4 in foreground

b Hearth of house 5 with notched end-slab

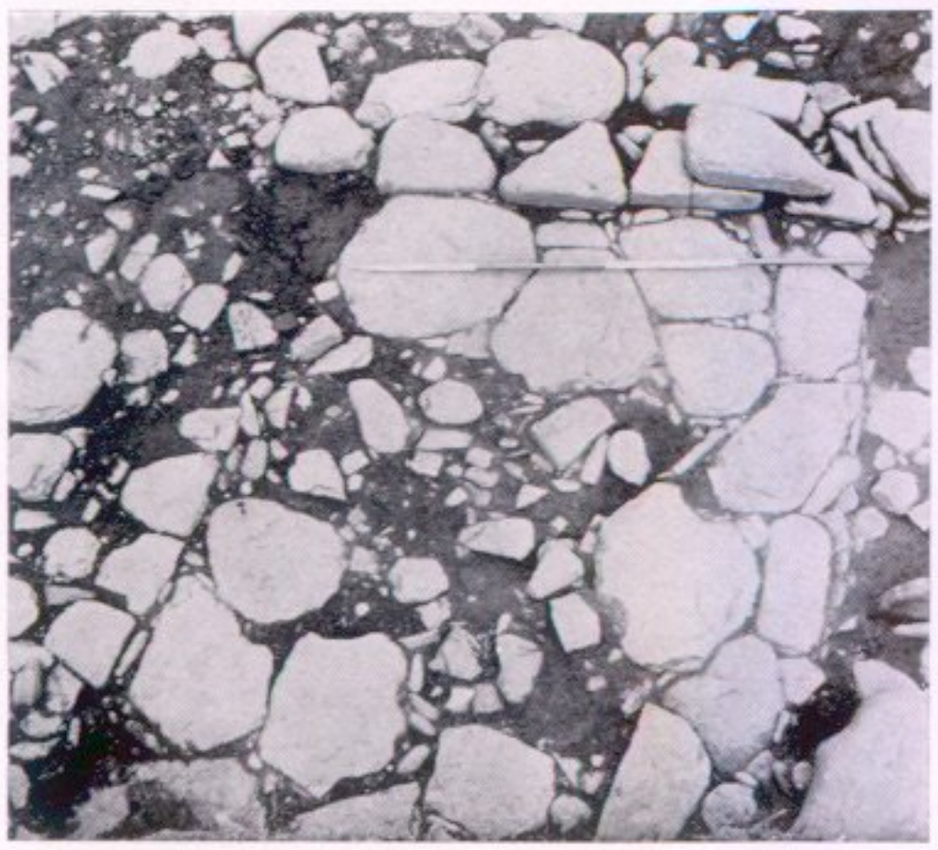
House 4 from SE

a Secondary paving in house 4

b Long cist

c Long cist burial

a Norse byre, house 3

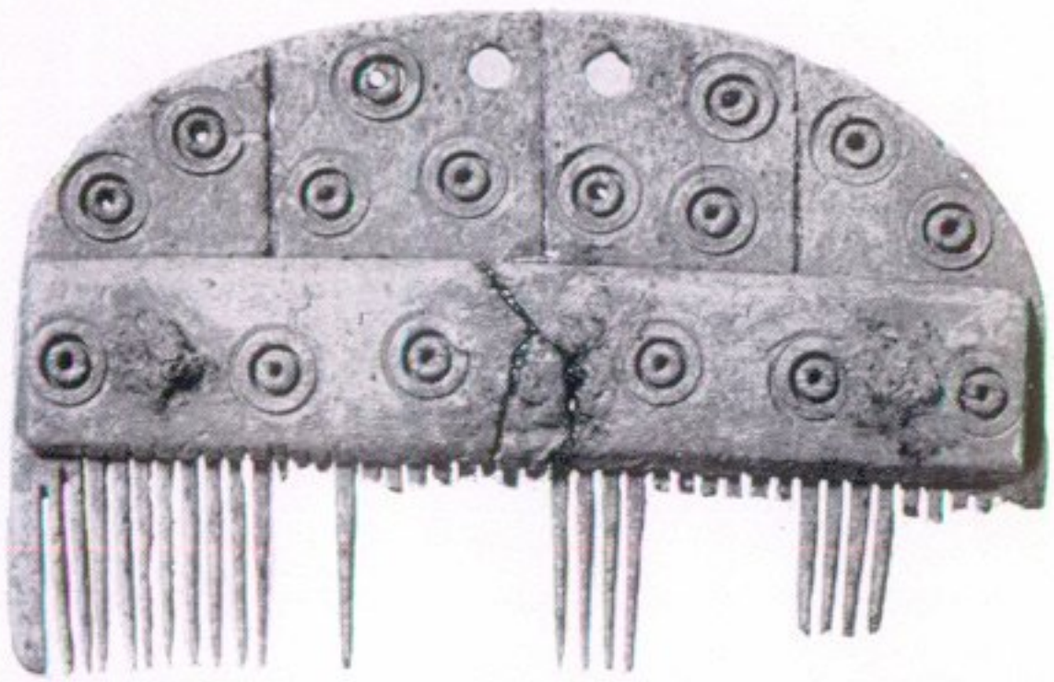


b Norse barn, house 2

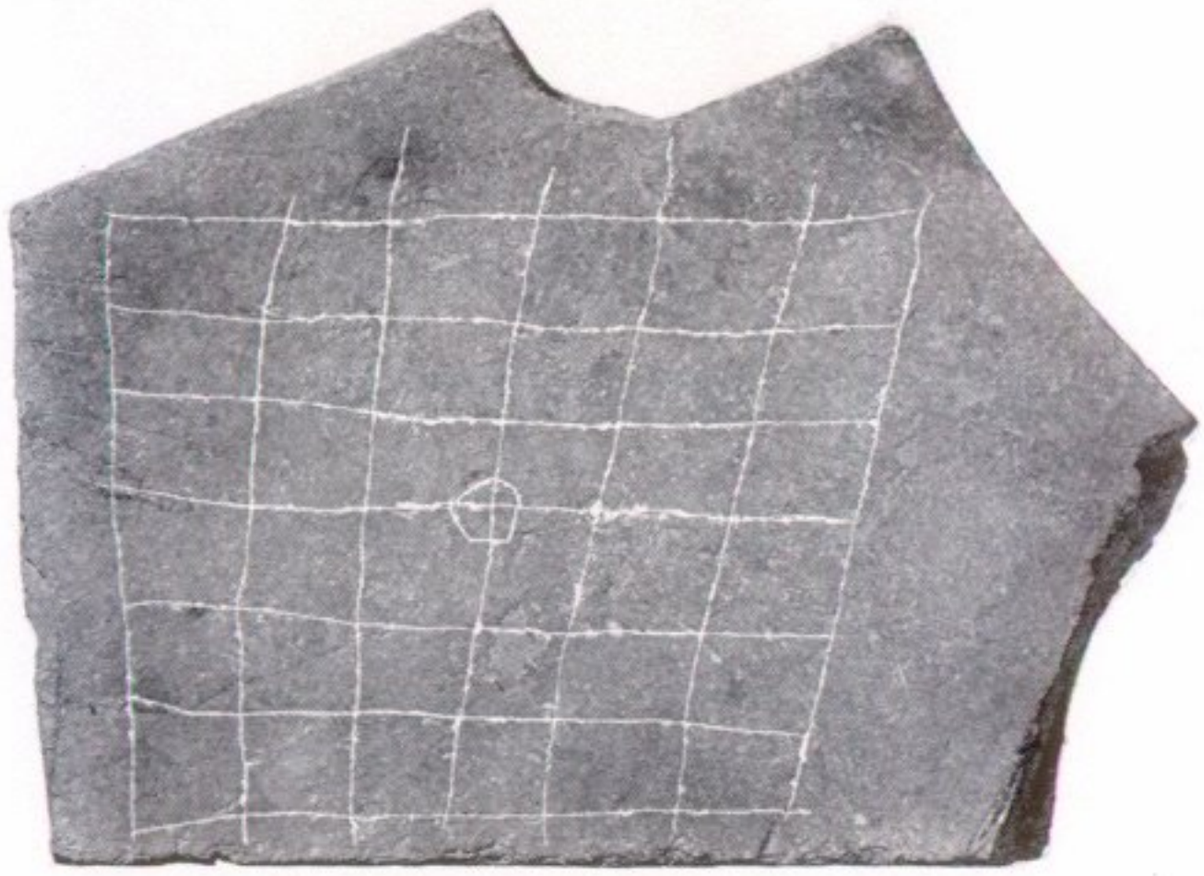
c Paving and yard wall outside Norse house 1

d Paving inside blocked entrance into Norse house 1

a Ogam-inscribed spindle whorl, no. 84 (Institute of Geological Sciences photograph published by permission of the Director; NERC copyright)



b Bone comb, no. 47



c Stone gaming-board, no. 90

Grave-goods from Norse burial, phase VI (scale 4 : 5)