HORACE FAIRHURST

EXCAVATIONS AT CROSSKIRK BROCH, CAITHNESS

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PREFACE AND ACKNOWLEDGEMENTS

Informal discussions about a rescue excavation at the Crosskirk broch began in 1961 when the Inspectorate of Ancient Monuments in Scotland realised the need for action before the site became dangerous. It was agreed to organise operations from the Archaeology Department at the University of Glasgow. The first major effort was planned for 1966. Reconnaissance had given little indication of the vast amount of rubble which was subsequently found to mantle the broch itself, nor of the existence of an external settlement and rampart. In all, five seasons were spent on the site between 1966-1972, amounting to some fifteen weeks. The work force varied considerably in size but reached fifty at peak periods.

Access for mechanical earth-movers, huts and heavy equipment was rather uncertain over disused field tracks, which formed the only feasible route. Fortunately, day-to-day access was made much easier by courtesy of the commanding officers at the nearby American Naval Station who allowed us to use their private road. We were uniformly fortunate, too, with the operators of the mechanical equipment.

Weather conditions had been regarded as an almost certain handicap, but in fact there was little heavy rain throughout. Drizzle was a hindrance and the wind was normally troublesome: it could become extremely strong and even violent upon occasion.

ACKNOWLEDGEMENTS

First and foremost a tribute must be paid to the co-director of excavations on the site, Mr David B Taylor. His help, especially in day-to-day organisation, was invaluable, and indeed the investigations would not have been contemplated without his aid. We discussed, at great length, procedure, methods and interpretation, and subsequently his interest and comments on the text of the report are to be fully acknowledged. Nevertheless, the final text is my personal responsibility and mine alone.

Miss Dorothy Marshall was responsible throughout for the record of the finds and for packaging them for transport. The plans and sections were the work of Miss Lesley Ketteringham aided by Miss Jean Forbes, except for the general survey of the site which was undertaken by Mr Leslie Hunter.

The majority of the labour force consisted of amateurs many of whom had helped us on other sites and who could be relied upon for intensive work and sustained enthusiasm. In addition, there was a contingent of students from the Department of Archaeology in the University of Glasgow, and Mr Taylor brought a number of selected senior pupils from the Morgan Academy, Dundee. It is a great pleasure to recall that extraordinarily good relations existed throughout in spite of very different backgrounds and age groups. I am grateful to all who worked on the excavations on that exposed site with unfailing cheerfulness and an interest which was an inspiration.

The various specialist reports are included in the body of the text and have not been treated as appendices. It is a great pleasure to record my personal appreciation of the co-operation of each of the contributors.

Consultation and advice from so many friends and colleagues in what has been a prolonged period, make it impossible to thank each individually. However, I must record in particular the assistance of the following, often given over a number of years:

The Inspectorate of Ancient Monuments in Scotland and especially Mr Ian MacIvor, Mr Roy Ritchie and latterly, Dr David Breeze.
Mrs Margaret Scott for her care in drawing the artifacts.
Professor H W Wilson and Dr D D Harkness, Scottish Universities Research and Reactor Centre, for the radiocarbon dates.
University of Glasgow, Department of Topographic Science, for reproduction of the photographs and plans.
Dr E W MacKie, for conservation of the bronzes and storage of the artifacts in the Hunterian Museum, University of Glasgow.
The Department of Agriculture, Caithness Office, for permission to excavate.
The American Naval Station, through its Commanding Officers, for access to the site and many favours with equipment.
Mr Donald Carmichael for valuable help with public relations in Caithness.

ACKNOWLEDGEMENTS FOR THE ILLUSTRATIONS

I am grateful to the individuals mentioned above, and to Mr T Borthwick, who assembled some of the plates for the line drawings of artifacts in this report. The graphs were prepared by Mr P Glennie. The majority of the site drawings were prepared for publication in the Departments of Archaeology and Topographic Science, University of Glasgow.

With the exceptions of Ills *1* and *3,* specifically acknowledged in their captions, the site photographs were all taken by the author and are Crown Copyright reserved. The small finds photographs, and those illustrating the specialists' contributions, were taken by the Departments of Anatomy, Archaeology, Botany and Veterinary Anatomy in the University of Glasgow.

Finally, I would wish to record formally my deep appreciation of the financial help, which was available to me through the Court, and of the sustained support of so many of my colleagues in the University of Glasgow until my retirement in 1973.

Horace Fairhurst
Lamlash
1979

EDITORIAL NOTE

The submission of this report to the Inspectorate of Ancient Monuments took place in mid-1979. Part of the ensuing delay in publication resulted from the need to reduce the illustrative content of the report in the interests of economy, and to archive some of the more detailed anatomical measurements. All this material, as well as a copy of the author's typescript, and the primary site archive, can be consulted on application to the Hunterian Museum, in the University of Glasgow.

Readers' attention is drawn to the fact that the scales used in the photographs in this report are in Imperial units.

Ian Ralston.

ILLUSTRATIONS

TABLES

SUMMARY

The site lay on the edge of the sandstone cliffs of a narrow headland on the northern coast of Caithness (ND 025701). Immediately outside this point is the cemetery wall and ancient chapel of St Mary, the Crosskirk. Traces of the wall of a broch were clearly visible on the seaward side of a grassy mound. Immediately below, the sea was undercutting the cliff deeply and erosion had already led to the collapse of a sector of the outer face of the wall. As preservation was deemed impossible, excavation began in 1966, under the auspices of the Inspectorate of Ancient Monuments in Scotland.

On excavation, the site proved to be more complex than anticipated. Major elements of the occupation sequence, including the substantial remains of the defences of a pre-broch fort, and an external settlement related to the broch, were completely masked by the turf of the headland. The operations provided a task far greater than was originally contemplated and field work continued in seasons of three to four weeks until 1972 with a workforce which had grown to fifty.

The report examines the environmental conditions presented by the Old Red Sandstone plain of Caithness where the number of known and suspected broch sites amounts to nearly one hundred and fifty. The Crosskirk site is one of three in close proximity, and both the regional and local concentrations receive a preliminary consideration.

The history of the site's use is dealt with chronologically. The dry-stone wall of the pre-broch fort was penetrated by an entrance passage with door checks and bar-hole. A cell, not unlike a guard chamber, was also present. Further across the headland, this defence appears to have been no more than a barrier of erect flagstones. Associated pottery contrasted markedly with that of the succeeding broch period.

In plan, the broch fitted the normal Caithness pattern with a thick wall and no ground level gallery, but the entrance passage (with its associated guard cell), the intra-mural cell and the stair entry were all crowded together into one third of the perimeter. There was no evidence either of a scarcement or of a gallery which could have been expected at the height attained by the inner wall face and the highest parts of the wall as a whole. Inside the broch, a radial pattern was traceable amid the paving slabs of the earliest floor, marking the position of what had been upright flagstones. There was a central hearth, several slab-sided boxes and a rock-cut well close to the stair entry. The rubbish indicated domestic occupation from the beginning, but considerable alterations in the lay-out had been made during what appears to have been a long occupation. Partly the changes were due to a major collapse of the inner wall face which blocked the entrance of the intra-mural cell. At a late period, the interior was re-organized around a new central hearth. The presence of samian sherds suggests a date in the second century AD for this re-organization.

The broch wall proved to be very unstable. In one short sector it had been breached and robbed down to the foundation slabs, but elsewhere it reached a height of as much as four to five metres, preserved by its own debris. Instability was largely due to structural defects as the core between the original facings of sandstone slabs consisted of earth, stone, boulders and even domestic refuse. Extensive collapse of the wall faces had occurred repeatedly during the occupation, especially along the outer face. This had been shored up by a supporting "skin" of carefully laid slabs, in which two or even three phases of repair could be recognized. The external settlement was not completely examined. Trenching showed that buildings were confined to the headland E to the cliff and S to the wall of the pre-broch fort. Owing to the scale of operations involved, excavation was concentrated on the area nearest to the broch and a good third of the area is untouched. Superimposition of dry-stone walling, earth floors and pavements indicated four or five phases of quite major reconstruction, but the precise lay-out at any one period was difficult to determine. At an early stage in the excavations in the settlement, an extraordinary passage was found to project from the broch entrance as far

as an area of paving beyond the entrance in the pre-broch wall, a distance of some twenty metres. This passage had been extended in at least three periods. In its final form, dated to the second century AD, it can have had no military significance whatsoever. The general appearance and some minor features suggested a souterrain. Underneath, older domestic enclosures, extending up to the broch wall, were examined. In an oval building E of the broch, an aged cripple had been buried in a sitting position beside a hearth.

The broch itself was becoming ruinous before the late reconstructions in the settlement, and over the centuries it became a cairn-like mound formed of its own debris. A Pictish symbol stone has been reported from Crosskirk, but the only evidence from the site at that period seems to consist of two long-cist burials overlying the remains of the settlement.

Judged by some broch sites, the artifacts recovered were not abundant in view of the scale of the operations, although the collection is fully representative of the earlier broch period. The bronzes were badly corroded but included several pins, fragments of spiral finger rings and part of a small bowl. Iron slag was encountered but no iron tools. Several beads were found and a pendant of amber. A stone lamp was recorded as well as a painted pebble and a stone ball. Both saddle- and rotary-querns were recovered, but the latter type was more commonly represented. Apart from a broken toilet comb, the bonework was of no particular merit though it was well preserved. The local pottery occurred in quantity and a marked change in fabric took place in the later broch period.

Specialist reports indicate that cattle, sheep and pigs were reared, that shell-fish were collected in quantity, and that barley was grown. Other contributions to diet came from fowling, fishing and the collection of wild produce. Other reports deal with the human skeletal material, and the significance of the set of radiocarbon dates from the site.

A general review of the excavation and the material it produced concludes the report. In the writer's opinion, taking into account the structural evidence and the sequence of radiocarbon dates, the Crosskirk broch is probably an early example of the type. It did not attain the height of the tower-like brochs such as Mousa. A date around 200 BC is suggested tentatively for its construction.

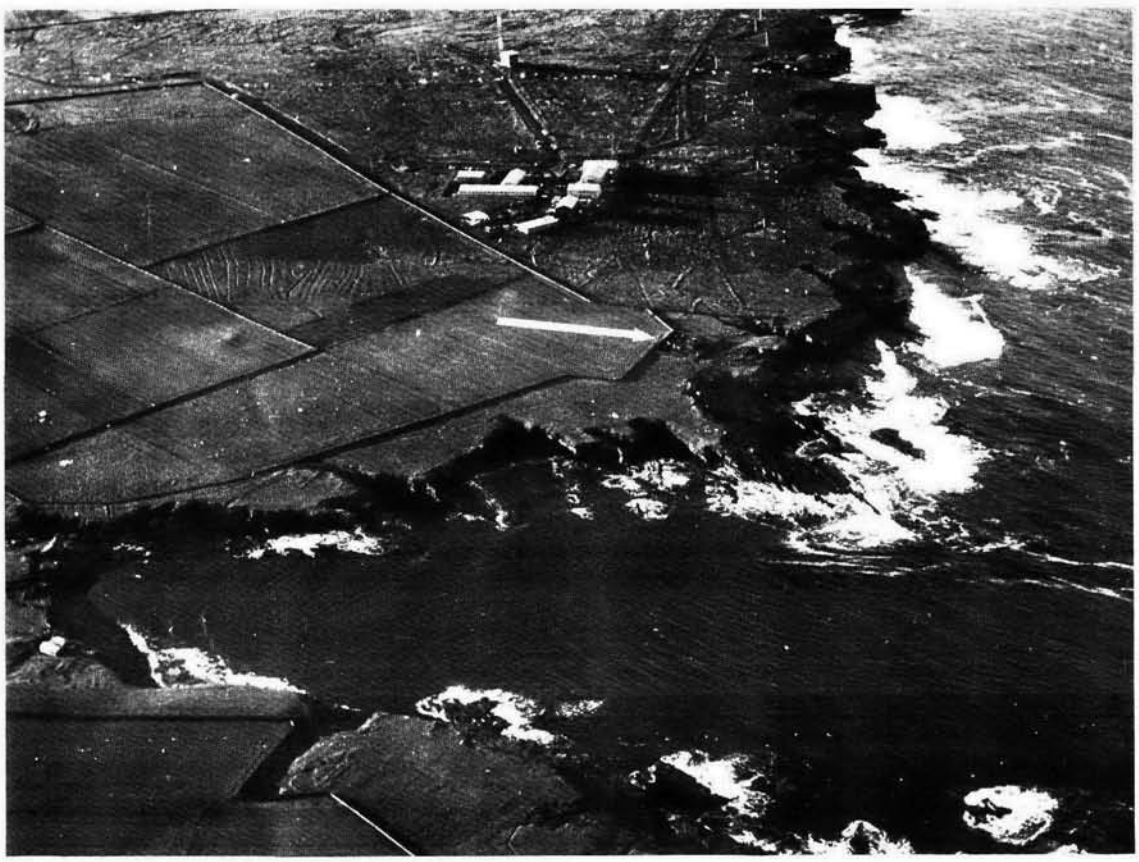
Finally, the implications of the Crosskirk investigations are discussed in relation to the problem of the brochs as a whole. The view that they probably originated in the Caithness-Orkney region is supported. Thence came dispersal, ultimately as far N as Shetland and as far S as the Tweed, but particularly to the W coasts of Scotland. Here are to be found the remains not only of the brochs themselves but also of the so-called broch-like structures. The latter, it is suggested, include brochs adapted in plan to suit local site conditions, as well as the "semi-brochs" and "galleried duns" of the literature. These are best regarded as either broch equivalents or broch derivatives, at least until extensive excavation proves them to be otherwise.

1 THE GENERAL SETTING OF THE CROSSKIRK SITE

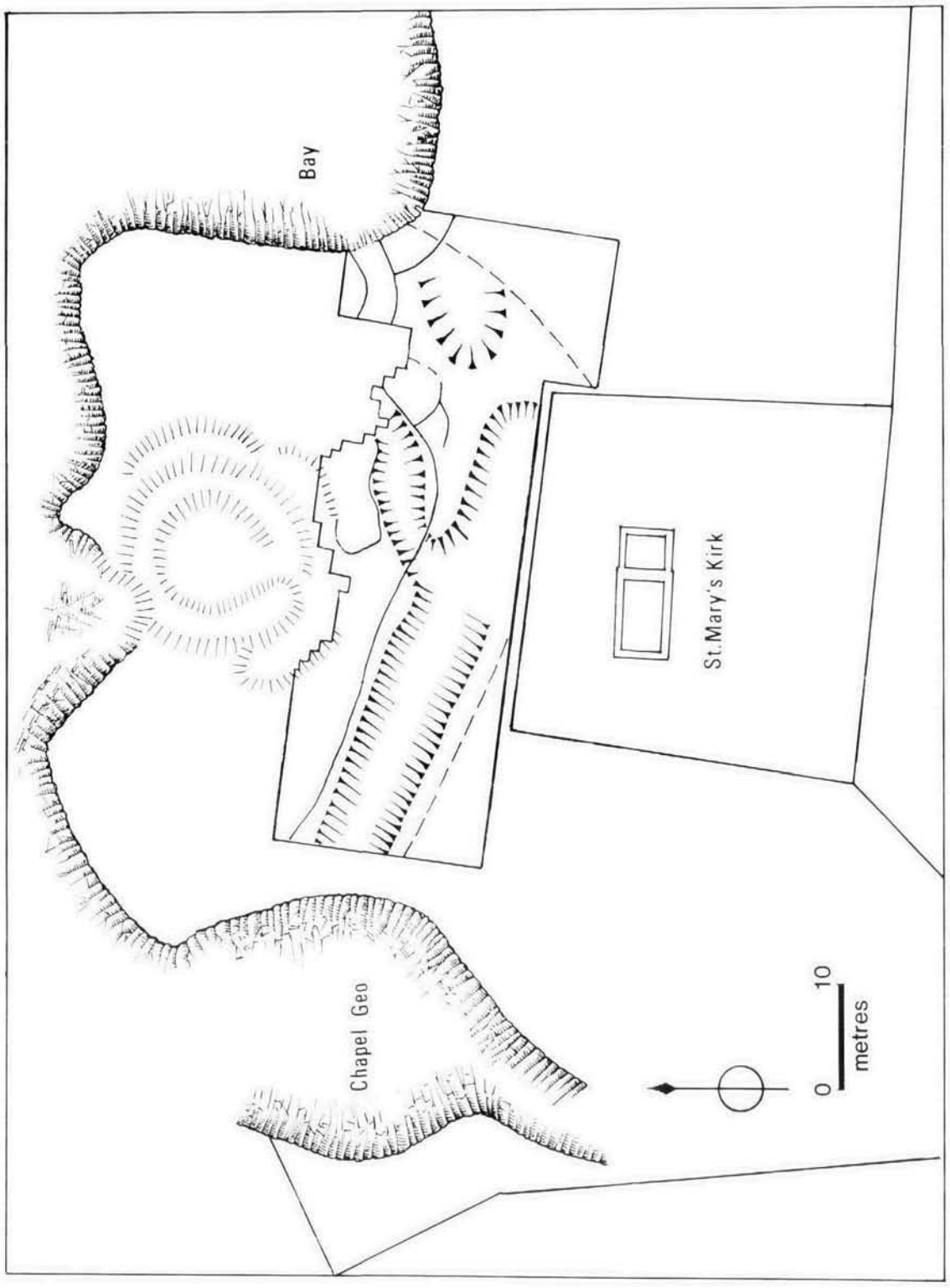
THE ENVIRONMENT

The ruins of St Mary's Chapel, known as the 'Crosskirk', are located 8 km W of Thurso near the cliffs on the much-fretted northern coast of Caithness (ND 025701). Before the excavations of 1966-72, the remains of a broch were to be seen as a grassy mound on the edge of the cliff immediately N of the chapel (Ill 1). Both chapel and broch were described in the Inventory of Caithness (RCAHMS, 1911a, nos 338 and 347). Why this windswept headland, facing a vast expanse of sea, should have been chosen as a building site in these two different periods, is a question which will recur time and again in the course of this report. A survey of the physical environment and the social setting in Iron Age times is an obvious prelude to an account of the investigations.

The Old Red Sandstones, which underlie the plain of Caithness, are exposed at Crosskirk in an irregular cliff that stands 12 to 15 m above High Water Mark. Directly in front of the site, a stack, which has been eroded to a fantastic shape, rises from a rock shelf sloping gently seaward.



ILL 1 : Crosskirk Bay and headland from the E: St Mary's Chapel and the broch are indicated by the arrow. By permission of the Commander, American Naval Base



ILL. 2 : Plan of the site before excavation, including an interpretation of the results of geophysical survey of the area S of the broch by A J Clark and D Haddon-Reece

ILL 3 : Erosion of the broch wall on the seaward side of the site

To the W, there is a deep cleft known as Chapel Geo, a slot probably formed by the collapse of the roof of a cave cut along a line of weakness. To the E, the River Forss runs into a wide rocky bay of the same name: both river and bay provide excellent salmon fishing and may have supplied an important part of the diet of the early inhabitants. The Crosskirk headland looks northwards over the Pentland Firth to the W of the Orkneys.

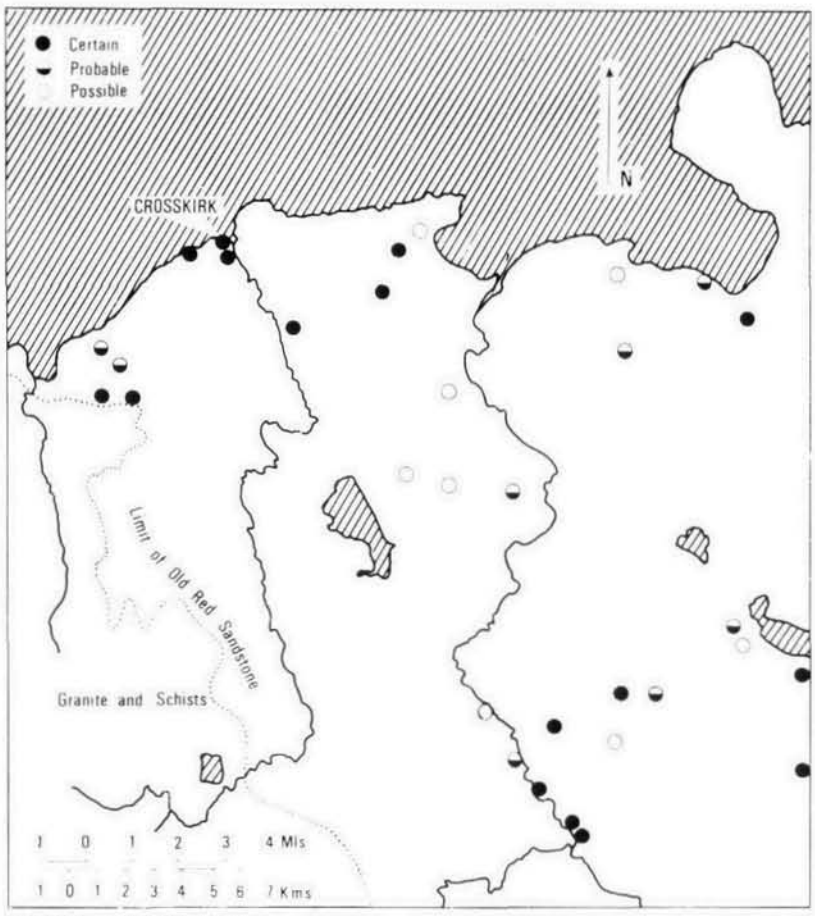
There can be little doubt that considerable change has taken place at the headland since the Iron Age, and a marked recession seems to have occurred particularly in recent times (Ill 2). In 1872, the Ordnance Survey depicted the broch mound as a circle about 18 m in diameter, placed about 9 m back from the cliff edge (Caithness, 1:2,500, sheet IV-3). Now, on the seaward side, a deep V-shaped re-entrant bites into the outer wall of the broch and only the foundation stones of the outer face remain (Ill 3). It is very remarkable that the detailed account of the Inventory in 1911 records that the broch wall was standing 5 ft (1.50 m) high on the seaward side, with no further comment. However, since Chapel Geo is an ancient feature, the sea cannot have been far distant in prehistoric times.

The reasons for the rapid erosion, at least in recent times, are obvious when the site is viewed from the low-tide mark. The Old Red Sandstones locally consist of numerous beds of very variable resistance, and some of the flagstones are limy. Only at the base of the cliff does a compact mudstone appear. Immediately over this, just above high water level, a limy stratum about 0.5 m thick has proved so soluble that it has been eroded away to form a great horizontal cut penetrating several metres into the cliff, underneath the broch site. Since our first visit to the headland in 1962, there has been a little subsidence so that this horizontal cleft has closed up to some extent. It is obvious that great blocks of sandstone between the joints are liable to movement. The strata generally dip gently to the NW, greatly facilitating wave action and allowing the blocks to slip seaward. A further

minor point is that a very slight fault is traceable on the rock face, both beneath the broch and on the outlying stack. All these features contribute to a marked coastal instability in the face of wave action which comes with a very long fetch from the NW and N.

In this respect, we had a most instructive if disagreeable experience during the 1970 excavation season. Gale force winds from the NW blew for three days in July, sometimes reaching 100 km per hour. Work was out of the question except in complete shelter, and photography was almost impossible because of the spray flying over the headland. It was easy to appreciate the conditions under which the broch occupants must have lived during long periods in the winters of those days. There was, however, an excellent opportunity to observe local wave action. At the present time, a rock shelf running out from the far side of Chapel Geo breaks the force of the waves from the NW before they strike the headland itself. The outlying stack to the N had a similar protective role in that direction. Both shelf and stack must be the mere remnants of land which formerly existed and when they too have gone, the sea will drive straight against the headland. Under these circumstances, long-term preservation of the site was considered impossible and excavation was deemed necessary before the broch became endangered, perhaps within a matter of years.

Whilst considering coastal erosion, it is worth remarking that although the cliff may now break down to give large slabs ready to hand, much of the material available to the broch builders must have been very liable to weathering. This offers a marked contrast with the tough stone which has been quarried elsewhere in Caithness during the recent past. It is to be noted, too, that there is no safe anchorage at the headland, nor is there even an adequate supply of fresh water nearby. What recommended the site to the original builders is certainly difficult to see.



ILL. 4 : Broch sites in NW Caithness

THE REGIONAL SETTING

Turning now from the coastal aspect to more general issues, the site at Crosskirk must be considered within the physical and prehistoric setting of a wider region (Ill 4). This comprises essentially the strongly characterised plain of Caithness, though some reference must also be made to the Orkneys, again developed on Old Red Sandstone, and to the very different highland glens of adjacent Sutherland. The unifying factor within this larger region is the great concentration of broch sites. Caithness itself with 148 examples accounts for over a quarter of all known broch sites (certain or doubtful) and the two adjacent areas raise the total to almost 60 per cent, according to the list in Graham (1947) supplemented by Hamilton (1968).

Inland from the cliffs at Crosskirk, the Old Red Sandstone forms a rolling tableland which does not rise to 200 m in altitude until the tough Highland rocks emerge along the mountainous Sutherland border. Basically, however, Caithness may more usefully be divided into two contrasting areas, the NE, beyond a line roughly from Reay to Latheron, and the S and W. The former area, which makes up nearly two thirds of the total, is predominantly fertile with only occasional uplands, unreclaimed moorland or low peaty hollows. With the exception of narrow coastal strips, the remainder, in the S and W, is largely a wilderness of peaty moorland with numerous shallow lochs, and was as devoid of brochs in the Iron Age as it is of good farmland today.

Climatically, Caithness is characterised by strong winds, cool summers, mild winters, and, particularly in the NE, by a rather low annual rainfall (under 750 mm). Spring comes late, nearly a month behind SW Scotland or the English Midlands, but the long summer days to some extent counteract the late start. Conversely the very long nights of mid-winter must have restricted outdoor activity greatly in the prehistoric period. The treeless nature of the landscape of today is well known but has perhaps been over-emphasised. Apart from recent plantings by the Forestry Commission, a grove of sycamores grows less than a kilometre from Crosskirk, though they are not by any means good timber trees. As yet, little work has been published on soil and pollen studies in the region and samples taken by Dr J Dickson during the excavations provide an important contribution to the knowledge of environmental conditions in the Iron Age (Ch 10).

In view of the remoteness of the Caithness plain, the somewhat austere climatic conditions and the long dark winters, the casual visitor from the south is apt to be surprised by the amount of good farmland, and this fertility goes at least some way towards an understanding of the concentration of broch sites. The distribution, however, displays some unexpected features which raise considerable problems in attempting to comprehend the social conditions of the time. Within the broch country of the NE division of Caithness, there is roughly speaking one known site for every five square kilometres of land. Even within the more favoured areas, much clearance of peat has undoubtedly taken place over the centuries, and a smaller area of farm land would have been available to the Iron Age population, making the density of brochs even more remarkable. Moreover, some sites may well have been eliminated in the past, although the complete destruction of all traces of such a massive structure as a broch must be regarded as an uncommon occurrence.

Perhaps the more restricted area of good land available in the Iron Age in Caithness is reflected in a noteworthy feature of the broch distribution, which does not seem to have been sufficiently stressed. The sites undoubtedly cluster in relatively close proximity to each other within certain well-defined areas. The three brochs at Keiss occur within a square kilometre, a fact which has attracted comment in the past. At Crosskirk itself, two other brochs (Tulloch of Lybster and Green Tulloch) lie within 800 m and 1300 m respectively to the SSE and SW. On a larger scale, there is a marked cluster in the area around and to the N of Westerdale, where fifteen broch sites (eleven definite and four possible) are crowded together within an area of 6 km by 5 km (RCAHMS, 1911a, nos 96-108 and 474-5). Three pairs are each within 400 m, and no one broch in the cluster is more than 2.5 km from its nearest neighbour. The density here is most remarkable, bearing in mind the amount of labour involved in the construction of even a single broch. In this respect, only the redoubtable Captain Thomas writing over a century ago (1867), seems to have attempted an estimate—sixty men working for one hundred days with the materials ready to hand. This might of course be worded otherwise (if the relative inefficiency of very small numbers was to be ignored) as six men working

for a thousand days, spread over a number of years. In a Caithness setting with long winter nights and a marked burst of farming activity in the short summer, the latter assessment of man-days might well be more realistic. It hardly seems possible to visualise the small social units, represented archaeologically by the clusters of brochs, being able to muster sufficient labour to complete a broch in a single season.

Seen as a whole, both the concentration of brochs within lowland Caithness and the clustering which is apparent, inevitably call to mind the problem of the purpose for which the brochs were built. The absolute total, even if they were not all contemporaneous, seems so great as to preclude the idea of each belonging to a local chieftain, ensconced in a 'castle'. Moreover, many sites both here and in the adjacent areas of Orkney and the E coast of Sutherland, are accompanied by a settlement immediately outside the broch wall. On what is really very inadequate evidence, these external settlements have been regarded as later developments, constructed when the brochs were becoming obsolete. With the exception of the brochs and their associated settlements there is singularly little evidence of Iron Age occupation of other categories of site, judging at least from the Inventories of Caithness and the Orkneys (RCAHMS, 1911a, 1946). An occasional large hillfort appears as at Buaile Oscar or Garrywhin, but their dating in relation to the broch period is quite obscure. Across the boundary in the glens of Sutherland, however, hut-circles, souterrains, field boundaries and clearance cairns, as well as brochs, all become common (Fairhurst, 1971). Whilst the destruction of sites, outlying from the brochs and their associated settlements, may certainly have been considerable in the intensively farmed areas of Caithness and Orkney, survivals in greater numbers might have been expected.

Viewing all the facts together, the brochs and their external settlements seem to involve farming units distributed in clustered communities over the more productive land. A population of exceptional density for the Iron Age in Scotland seems to be indicated, even without any groups living away from the brochs, for example in dispersed hut-circles. To what extent the brochs and their associated settlements were contemporaneous, both with each other and with the other sites in the clusters, is obviously a key issue in assessing this density. Evidence for a longer period of broch development and construction than has usually been considered probable would be very significant, and is indeed suggested by the Crosskirk excavations.

The excavation of one site at Crosskirk could scarcely be expected in itself to solve these complex problems, but fresh evidence from Caithness in particular is urgently needed. Many broch and settlement sites there have been investigated in the past, but excavation has been crude and the reports singularly short and inadequate. From these accounts, it is not possible to begin to understand the nature of the social organisation. More prosaically, much has remained obscure with regard to architectural features of the brochs themselves, in particular the problems of the roofing arrangements, the original height of the wall, and internal structural organisation. Indeed, it is often not known whether the sites were used for continuous occupation or as refuges.

An invitation to conduct a rescue operation at Crosskirk involved a heavy responsibility after so many unrewarding efforts in the past in Caithness, but it also offered a most attractive prospect for research. In the final sections of this report (Chs 11 and 12), a review of the investigations and a discussion of the problems of the brochs in general are presented, and an attempt is made to provide an answer to at least some of the questions which have just been raised.

THE SITE BEFORE EXCAVATION

From the low summit of Lybster Hill, the farmland of today falls gently N to the headland where St Mary's Chapel and Crosskirk broch site are situated (Ills 1, 2). The fields and the cemetery wall are enclosed by dry-stone dykes for which building material may well have been taken from the broch mound. The headland itself now consists of open pasture but plough rigs of the recent past can be detected, especially to the W of the cemetery. Traces of two old turf-and-stone dykes run outwards from the two N corners of the cemetery wall towards the cliffs on either side of the broch; they

Ill 5 : The broch mound before excavation showing the breach on the S side: Crown Copyright reserved

are marked on the Ordnance Survey map referred to previously, and are of little antiquity, although visitors repeatedly tried to see them as 'outworks' of the broch.

From the N wall of the cemetery, the ground begins to rise gently towards the cliff edge where the broch mound stood before excavation. The mound itself was largely grass-grown and, except for recent disturbances, was generally smooth-sided. Its perimeter rose sharply upwards but fell away again in the centre to form a broad saucer-shaped hollow like a crater. This latter was visible from the outside in the S sector of its circumference where the rim had been breached and a ramp-like feature containing some loose rubble led up to the interior (Ill 5). Overall, the mound measured about 30 m E-W, but rather less at right angles to this owing to erosion on the seaward side. It rose 2 to 3 m above the general external level, with the central hollow reducing this to 1 to 1.5 m. On either side of the mound, as far as the edge of the cliff, there was a level area which might well have extended round the back of the broch in prehistoric times.

It must be emphasised that the appearance of the site before operations began was most deceptive. The very distinctive mound was in fact confined to the area of the broch itself, while the pastureland to the E and S gave not the slightest indication either of the extensive structures which were to be encountered during excavations, nor of the 2 m of made ground concealing this external settlement. The saucer-shaped hollow in the centre of the mound seemed to promise a depth of rubble of not much more than 1 m, as the broch appeared to surmount a rocky knoll. In fact, there proved to be 2.5 to 3 m of overburden to remove. The rock surface beneath the broch was shown to be flat, although it was surprisingly uneven in parts of the settlement. These details seem worth recording for one apparently typical Caithness broch site, and do something to explain our repeated extensions and changes of programme.

The description of the site was similarly over-simplified in the Inventory for Caithness (RCAHMS, 1911a, no 347): this report however gives rise to another problem. Running round the base of the mound from the NE through S to W, was a grass-grown trench some 0.5 m deep in places, with rather sharply defined edges and with traces of a bank on the outside, most noticeably in the SW. The trench was discontinuous where the ramp led to the interior of the broch, and again in the ESE where the original entrance was later discovered. A robber trench seemed clearly indicated but the Inventory states (RCAHMS, 1911a, 93):

> '. . . on the landward side, about 10 ft from the broch, are the remains of an outer bank or wall now 8 ft wide at the base'.

The meaning of this is obscure: it might refer to the slight bank outside the robber trench, but one suspects there has been confusion with the adjacent site of Green Tulloch (RCAHMS, 1911a, no 348) where a bank is clearly to be seen. Old quarrying operations in the mound, accounting for the trench at Crosskirk, could have taken place as long ago as the construction of the Chapel, or more recently with the building of the stone dykes. One point which was very clear from the beginning

of the investigations, was that the S wall of the broch was damaged down to its foundations at the ramp and thence eastwards for several metres.

On either side of this breach into the interior on the S side, very slight indications of internal walling could be detected. That to the W was noted in the Inventory and proved to be part of the stair wall. On the E, even vaguer traces led to the discovery of an intra-mural cell. At the outset, the breach and its associated ramp seemed to be the most likely place for the original broch entrance. Within the saucer-shaped hollow, prior to the excavation, there was no sign of the internal wall face, nor of a scarcement, nor of a gallery within the wall.

The external wall face of the broch was traceable in two sectors. In the SW there was a short stretch of two or three courses showing through the turf; in this sector, the local sandstone slabs were badly weathered along the edges. On the seaward side of the mound, where the ground fell away to the cliff edge, the outer wall face was visible continuously over a distance of nearly 12 m, and here the stone was not markedly weathered. Erosion above the sea cliff had however bitten deeply into the wall and sapped a breach 5 m across. This extended downwards almost to the foundation courses and even these were undercut during the period 1962-72 (Ills 2, 3). This breach was extended by some illicit and utterly pointless digging at the cliff edge between our working seasons. The core of the wall exposed in the breach appeared as a loose scree running down to the cliff edge, with only a few slabs or large pieces of stone visible amidst the rubble. A puzzling feature occurred on either side of the breach in the form of two well-built wall faces or revetments, immediately parallel to the outer face of the broch, and to one another. The disintegration of these faces in the central part of the breach made it difficult to see a direct connection between them, and in fact one of the revetments ended at a square corner. It was wrongly suspected initially that the original broch wall had been built in sections in a form which Hamilton described as 'duplex walling' (1968, 50). It was somewhat reminiscent of the so-called 'median face' at the galleried dun at Kildonan, Kintyre, a monument which had other broch-like features (Fairhurst, 1939).

As with many Caithness broch sites, a striking aspect of Crosskirk was the scarcity of building slabs appearing on the surface of the mound. Elsewhere, many potential brochs can only be classed as 'probables' owing to their grass-grown appearance. The usual explanation has been that all the good building stones have been removed for use elsewhere. Another explanation appeared during our excavations: recognizable building slabs may never have been plentiful as the number of good slabs used in the construction of the broch wall was considerably fewer than might have been anticipated. In passing, it is worth remarking that although there may have been a very wide view seaward from the original wall top, it cannot have taken in the immediate inshore water, especially if the cliff edge were further out in those days.

Finally, for comparative purposes, notice must be taken of the two neighbouring broch sites. The nearest is Tulloch (hillock) of Lybster some 730 m to the SSE (RCAHMS, 1911a, no 346; ND 028695). It lies in arable ground and is set well back from the low cliff on the W side of Forss Bay. It is almost totally demolished now, but the Commission recorded an external rampart and ditch, the former being set some 7 m out and faced on the inside with stone; it was also suggested that there may have been an external settlement on its E side. The second site is one of two Green Tullochs on the edge of the cliff 1280 m WSW of Crosskirk (RCAHMS, 1911a, no 348; ND 013697). It is difficult to see anything to recommend the very exposed site. At present the broch wall appears to be represented by a great bank of rubble which the Inventory described as 'disintegration'. Once again, there is a defensive bank set some 10.5 m out and the Inventory suggested another wall just outside the broch mound. A precipitous geo, like a roofless cave, penetrates the sandstone cliff and reaches into the site. It is such a spectacular feature that it is probably the one referred to by Sir Archibald Geikie (1887, 67) nearly a century ago in 'The Scenery of Scotland', as follows:

> 'A few years go on the northern coast of Caithness I observed an interesting proof of the inroads of the sea upon the hard flagstones of the iron-bound shore. A "brough" or "Picts' House" which, of course, had been originally entire, and had, no doubt, been built near the edge of the cliff for safety, was deeply trenched by the advance of a narrow gully in the precipice'.

The description fits Green Tulloch so accurately that it seems safe to rule out Crosskirk as the site described by Geikie. At Crosskirk, the broch has certainly never been "trenched" by an advancing gully.

2 THE EXCAVATIONS AND THE SCHEME OF PERIODS

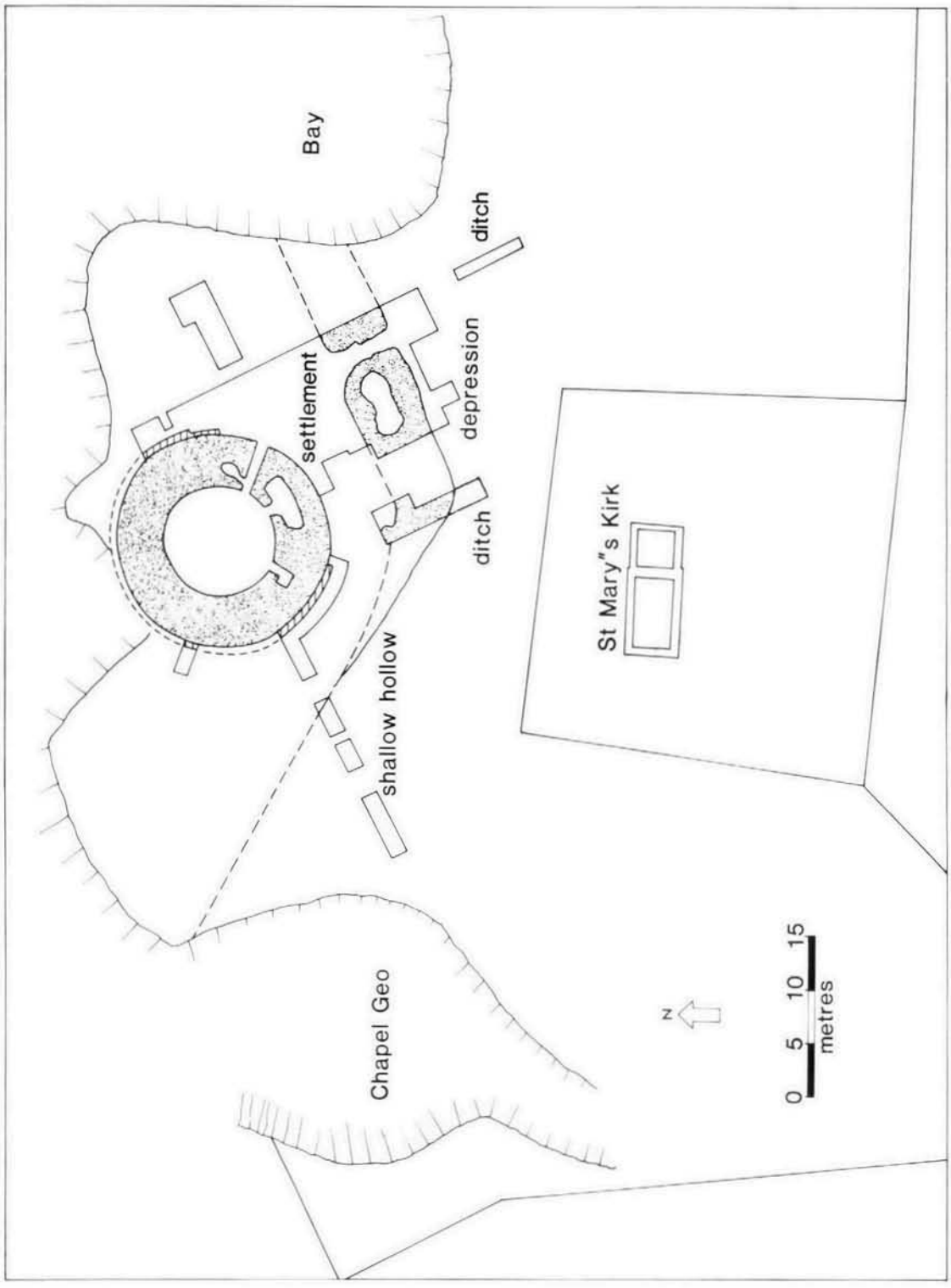
In this chapter, the work carried out at Crosskirk will be discussed first in the order in which it was done, and second in terms of the archaeological periods which were detected during the excavations. It has already been mentioned that the examination of the structural sequence proved to be a much more complex undertaking than the outward appearance of the site suggested before work began. Thus, the excavation strategy had to be considerably modified during the course of the work. Our first objective is therefore to examine the sequence of the excavations in the light of the discoveries that were made (Ill 6).

1966 SEASON

Work was carried on throughout July, utilising a power-driven dumper truck which rapidly proved troublesome and inappropriate. The plan was to excavate within the broch in quadrants, with trenches extending outwards beyond the wall to the W, S and E. Baulks were left between quadrants, but examination of the SW quadrant was postponed, as that sector of the site served as a loading platform adjacent to the breach in the broch wall where the ramp gave ready access. Had the depth of rubble inside not exceeded the metre or so we anticipated, this scheme might have worked, but trouble quickly developed. It took three weeks to reach any recognisable horizon of occupation, which was never less than 1.5 m below the turf in the centre of the broch. Baulks had to be removed as we progressed downwards through an unstable mixture of rubble, slabs and clay. Eventually, some discontinuous and uneven flagging was reached in the NW, NE and SE quadrants. This was set around a large hearth and a slab-lined tank. The entrance passage and an intra-mural cell had been located: although both were in an unstable condition, excavation was begun. The trenches outside the broch led to the discovery of a settlement to the E and S; progress was impeded on the E by the discovery of a small deposit of human bones. At the end of the season, we stabilised the site temporarily, backfilling where necessary, and retired with little enthusiasm for a return (Ill 7). A notable contribution was a site plan, surveyed by Mr Leslie Hunter.

1969 SEASON

Obviously further operations were essential even to appreciate the potential of the site, and to reach the deepest part of the interior of the broch. We were again approached to take up the now formidable task, and after much deliberation, decided to make a fresh start in 1969. Only a small scale excavation was organised to prepare for a major effort the following year. There were two main objectives. The first was to remove, by means of a mechanical excavator, the great quantity of rubble and earth which was known to fill much of the centre of the broch. This was achieved without mishap after loosening and examining the material by hand in the first place. The great value of the mechanical excavator with its highly skilled and deeply interested operator, pointed to further continuous use of this type of machine on the site. Secondly, a small area excavation was opened outside the entrance passage where indications of a settlement had been noted. Unfortunately, the 25m^2 area which had



ILL 6 : Site plan showing excavated area

ILL 7 : The site at the end of the 1966 season, showing the stair in the broch wall and an external buttress

been selected proved to be without doubt the most difficult complex of masonry on the whole site, and included the only substantial feature of late medieval times. However, the settlement was shown to belong to at least three phases and to have been systematically levelled, presumably at the time of construction of St Mary's Chapel. This operation would account for the absence of surface features outside the broch and indicated that much devastation could be expected within the remains of a composite settlement. Nevertheless, this pilot excavation had not been carried down below the top of the ruinous walling: we had obtained no true indication of the depth of material above bedrock and no inkling of the full extent of the settlement.

At the end of the season, a decision was reached to complete the excavation of the broch as the first priority. However, we wished at the same time to examine that part of the settlement which lay in the immediate vicinity of the entrance passage.

1970 SEASON

A mechanical excavator was employed during this season and in subsequent operations on site. For the most part it was used to lift slabs, rubble and earth clear of the excavations: the scoop was lowered into some convenient position and then filled by hand. Incidentally, both the vehicle itself and the scoop which could be raised to a height of 4-5 m in a pre-selected position, formed an excellent photographic platform; and so we dispensed with the fixed steel tower used in 1966. To offset the hire of the excavator, the working season was kept down to three weeks during July, but the party was increased to about forty, the maximum which could be employed at one time.

On resuming excavations in the interior of the broch, a late central hearth was located almost immediately, directly beneath the filling of stone and rubble. It clearly overlay earlier structures and was in fact partly above a slab-lined tank which still contained water. At the lower horizon, other features were soon found to show that modifications on a considerable scale had occurred after the primary occupation of the broch but before the floor around the upper hearth was laid down. A threefold division into phases was adopted: the late occupation, marked by the upper hearth, was referred to as Phase Three: the hearth and flagging of the primary floor became Phase One:

everything stratified between these and not demonstrably belonging to either was referred to as Phase Two. This *ad hoc* distinction proved appropriate throughout the excavation of the interior of the broch, as it was not found possible to sub-divide the intermediate stratum. As work proceeded, it became clear that most of the interior of the broch had been flagged: it had been subdivided by means of rows of flagstones set on end. Some of this stonework was primary but extensive modification had taken place in Phase Two. Extensive collapse of the internal wall face was also found to have occurred, more than once, and obviously measures had been taken to stabilise the structure. In view of these complexities, work proceeded more slowly than anticipated and was further impeded by some heavy rain and a severe gale. However, by the end of the season, almost two-thirds of the interior had been excavated down to the primary floor.

Although the broch was not proving particularly prolific in terms of the number of artifacts recovered, a very useful and comprehensive collection of pottery, bronze, bonework, antler and stone objects was accumulating. It was noticeable that the great bulk of the material was typical of the broch period of the N mainland of Scotland. The reorganisation of the floor space as well as diagnostically different pottery contributed to the separation of Phase Three, but these changes could not be matched by any obvious difference in material culture generally.

In the settlement area outside, a N-S line some 14.5 m E of the centre of the broch was taken as the general limit of excavation. From the pilot square opened the previous season, operations were extended along the general line of a flagged passage which continued outwards from the original broch entrance and began to curve round towards the S. It was followed for 12 m but still continued beyond the line reached during the season's excavations. It lay beneath a later medieval structure and at some stage had been purposely reduced in width. How this alteration related to those within the broch was not clear.

Consultation with the Inspectorate of Ancient Monuments confirmed that the whole area would eventually be backfilled and a cairn formed of the remnants of the broch if there were any surplus rubble left. At the time, the stonework on the inside of the broch, together with that of the stair and entrance passage, was deteriorating and increasingly threatened to collapse.

1971 SEASON

Operations on the same scale as for 1970 promised to go far towards bringing investigations to a convenient close, but further major complications occurred in the external settlement area. The interior of the broch was excavated down to the underlying Boulder Clay and a well was discovered in removing the last of the flagged floor. A narrow trench was excavated down to bedrock on the E-W axis. It became increasingly obvious that extensive buttressing had been constructed along both the internal and external wall face of the broch as instability had develolped during its use. It was a relief when the time came to make a cairn from the remnants of the broch using a mechanical earth-mover, as the disintegration of the inner wall face on the N, where it was standing up to 3 m high, was an immediate danger. The wall was demolished down to about 1 m above the foundation courses. In the process, a careful examination was made of the core of the wall. This was found to consist not so much of stone slabs, but of earth, rubble and boulders, held in place by the revetments which formed its inner and outer faces.

Meanwhile, work continued in the area of the settlement, extending the excavations both along the broch wall seaward and following still further the passage which continued outwards from the original entrance to the broch. The later walling which had reduced the width of the passage by half, was removed but still the function of the structure remained obscure, as no apparent military significance could be attached to this passageway, irrespective of its width. Towards the end of the season, this elongated structure was found to pass through an older gateway set in a massive outer wall or rampart of which no trace had appeared at the surface. Between the broch and this gateway, two long cist burials were found superimposed on a rough platform, flanking the pasage on the W. To the N of the broch entrance, investigations continued amid walling and pavements at three

or four different levels:.a hearth set on Boulder Clay was found in an enclosure immediately adjacent to the broch wall.

During the ensuing months, Mr P R Ritchie organised a geophysical survey of the site in an effort to identify the course of the outer wall which had been discovered between the broch and the wall of St Mary's Cemetery. Such complexity appeared in the survey results, however, that the only course was further excavation.

1972 SEASON

This perforce was to be the last season and within the area already opened up, much excavation had to be hurried forward to establish the pattern of enclosures within the settlement on either side of, as well as underneath, the long passageway. The natural, usually Boulder Clay but intermittently bedrock, was found to occur at a depth of nearly 2 m below the turf. So much alteration had occurred during what had obviously been a long occupation, that it was difficult to establish the outlines of the walling of any one phase of construction. In the N of the settlement area, a curious free-standing wall was traced seaward and found to have formed a buttress where there had been an extensive collapse of a secondary casing to the broch wall. Eastwards from the broch entrance, an oval enclosure which was obviously not a primary structure in the settlement, was examined despite its extension beyond the present limit of excavation. It was decided to investigate this to find a hearth if possible, and to establish the full width of the structure. In the process, further walling was located at considerable depth: it became clear that the settlement had once extended as far as the present cliff edge, some 20 m distant from the broch wall. Further complexity occurred inside the oval enclousre where a burial in a seated position was found against the hearth.

A major preoccupation was with the outer wall and the area beyond where the geophysical survey had yielded such indeterminate results. These excavations are to be considered in detail in the section of the report which follows (Ch 3), and no attempt need now be made to indicate the ramificaions of that work. The passage through the gateway and its immediate approach from the S were excavated down to bedrock, while trenches were extended southwards to investigate a broad hollow which traversed the area N of the present cemetery wall. A depth of 3 m below turf was involved in the examination of the E part, but westwards, towards Chapel Geo, bedrock rose markedly and the hollow faded away. Time did not permit the investigation of the simple rampart wall running towards the nearby cliff E of the gateway. To the W, the defences included a complex structure which contained two cell-like features. Of these, the larger one, which had been located in 1971, yielded from below the primary floor a type of pottery little represented on the site, indicating that the broch had been preceded by an earlier promontory fort. Passing westwards towards Chapel Geo, the rampart wall gave place to a terrace-like feature and then, in the very last hours of operations, we were able to show that this in turn connected with what had been a row of large flagstones set end to end and reaching to the cliff edge. We had already established that there was no ditch in front on this line of defence. In this way, to the last, the Crosskirk site continued to present features for which parallels seem hard to find.

THE END OF EXCAVATIONS

In the last week of July 1972, the mechanical excavator back-filled the site which was then reseeded, and operations were brought to a close. Several obvious questions remained unsolved, notably the eastward extension of the external rampart and of the settlement area enclosed by it, and also the stratigraphical relationship between the prehistoric site and St Mary's Chapel. However, neither my co-director of excavations, Mr David B Taylor, nor I, felt we could prolong the seasonal effort further, especially as I was to retire from university life in 1973 and the resources of the Archaeology Department in Glasgow would not be available as formerly. Moreover, the preparation of a complex

report had to be envisaged. We felt justified in completing operations after establishing the framework of periods as outlined below. Throughout, it had been a happy group effort and Crosskirk will be remembered by many helpers from many parts of Britain for much more than its archaeological significance.

THE CROSSKIRK SEQUENCE: PERIODS AND PHASES

The disturbances to which the site had been subjected during its long occupation, coupled with the systematic levelling of medieval times, left little chance of establishing a sealed stratification covering more than short invervals of time. The relatively late discovery of the existence of the pre-broch fort rendered invalid early assumptions concerning a 'primary' deposit at the base of the broch, and a 'secondary' development, comprising the settlement area. Nevertheless, in retrospect, the broad sequence of events on the site seems reasonably clear. Two points, however, need to be made. The difficulty of connecting the stratification inside the broch with that outside in the settlement makes it advisable, especially when considering the artifacts, to recognise distinctive 'phases' for the broch. Secondly, the inference that the division into 'periods' necessarily involved breaks in the continuity of occupation is unsound, although one major break must have occurred prior to the construction of St Mary's Chapel and others are possible.

In this report, the term 'Phase' is reserved for stages in the use of the broch. These 'phases' may be correlated with the 'Periods' recognized in the structural sequence of the remainder of the site. The framework of periods and phases used subsequently is as follows:

Period One	The promontory fort.
Period Two	All remains approximately contemporaneous with the construction of the broch and its initial occupation in Phase One.
Period Three	Subsequent occupation of the broch in Phase Two: approximately contemporaneous growth of the settlement and first extension outside the broch entrance.
Period Four	Reorganisation of the broch interior in Phase Three: construction of an extended entrance passage outwards through the gateway in the Period One rampart: subsequent narrowing of the extended passage.
Period Five	Burials in the settlement area: a Pictish symbol stone: construction of St Mary's Chapel.

3 THE OUTER FORTIFICATIONS

On many broch sites on the northern mainland of Scotland and in the Northern Isles, there are to be seen the traces of an outer system of defences which usually appear as grass-grown mounds. Sometimes a bank of rubble is characteristic, as at the neighbouring broch to Crosskirk, the Green Tulloch (RCAHMS, 1911a, no 348). In some cases excavation has revealed massive walling as in the ramparts at Midhowe (Callander and Grant, 1934) and Gurness (Richardson, 1948) in Orkney, and at Nybster (RCAHMS, 1911a, no 518) in Caithness. Hamilton's excavations at Clickhimin (1968) showed that the broch was preceded both by a freestanding structure with broch-like features known as the Forework, and by an even earlier ring-fort. Apart from this latter instance, there has been much speculation as to whether these external systems of defences were in fact 'outworks' constructed at the same time as the brochs themselves, or whether they represented earlier fortified enclosures. The evidence from both excavations and field studies is ambiguous, but the point is of considerable significance. If the broch-like features which can be detected in some of the outer walls and particularly in the Forework at Clickhimin are in fact earlier than the brochs, then obviously these structural characteristics are relevant in a discussion of the origins and development of the brochs themselves. One of the difficulties in regarding the northern mainland and Orkney, where so many are concentrated, as the probable home of the brochs, has been the relative lack of prototype forms. Evidence for pre-broch structures in these areas is thus of especial interest.

The outer defences at Crosskirk, as briefly indicated in the previous chapter, would appear to pre-date the broch. Since this point has a direct bearing on the interpretation of the evidence from both the broch and the settlement alike, the system of outer defences must receive prior consideration, although the relevant excavations were carried out only at a very late stage in the investigations.

THE EASTERN WALLING AND THE GATEWAY

In excavating the long passage which extended outwards in a south-easterly direction from the broch entrance across the settlement area, a significant change was noted some 13 m from the broch wall. Here the pavement of the passage was seen to pass through a gateway which was flanked by a clay-cored wall to the E, and what appeared to be a small walled enclosure to the W (Ill 6). In the complete absence of surface indications, it was impossible to forecast the probable trend of what was suspected to be an outer system of defences.

At this stage, the geophysical survey was organised by Mr P R Ritchie: the relevant report may be consulted in the Crosskirk archive. Unfortunately, the results were so complex that no clear guidance could be obtained from them. In brief, it would now appear that the confusion arose for several reasons, amongst which the variable depth of bedrock, which was completely unexpected at the time of the survey, was a contributory factor. Additionally, the long passage leading through the gateway proved to be a late feature which had involved massive reconstruction. As described in detail later, a large quantity of sandstone blocks had been laid down both within and outside the gateway, reaching a depth of nearly 1 m in places, in order to provide a level for the late pavement. This great mass of slabs seems to have contributed considerably to the complexity shown by the survey.

The walling, which had been discovered to the E of the gateway, was uncovered over a distance of 3 m as far as the main N/S limit of the excavations (Ill 8). It proved to be a substantial rampart wall revetted with stone, one slab in thickness, with a core consisting mainly of clay with some small

ILL 8 : The gateway in the outer defensive wall, looking NW: Enclosure III is visible behind the vertical ranging pole

admixture of slabs. The core was closely packed though there was no evidence of ramming. The total width of this wall was approximately 4.5 m, and the structure survived to a height of 1.25 m above Boulder Clay. The internal revetment was vertical, but there was a distinct batter to the revetment on the outside of this wall. In this regard, and indeed in terms of its general construction, the wall noticeably resembled the broch wall to be described later. At the foot of the external face, at the limit of the excavation, what appeared to be the surviving end of a square-built slab drain was discovered, running at right angles towards the present edge of the headland, which lies some 9 m to the E. At the time of the excavation, it was taken for granted that both wall and drain continued on the same trend, though no trace of either could be seen overlying the Boulder Clay in the exposed section at the cliff.

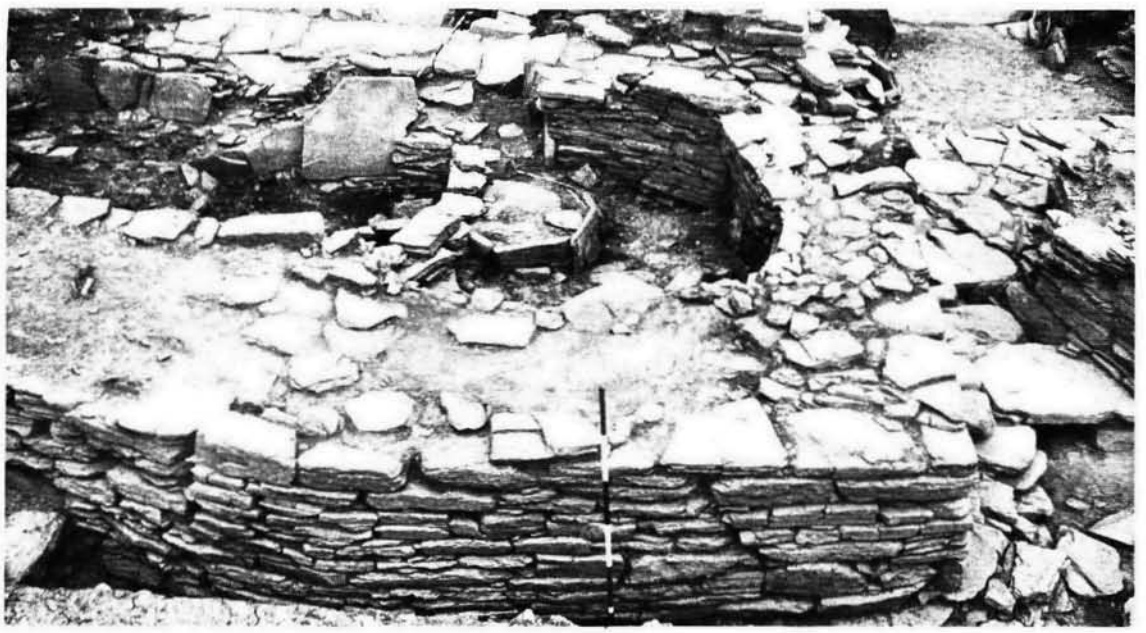
The gateway was about 1.4 m wide at its narrowest point, which was one-third of the way towards the outside. At this position, it had been provided with door-checks in the form of a pair of long, thin upright slabs, one on either side, (Ill 8) accompanied by a bar-hole on the W. Modifications may have occurred here, as the masonry at the checks suggested that they were secondary insertions. In plan, the widening of the passage outwards from the checks is the reverse of what normally occurs in a broch entrance, exemplified in the broch at Crosskirk, where the outer half of the original passage is markedly narrower. This wide-open gateway would appear to have given considerable scope for manoeuvre to an attacking force attempting to use a battering ram on the door itself.

On the other hand, the floor of the gateway outside the position of the door as indicated by the checks was either designed purposely to impede movement, or much more probably, was incomplete. Beyond the door-checks, the pavement came to an abrupt end at a huge horizontal slab which was bonded into the side walls. The outer end of the gateway had merely an earthen floor set on Boulder Clay, at the level of the bottom of a drain. This emerged from under the pavement and came from the interior of the site. Careful excavation revealed no evidence of a collapsed pavement here and either the marked step downwards to the earthen floor was designed as an obstacle, or the continuation of the pavement had collapsed into the drain during the occupation and the slabs had been carefully removed. In either case, it was impossible to show that the drain had turned sharply through a right angle at the outer corner of the gateway, in order to connect with the remnant of a drain located outside the outer defence at the E limit of the excavation (Ill 34). It seems necessary to record the confused details in the gateway area in view of the evidence, discussed below, which indicates that its construction pre-dated the broch and had possibly been modified when the latter was built.

To the N of the gateway, the pavement and its underlying drain continued into the settlement area in the direction of a building (Enclosure VII) to be discussed subsequently. Branching off at right angles and running immediately at the foot of the inner face of the rampart wall E of the gateway, there was a well-laid pavement of heavy slabs. This was 1.25 m wide. On its N side, this pavement stopped abruptly parallel to the rampart, with no traces of any adjacent wall foundations to account for the very even limit. Beyond the pavement to the N lay an earthen floor only slightly above bedrock. Crossing this floor in a northerly direction were two anomalous lines of flagstones on end, which emerged from the N/S bank that delimited the excavation: these were almost certainly later in date than the rampart. An anvil stone was still firmly in position in this earthen floor.

To the W of the gateway, the character of the outer defence system changed abruptly (Ill 34). The width of the rampart wall increased to over 5 m, but much of the space on the inner side was occupied by an oval, cell-like structure (Enclosure III*a*), which was set within the thickness of the wall. On the outer side, the cell gave place to a narrow counterpart of the earth-cored wall, and was separated from the NW corner of the gateway by a dry-stone wall about 0.6 m thick. This segment of walling, between the cell (Enclosure III*a*) and the NW corner of the gateway appears to have been considered a weak point of the original design. The evidence for this consists of an arrangement of stone, crescentic in plan, which overlay a hearth in, and filled the E half of, Enclosure III*a*. This additional stonework greatly increased the thickness of the wall at the NE angle of the entrance. A consequent modification to the cell produced Enclosure III*b*(Ills 9, 39) a larger oval-shaped cell, which extended further W.

Enclosure III*a* measured about 3 m in diameter; its S margin was delimited by slabs set on end facing the core of the defensive wall. Its N side, however, consisted of dry-stone walling which was built in panels rather than as a continuous stretch. The entrance would seem to have been in the NW, but certainty is impossible because subsequent reconstruction and a late long-cist burial had caused some disturbance. The floor had been built up with Boulder Clay to a height of about 0.3 m above the level of the pavement in the gateway outside. Within this clay deposit were found the sherds from a number of vessels of thick, coarsely decorated fabric, distinct from the broch pottery found elsewhere on the Crosskirk site. This decorated ware was strictly confined to this one deposit and to one other, again occurring in a structure within the rampart wall. The vessels will be described in detail in due course, but they must pre-date the construction of the broch: it follows that the



ILL 9 : Enclosure III*a* in the outer wall, showing the wall-line of Enclosure III*b*, which replaced it, crossing the original hearth

ILL 10 : Enclosure III*a*, showing the circular baking stone and the central hearth before the removal of the clay floor and the overlying wall of Enclosure III*b*

rampart wall must be assigned to Period One. On the surface of the floor around the hearth of Enclosure III*a*, the occupation material was typical of the broch period. Apart from the usual pottery, the finds included a flat circular stone 0.24 m in diameter, which resembled a baking stone. The hearth, around which was a plentiful supply of ash, was carefully built. It had a kerb of thin slabs set on end delimiting a central rounded flagstone cracked by heat, the whole measuring 1.4 to 1.5 m across (Ill 10). This occupied a disproportionately high fraction of the available floor space, and would indicate that the chamber was not intended for ordinary domestic use. From some small fragments of charcoal collected close to the hearth and at the same level, a radiocarbon date of 170 bc±50 has been obtained. This date may indicate the period just preceding the modification of Enclosure III*a* to produce Enclosure III*b*, but it cannot be regarded as dating either the original rampart or the pottery from below the level of the hearth. The debris on the floor and the hearth would seem to indicate that the chamber or cell referred to as Enclosure III*a* had been roofed, but the comparatively thin dry-stone wall of its northern sector appeared to be too weak to have supported a tall corbelled roof of slabs such as occurred in a chamber found within the broch wall. However, this cell may have had a flatter cover of long slabs.

The later reorganisation produced an oval chamber (Enclosure III*b*) measuring some 4.15 m by 2.2 m. When excavated, its interior was filled with rather large flat slabs. These overlay a heavily carbonised earth floor in which the only recognisable feature was a square setting of small slabs on end: this has been interpreted as a socket to steady a vertical post positioned against the E wall. The pot sherds recovered from the floor were characteristic of the broch period. The walling on the E, S and W sides was of dry-stone masonry and lacked the vertical slabs and panelling which were noted in the earlier cell. The vestiges of the N wall consisted of single flagstones on end, but there had been much disturbance: it appeared that an earlier structure on the site of Enclosure VII within the settlement area, had abutted against the rampart. Subsequently, at a still later stage, a

narrow passage, running along the back of the rampart, had been constructed at a higher level. These features were the most westerly noted on the line of the rampart in the main excavation area outside the broch.

A further trench was opened across the outer rampart 6 m away on the W, and was extended for a distance of 10 m from the area S of the broch to a point as near to the cemetery wall as would allow the mechanical excavator to pass safely (Ills 6, 34). The continuation of the rampart was located in the N part of the trench. Here, a marked change in alignment of the rampart occurred and a stone-walled recess, rather like a cell, was positioned against its inner face. This penetrated about 1.5 m into the back of the rampart and was outlined by large slabs carefully placed in line and surmounted by remnants of dry-stone walling (Ill 11). On its flagged floor, was an accumulation of midden material to a depth of nearly 0.5 m. In this midden, which included a large quantity of shells and some animal bones, there again occurred sherds of the thick, coarsely decorated pottery which would appear to belong to Period One. Dr Dickson has reported the presence of carbonised cereal grains in the same deposit (Ch 10). Time did not permit further examination of this cell-like structure, nor was it possible to extend the trench N to the broch wall, but it is known, from excavations in 1966, that this area had suffered very severely at the hands of the stone robbers.

In this W trench, the outer revetment of the earthen core of the rampart was found to be standing to a height of 1.2 m: it had been built, rather precariously, on the edge of a ditch-like hollow in the Boulder Clay (Ill 12). Beyond the revetment, this trench had to be cut to a depth of 3 m to reach bedrock as close to the cemetery wall as excavation could be conducted. Above bedrock, there was between 0.25 and 0.5 m of undisturbed clay, overlain by about 0.3 m of dark earth with thin irregular patches of carbonised material at about the level of the foundations of the revetment. This dark deposit was apparently due to silting during the period that this ditch-like hollow was open: the absence of a true soil profile above the Boulder Clay seemed to show that the hollow was in part artificial. Above the silted accumulation was a deposit, 0.9-1.2 m thick, of grey earth, mixed with rubble, which contained animal bones and a single sherd of broch pottery. This part of the hollow had been purposely filled approximately to the present level of the top of the rampart. The uppermost layer consisted of another natural accumulation of soil and sub-soil, some 0.25-0.7 m thick, below the present ground surface. The underlying layer, containing the bones and potsherd, is the counterpart of the great mass of carefully laid slabs, in what appears to be a continuation of the same wide hollow or ditch outside the gateway to the E.

Ill. 11 : Cell-like structure against the inner face of the rampart wall in the W trench

ILL 12 : The outer revetment of the rampart wall in the W trench, showing the rubble fill of the ditch in section

At this point it is appropriate to discuss some of the evidence from a trench cut along the same N/S line as the baulk forming the E limit of the excavated area around the gateway (Ill 6). This trench commenced 6 m south of the outer face of the rampart and continued for 7 m. The original intention in excavating here was to define the extent of the pavement formed by the late slabs in and immediately in front of the gateway, and also to elucidate a complex situation indicated by the geophysical survey. Fortunately, the outer edge of the late pavement was at once located, but it was obvious that the earth in front of it had been disturbed. An extension southwards confirmed that a low bank appearing at the surface, and crossing from the edge of the headland diagonally to the nearby NE corner of the cemetery, was nothing more than the remains of an old field dyke, as shown on the 25" O.S. map. The little heap of irregular stones underlying the bank penetrated no further downwards than the top-soil and matched very closely the remains of the complementary dyke crossing from the NW corner of the cemetery to Chapel Geo.

In what might have been thought a short and simple operation to find natural ground, this trench was extended and deepened. The Boulder Clay was found to dip steeply away from the edge of the late pavement and a great mass of disturbed top-soil and reddish clay was encountered, bedrock being reached at a depth of as much as 2 m. The pavement therefore ended on the lip of what had been a wide hollow which had been deliberately filled with dark earth and clay. On the S side of this hollow, sundry disturbed flagstones indicated that it had not extended much further than the end of the trench. This arrangement closely resembled that in the W trench described above, but the fact that the Boulder Clay lay comparatively close to the present-day surface at the N end of the S trench presently under consideration, suggests that two hollows are represented, or perhaps two branches of the same hollow. One seems to have run along the foot of the rampart: the second lay further S. Clearly, however, the ground in front of the outer defence system was by no means the level surface which the even spread of turf between the cemetery wall and the broch suggested. In both sections across the hollows, the absence of any recognisable ancient soil profile on the Boulder Clay would indicate that both had been artificially steepened and deepened. Perhaps this was for defensive purposes, but also there is the possibility that they simply provided a source for the earth which formed the core of the rampart wall and perhaps also that of the wall of the broch.

THE WESTERN FLANK OF THE OUTER DEFENCES

In the early stages of the excavations, trenches were laid out onto the grassy platform to the W of the broch, but no indications of building activities were found at this stage. Later, the geophysical survey indicated marked anomalies in a linear strip further W and these trenches were then extended 25 m, from the broch to the lip of Chapel Geo which was there more of a steep grassy hollow than a cleft. All that was to be found in the area where the geophysical anomalies were concentrated was a shallow dip in the surface of the Boulder Clay. There were no signs of the extensive filling which had occurred further to the E in what was apparently a continuation of the same hollow. However, bedrock was unexpectedly encountered at a depth of only 0.6 m in the centre of this depression and the inference is that the rock surface rose markedly westwards from the vicinity of the gateway.

The N edge of this depression, on the broch side, had been slightly steepened artificially, but only to a depth of 0.15 m. A series of large low slabs, jutting above the Boulder Clay, and forming an alignment, lay adjacent to this margin of the hollow. Obviously these were chock stones which had formerly supported a line of flagstones on end, such as still surround so many of the fields in Caithness at the present day. Once this alignment had been located, it could be followed as a very slight grassy bank, extending to the cliff edge at Chapel Geo. This line was several metres from, and ran obliquely to, the line of the field dyke running from the NW corner of the cemetery wall to Chapel Geo; the line of this latter feature was located without difficulty in our trenches.

The significance of the chock-stones was not fully established until the very last hours of the excavations. At this stage, we had been working along the outer face of the rampart to trace its course W from the W trench, discussed above. In this area, the external face of the wall was very ruinous, but had been built where bedrock was sloping upwards towards the platform on which the broch was located. The rampart may thus have become more in the nature of a terrace-like feature than a wall with interior cells. When finally established, the line of the outer face curved markedly to the WNW and then continued straight, on the precise alignment of the chock-stones and the low bank running to Chapel Geo (Ill 6). The exact connection was not uncovered but there can be no doubt of the alignment. Nothing could be done in the short time available to follow the line of the inner face. It was known to be crossing a very badly disturbed area outside the broch wall, where previous excavation had shown that stone robbers had destroyed any walling down to foundations.

THE OUTER DEFENCES: GENERAL CONSIDERATIONS

In considering the outer defences, it is necessary to think in terms of a relatively massive wall in the area of the gateway, which became a more terrace-like feature to the W overlooking a broad hollow or ditch as the bedrock rose closer to the surface, and which finally deteriorated into an alignment of flagstones on end. This last sector, with no serious natural obstacle in front, would seem to have been an astonishingly flimsy defence, unless it were intended to be no more than a barricade to keep livestock penned on the headland. Although an attacking force might have clambered over the fence without much difficulty, the livestock could not have been driven away so easily. It is probable that the massive wall continued for at least 9 m further to the edge of the headland on the E, but the absence of any signs of walling at the present day cliff line make it possible that here, too, a more flimsly line might be envisaged. If the broch were to be considered as a later addition to a pre-existing defence system on the headland, it might be interpreted as strengthening the weak W flank. Probably a more realistic approach to the problem is to think of a complex including the outer defences, together with the broch and the settlement as growing without any overall tactical plan, the main objective being the *appearance* of strength from the landward side.

No close parallel to the outer system of fortifications at Crosskirk can be suggested, though 'outworks' on broch sites are not uncommon on the northern mainland and in the Northern Isles.

A headland at Sgarbach in the extreme NE of Caithness (RCAHMS, 1911*a*, no 45) was defended by a single wall, with a broch-like entrance and guard cell, but, except for a little clearance many years ago, nothing is known about the fort as a whole. The site at Nybster, again in NE Caithness (RCAHMS, 1911*a*, no 518), comes to mind, in that there is a broch, a settlement and an outer wall across the neck of a rocky headland, but nothing is known of their order of construction. The outer wall there has a gateway, and behind this is a straight stair leading to the wall head: however, as a defensive system, the whole has a curiously incoherent appearance and may be composite. In sharp contrast, the well known and very massive ramparts outside the brochs of Midhowe and Gurness in Orkney (RCAHAMS, 1946, nos 263, 553) seem clearly to suggest an integrated system, and offer a resemblance to a Medieval castle with the broch as the central tower within an outer enclosure.

A further possibility in connection with the outer defences at Crosskirk remains to be considered: this is the so-called 'Forework' at Clickhimin in Shetland (RCAHMS, 1946, no 1246). Briefly, the structure consists of a free-standing length of thick walling, complete in itself, and provided with a broch-like entrance, intra-mural cells, a stair and a scarcement. The structure is slightly curved in plan and stands directly behind the entrance to a ring-fort: it was likened to a blockhouse by Hamilton (1968). He believed that the construction of both the Forework and the ring-fort preceded that of the broch which stood within the latter. He emphasised parallels with two other sites in Shetland. The Ness of Burgi (RCAHMS, 1946, no 1154) is somewhat similar, although more ruinous than the Clickhimin Forework, but at this site the length of thick walling, with cells on either side of the entrance, stands on its own on a rocky headland, behind a double ditch. The Loch of Huxter, in the same area, (RCAHMS, 1946, no 1316), again involves a similar feature but in this case it is linked to a ring-wall, although the two appear to have been built separately. Hamilton's interpretation of all three sites is that at its original height, their broch-like walling formed the stone support for timber dwellings of two stories, which were built up against their inner faces. This idea is in fact supported by comparatively little structural evidence on the sites and has been severely criticised, but whatever their precise function, the three structures must be a reminder that seemingly strange forms of defensive works existed during the Iron Age in the northern part of the Atlantic Province. All three Shetland sites offer a direct comparison with Crosskirk, in that an apparently inadequate defensive arrangement is found on the flanks of the strongly built, broch-like walling. These parallels must be left for further discussion below but it might now be suggested that the gateway section of the outer defences at Crosskirk is not the unique, somewhat incomprehensible, feature it might appear to be at first sight.

4 THE STRUCTURAL CHARACTERISTICS OF THE BROCH WALL

GENERAL FEATURES

It has long been recognised that the brochs of Caithness and Orkney differ from those of the western coastlands in certain details; as Graham suggested, 'two strains' are involved (Graham, 1947; Mackie, 1965). In the northern type, the encircling wall tends to be more massive and the central space is small in proportion; secondly, the lowest gallery does not normally occur at ground level, so that there is a relatively solid base. The Crosskirk broch (Ill 6) fits the regional pattern. The wall at ground level was 4.3 to 5.8 m thick, the maximum width being on the seaward side, while the central space formed only a low proportion of the overall diameter, about 50% on the E/W axis. There was no ground gallery. The entrance was typical, with door-checks and a bar-hole half way along, while a 'guard cell' opened off on the right on entering the broch. There was one intra-mural cell and a single stair, the entrance to which was rather less than a quarter of the way round the inner perimeter of the broch wall to the left of the main entrance.

The plan, however, immediately suggests peculiarities. The guard cell, entrance, intra-mural cell and stair entry all occurred within a sector of 140 degrees in the SE of the broch, while the remainder of the circuit was uninterrupted. There was no gallery running from the stair foot to a cell or rounded end within the thickness of the wall, although this feature often occurs in Caithness brochs (RCAHMS, 1911a, nos 446, 508, 509, 513, 515, 517, 520). The interior walling of the intra-mural cell came exceptionally close to the broch entrance. The guard cell was misshapen by normal standards and the entry to it was extremely close to the internal wall face of the broch. This overcrowding of features in the one sector at Crosskirk seems to show a lack of balance in design and points to the possibility of architectural problems. The position of a rock-cut well within this same sector still further emphasises the lack of symmetry. Moreover, the extensive buttressing added to both faces of the broch wall provides further remarkable features which give a clear indication of structural instability.

The broch wall in its original form, devoid of secondary casings and buttresses, varied considerably in the height to which it had survived. Except in the badly destroyed S sector, it still stood about 3-3.5 m above Boulder Clay. However, this included an upper portion, about 1 m high, which consisted of a grass-grown mound of rubble from which the occasional slab protruded. The maximum height attained was normally reached about half way between the inner and outer faces of the broch wall.

The building stone which had been used for the faces came from the upper strata of the Old Red Sandstone, now exposed in the cliff on the seaward side and in Chapel Geo, which had almost certainly been widened by quarrying. Some large slabs are to be seen at present in the geo, but not along the seaward side of the site. These are almost ready-made naturally for building purposes, but are not present in any great quantity. The upper strata of rather limy flagstones could be prised apart readily and appear to have been used on a considerable scale in the broch, but they weathered badly as could be seen in many places where lengthy exposure had occurred. Sometimes, for example in the lower courses around the inner end of the main entrance passage, the stone had rotted leaving the wall face in a dangerous state. Numerous cavities, many due to the disintegration of the stonework were visible on the inner face (Ill 13), but there was a problem here as other cavities were much wider and penetrated more deeply into the thickness of the wall: no precise interpretation for them

Ill. 13 : The inner face of the broch wall on its N side: some of the cavities may be explained by the subsequent disintegration of the sandstone used in the construction. Part of the stone ladder is visible

had been discovered. Structural instability in the broch may have developed in part as a result of the extensive weathering.

The inner face of the broch wall was by far the better preserved. Material falling from the wall into the broch had accumulated to a greater depth than occurred outside, where the radial dispersal of debris had led to its distribution over a much wider area. This process seems to be responsible for the shape of many Caithness broch mounds which resemble an inverted bowl. The inner face was still standing 2-2.5 m above the natural surface for two-thirds of the circumference of the broch, from the stairway clockwise to the broch entrance. It was an impressive sight when excavated but was obviously in a dangerously unstable condition, as it was weakened by some huge cavities. The face was strictly vertical except in the E where there was a slight overhang. This was probably due to reconstruction which was indicated by the use of harder stone than usual. In the S sector, where refacing and buttressing had been necessary, the original face was only about 0.6 m high at the cell entry. Similarly, at the stair entry, the face was only the same height, due in this case to the activities of stone robbers creating a breach from outside.

The individual blocks employed in the construction of the inner face varied greatly in size, shape and degree of resistance to weathering. Slabs as much as 1 m long, 0.15-0.2 m thick, and 0.3 m wide, had been used, but smaller slabs, blocks, small pieces for packing, and even thin plates to level off irregular slabs, made a varied pattern. All were laid horizontally, sometimes three or four large slabs in a row, and were packed tightly to give the effect of rough coursing. Nevertheless, the individual stones were so variable that the builders sometimes ended with vertical joins running one directly above another through several layers for a distance of as much as 0.3 m (Ill 13). It is not difficult to visualise the purposeful removal of one or even more of the larger blocks from the wall face without provoking a massive downfall, but it is extremely difficult to see how a secondary feature, such as a stone ladder, could possibly have been inserted into a wall face rising to anything like tower height.

Comparatively little can be said of the original outer face of the broch: it was much lower and very extensive secondary casings covered up much of what had survived. In the N part of its circuit, it survived to a height of between 1 and 1.50 m. On the other hand, the sector comprising about 10 per cent of the circumference, from the stair eastwards to the back of the intra-mural cell, was either completely destroyed or reduced to one foundation slab in height over a distance of 8 m. Where measurement of the original outer face was possible, there was a marked batter of one unit inwards over a rise of six. The slabs were generally as large as the bigger ones noted in the inner face, but they were consistently of the same size and little packing was to be seen, giving a more massive appearance.

THE CONSTRUCTION OF THE BROCH WALL

Investigations in the S sector showed that construction had begun with the positioning of the foundation slabs for the inner and outer wall faces. Inside the broch, these were laid in a perfect circle 9.86 m in diameter, but strangely the northern half of the inner face did not correspond (Ill 28). From the position of the stair northwards, the lower courses of the wall began to diverge from the line of the foundations until they were set back by as much as 0.3-0.35 m in the northern sector: the inner wall line returned to the true circle just before the main entrance. Around the N and E sectors of the interior, the foundation slabs were laid on Boulder Clay, but in the SW there was an intervening layer, up to 0.45 m thick, of dark humified soil as though a hollow had been levelled in preparation for the setting out of the foundation slabs. These were laid in a horizontal plane with a margin of error of only 0.17 m over the entire circumference. Where observation of the outer face was possible, on the SW side and N of the entrance passage, the wall face was again set back 0.1 m or so behind the projecting flagstones which formed the foundations, established on the Boulder Clay.

Drawing a perfect circle for the interior on a level surface would have been a simple matter using a central stake and a rope, but problems seem to have been encountered by the original constructors in the N sector of the outer face of the wall, which was at the edge of the cliff by the time of the excavation. The vertical drop, coupled with loose rubble and the presence of two casings on the outer wall-face, made examination difficult. However, it appears likely that the pre-broch ground surface dipped seawards in this area. In response to this, the broch-builders appear to have widened the original broch wall from an average thickness of 4.27-4.42 m, noted in the S sector, to as much as 5.80 m. This thickening may have arisen in an attempt to arrive at a strictly circular enclosure at the plane of the broch floor, taking into account the downward slope, but also the builders may have had to strengthen the wall for greater stability on the slope. The later addition of two casings certainly indicates concern over this sector. It might be suggested that the need to diverge from the circular plan of the outer face was overestimated. When the builders realised their mistake, on reaching the plane of the interior floor, the internal wall was realigned outside the foundation course to avoid building an unnecessarily thick wall.

The next stage was to build up the two faces of the broch more or less simultaneously, using the larger slabs primarily on the outside. The core of the wall was filled with anything available—Boulder Clay, rubble, slabs, domestic refuse and even rounded boulders—but the major part of the fill consisted of earth. It is little wonder that the broch occupants resorted to constructing casings and buttresses against the wall when signs of weakness developed.

Exposures of this predominantly earthen core had been noted early in the investigations but their extent and significance were not appreciated. Loose rubble, forming a scree slope, appeared in the eroded area on the cliff edge: masses of domestic refuse and whalebone were found under the floor of the intra-mural cell: the bottom step of the stair had been established on a mound of clay and refuse. Full realisation came only when the time arrived to make a cairn of the remnants of the broch, and an opportunity was offered to examine the core of the wall.

A section was cut across the wall half way along the stair, using the mechanical excavator.

ILL 14 : The broch wall, sectioned by the mechanical excavator, showing the sandy clay of the core under the stair

Underneath the steps (Ill 14), the packing consisted mainly of sandy clay; however, the spaces between the walls flanking the stairway and the inner and outer walls of the broch had been filled with carefully laid slabs. Presumably this reflects the need for greater structural stability. The staircase had been built up as the wall itself was raised. A second section was cut by machine just N of the stair, and this showed a core of earth up to 2.15 m above ground surface, in which a huge rounded boulder was a prominent feature. It was clear that the inner and outer revetments of the core were no more than one slab in thickness. Observations elsewhere revealed parallel conditions. A noticeable feature in the NE sector was a core of sandy earth nearly 1.85 m high. It became apparent that a wall core of built slabs was reserved for those parts of the broch wall adjacent to the entrance and the two cells, as well as the stair. Elsewhere, the heterogeneous core was solidly packed but there was no evidence of ramming. When the wall was cut, the core materials came to rest at an angle of 60 degrees immediately after a section had been made, indicating the general but temporary angle of rest of the material.

It will be recalled that the external rampart had been constructed with an earth core, but slight differences could be detected. The revetments of the rampart incorporated slabs which were thinner than those used generally in the broch. Its core, although not sectioned, seemed from superficial examination to be more tightly packed and to consist of more homogeneous materials. Obviously a very considerable volume of earth had been used for the cores of both the broch and rampart walls.

In spite of the fact that numerous broch sites have been excavated in the past, especially in Caithness and Orkney, almost no observations seem to have been made relating to the core of their walls. There are many loose statements in the broch literature about the good and even excellent masonry, but it seems to have been taken for granted that the solid-based northern brochs were built entirely of stone. The large amount of rubble and earth to be seen on many sites has been glossed over, usually with some statement about stone robbing to build houses, dykes and roads. In a controversy with Sir Lindsay Scott over the original height of the broch towers, Graham was able to show that slabs could in fact be carted away for great distances (1947). Nevertheless, the Crosskirk evidence clearly indicates the possibility of other solid-based brochs having wall cores which consist primarily of earth.

THE SUPERSTRUCTURE

The original height of the broch wall at Crosskirk presents a complex problem of much more than local interest. At the time of excavation, it survived to a maximum height of 4 m. Scott's thesis

(1947), that only a very few brochs reached the height of Mousa, Dun Carloway or Dun Telve, and that most were relatively low, fortified farmhouses, has received little support, whereas Hamilton's idea (1968) that houses of two storeys were built up against the inside wall, has at least received wide publicity. Observations at Crosskirk, however, raise the height problem in a new form: could a high tower, with five or six superimposed galleries, have been constructed on a base with an earth and rubble core? The following details are recorded since they bear not only on the question of broch heights but also on the origins of the broch themselves. One major difficulty lies in the fact that the wall of the broch at Crosskirk may have been reduced in height before the end of the occupation. Evidence from the settlement, discussed below, and from the filling of the hollow ground in front of the rampart, shows that a very considerable volume of earth and slabs had been dumped in levelling operations after the broch had become unstable.

A close examination of the top of the wall as it survived was made for signs of a gallery and scarcement, both of which might have been expected since the inner wall face stood as much as 3 m high. Few examples of brochs can in fact provide statistical information of scarcement height above the original floor level, and this is particularly true of Caithness. Almost the only site from the Old Red Sandstone lowlands where measurement is possible is the Broch of Yarrows (RCAHMS, 1911a, no 509) and here the remnant of a secondary casing seems to be involved and not a true scarcement. In the solid-based type of broch, the level of the scarcement is also very much the same as the floor of the first gallery. According to Graham in his invaluable statistical analysis (1947), and excepting the rare high-level examples at Mousa and Dun Telve, the average height of the scarcement is 8 ft (2.44 m) but there is an example at the Knowe of Burristae in Orkney (RCAHMS, 1946, no 1034) which is as high as 12 ft 6 ins (3.81 m).

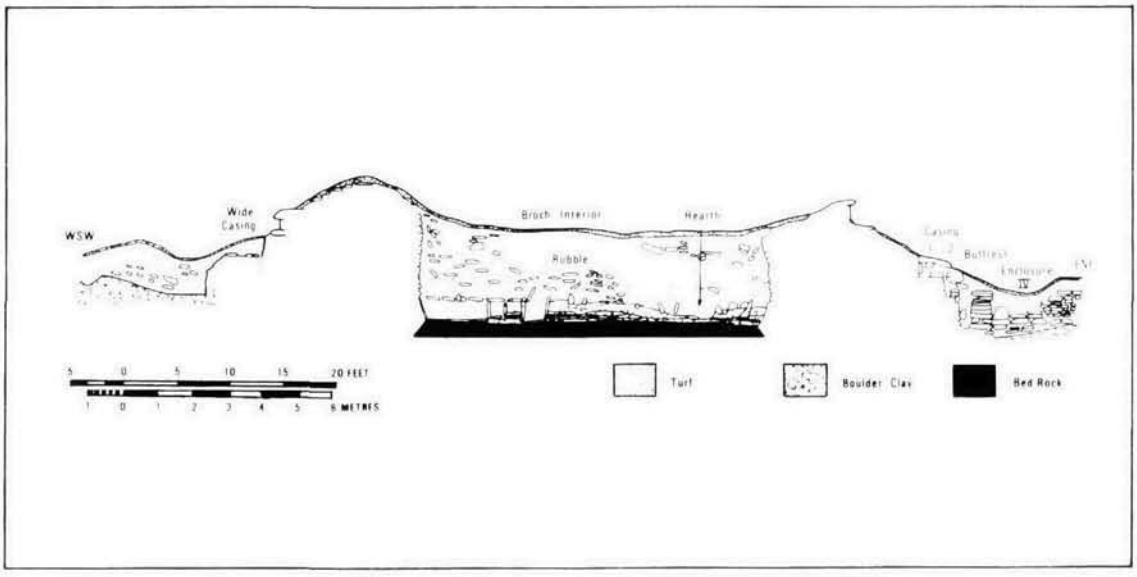
At the top of the wall at Crosskirk, there was little to be seen other than a slight overhang of 0.05 m in three adjacent slabs at a height of 2.75 m above the foundations in the NW sector, where the inner face survived to maximum height of 3.0 m. Another slab, at a height of 2.65 m on the same side, again showed a slight projection. If this were something more than a slip in both cases, which is very doubtful, it could only imply the beginning of corbelling below a scarcement and not the scarcement itself.

The evidence for a gallery was equally obscure. In the E sector of the inner wall face of the broch, some horizontal slabbing was uncovered early in the excavations and was sufficiently noteworthy to give the impression that the broch wall consisted of solid stonework. Again, horizontal slabbing occurred at a height of 3.21 m on the W side of the broch wall. If this horizontal slabbing at somewhere about 3 m were to be regarded as significant, it could only represent the foundations for a gallery established on the core of the wall, and not the floor of the gallery itself.

In fact the evidence for the existence of a gallery and a scarcement is in our opinion both indirect and very slight, apart from the rather consistent occurrences of noteworthy features at a height of about 2.75 m (the level of the topmost step of the staircase), and even these could well be the remains of a wall-walk rather than a gallery. Moreover, a corbelled scarcement at a height above the average noted by Graham (1947) would be most unlikely at Crosskirk since it would be resting on the inner facing to the core, which was only one slab thick.

THE ORIGINAL WALL HEIGHT AND THE EFFECTS OF STONE ROBBING

Although there is so little evidence to show that a gallery or galleries ever existed at Crosskirk, it is only reasonable to suppose that after two thousand years in such an exposed position, the original wall height has been much reduced. Any attempt to estimate the amount of reduction is very difficult because so many factors are involved. The size of the mound of debris on the site is deceptive: it rose in the interior of the broch to a height of as much as 2.75 m above the original floor. However, the remains of the external settlement proved to have been levelled artificially and material from



ILL 15 : Section across the broch from WSW to ENE

the broch mound had probably been employed to achieve this. Moreover, stone robbing must have occurred when the S ramp was constructed into the broch and when the robber trench outside the broch was dug. In this connection, however, it must be remarked that the stone slabs which were used in building the comparatively recent cemetery wall and the adjacent field dykes, appear to be tougher than those which could be expected to have come from the broch and its debris.

Unfortunately, not a single datable object was recovered which could throw light upon the periods involved in the accumulation of the great mound over the Crosskirk site. The material filling the interior of the broch, however, calls for comment. After the tumbled stone had been removed, it was obvious that the internal wall face was scarcely weathered at all up to a height of about 0.6 m above Boulder Clay. This must represent approximately the height to which occupation material had accumulated before the end of the regular use of the broch. Above 0.6 m, the stonework was deeply weathered, as has already been noted. Presumably this implies exposure of the upper parts of the wall over a long period of time. The debris in the interior, above this level of 0.6 m, contained slabs in some quantity for another 0.3 m or so in the central area, rising to a rather greater height around the periphery of the broch court (Ill 15). These slabs must represent tumble from the wall face. This deposit, the limits of which were somewhat indistinct, was overlain by an accumulation of 1.5-2.2 m of material, which was extremely puzzling to us in the earliest days of the excavations. It consisted of wet, sticky Boulder Clay and rubble, mixed with a few wall slabs but with occasional bones of domesticated animals and sea shells, which were found either in isolation or in little pockets. Intermittently represented in this deposit were elongated beach cobbles, abraded at one or both ends, which were presumably pounders or mauls, as well as rare sherds of broch pottery. There was no sign of occupation horizons, whether permanent or temporary, within this accumulation of debris. Such a considerable volume of earth and rubble was encountered that it led to a serious discussion of the possibility of a former clay superstructure associated with the broch. It would now seem that the material came from the core of the broch wall when the stones of the retaining face were pulled away or collapsed. The complete lack of stratification in the upper layer suggested collapse provoked by a sudden onslaught by stone robbers and not intermittent disintegration.

In two places, one high up against the wall face in the NW part of the interior and one at the foot of the stone ladder, discussed below, small flagged platforms were found: these lacked both signs of burning and an associated occupation deposit. The NW example (Ill 16) was well constructed, having been originally defined by a low kerb of stones on end, which outlined a crescent-shaped 2.2 m by 0.6 m, along the wall. These platforms may have been laid to give stable footing for stone robbers.

Both the evidence for stone robbing, and the nature of the debris inside the broch, show that the wall had been reduced in height after cessation of occupation, but by how much is another matter. The earth, rubble and slabs which made up the mound inside and immediately outside the broch would account for little more than would be necessary to bring up the S sector of the wall to the surviving height of the N portion and to level off the wall top.

A great many quarried slabs, which would have formed suitable building material for the revetments of both the broch and the rampart wall, were found amongst the mass of stone blocks which had been laid down in front of the rampart gateway, as referred to previously. Similar blocks occurred in the late extended passage linking the broch entrance and the gateway. It is difficult to see why such good blocks were used as filling material unless dismantling operations had rendered them superfluous. The mass of earth and rubble encountered in the trench to the W of the gateway outside the rampart, could well have come from the core either of the rampart itself, or from the broch wall. Although proof is lacking, it seems a reasonable inference that one or even both had been purposely reduced, in the case of the broch because of instability. The matter of a possible reduction of the fortifications will be taken up again in a later section of the report.

After careful consideration of all the evidence, it seems reasonable to assume that the walling might well have been stabilised during the last phase of the occupation at a level not much above the maximum height of the structure at the time of our excavations, ie at about 4.5 m. In considering the original height, the limiting factor must surely have been the strength of the basal structure with its earth and rubble core. Tightly packed clay in a carefully revetted wall, protected from weathering by a capping of slabs, might well have formed a very stable wall. However, in the broch, the heterogeneous core was not firmly consolidated. Any disintegration at the top of the very exposed superstructure of the broch through frost, rain and wind, would soon have allowed the penetration

ILL 16 : Upper platform, overlying accumulated debris, in the NW sector of the interior of the broch

ILL 17 : The buckled steps of the intra-mural stair: the breach in the foreground was made by later stone-robbers

of rainwater. In time, downward and outward slip would have developed, and would have pressed on wall faces which themselves would have suffered from storm damage and frost action. Thrusts inward, towards the centre of the broch, may have served to force the blocks of the inner revetment together, rather like an arch laid horizontally. Contrastingly, pressure in the opposite direction would have tended to force the stonework apart. Perhaps experience had shown the need for a marked batter to strengthen the outer wall face: casings and buttresses resting against the batter of the external wall face may then have seemed an obvious expedient should signs of disintegration have occurred.

In summary, the broch produced no direct evidence for a gallery or a scarcement, and no proof that the wall had ever been very stable above about 4 m. Obvious signs of instability appear to have developed in the early stages of the occupation. The apparent weakness of the basal structure, combined with the factors just discussed, make it difficult to believe that the Crosskirk broch ever rose higher than 6 m, that is, less than half the height of the Broch of Mousa. The subsequent reduction would have involved a further one or two metres. A wall-walk and breast-work are envisaged in both cases.

THE INTRA-MURAL STAIR

The slight traces of a built face within the broch wall which were reported by the Commission (RCAHMS, 1911a), proved to be part of an intra-mural stair (Ill 17). Decay of the sandstone, and perhaps falling slabs, had damaged the structure, while pressure from above on the side walls into which the individual steps were bonded, had caused some of them to buckle and break. Sixteen steps had survived in the flight which rose steeply for 2.14 m over a total distance of 3.30 m. The stair was 0.78 m across at the uppermost step but widened downwards towards the lowest step which was set in a low clay mound mentioned earlier. Often two or even three blocks had been used to make one of the steps. The best preserved and the largest had a tread of only 0.15 m for a rise of 0.10 m: by modern standards most of the steps were minute (as at Mousa), especially if the main purpose of the stair had been to facilitate the transport of heavy loads during broch construction,

On either side of the steps, the walls, which curved in accordance with the main broch wall, were very rough indeed. The broch wall at the stair position was slightly narrower than elsewhere:

at a point half way up the existing stair, the wall thickness to the outside of the external face was 1.50 m, consisting of about four slabs, whereas on the inside it was 1.70 m wide, and consisted of five slabs. One can only comment that this steep, narrow and irregular stair which must also have been dark when covered over, seemed singularly ill-made if it had been designed to give access to an upper range of timber buildings, such as Hamilton has postulated as dwelling quarters against the inside walls of brochs generally. Moreover, signs of wear by constant treading were noticeably absent.

There was a separate entry to the stair foot from the interior of the broch, although this point became certain only after excavation of the intra-mural cell had shown that its W end did not give access to a gallery leading to the stair. The latter arrangement might be considered typical for a Caithness broch. Excavation revealed that stone robbers, forcing a way into this sector of the broch, had destroyed the whole of the stair entry except for what was problably a small remnant of its NE corner, and a threshold slab, laid 0.55 m above the the floor level of the broch. In this area, too, the outer wall face of the broch had been removed down to the very foundations by stone robbing. This devastation was most frustrating as some slight indications exist, as will appear, to show that a second entrance to the broch, utilising the stair entry, may have been constructed at a late stage in the occupation. This alteration could conceivably have been made after the wall had been reduced in height. It would have been extremely difficult to force a new entrance through the full width of

ILL 18 : The stone ladder, recessed into the inner face of the broch wall on its N side

a broch wall, especially one constructed with an earth and rubble core, as at Crosskirk. However, the carefully laid slabs, noted in the wall on either side of the stair, may well have extended round the stair entry. If this had been the case, such a modification might have been more feasible.

In the Inventory for Caithness, no less than six brochs out of the relatively small number for which details are available, have two separate entrances. In five of these cases, the second entrance passes the stair foot (RCAHMS, 1911a, nos 33, 34, 509, 515 and 517). Graham (1947) believed that most if not all of these entrances were not primary features.

THE STONE LADDER

Directly across the broch from the stair entry were the remains of a neat stone ladder for which no parallel can be quoted. It was somewhat broken away on one side but it had been about 0.48 m wide where it was inset into the broch wall. Each 'rung' consisted of a slab carefully packed into position 0.13 m above the one below, just allowing space between for the tight insertion of the toes. It began at least 1.30 m above the foundation level. The lowest two or three 'rungs' were set successively further into the thickness of the wall, but the remaining four then rose vertically about 0.6 m back from the internal wall face (Ill 18). There was no evidence to prove that this feature was a late insertion as the stonework on either side was much weathered and broken away, though the rungs appeared surprisingly fresh when first exposed.

The fact that the ladder is recessed into the thickness of the wall seems to indicate that some obstacle occupying the interior of the broch about 3 m above the original floor level, such as a roof or the inner edge of a veranda-like structure, had to be negotiated in order to reach the wall face above. Otherwise a simple vertical ladder or projecting steps like a stone stile would have been sufficient. There was a huge slab (1.25 m × 0.48 m × 0.23 m) which rested at an angle underneath the ladder as though to improve access to the lowest rung (in the foreground of Ill 18). The ladder may have served at a late stage in the occupation to reach the wall head on the seaward side of the broch.

THE INTRA-MURAL CELL

In outline, at ground level, the cell measured 5.2 m by 1.75 m wide (Ill 28). It reached to within 1 m of the broch entrance at one point and the other end was about 2.75 m from the stair entry. The inner end of the cell entry was 0.92 m wide, but the outer part was largely destroyed owing to the collapse of the inside face of the broch wall. This part only survived to a height of 0.60 m above the foundations. The collapse had occurred at a comparatively early stage in the occupation of the broch and the whole area between the stair entry and the main entrance had been walled off subsequently. The interior of the cell was packed with rubble and fallen stones. The outer wall of the broch had been robbed to its foundations over the length of the cell, except at the E end, and the cell wall had been reduced at the SW corner to floor level. At this point, the outline could be traced only through thin upright slabs at the edge of the floor. Remarkably, in all this destruction, the corbelled walling at the NE corner of the cell had survived to a height of 1.85 m, although the overhanging stonework was unsupported and had to be partly dismantled to allow excavation to proceed. It is clear that the beehive roof must have risen some 2.75 m above floor level. The cell appears somewhat angular in ground plan but it assumed an oval shape relatively quickly at the higher levels. The individual stones producing the corbelled overhang were rough and surprisingly small, rarely approaching 0.6 m in length, and irregular in size. There was no systematic placing of large slabs chordwise at the end; a feature looked for at Graham's behest (1947).

The floor was of earth and irregular flagstones for the most part but, opposite the entry, the remnant of a low tabular platform was delimited by a kerb of thin upright slabs. This may originally have been about 0.45 m square but the sandstone had disintegrated badly and the stone robbers had penetrated down to it from the outside. Its form was suggestive of a hearth, but there were signs neither of burning nor of a recognisable ash deposit. At the rounded E end of the cell, there was another platform like a stone seat, about 0.6 m high and up to 0.45 m wide (Ill 19). It had been built separately against the cell wall utilising a large angular boulder, and consisted of thin, carefully laid slabs. No satisfactory explanation can be suggested for these tabular structures, and indeed, the purpose of the cell remains obscure. It may have been a store for perishables.

Between the floor of the cell and the undisturbed Boulder Clay, was a deposit of soil which contained much domestic rubbish, including animal bones, potsherds, part of a long-handled weaving comb and a plate of whalebone. This was, however, no more than might have occurred elsewhere in the earth and rubble core of the broch wall.

ILL 19 : The intra-mural cell in the broch wall, showing the seat-like structure at its rounded, E, end

THE ENTRANCE PASSAGE

This section of the report is concerned with the original entrance passage through the broch wall: subsequent extensions to this, which ultimately resulted in a continuous passage through to the gateway in the outer rampart, will be discussed in relation to the settlement area.

The discovery of a lintel stone on the inside wall face was the first sign of the presence of an entrance in the SE sector of the broch. The lintel had slipped and was the only one to have survived but it indicated that the original passage was about 1.5 m high. The whole of the inner end of the passage was in a very poor state of preservation owing to the use of shaley flagstones which had crumbled in the lower courses at the corners.

Passing outwards along the entrance passage (with the guard cell immediately on the left) the masonry on the side walls, away from the inner face of the broch, proved to be the finest on the Crosskirk site. At the inner end, the passage was 1 m wide (Ill 28). Two metres from the inner end were a pair of checks for a door; that on the right consisted of a comparatively thin vertical flagstone standing almost 1.85 m high, built into the side wall and jutting out for 0.15 m. Directly opposite,

there was a socket for a similar flagstone, which had disintegrated, with a bar-hole behind running back into the guard cell. The slabs in the side walls outside the door checks were laid in courses and were noticeably long, some attaining 1.3 to 1.8 m in length. In this part, the passage was slightly narrower (0.8 m), but it widened again to 1.05 m towards the exterior. At the original end to the passage, sloping joints could be seen where a secondary extension commenced at the outer face of the broch wall, and there was a second doorway, described later, about 1.2 m further out.

The pavement of the passage included some very large flagstones indeed, but they were variable in shape: rather large gaps showed earth between them. Underneath this pavement was a slab-sided drain with an earth and cobble floor: it was generally about 0.35 m wide and 0.25 m deep. However, its width increased somewhat at the inner end, where the bottom of the drain was at the primary floor level of the interior of the broch. The first flagstone of the passage had the appearance of a secondary feature and some repaving seems to have occurred.

One possible secondary modification to the entrance will never be fully understood. The late buttress against the inner wall of the broch, which ran anticlockwise across the cell entry, appeared to come to a ragged end, outwards from, but in line with, the S corner of the entrance passage. Immediately, in front of the opposite corner of the entrance passage on the N, several large slabs placed against the broch wall suggested that the buttressing may have continued completely across the entrance passage itself. Excavation of these featuress, it must be stated, was carried out in the very early stages, before the significance of the buttress was at all appreciated: it now seems possible that the inner end of the passage was blocked off by a continuation of the buttress, and a secondary entrance may have become necessary. This possibility is discussed further below.

ILL. 20 : The partially-excavated guard cell with its entrance blocked below the rounded lintel stone

THE GUARD CELL

Like the internal corners of the entrance passage, the guard cell was in part constructed of a shaley sandstone, which had disintegrated, to the detriment of the stability of the structure. The use of an elongated rounded boulder, which looked most insecure, as the lintel at the entry, contributed to its unsoundness. An acutely dangerous situation was made worse by the incredibly stupid conduct of visitors in our absence: this further weakened the structure. Shoring became necessary after the lintel at the wall face had been removed, and it was not possible to clear the cell of debris down to the floor, thereby exposing the lowest courses of the wall.

Nonetheless, the guard cell exhibited some curious features (Ill 20). In the first place, the entry was built exceptionally close to the internal wall face of the broch, a mere 0.6 m separating the two corners. The entry itself was 0.76 m wide and the rounded lintel stone was 0.92 m above the level of the pavement in the entrance passage. The access passage which was still lintelled over, was 0.85 m long and 1.2-1.45 m high. The cell itself was more pear-shaped than oval, owing to the close proximity of the inner wall face of the broch, and measured 2.2 m by 1.85 m internally. The roof was absent, but, judging from the overhang along the upper part of the remaining wall, it must have risen nearly 2 m above the floor level.

The markedly asymmetrical plan of the cell would have allowed the bar for the door to be operated from inside the cell. This bar would have been drawn through a slot, still visible behind the door check in the main entrance passage. A comparable arrangement is to be seen in the Ousedale Broch (Mackay, 1892, 352) and at Dun Mor Vaul in Tiree (MacKie, 1974). The cell itself was filled with rubble which seemed to have been packed firmly in position before the end of the occupation.

It might be suggested that the primary function of the guard cell was to allow the bar for the door to be worked from inside. As with a number of other examples, the low entry is more suggestive of a dog kennel than a sentry box.

CASINGS AND BUTTRESSES

The various casings and buttresses, to which reference has been repeatedly made, are an outstanding feature of the broch at Crosskirk and require detailed description. The question of their significance was considered from the beginning of operations, as two of these additional 'skins' were clearly exposed outside the external wall face of the broch where it had been eroded on the cliff edge (Ill 3). Structural instability had obviously developed long before the end of occupation, and some reinforcement of the wall faces had been undertaken almost all the way round the outside of the broch, as well as on the inside in the S half. The casings were never bonded into the main wall. They cannot have been of any great strength as they were sometimes no more than 0.3 m thick. Those on the outer face rested against the pronounced batter of the main wall, but a vertical skin built against the inside face could hardly have remained stable for very long. Incidentally, the slot-like apertures and cavities on the N internal wall face of the broch, discussed above, cannot represent an attempt to bond in a casing, as none existed along the whole of the appropriate sector.

These extra casings have been noted on a number of broch sites, particularly in Caithness. Beyond some comment on 'refacing' the wall, little has been said about the reason behind them. In some cases, these secondary 'skins', built against the inner wall face, have been described as the remains of a scarcement. The Broch of Yarrows (Caithness, RCAHMS, 1911a, no 509) is a case in point and we believe that at the Strathsteven Broch in E Sutherland (RCAHMS, 1911b, no 270), the very irregular 'scarcement' is much more probably a casing.

Three main types of structure may be distinguished:

Type 1

The first type was used mainly along the external face on the E and N where in places it appeared in duplicate, as on the cliff edge. It consisted of a casing 0.30-0.75 m thick, built to a face on the outside, though the standard of workmanship was usually well below that of the original wall of the broch. Near the edge of the cliff on the NE, the casings were still standing 1.5 m high and obviously had been originally higher. The two skins in this sector at first suggested a type of walling built all in one piece, which Hamilton refers to as 'duplex' (1968, 51). Examination in more detail, however, showed that the original wall face had definite signs of weathering behind the casing which therefore cannot have been original. One short stretch of this type of casing is of particular interest. It commenced about 3 m N of the broch entrance, inside a building to be described later as Enclosure IV. The N wall of this Enclosure abutted directly on to the casing (Ills 15, 21). It can be shown that the enclosure was not later than two radiocarbon dates, centered on the second century bc. In fact, the casing must have been erected not very long after the construction of the broch.

Type 2

The second type was utilised when it was necessary to contain rubble and slabs after a collapse had actually occurred. This was to be seen in a somewhat complex situation in the NE sector of the outer wall face, as far as the cliff edge. A first casing, a continuation of the one already mentioned, had literally peeled away from the original wall face over a distance of some 4 m. A new casing, beginning at a carefully squared end immediately north of the abutment of Enclosure IV (Ill 21), appeared at first sight to be simply another skin on the first casing, but it was found to diverge from the first

Ill. 21 : In the foreground is Enclosure IV: a casing, set along the exnternal face of the broch wall and incorporating a pillar stone, lies beside the ranging pole: the squared end of a second casing is also visible

ILL 22 : Two casings outside the external face of the broch wall in its NE sector

casing, which remained against the broch wall (Ill 22). It later became apparent that the remains of the first casing had been walled off in a crescent-shaped area which was about 1 m wide at the maximum. On the N side of this collapse, but still E of the undermined section of the broch wall, the second casing converged on the original outer wall of the broch, but further complications arose before their convergence: the earlier simple casing had been duplicated, and the result was that three 'skins' occurred in this short section. The duplication gave rise to the two casings which were so clearly visible on the seaward side of the broch. Both of these seemed to end amid loose rubble at the cliff in another square-built end.

A curious anomaly arose in this NE sector of the broch. The poorest masonry anywhere in the original broch wall was to be found here on the outside face: nevertheless, weathering had taken place before the casings were added. On the other hand, the masonry of the outside casing was exceptionally good and was for long mistaken as the original broch wall. Perhaps because it was out of sight on the seaward side, the standard of masonry on this part of the circumference of the broch may reflect simply poor workmanship. However, the addition of at least two casings testify to structural weaknesses emerging more than once.

A collapse, which was probably more serious, occurred inside the broch around the entry to the intra-mural cell, an event to which reference has already been made (Ills 30, 31). A simple casing of type 1, which was much robbed, was traceable from a point 4.1 m N of the stair entry round to the entry corner. It was some 0.3 m thick and was set in domestic midden material; it might simply have been interpreted as refacing the inner wall. However, on either side of the stair entry, there were found two parallel rows of flagstones on end as though emphasising the entry on the inside of the broch. Beyond them, precisely similar walling to that of the first section of casing, commenced at a point some 0.6 m out from the broch wall at the E of the stair entry. Thence the walling could be traced in a curve diverging from the broch wall until it was projecting by 1.15 m at the cell entry, across which it continued unbroken. The walling or casing was holding back rubble and stone which had clearly fallen from the broch face of which only 0.6 m remained at one point. This casing does

not appear to have been carried across the main entrance. So far, there is a close parallel to the state of affairs on the NE external face of the broch, but further trouble arose around the cell. A much rougher buttress, as much as 1.20 m wide, was then superimposed on the first casing which would also appear to have collapsed. A remarkably similar rough buttress was constructed against an earlier casing, directly opposite on the external wall face; here the stonework was as much as 2.15 m thick. This latter buttress can be shown to belong to the later part of Period Three. If the broch had not been reduced in height by that time, it was certainly in a very insecure state. It is to this period that we would look for a breach at the stair entry to provide a second entrance. The double row of flagstones on end then assumes special significance, as an indication of the insertion of this secondary entrance.

Type 3

A low, solidly built platform had been constructed all along the external wall face of the broch from the edge of the cliff in the W, southwards to the area opposite the stair entry, beyond which point it had been destroyed (Ill 7). In a characteristic section (Ill 15), it stood 0.7 m high and was 1.1 m wide, with a marked batter on the outer side. It had been constructed on shaley rubble which represented weathering from the original broch face. The platform had an even upper surface and the top was roughly flagged above the rubble core. At one point, a handul of broch pot sherds was found on these flagstones. The broch wall behind showed signs of weathering so that the platform cannot be original. There is no possibility of interpreting this well-made structure as piled-up stone from the time the upper levels of the broch were dismantled, and it seems to have been intended to buttress the lower part of the wall. This would mean that the whole external circumference of the broch was reinforced by at least one type of casement, with the sole exception of the sector N of the entrance in the E, within Enclosure IV.

THE SIGNIFICANCE OF STRUCTURAL INSTABILITY

In concluding this section of the report, we are conscious of having emphasised the problems of structural instability encountered at Crosskirk. Partly this is because so little has been written in any detail in broch excavation reports on the characteristics of the walling, and loose talk of 'magnificent broch masonry' can be completely misleading. Partly, too, we are convinced that the myth of the broch as a sudden, brilliant architectural conception is utterly misguided. At Crosskirk, structural weaknesses in the original, ineffectual expedients by way of repairs, and successive catastrophes, seem to betoken above all the inadequate experience of the builders in constructing high walling, even though the broch may never have risen to anything like the height of Mousa.

5 THE INTERIOR OF THE BROCH

There has been much criticism of the many excavators of brochs in the past who failed to report on stratification. It is to be remembered, however, that the interior of a broch is the inside of a building where the chances of finding clear stratification are small. The space was cramped and internal partitions tended to be thin-walled and liable to alteration in the course of time. Later, masonry falling from the higher levels must have caused much damage to the occupation material and to minor internal structures. Stone robbers have been notoriously destructive on broch sites. At Crosskirk, after much frustration, we had to be content with the only reliable expedient of the threefold division already sketched:

Phase One: The original construction and very early occupation of the broch.
Phase Two: Subsequent minor alterations over a period of time during which instability produced some internal collapse.
Phase Three: A late, radical reorganisation, perhaps after a break in continuity, before regular occupation ceased.

There remain the possibilities of pre-broch objects and structures surviving within the interior of the broch, and of post-broch material occurring at least up to the date of the construction of St Mary's Chapel.

THE EARLIEST FEATURES

The quest for any regular, conformable sequence of sealed deposits was rendered difficult by reason of secondary changes in the lay-out of the central area, for which clear, stratigraphic evidence was to be seen in upcast deposits overlying dark carbonised material. In addition, there was another difficulty for which no fully adequate explanation can be offered. As previously described, some 2 m depth of debris overlay the Phase Three material: it consisted of sticky, wet earth and rubble with some fallen building slabs. On working downwards through the fill of the broch during the first season, the deposit became increasingly wet until, on nearing the primary floor level, every minor hollow filled with water and excavation became difficult. Water continued to be troublesome in the low levels until a late stage in 1970, but before operations were finally completed in 1971, the ground had ceased to be waterlogged. Where this water came from is still a puzzle, especially as a deep rock-cut cavity which was found below the broch floor in 1971 was almost completely dry. These damp conditions would seem not to have pertained early in the history of the site for there was no exceptional preservation of perishable materials such as textiles and leather, although pieces of wood were occasionally recovered. It is possible that the extensive levelling operations of late medieval times interfered with the natural drainage and caused water to be retained in the broch. Whatever the cause, the external settlement was not affected by this problem.

Other problems of broch archaeology, raised by excavations in the past, called for special consideration. The question of a possible roof was one. Closely related was the purpose for which the broch was constructed: in particular, there was the suggestion put forward by Hamilton, on the basis of the Clickhimin excavation, of timber ranges built around the interior of the broch as living quarters. Always in the background was the problem of dating a site which lay in a region often considered as the homeland of the brochs.

THE NATURAL SURFACE AND FEATURES CUT INTO IT

As a final stage in the excavation of the interior, a narrow trench, running NE/SW across the centre of the broch, was cut down to bedrock which appeared as an almost level surface without noticeable fissures (Ill 15). A very obvious banding was to be seen in the Boulder Clay, due to natural soil forming processes, as indicated in Table 1. In places, the uppermost stratum merged with the dark occupation material where the latter had been trampled into the Boulder Clay.

Depth	Material
0-0.23 m	Yellowish-brown mottled clay, rather sandy
0.23-0.27 m	Brown, with subjacent grey friable earth
0.27-0.35/0.50 m	Yellowish-brown sandy clay resting on bedrock

Table 1 *Stratification of the Boulder Clay*

In various places in the central area of the broch several features appeared which were cut into the natural, notably a curious stone-lined depression against the wall in the south west, and a deep rock cavity or well. One group may be dismissed quickly. It shows up prominently in the photograph (Ill 23) of the NE part of the broch when excavated down to this level. Four depressions are visible

ILL 23 : The top of boulder clay within the broch: bedrock is exposed in the narrow trench

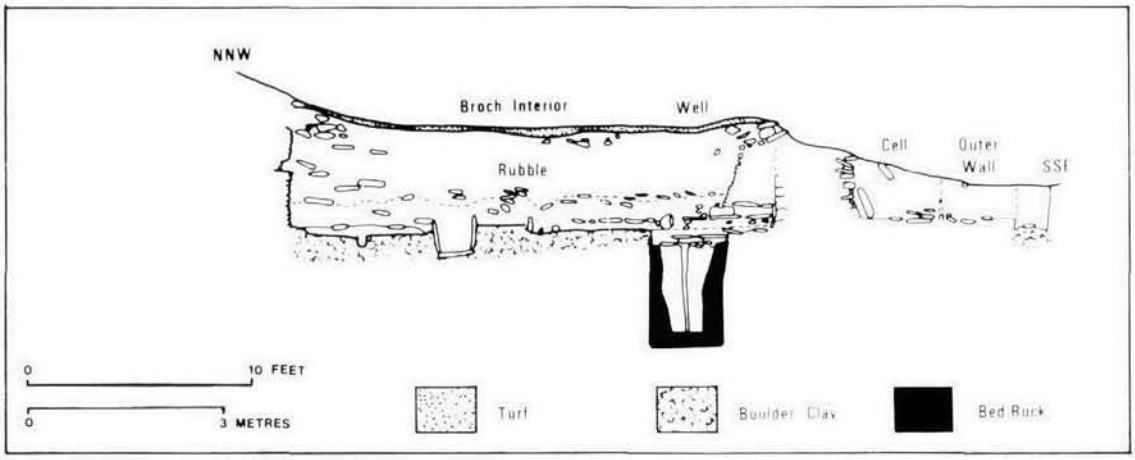
in an uneven row, and when first found, were filled with dark friable earth. Most important was a rectangle almost against the internal wall-face of the NE side of the broch. It was almost certainly the site of a slab-sided tank (of which there were a number in the broch) that had been dismantled during the occupation. A square depression also marks the site of another little tank which had been removed during excavations. The other depressions had been over-emphasised when investigated and in fact represent no more than minor irregularities. It can be stated clearly that none of these could possibly be interpreted as post-holes.

Immediately beneath a large flagstone in the centre of the broch some litter-like material was recovered, and when Dr Dickson found on examination of a sample that it was rich in plant remains, it was submitted for radiocarbon analysis, under the impression that it might have an indication of the date of construction of the broch. The result was 430 bc±45. This suggests that the litter was perhaps contemporaneous with the earlier promontory fort of Period One at Crosskirk, and not with the broch. From the botanical content it would appear that the litter may have been trampled into the top of the natural.

Ill. 24 : Phase One of the broch interior showing the well at the foot of the intra-mural stair: the intra-mural cell is visible on the left

THE ROCK-CUT CAVITY OR WELL

During the excavation of the last small area of the primary pavement, almost immediately in front of the stair entry where it could least have been expected, the flagstones suddenly collapsed to reveal a deep, rock-cut cavity (Ills 24, 25). It was obvious that the mouth had been flagged over and sealed down with clay. The cavity descended for 2.15 m below the primary floor level, of which 1.84 m was cut into the solid rock. The sides of the well were damp, although there was no running water, and the bottom was quite empty except for a small puddle at the deepest point. The mouth was quadrilateral in shape, with maximum dimensions of 2.05 m by 1.06 m. For the topmost 0.6 m or



ILL 25 : Section across the broch from NNW to SSE, showing the well

so, the sides were vertical, except in the SW where there were three rough steps. Then the whole cavity narrowed smoothly, and finally it ended in a fissure-like cleft with a slight overhang on its E side. Above bedrock, this cavity had been carefully built up to floor level with small thin slabs (Ill 26). There seemed very little to show that the cavity had ever held water and only a very small amount of fine black mud had accumulated at the deepest point. Perhaps a fissure or joint had been reached and the enterprise abandoned: the cavity had then been covered with flagstones.

ILL 26 : The W side of the well showing three rock-cut steps and the levelling achieved by the use of small slabs

Ill. 27 : The slab-lined depression below the primary floor of the broch on the W: the flagging, top left, concealed the well

Wells and rock-cut cisterns are not uncommon on broch sites, but there are also examples of large dry 'tanks', as for instance those at the Roadside Broch at Strathsteven, Sutherland (RCAHMS, 1911b, no 270) which was re-excavated by the late John Corcoran; in that case they could not have held water. No single explanation has been advanced for these features, but they were not all intended to be wells.

A single potsherd (*408*) was recovered from the cistern at Crosskirk. It was the only one of its type found on the site and Dr Corcoran stressed its resemblance to the cinerary urns of the Bronze Age. There was no other evidence of a date for this well earlier than the construction of the broch: no sign of a related spoil heap could be found in the vicinity of its mouth. The occurrence of the isolated potsherd, however, gains in significance in view of the early date for a radiocarbon sample of 820bc±100 taken from a building (Enclosure VII) in the settlement at Crosskirk.

THE WALLED DEPRESSION WITH STONE BOXES

Along the inner face of the broch wall in the W, the original ground surface had been dug down to the horizontal bedrock 0.45-0.5 m below the primary floor level, to accommodate a feature for which no parallels have been found (Ill 27). A row of slabs on end, each resting on bedrock, formed the W side of this structure over a distance of 3 m. Two or three of the slabs were missing, exposing dark soil under the broch wall instead of the normal Boulder Clay. The upper edge of the slabs was carefully inserted under the edge of the foundation stones of the broch wall. The low N and

S side walls of the depression did not extend under these foundation stones, and the general alignment of the structure clearly indicated that it belonged to the period of the early occupation of the broch (Phase One). The rather irregular side walls, which nowhere rose above primary floor level, each extended some 1.8 m radially outwards and were joined at the outer ends by another low wall 2 m long. The floor of this feature was paved. The structure had subsequently been packed with flat slabs to the level of the broch floor. This construction had never been intended to contain water as the side walls, consisting partly of dry-stone panels and partly of slabs on end, were not luted with clay. When first located, the depression was water-filled, but that was only normal at this depth at that stage of the excavations.

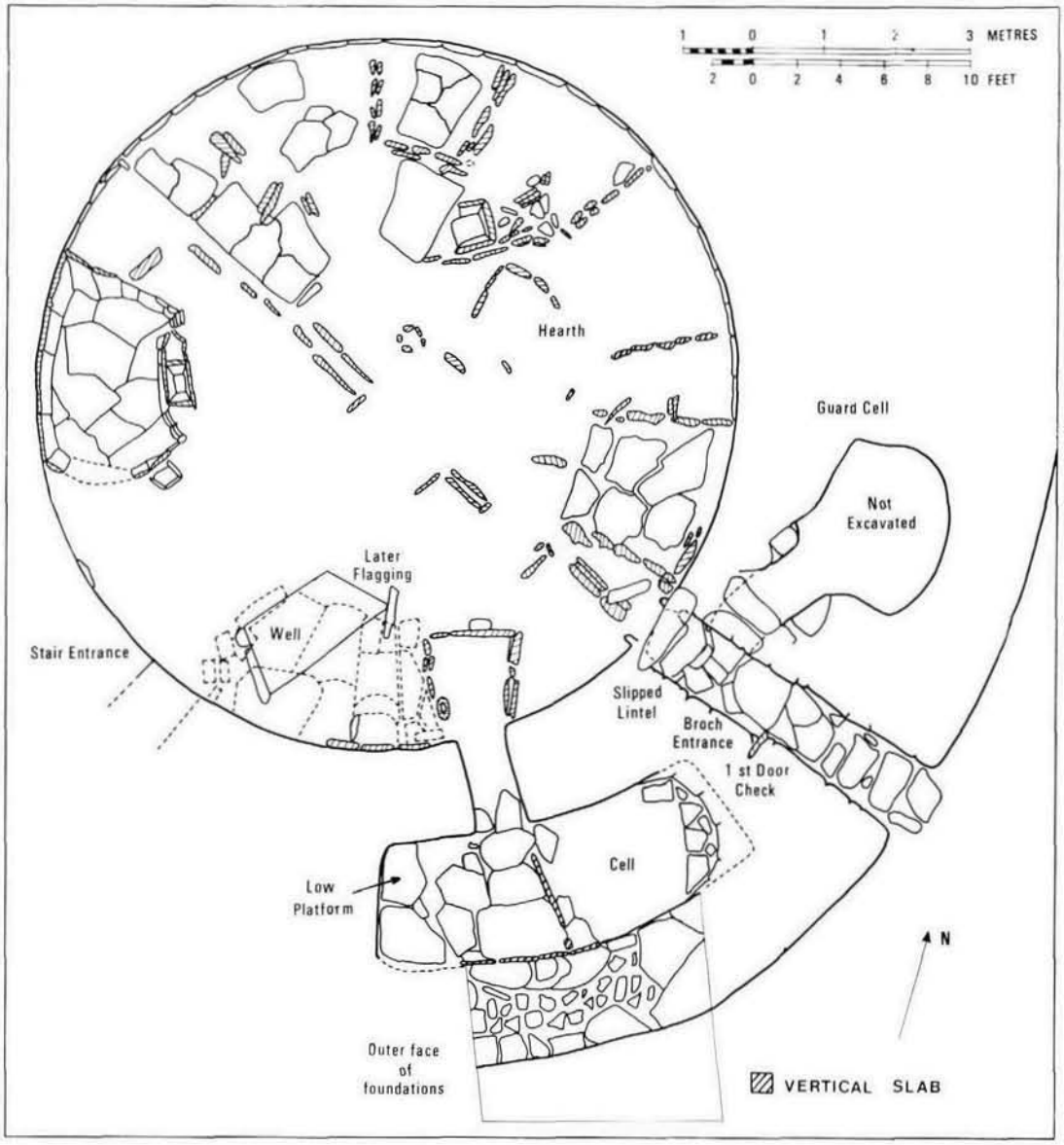
Adjacent to the S wall were the remains of a slab-sided stone box, rising to the general level of the broch pavement, and the remains of another were traceable at the SE corner of this structure. In the E wall of the depression, there was a large slab-lined tank, similar to others found in the broch, except that it had been divided by a cross-slab. Overall, this measured 1.02 by 0.45 by 0.36 m deep. A stone lid, measuring 0.66 by 0.56 m, was found in a sloping position against the W side of the tank, having slid down into the walled depression alongside. In the top, there was an hour-glass perforation 3-4 cm across, with a pebble acting as a stopper, still tightly in position. Under the secondary slabs filling the walled depression, but above its primary floor, two bone spatulae were found (*321, 325*): there were also several fragments of broch pottery covered with some smooth yellow substance which has defied analysis. From the depression there also came some grey organic material which was found by Dr Dickson to contain numerous fragments of the heads of cereals, mainly barley; he has suggested that the walled depression had been used as a threshing floor.

THE BROCH FLOOR AND INTERNAL PARTITIONS

As the broch floor had obviously been reorganised from time to time, it was difficult to establish the original arrangement with any precision (Ill 28). Most of the area had been flagged, the slabs being variable in size and shape. Some had been very large but had tended to break up on exposure, while others seemed to have been damaged by falling masonry from the broch wall. The greater part of the interior had been sub-divided by rows of flagstones set on end. The uprights had not survived, but it was easy to recognise the rows of low slabs which had wedged them in position (Ill 29). The partitions had existed from the beginning of occupation but had been radically rearranged subsequently. Many brochs which have been excavated in the area of the Old Red Sandstone in Caithness and Orkney have yielded evidence of these internal divisions, notably Hill of Works, Ness, Kilmster and the Road Broch at Keiss, all in Caithness (RCAHMS, 1911a, nos 3, 33, 507, 517): in Orkney, Gurness and Mid Howe have restored uprights which are most spectacular (RCAHMS, 1946, nos 263, 553). In some cases, particularly at the Broch of Yarrows (RCAHMS, 1911a, no 509), the uprights appear to be secondary. What is impressive was the skill in erecting partitions and slab-sided tanks using stone and not wood as the constructional material. From the lowest occupation level at Crosskirk there was abundant evidence of domestic occupation from the beginning. There was no suggestion anywhere of a 'clean' refuge kept so by strict discipline, as suggested for Dun Mor Vaul by MacKie (1974).

A single large hearth was found off-centre towards the NNE, where the Boulder Clay had been baked orange-brown. It was delimited by a low kerb of stones which was incomplete but which had formed a ring about 1.4-1.45 m in diameter. A setting of six slabs on end, forming an inverted cone or socket, and obviously belonging to a later period, had been inserted into the floor of the hearth.

The interior of the broch was divided into two by a partition on a diameter from NW to SE, which approached the inner end of the entrance passage so closely that movement in and out must have been impeded (Ills 28, 30). The packing slabs marking the line were occasionally interrupted by others at right angles indicating that supporting flagstones had been necessary for a partition of some considerable height. Disturbance had occurred when a drain was built on much the same line in Phase Two: this connected with the outlet drain under the entrance passage of the broch.



ILL 28 : Crosskirk Period Two: plan of the Phase One arrangements within the broch

There was no clear evidence of a doorway from one half of the broch to the other, although one may well have existed half-way along the division.

Crosskirk is not the only example of a broch with a bisecting partition which commenced almost at the mouth of the entrance passage. The broch at Ness on Freswick Bay in Caithness seems to have had a similar arrangement (RCAHMS, 1911a, no 33), although it is illustrated as having an interconnecting doorway on the accompanying plan. Mid Howe in Orkney (RCAHMS, 1946, no 533) is also divided into two, although the partition does not approach the entrance passage closely.

The original divisions of the floor space, in so far as they could be disentangled, were mainly defined by radial rows of packing stones indicating partitions running towards the centre of the broch from the wall face, but stopping short after 1.25-2.15 m (Ill 28). Several of the compartments or bays between the radials had been flagged and traces of a kerb or partition across the inner end were noted. The curious walled depression in the W, discussed previously, vaguely fits into the radial lay-out.

ILL 29 : The E side of the broch interior at the level of the primary floor, showing the badly-ruined entry to the intra-mural cell on the right, the drain underlying the entrance passage and the remnants of internal subdivisions

The NE half of the broch was the more clearly sub-divided in this way with the main hearth centrally placed within the semicircle. One of the best defined radial compartments was that in the extreme N. This was flagged (one enormous flagstone is shown on the plan, Ill 28) and the compartment extended from the wall face inwards to a well-marked cross-partition at about 1.5 m from the inner wall face of the broch. The space thus defined was some 1.3-1.7 m wide. The slabs edging the compartment were arranged in two or three rows and were substantial enough to suggest the former presence of tall flagstones wedged upright to form a box-like structure against the broch wall. Just outside the SE corner of this N compartment there was a shallow hole in the earthen floor in which a pot had been standing when it was crushed flat, perhaps by falling flagstone. On reconstruction, this pot proved to be a decidedly misshapen storage jar (*138*).

The space between the N compartment, the hearth and the long bisecting wall had been carefully flagged over to a large extent, and then reflagged at a later time, but some upright slabs were present to show that we had been able to recover only part of the original plan (Ill 28). To the E were the remains of a slab-lined tank which had once stood near the opening to the next compartment. This latter was mainly earth-floored: it contained two and possibly three upright stones about 0.25 m high and 0.15 m across, which were well-worn on their upper surfaces and appeared to have served as anvils. These seem to indicate a working space, near the light and heat of the central fire: just outside this structure, however, was a confusion of slabs of which nothing could be made.

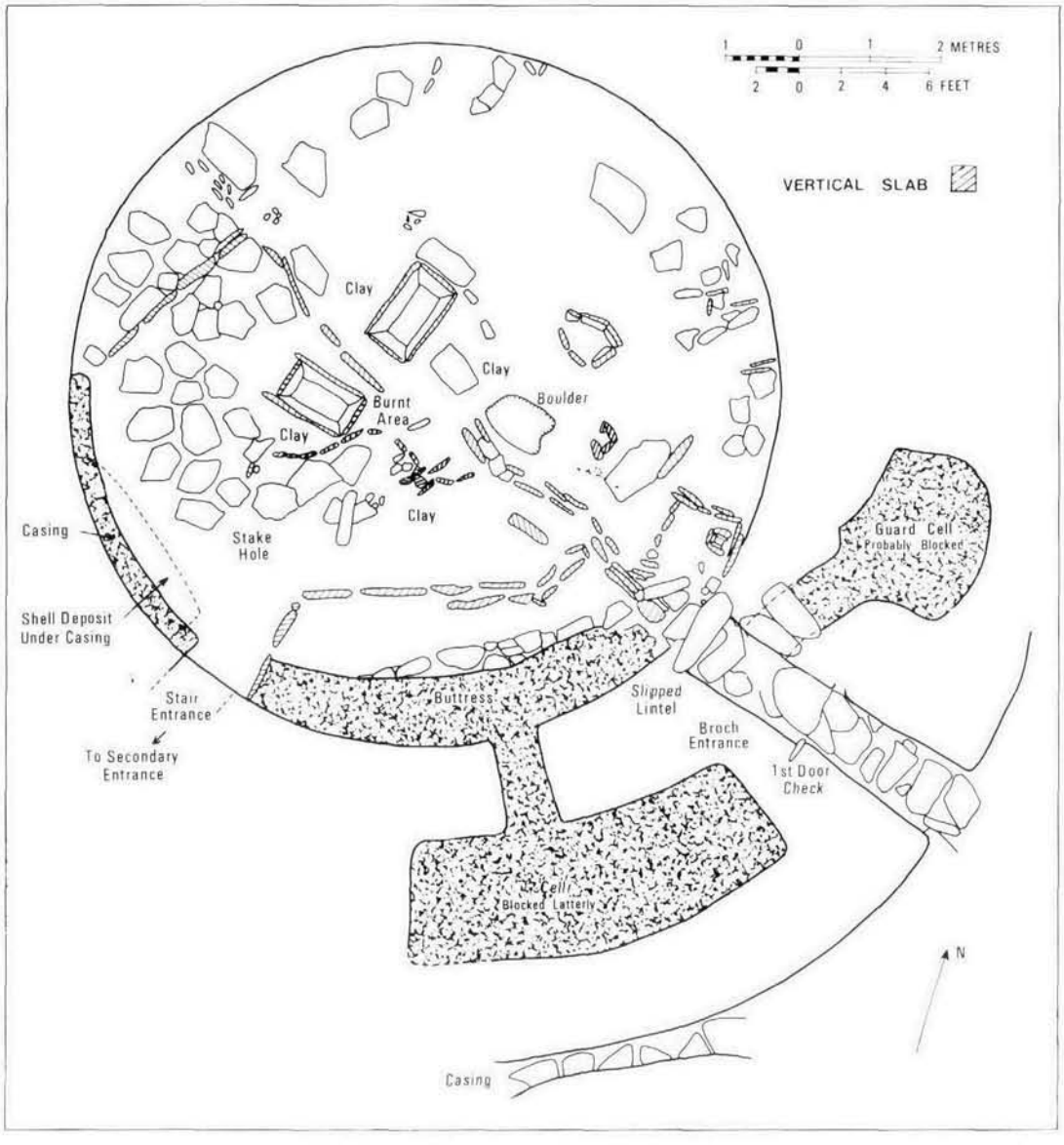
Continuing clockwise around the circumference of the broch, there were found two unequal but rather featureless compartments which were earth-floored: that on the N overlay the rectangular depression which seemed to be the site of a slab-lined tank as mentioned above. No distinction could be made between the earth floor of the central area and its extension into these two compartments.

Adjacent to the inner corner of the entrance passage was the last of these bays in the NE half of the broch (Ill 29). It was very obviously defined with rows of packing slabs on end, which projected about 2 m into the broch interior. This compartment was 1.75-2.35 m wide. It had been beautifully paved on at least two occasions with large smooth flags. This paving was overlain by a carbonised layer which could have represented bedding, but similar stretches of this burnt vegetable material occurred elsewhere, especially in the centre of the broch, which rather indicated the remains of thatch.

The main features of the SW half of the broch were the well, the shallow walled depression and the cell entry. In front of the latter was another small radial compartment (Ill 29). It was little more than 0.25 m square but was marked out by substantial slabs: inside it lay a broken mortar stone. After the well and the walled depression were flagged over, this entire area seems to have remained a clear space.

The excavation of the primary floor was disappointing in that most of the structures had been levelled almost to the ground: with the exception of the hearth, a new pattern emerged during Phase Two. The remains in the NE sector indicate the existence of living quarters from Phase One onwards. There are obvious similarities to the bays of the wheelhouses of the Hebrides and Shetland, and to various other Iron Age structures to which Sir Lindsay Scott drew attention (1948). In both halves of the broch, the dark carbonised earth both on and between the flagstones contained quantities of domestic refuse including querns, spindle whorls, bronze objects, discarded bone tools and pottery. All suggest regular occupation rather than retreat in times of danger from dwellings elsewhere. The presence of a restricted number of bays would point to occupation by a single family, perhaps an extended one: had this evidence been more convincing, such a conclusion would have been of great significance. For the moment, however, the obvious fact is that domestic occupation, for any length of time, must surely imply a roof over the occupants.

ILL 30 : The SW portion of the broch interior: the Phase Two arrangement. The partition on the line of the entrance passage survived in part: note the casing against the inner face of the broch wall



ILL 31 : Crosskirk Period Three: plan of the interior of the broch in Phase Two

THE INTERIOR OF THE BROCH: PHASE TWO

The primary floor of the broch was directly overlain by as much as 0.3 m of dark-brown to almost-black earth, with a plentiful admixture of slabs and stones. This deposit included quantities of pottery and other domestic artifacts, animal bones and shells. During the period in which the rubbish accumulated, Phase Two, there was no evidence of any break in the occupation (Ill 31). A change to Phase Three, however, was marked clearly enough by the superimposition of a new floor and hearth. In the deposits which accumulated above the primary pavement no significant stratification could be recognised over the central area as a whole, though intermittently a band of ash might be traceable over a distance of a metre or so, or elsewhere upcast earth indicated that a new slab-lined tank had been inserted. Extensive reflagging had also taken place at various times during Phase Two. During the early excavations in 1966, confusion found in the N sector of the broch court was

such as to suggest that cattle had been penned within the broch and had churned up the floor. This may have been so, but subsequent excavations suggested that numerous minor changes over a lengthy period might well account for much of the disturbance. The cumulative effect of these alterations produced a radical change in the general appearance of the interior. In the S sector, the disastrous collapse of the wall in the neighbourhood of the intra-mural cell led to the walling off of the cell itself, and perhaps the opening of a new entrance to the broch at the foot of the stair.

The early partition which bisected the interior on the diameter of the main entrance passage was largely obliterated. The exact situation is not clear as a roughly constructed V-shaped drain seems to have been inserted over much the same line, connecting with the well-built slab-sided drain under the entrance passage. A subsidiary drain, coming from the direction of the stair entry, joined up with this just outside the entrance passage in an area where structures were otherwise difficult to decipher.

Extensive repaving occurred above the level of the former peripheral 'bays', and both the walled depression against the W side of the broch and the well were completely concealed. Some fine large flagstones were laid in the N sector, but it was difficult to establish which parts were contemporaneous. The old packing stones of Phase One were apt to show up in this repaving and only a generalised plan can be given (Ills 30, 31). Clearly, however, the radial arrangement was largely superseded, and only one of the old peripheral bays was represented; it lay immediately N of the entrance and had been reshaped.

It is impossible to say for how long the hearth of Phase One continued in use. At some stage, conceivably however in Phase Three, a setting of slabs on end, like a socket for a post, had been inserted into it. No other hearth was recognised although there was some evidence of burning in the centre of the broch court. Here, there was a large rounded boulder the top of which was badly abraded: nearby a number of cobbles were found with evidence of use as pounders.

ILL 32 : Excavation of the S half of the broch interior: in the foreground is a tank, attributable to Phase Two, overlain by a hearth and other features of Phase Three

Two slab-lined tanks had been constructed during the phase: both were overlain by the hearth of Phase Three. They were almost identical in size, the more northerly and better preserved measuring $1.07 \times 0.55 \times 0.30$ m. When first discovered, its stone lid was still in position and the tank was half full of water (Ill 32). These slab-lined tanks at Crosskirk may have served different purposes but all had been luted with clay at the corners. The two constructed during Phase Two, at least, must have been used to keep shellfish fresh. At first there was doubt over this interpretation as no sea shells could be found in any of the tanks, but silt from the bottom of one of them was submitted to Dr Peter Norton, Zoology Department, the University of Glasgow. Under the microscope, he detected numerous finely comminuted fragments of periwinkles and mussels.

Throughout the excavation of the Phase Two deposits a very close watch was kept for sockets of postholes. Amid the confusion which resulted from repaving, the insertion of tanks and drains, and the remnants of packing stones which belonged in reality to the primary phase, attention was drawn from time to time to a number of very ambiguous groupings of stones on end. None seemed significant individually, but a record was kept of the least improbable. Several were located at the foot of the broch wall, and in the end without having any conscious pattern in mind five examples were found to enclose an area some 1.5 m across, around the two slab-lined tanks and the boulder where some evidence of burning had occurred. An inner ring of posts must be regarded as a possibility, especially as any man-made slots in the broch wall seem to have belonged to this phase (Ill 13).

Amid the multiplicity of structural changes which had taken place in the central area, no radical alteration to the basic culture of the inhabitants could be recognised. From the occupation debris of Phase Two came some of the most characteristic artifacts of the broch period generally, including a spiral finger ring and a ring-headed pin of bronze, a painted pebble, spindle whorls and long-handled weaving combs, and small stone discs. The gritty pottery, similar to that found on the primary floor, consisted of bowls or vase-shaped jars normally devoid of decoration. A radiocarbon date of 100 bc ±50 was obtained from occupation material of Phase Two in the extreme N of the interior, where a sample of small charcoal fragments was selected from a level distinctly above that of the primary floor.

THE INTERIOR OF THE BROCH: PHASE THREE

There was no sign of a sterile layer or turf lines between the occupation deposits of Phase Two and Three, and no obvious break in continuity could at first be recognised. In fact, the first clear evidence of an occupation deposit constituting a separate Phase Three came only in the third season of the excavations when a well-made hearth was found overlying two slab-lined tanks of the earlier period (Ill 32). The curious position of these tanks might well suggest that the occupants who built the Phase Three hearth were unaware of their existence. The carefully-paved hearth (Ill 33) was rectangular in shape, measuring 0.75 by 0.70 m, and delimited on three sides by a low kerb of stones on edge. A sample of small pieces of charcoal taken from the hearth yielded a radiocarbon date of 70 ad ±70.

With the level of the hearth as a guide, it was possible to trace an associated floor into the then-unexcavated S part of the broch as far as the buttress in front of the blocked intra-mural cell. The surface of the floor was only partially flagged and was very roughly constructed. The upright flagstones of Phase Two leading into the stair entry were still visible. This was perhaps the main entrance to the broch by this stage. The floor yielded little in the way of occupation deposit, and little more can be added to this description: the plan of this phase is incomplete of necessity.

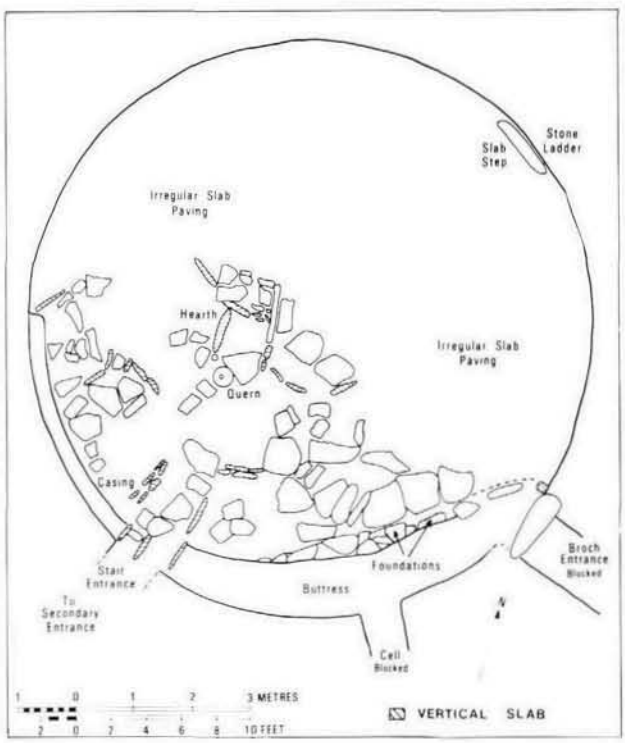
A type of pottery which differed from the earlier wares appeared approximately at the Phase Two-Phase Three horizon, although a definite association with the later broch period became certain only with the excavation of the external settlement. The pottery shapes, mainly bowls, resembled those of Phases One and Two, but the fabric had changed. It was less gritty and there were rolled-back and beaded rims. It will be referred to subsequently as Later Broch pottery, to distinguish it from the Early Broch ware of Phases One and Two: both are to be described in detail later (Ch 10). In addition, certain artifacts were recovered which must be associated with Phase Three

on typological grounds. They were found during the early days of the excavations, before the hearth was discovered, and were initially reported as being from Phase Two deposits. These objects included two sherds of Samian, a fragment of Roman glass and a nail-headed bronze pin which will receive further discussion.

The discovery of the hearth, the Samian sherds and the characteristic Later Broch pottery made it possible to associate this occupation of the broch interior with Period Four in the external settlement, where, as will appear later, a considerable reorganisation took place. What the occupation of the broch during Phase Three actually involved, however, is a difficult question. The well-constructed hearth seems to suggest a domestic function, but around the periphery of the floor, where slabs fallen from the wall had complicated the issue, little or no trace of occupation could be found. Rare and presumably treasured objects such as the Samian ware and Roman glass, and perhaps even the nail-headed pin, again seem to indicate that the hearth must represent something more than temporary squatting.

A further, chronological, difficulty has to be faced. If Phase Two of the broch began in the second century bc, as would appear likely from the radiocarbon dates, and the occupation of Phase Three marked by the Roman artifacts was in progress during the Antonine period, a continuous occupation of two hundred and fifty years or more would seem to be involved. It is hard to believe that a high dry-stone structure as weakly built as Crosskirk could have lasted so long without a major change of function and internal appearance. It is to be inferred that Phase Three came after a break in the occupation when the Later Broch pottery became characteristic on the site.

In dealing with the evidence for the relationship between Phase Two and Three in the broch, it has been very necessary to avoid over-simplification by reading into the data, with hindsight, a straightforward, coherent narrative of what probably happened. It is abundantly necessary, also, to emphasise the absence of distinct horizons together with the confusion which was actually observed, amid the chaos of disturbed earth floors and projecting stone slabs, poor paving, and ruinous tanks. These formed the evidence from which any deductions had to be made.



ILL 33 : Crosskirk Period Four: plan of the broch interior in Phase Three

THE QUESTION OF THE ROOF

The problem of the roof was a major preoccupation throughout the investigations at Crosskirk: but, in the end, little can be said with any confidence except by way of direct negatives. There was no evidence that a dome-shaped roof of stone had existed; Graham's injunction to look with great care was certainly borne in mind (1947). Nor was there any evidence whatever to indicate roofed timber ranges around the interior of the broch, as postulated by Hamilton (1968). Indeed, the absence of wear on the staircase, of sockets for stout upright posts and of any contrast between a central area open to the sky and a peripheral area under cover, all seems to disprove such a thesis. There was no inner ring of posts to support a veranda-like structure, and no positive evidence for a scarcement upon which it could have rested. There was no evidence, either, for a dome of timbers placed chordwise and resting on a scarcement—an arrangement which Graham seriously considered (1947). At the Crosskirk broch, with its rubble-core wall and revetments only one slab in depth, such an expedient seems highly improbable. As will appear later from the botanical evidence, trees were very scarce in Caithness during the broch period. While birches might have grown to some height in well-sheltered localities, good constructional timber, which birch is not, must have been remarkably scarce. In itself, this shortage would seem to argue against the existence of structures such as timber ranges which require wood in quantity. Even the rafters for a conical roof for a round-house might not have been easy to find locally.

If, as we are inclined to believe, Crosskirk represents a relatively early phase in the evolution of the brochs, it may be wrong to think in terms of some sophisticated roofing technique specially invented to form a cover within a high broch tower. Instead, there may have been a somewhat haphazard method applied from experience with other types of Iron Age houses. Experiments in Caithness would scarcely involve a structural form at all expensive in its use of timber. The hut-circles of N Scotland, admittedly rare in both Caithness and Orkney, were of much the same diameter as the interiors of the brochs, and even their modest requirements involved rafters supported on an inner ring of posts (Fairhurst, 1971a: Fairhurst and Taylor, 1971). With regard to the roofing arrangements in the wheelhouses of the Western Isles and Shetland, there is room for argument. Some may have been open above the central area while the surrounding bays were roofed with stone, in beehive fashion: others may have been provided with a central thatch, the rafters for which rested on the stone piers dividing off the bays (Fairhurst, 1971b).

Furthermore, in general terms, brochs may not have conformed to a strict pattern of internal arrangement. Hamilton's timber ranges could represent one way of dealing with the central area while Curle's ring of posts supporting a veranda at Dun Troddan may be another (1921). Both might represent solutions to the roofing problem in terms of the available natural resoruces, for areas where, above all, the long slabs of Old Red Sandstone were absent.

It is a noticeable fact that in the reports on the considerable number of brochs which have been excavated in Caithness and Orkney in the past, very little mention has been made of definite evidence for a roof. This in itself would seem to suggest that only a flimsy structure could have been in use, if these buildings were roofed at all. The very thick and high wall of a broch would have protected an internal structure from the wind and weather and the roof need not have been substantial, nor need it have covered the central area completely. Viewed in this light, there are possibilities which have not been sufficiently considered. Most attractive would seem to be the idea of a conical roof with thatch resting on rafters supported by an internal ring of posts. The latter would require little more than shallow sockets at ground level to support it, since it would be sheltered from strong winds. The rafters might also have been supported at the broch wall, or may even been slotted into the inner face. The drainage might have gone into the wall somewhat as a Hebridean black-house thatch drained into the earthen core of the very thick wall upon which it rested. Some of the many holes and cavities apparent in the inner face of the broch wall, especially those in a broad band between 1 m and 1.2 m above the level of the foundations, seem to have been purposely made: admittedly, these would appear to have been secondary features and not carefully constructed slots. These did however seem to be different in character from the gaps resulting from rotting stonework.

Other methods of constructing a decidely flimsy roof might be suggested. For example, a variety

of roofing materials—thatch, turves, flat slabs and even hides—perhaps partially supported on the upright flagstones of the internal partitions, may have been used initially. The entire interior need not have been covered over: indeed a drain, apparently inserted as a secondary feature within the SW half of the broch court, may be connected with the need to remove water from a variety of roofs within the broch. Such an arrangement may have been superseded later, with a conical roof utilising make-shift slots in the broch wall during Phase Two or even Three.

The whole problem is most frustrating, but obviously no simple solution can be suggested for Crosskirk. The modern mind may well hesitate at the thought of incarceration in the depth of a broch, in almost complete darkness, but it must be remarked that little daylight could reach even the interior of an Iron Age round-house during the long winter period with the long nights and low sun in Caithness.

6 THE EXTERNAL SETTLEMENT: THE STRUCTURES OF PERIODS ONE TO THREE

Many broch sites on the northern mainland of Scotland and in the Northern Isles have provided examples of more or less contemporaneous settlements immediately outside. Apart, however, from Jarlshof (Hamilton, 1956) and Clickhimin (Hamilton, 1968), most excavation reports have given little more than a plan showing a cluster or huddle of structures suggestive of more than one period of occupation. The general hypothesis has been that the brochs themselves continued in use until about the second century AD, and then followed a period of cultural decay during which the occupants of the site dwelt mainly in the external settlement (for a detailed interpretation, see Hamilton, 1962).

Wheelhouses seem to have been the usual form of construction in Shetland, but in Orkney and on the northern mainland, they are replaced by sub-rectangular or kidney-shaped enclosures attached to brochs. The sites at Mid Howe (Callander and Grant, 1934) and Gurness (Richardson, 1948) are outstanding examples, the settlements in both cases lying within massive outer fortifications. On mainland sites, the area of the settlement is often not so clearly defined and the structures, which tend to be rather indeterminate in shape, suggest occupation over a considerable period during which alteration and superimposition may have occurred. In particular, external settlements of this latter type occur associated with Carrol, Carn Liath and Kintradwell (RCAHMS, 1911b, nos 27, 270 and 467) and beside the Caithness brochs of Nybster and the three at Keiss (RCAHMS, 1911a, nos 518, 515-7). The structures outside the broch of Yarrows are spectacular in both size and form but are apparently not at all typical (RCAHMS, 1911a, no 509). These mainland sites were all excavated at least seventy years ago when comparatively little attention was paid to the settlements as distinct from the brochs themselves.

Our sympathies with the efforts of our forerunners grew as the complexities at Crosskirk were successively uncovered. With no superficial indications as a guide, the extent of the external settlement was not apparent until the last season of excavation. There was no immediate threat to the main area of the settlement, as there was to the broch, and objectives were limited to the solution of three major problems:

1 The character of the greatly extended passage leading out from the broch itself.
2 The sequence, in relation to the broch and the external rampart, of the superimposed structures encountered on either side of the passage.
3 The nature of any early or late Medieval activity on the site after the decay of the settlement.

Some restricted investigations were undertaken to define the approximate limits of the settlement, but total excavations was not possible in the time available. Moreover, precise data on the nature of these settlements on the northern mainland was so scanty that much of the work at Crosskirk was exploratory in character: the complexity revealed was such that major issues became obscured by a welter of detail.

THE EXCAVATION OF THE SETTLEMENT: GENERAL REMARKS

As far as could be determined the settlement grew up within the area defined by the Period One rampart and in the lee of the broch; it extended eastwards to the cliff, a distance of almost 20 m. Walling was in fact to be seen outside the excavation area in the extreme NE of the site, but it was

overlooked until a late stage in the investigations because of its unexpected depth below the surface at the cliff edge. Westwards, nothing was found in a trench from the broch over the ground as far as Chapel Geo: this stretch was very much exposed to wind and spray during storms. The area of the settlement which was excavated (Ill 6) was largely determined in the first place by the length and direction of the extended passsage leading outwards from the broch. The E limit of the investigations was set at a line, 14 m from the centre of the broch, running NNW-SSE for a distance of 29 m. However, an extension was made E beyond this line for another 9 m opposite the broch entrance, for reasons to be explained later. The W limit varied in accordance with the shape of the structures encountered, but broadly the area excavated S of the broch was not less than 10 m wide.

Bedrock, which sloped gently SE in the area of the settlement, was reached at a depth of 1.5 to 1.85 m. The foundations of the earliest walling and the main pavements of the same period were left intact and back-filled, but wherever possible elsewhere, excavations were carried down to bedrock or Boulder Clay. In excavating the settlement area, the fragmentation of the structures encountered, which were found in fact to belong to five or even six phases, sometimes presented such confusion in day-to-day operations as to involve an almost unmanageable mass of detail. Differences observable in the material culture of prehistoric times—on this site continuing until the end of the broch period—were so slight that reliance had to be placed very largely on structural details. These included the superimposition of walling, pavements, earth floors and drains, many of which had been disturbed or levelled: the re-use of stonework was common. Nevertheless, the broad features of the sequence could be established, although some minor details must be a matter of personal opinion.

Amongst the ruins of the stonework, loamy earth mixed with some rubble seemed to make up a surprisingly large part of the accumulation between the natural, whether bedrock or Boulder Clay, and the turf. A proportion of these deposits may have come from the earth-and-rubble core of the broch wall or of the external rampart. However, the site of the settlement on the rocky promontory of Crosskirk seems to preclude any source of wind-borne material, other than, perhaps, from some cultivated ground on the rising slope of Lybster Hill directly to the S. In this connection, the mysterious filling of topsoil which we located in the broad hollow beyond the outer rampart in the gateway section may be recalled as evidence of ancient cultivation. Another possibility, however, provides a link with a different problem, that of the construction of the buildings in the settlement: it may be that sods were commonly used and provided the basis of the mass of loamy soil. Nowhere, however, was evidence of turf-lines obtained.

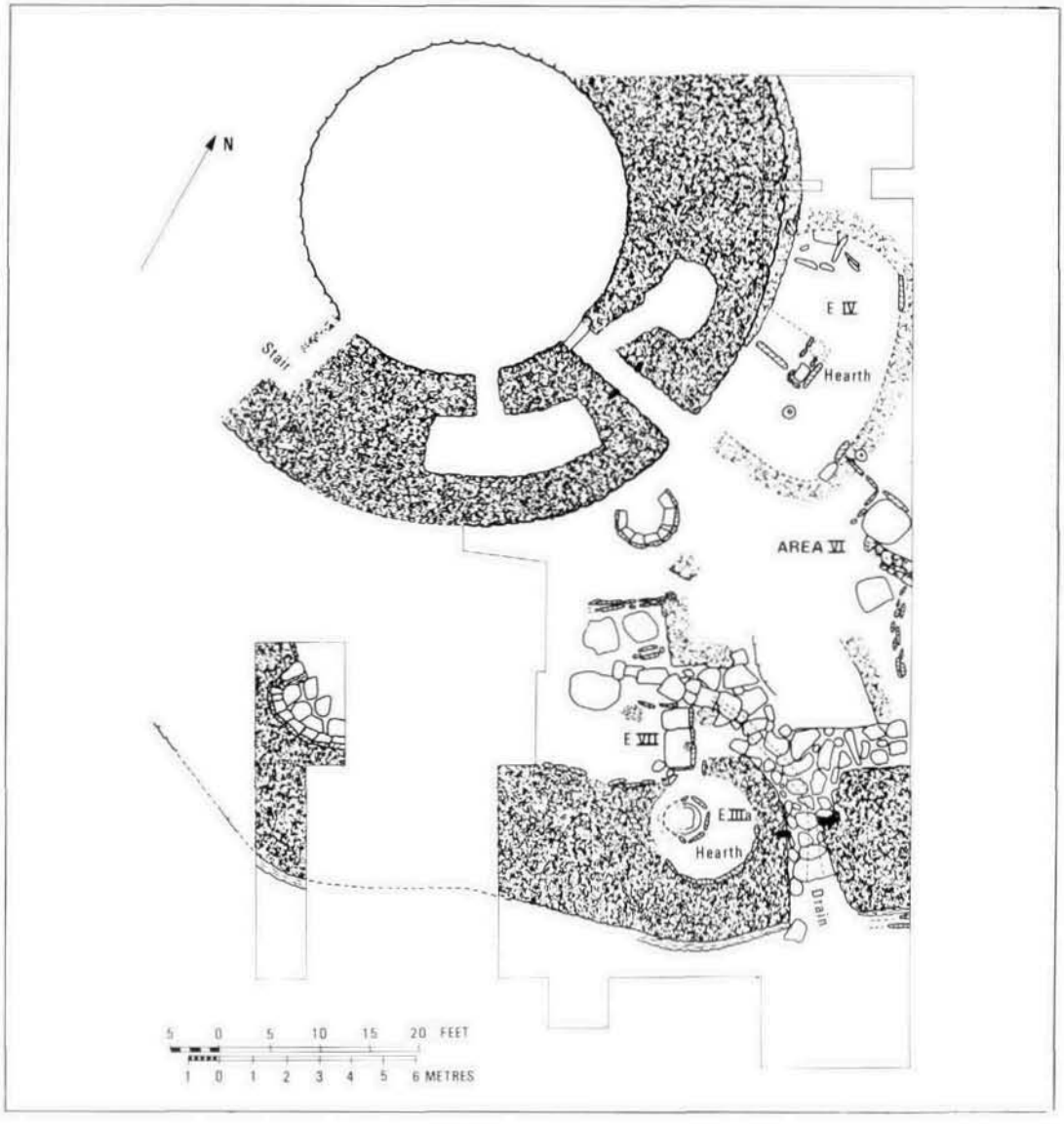
It was normally difficult and often impossible to recognise any external facing to the walls of the individual enclosures, although the inner face was, quite plainly, a combination of upright slabs or flagstones and of dry-stone walling which was sometimes built in panels. The possibility of sod-built walls may be borne in mind.

The character of the roofing was also a problem. Neither post-holes nor sockets for supporting poles were located. The use of upright slabs and flagstones in the walls of the structures may have been to introduce some stability against a thrust from a roof of rafters, turf and perhaps even thin flagstones. There was no indication of stone-built piers like those used in the wheelhouses of Shetland or the Outer Hebrides.

In one area, around Enclosures I and II of the late Period Three rebuilding, extensive burning seemed to suggest the destruction of a thatched roof. Elsewhere turf may have been employed as a roofing material. Although layers of slabs were found lying flat on floors and pavements in some places, they invariably proved to be the result of purposeful levelling operations and not the remains of collapsed flagstone roofs. Clearly, there are similarities in the problems posed in a discussion of the roofing arrangements in the settlement with those in the broch interior.

EARLY STRUCTURES AND PAVEMENTS IN THE SETTLEMENT: PERIODS ONE AND TWO

Between the gateway area in the external rampart and the broch itself there were indications of various early structures, some relatively explicit, others vague in the extreme. They were all established directly



Ill. 34 : Plan of the initial structures: Period One to early Period Three. The external fortification is shown in its Period One configuration: the broch as it was constructed in Phase One (Period Two). The settlement area includes all structures pre-dating the late Period Three reconstruction

on a thin layer of Boulder Clay which overlay bedrock, but there was no proof that they were all contemporary. There may even have been survivals from the pre-broch period, but nothing was obtained in the occupation material to substantiate this. One apparently anomalous radiocarbon date, to be discussed later, has given a date as early as the ninth century bc. A point which has become clear is that Enclosure IV, constructed against the broch wall, (Ill 34) came into being very quickly indeed after the broch itself was built. Another Enclosure (VII), against the inner face of the rampart,

seems also to be early, perhaps even pre-dating Enclosure IV. The settlement is definitely not a late development of 'Romano-British' times.

Apart from these two structures, it is difficult to recognise the general lay-out of the early settlement owing to the subsequent replacement of walling SE of the broch entrance. Here, only vague alignments of flagstones on end and isolated hearths could be found to mark the lowest occupation. No planned lay-out was apparent and our personal view is that the earlier structures came into being over a period of time and in a haphazard manner, such that a rearrangement, to clear the way to and from the broch entrance, became necessary ultimately.

Access to the settlement area through the gateway in the external rampart was provided, as previously described, by a pavement of very large flagstones. This had been laid over a drain which had partly collapsed. Where it was intact, this measured 0.28 m deep and 0.30 m across the bottom, widening slightly upwards. Immediately inwards from the gateway there was a bifurcation in the pavement. One branch turned at right angles to run E along the inner face of the rampart, and continued to the limit of the excavated area; this pavement, with the open space which accompanied it to the N, has already been discussed (p 33). The other branch turned a little NW as though to avoid a structure of which only a trace of walling was standing, and then it also divided (Ills 34, 35). To the W, a short pavement with a drain underneath came from the door of a building, Enclosure VII, which had been constructed against the inner face of the rampart. The second branch led for about 2 m in the general direction of the broch entrance, but became impossible to follow amongst the ruins of a later structure. Had this pavement continued on the same line, it would have connected with the broch entrance at a very sharp angle, following a course to the W of that adopted by the later extended entrance passage. A careful examination showed no sign of such a continuation to

ILL 35 : The main settlement area: in the foreground is Enclosure VII and to the left of it lie various pavements. The external rampart wall, and its associated cell, are in the background

the broch, although it might seem probable on general grounds. The curious variations in the course of the pavement as a whole as it runs inwards from the rampart gateway, seem to indicate the former presence of structures of which not even the outlines could be traced.

ENCLOSURE VII (EARLY PERIOD THREE)

Entered from a branch of the pavement, Enclosure VII was the best preserved of the earlier structures in the settlement (Ills 34, 35). Its survival, up to a maximum height of 0.6 m in the S, is to be accounted for by the fact that it had been purposefully filled with slabs and midden material and subsequently levelled during Period Three. The enclosure was discovered in the last few days of the excavations and only the E part was uncovered: this may have amounted to perhaps as much as half or even as little as a third of the original structure, judging by the alignment of the inner face of the rampart which it directly adjoined.

The E end of this enclosure was rectangular, measuring some 4.85 m across internally, with the entrance midway along the E side. The floor was followed for 3.2 m towards the W, without a built hearth being located. The floor itself was of earth with some flagstones and was only just above bedrock. The SE corner had been carefuly flagged, some of the slabs being cracked with heat: ash and charcoal occurred particularly in this corner. Most of the internal outline of this building was marked by rows of flagstones on end, which were set double on the N side: these uprights seem to have acted as a facing for a dry-stone wall. Other vertical flags ran inwards from the doorway and similar stones also occurred in isolation elsewhere. On the S side, which was much disturbed, there was no clear distinction from Enclosure III*b*. This latter structure, which lay within the external rampart, and which has already been described (p 33), was occupied during the same period. A row of flagstones, which had survived as part of the division between these structures, abutted directly onto the earthen core of the rampart, as though marking its inner face.

A sample for radiocarbon analysis was carefully selected from the occupation material lying below the filling of slabs and midden, and was taken from small pieces of charcoal lying directly on the paved area. It was believed at the time that a date would be afforded for the early occupation both of Enclosure VII and the settlement itself. The result was much earlier than anticipated, being 820 bc ±100. The building could pre-date the broch, but the occupation material yielded only some gritty potsherds which were definitely not of the type found below the floor of the cell-like Enclosure III*a* (p 33): the sherds from Enclosure VII would all have been at home in the material of Phases One and Two of the broch itself.

Apart from the potsherds, together with some animal bones and shells, nothing of interest was recovered from Enclosure VII. It seems to have been a substantially built dwelling of dry-stone lined with flagstones on the inside: with several other vertical slabs located nearby, these flagstones may have helped to support a heavy roof. There were only the vaguest traces of the external outline of the building.

ENCLOSURE IV PHASE *A* (EARLY PERIOD THREE)

Another structure dating back to the early period of the settlement was found directly against the outer face of the wall, and immediately N of the entrance of the broch (Ills 34, 36). The floor and hearth of what appears to have been a dwelling had been preserved beneath the pavement of a somewhat later structure of much the same size and shape, but the original boundary wall was fragmentary and difficult to distinguish. On the plan, the two buildings have been grouped together as Enclosure IV, but for descriptive purposes, the two must be separated into an earlier phase *a*, and a later phase *b* which is to be discussed in another context (p 83).

ILL 36 : Enclosure IV*a* adjacent to the external wall-face of the broch. The stones of its elongated hearth may be seen left of centre. Note the pillar stone set in the casing added to the broch wall

In spite of the confusion caused by the superimposition and also by the presence of the robber trench along this sector of the broch wall, the stratification of the centre of Enclosure IV could be established with some clarity, which was a most exceptional occurrence in the settlement area (Ill 15). Just below turf, there was a layer of horizontal slabs which seems to betoken the medieval horizon associated with the building of St Mary's Chapel. Below some 0.25 m of topsoil, in which these slabs lay, were located the remnants of substantial dry-stone walling. This walling, belonging to Period Three of the settlement, defined Enclosures I and II which were contemporaneous and are described below. The floors of these buildings were to be found around 0.9 m below turf. Below them lay midden material, itself underlain by the pavement of Enclosure IV *b* at a depth of about 1.32 m: the surrounding wall was in part directly below that of Enclosure II, but was clearly distinguishable by reason of the different alignment and the contrasting stonework. At the base of these deposits lay the hearth and the earth-and-flagged floor of Enclosure IV *a*, which rested on the Boulder Clay some 1.70 m below turf. The clay in this locality was distinctly moist and contained much fine rubble, perhaps as a result of trampling at the time of the construction of the broch.

The hearth of Enclosure IV *a* had been very well preserved under the later pavement. It was rectangular and measured 1.22 m, parallel to the broch wall, with a width of 0.52 m. There was a kerb of upright stones surrounding a paved area which had been cracked by heat (Ill 36). The hearth was 1.6 m from the broch wall and would seem to have lain more or less centrally within

the enclosure. The outer limit of the floor on the E was incompletely marked by slabs on end representing the inner face of the E wall and suggesting comparison with Enclosure VII. However, the two ends of what appeared to have been a kidney-shaped building, constructed against the broch wall, were indeterminate: its over-all dimensions must have been of the order of 5.5 m long by 3.7 m wide. No recognisable fragment of an outer face to the wall appeared to have survived anywhere on its perimeter.

Within this structure, adjacent to the broch wall, elongated slabs showed in the floor at several places, especially in the NW corner: they did not rise markedly above floor level but were suggestive of the kind of vertical flagstones which had formed box-like structures. This feature again offered a vague resemblance to Enclosure VII. The entrance to Enclosure IV *a* presents a problem but it would seem to have been along the broch wall from the main passage, on the site of the later entrance in Phase IV *b* shown on the plan (Ill 34). No indication of any other opening was located elsewhere on the periphery: admittedly the evidence of the walling was fragmentary but traces of door jambs could have been expected to show.

Comparatively little rubbish was found on the floor of Enclosure IV *a* and only a very little broch pottery was recovered. Some fragments of charcoal were collected but seemed unsuitable for radiocarbon determination because of the danger of contamination as the hearth may have continued in use into phase *b*. A general similarity in shape led us at first to compare the hearth with that of Phase Three inside the broch, but such a comparison is not chronologically helpful, as two radiocarbon samples from Enclosure I, stratified above the subsequent, modified version of Enclosure IV, have given dates in the second century bc. There was nothing whatever in the occupation material to indicate a pre-broch date for Enclosure IV *a* and nothing to substantiate a dating as nearly as the anomalous 820 bc obtained from the charcoal on the pavement of Enclosure VII. Indeed, as has already been noted, the location of Enclosure IV *a* immediately outside the broch wall strongly suggests that it post-dates the construction of the broch.

ILL 37 : A hearth with a low kerb flanked by a circular flat slab. These features, found below the paved floor of the extended entrance passage, may have fulfilled an industrial function during the early period of the settlement

THE AREA OF ENCLOSURES V AND VI

There is little doubt that both Enclosures IV *a* and VII should be placed early in Period Three of the Crosskirk chronology as it has been defined earlier (Ch 2). No break in the occupation of the settlement generally can be detected at this time, and further building and modification seem to have continued intermittently, in particular during the currency of Period Three. A phase, however, has now been reached in which the evidence is particularly difficult to interpret by reason of the fact that considerable demolition and reconstruction late in Period Three have affected the evidence for the whole area E and S of the broch.

It is almost certain that the redevelopment affected structures which were more or less contemporaneous with Enclosures IV *a* and VII. From the plan (Ill 34), it can be seen that a double row of flagstones ran in an arc nearly parallel to the main N/S baulk in this area. They were set on end directly into the Boulder Clay and could be contemporary with the Period One rampart: they are however structurally similar to the walling of Enclosures IV *a* and VII, and indeed, of the interior of the broch in Phase One. Somewhat similar flagstones on end also survived just outside the SE corner of Enclosure IV *a*. These two sets were probably connected, although their function was not obvious. Nearby, some 9 m E of the broch entrance, was at least one other hearth, resting directly on the Boulder Clay. It consisted of a flat rounded slab, showing signs of heat, surrounded by a low irregular kerb: ash was scattered around. Almost alongside, was another somewhat similar stone; both may have had some industrial purpose (Ill 37).

Further vague traces of walling had survived at a slightly later horizon within the same area E and SE of the broch entrance. In this case, the walling was founded on a thin layer of occupation soil, not directly on the Boulder Clay, but it clearly pre-dated the reconstruction of late Period Three. A dry-stone revetment facing N was located jutting outwards from the main N/S baulk for a distance of just over 2 m, when it became confused with flagstones of an earlier period. Two or three courses of the revetment had survived, but there was no return face behind, only a mass of irregularly placed slabs. For purposes of reference, the area to the north was termed Area V while the more or less open space lying to the south became Area VI on the plan. Fragments of a large pot were recovered from the immediate vicinity of the remains of a hearth, just N of the wall and some 6 m from the broch entrance. Only too obviously, the lay-out of the settlement as shown on the plan (Ill 34) is very incomplete, and further details of the excavations become pointless as the evidence ceases to be meaningful as a result of much subsequent disturbance.

AN OVAL SETTING OF FLAGSTONES

Amid the general confusion, one feature had survived in a recognisable shape because it had been incorporated into later structures. Against the outer face of the broch wall S of the entrance passage, there was an oval setting of flagstones on end (Ill 34). These sloped slightly outwards and each was between 0.25 and 0.5 m high, although some were broken. This structure had a maximum diameter of 1.80 m at the top. A buttress to the broch wall lay against it to the SW: the oval setting had been incorporated into the wall of the passage near the broch entrance and there was a casing over the top of it. Time did not allow these massive supports on either side to be removed, but the setting obviously had a flagged floor and was built over occupation debris. It was vaguely reminiscent of a corn-drying kiln, but no flue was visible and there was no sign either of ash or of scorching.

ILL 38 : A cell in a length of walling below the level of Enclosure I and to the E of the broch. Apparently associated was a low pillar edged by oval cobbles.

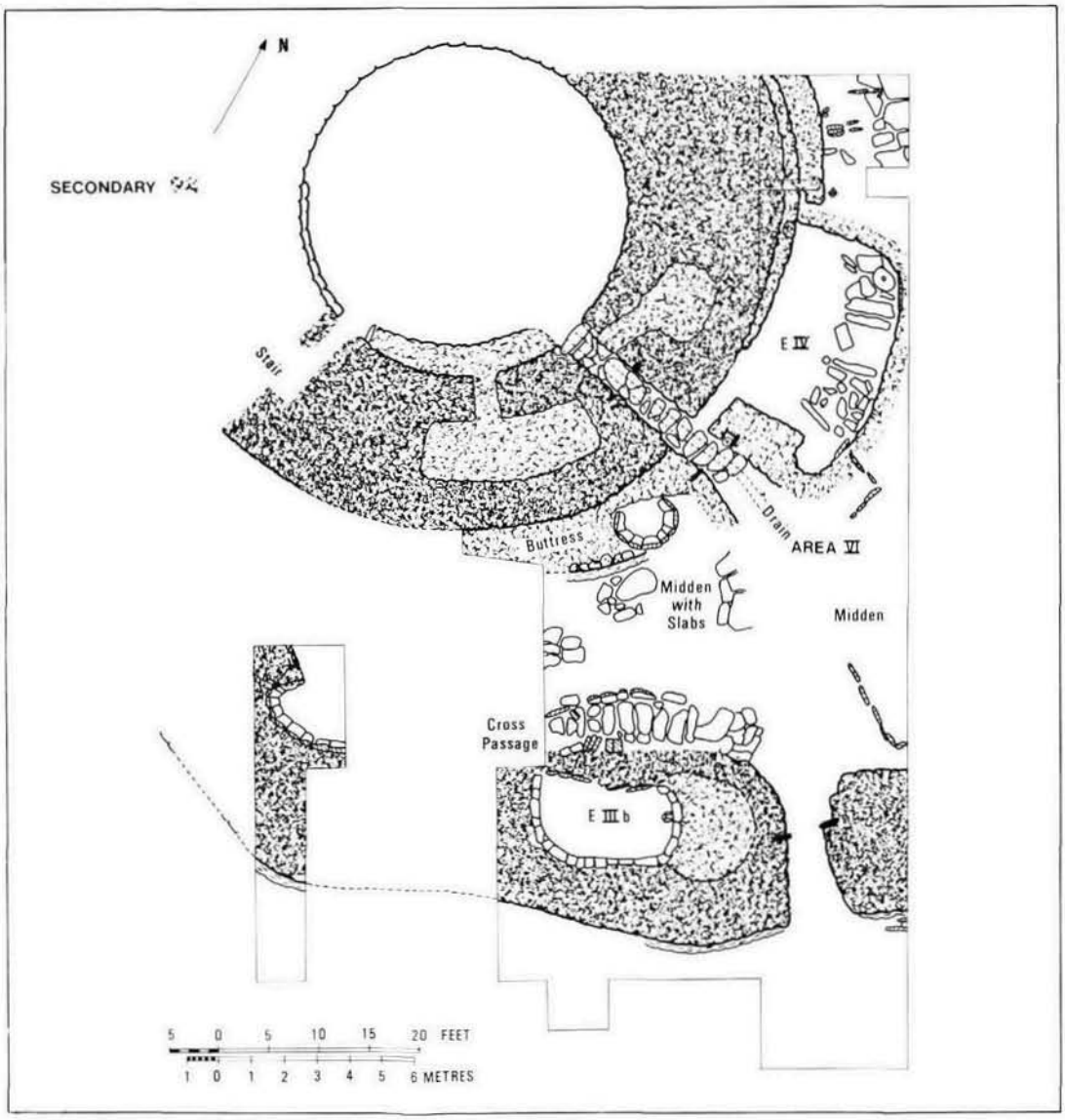
THE WALLED RECESS AND PILLAR STONE

Late in the excavations it was found necessary to open a trench to the NE of Enclosure I (Ill 42). This was in an effort to locate the outer face of the walling on its E side, but the trench had to be extended as the face proved elusive and this led to the discovery of a tangle of slabs with some flagstones on end. While investigating these latter, dry-stone walling was discovered at a depth of some 0.5 m below the level of the turf. Eventually, by the last day of the excavations, an elongated cell was exposed, about 15 m E of the broch (Ill 38). The cell opened off a dry-stone face which appeared, within the constraints imposed by a narrow trench, to resemble a revetment facing N, and which stood up to 0.5 m high. The chamber was 1.45 m long and 0.62-0.78 m wide: its S end was semi-circular and the upper slabs began to oversail as for a beehive roof. In front of the N opening of this cell was a rather rough pillar slab 0.4 m high, firmly set in a dark earth floor. On either side of the base had been placed a slightly elongated cobble from the beach, the whole arrangement being suggestive of a fertility symbol. The chamber itself was not unlike one of those short side openings sometimes found in souterrains, though the structure as a whole was not below original ground level. This structure must pre-date Enclosure I, which belongs to late Period Three, and the tangle of slabs to which reference has already been made.

REORGANISATION OF THE SETTLEMENT DURING PERIOD THREE

THE FIRST EXTENSION TO THE BROCH ENTRANCE PASSAGE

The reconstruction of the settlement area in front of the entrance to the broch followed upon an outward extension of the entrance passage itself. This series of events forms an important landmark in the development of the settlement during Period Three. The extension involved a passage which led outwards from the broch for at least 4 m, widening as it did so: it housed a second doorway to the broch. The exact length of the extension is difficult to define precisely (Ill 39). A later addition was to extend the passage much further—as far as the gateway in the external rampart. In this second addition, the stonework of the side-walls was obviously poorer, but the actual junction was obscured by later structures.



ILL 39 : Plan of the first reconstruction of the settlement during Period Three

ILL 40 : In the foreground, the floor of the first extension to the broch entrance passage is visible. Associated with this are a door-check and swivel stone. The wall in the background is the original external face of the broch: in front of it is the later blocking of the entrance to Enclosure IV*b*

The extension began where two joints were to be seen at the outer corners of the original passage where the broch wall as elsewhere had been built with a decided batter. The flagged pavement of the original passage with the drain beneath continued without any noticeable addition at the position of the joints: it has already been suggested that both the drain and the pavement may have been secondary features in their entirety. On the N side, the joint marked the corner of a short side-passage which led N along the broch wall into the reconstructed Enclosure IV, phase *b*, to be described below. The side-passage had subsequently been walled up, but the pavement was clearly traceable below (Ill 40). This blocked opening was not at first obvious as the robber trench along the broch wall had penetrated downwards almost to the floor level. Beyond the side-passage, the extension of the main entrance took the form of a well-built free-standing wall which housed the new door check, but which also formed the S side of Enclosure IV *b*. On the S side of the passage, the secondary walling abutted directly onto the broch at the joint: it was still standing to a height of 1.2 m and the stonework was rather similar to that of the original passage, suggesting that no great length of time had elapsed before the extension was added. At the checks, the passage narrowed to 0.79 m, but it opened out to the E, attaining 1.1 m in width, and was slightly curved.

The new doorway was placed approximately 1.2 m E of the external face of the broch wall (Ill 40). The two checks were each formed of a large but relatively thin upright slab, and a bar-hole was visible on the S side at a height of about 0.8 m above the pavement. The N jamb was accompanied by a most unusual vertical recess on its W side, which was some 0.28 m wide and 0.46 m deep, measured across the slab forming the check. Set at the bottom of the recess was a swivel stone, the cup being roughly in line with the N passage wall. A very smooth pebble about 5 cm across, which just fitted the cup, was found nearby and suggested a bearing on which the door had rotated. The pebble, however, seemed to be too small to have been effective with a large and heavy door: moreover,

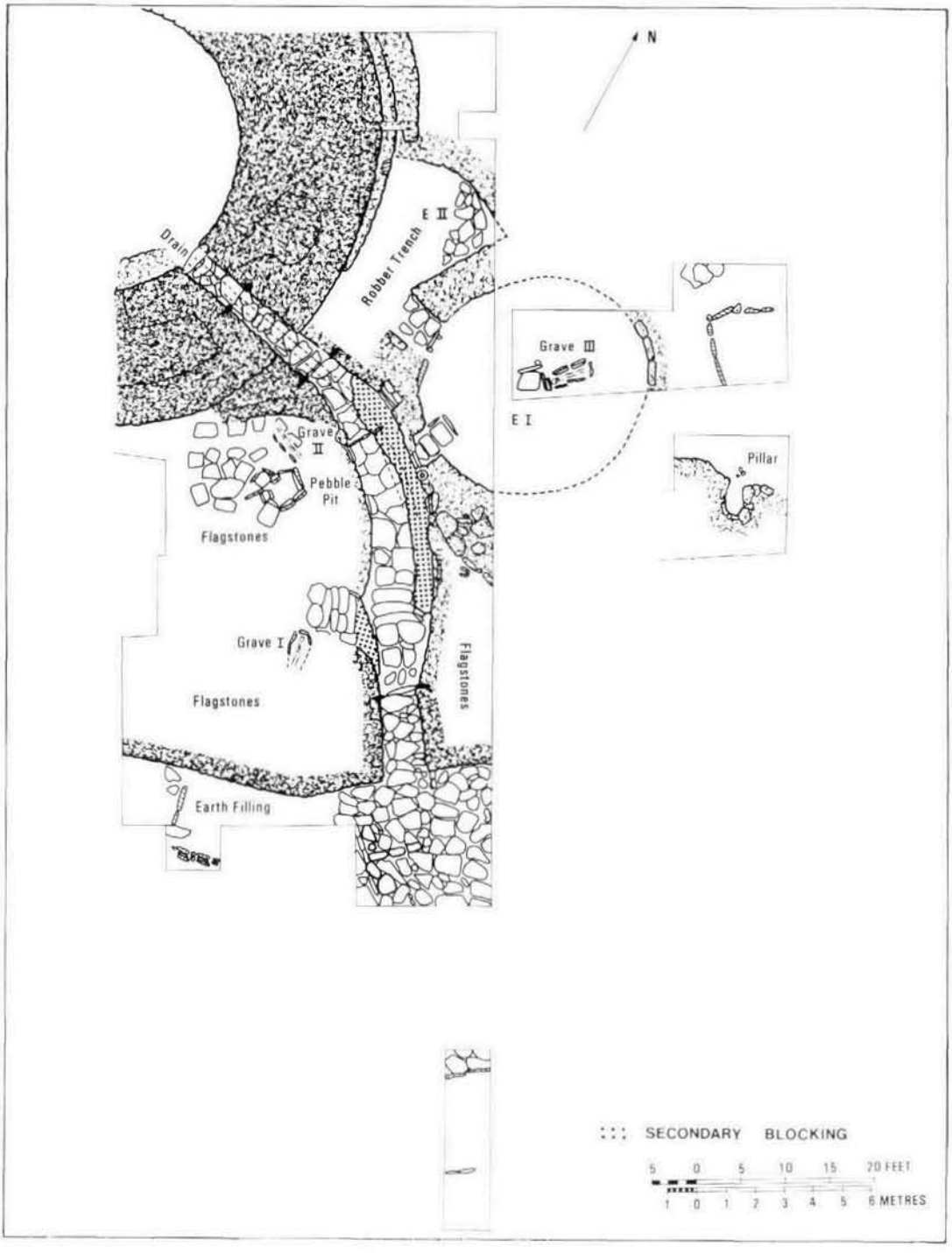
it should have shown signs of scratching or grooving, rather than exhibiting an almost polished surface. No parallel for this recess can be quoted and the question arises as to how the door was slung.

BROCH DOORS: A DISCUSSION

It is rather curious that although door checks and a bar hole may have been noted in the entrance of many brochs and duns, there does not seem to be a very satisfactory explanation as to how the system actually operated. For example, Cruden (1963, 2), when writing of brochs in general and that of Mousa in particular, confines himself to the remark that, half-way along the entrance passage, ". . . checks or jambs were provided against which a heavy door (probably a stone slab) could be placed and barred". This avoids the problem that no such slab has ever been found. At a curious site on Mull at Bunessan, there is on record an entrance passage to a dun where a rolling slab, normally housed in a recess, seems to have been used to block the way, but the arrangement was quite unlike the secondary doorway at Crosskirk (Fairhurst, 1962). Cruden's remark might perhaps be applied to the original doorway at Crosskirk, but the greater width of the extended passage, and the presence of the recess, seem to imply a wooden door.

It would seem necessary to envisage a wooden door well provided with battens, hanging upon a heavy stile. Metal pins at the top and bottom of this stile would be set, one in a socket in a lintel stone overhead, the other in the cup of the swivel stone. This latter would be set more or less as we found it with the cup in line with the passage wall. The recess would allow the stout stile to rotate sufficiently for the door to lie against the passage wall. It is noteworthy, however, that a door of the maximum possible width of 1.05 m would somewhat obstruct entry into the side passage giving access to Enclosure IV *b*. With a bar slid into the slot provided opposite the recess, such a door would be difficult to force inwards, as the stile would be effectively wedged within the recess itself.

ILL 41 : In the foreground is Enclosure IV*b* showing the associated niche in the S wall. The vertical ranging pole is placed against the original external face of the broch. At its foot is the paved entry to this Enclosure: secondary blocking to this, on the line of the first extension to the passage, is just visible. In the background, the line of junction between the original external battered face of the broch and the extension to the passage is apparent. The bar-hole and a jamb, associated with this extension, can be seen. On the extreme left is a set of steps of Period Four.



ILL. 42 : Plan of late Period Three additions to the settlement and the reconstruction of the entrance passage in Period Four. The walled recess and the pillar stone in the E trenches may belong earlier in Period Three

THE PASSAGE SE OF THE DOORWAY

Beyond the two new jambs, the extension continued E for rather more than 2 m. The exact limit seems to have been at the site of two short flights of stairs, which appear to belong to Period Four. The main drain from the broch via the entrance passage could also be traced to this line. The construction of the new extension to the passage was effected in a decidedly curious fashion, with strongly contrasting building techniques employed on either side of it. The walling of the S side was backed by a massive block of wedge-shaped masonry, (Ill 42), built up against the broch wall along which it extended for about 3 m, partially covering the oval setting of flagstones previously described (p 77). The projecting point of the wedge-shaped block had been broken away in a later reconstruction, and the walling on the outer face of the wedge could not be traced as far as the side wall of the entrance passage. On the opposite side of the passage, the solution seems to have been an improvisation. Here, the free-standing wall which formed the setting of the door jamb also formed the S limit of the reconstructed Enclosure IV (phase *b*). The defensive aspect of this general arrangement is most curious. The great value of a doorway with checks and a bar-hole is surely to be obtained when it is roofed over, as in the original broch passage. Presumably, the new extension was designed to be slabbed over, at least in part, the ends of the roofing slabs resting on the wedge-shaped masonry and on the thick freestanding wall to the N. The whole defensive position, however, could now be turned by an aggressor using the side passage coming in from Enclosure IV *b*. Perhaps the outer walling of the latter, together with any adjacent structures in the settlement huddling against it, could have concealed the defect. On the whole, the evidence indicates that the main purpose of the new, improvised, doorway was to keep out stock or perhaps wolves, rather than any hostile force. Had it not been for the apparent weakness in the design identified above, it might have been inferred that the primary beehive guard cell at the inner end of the original broch entrance passage had by this time proved unstable and that a new guardroom had been improvised in the form of Enclosure IV *b*, with access to it available behind the new doorway.

ENCLOSURE IV: THE RECONSTRUCTION OF PHASE *B*

As is apparent from the plan, Enclosure IV underwent a substantial reconstruction during Period Three: this is referred to as Enclosure IV *b* (Ill 39). The entrance passage, along the broch wall, measured 0.7 m wide by 1.2 m long. It was well paved with large flagstones which continued into the floor area of the rebuilt Enclosure IV *b* (Ill 41). This floor appeared to overlie the earlier hearth but unfortunately the robber trench had penetrated so deeply that the point was not clearly established. A mass of ash was found on a large flagstone in the N corner, by the broch wall, but there was no built hearth and the old one may still have been utilised. A rotary quern was included in the pavement and presumably the enclosure was a dwelling. The structure measured approximately 6 m by 4.5 m internally.

The outer wall was constructed of slabs laid horizontally on top of the paved floor and was traceable more or less on the same line as the earlier Enclosure IV *a*. An outer face was not preserved anywhere, except at the freestanding wall, adjacent to the passage in the S: this was 1.2 m thick, except in the SE corner where a niche penetrated into it from the enclosure. This recess was 0.9 m long by 0.8 m wide at its aperture: its function is unknown.

By this time, a casing had been built along the broch wall northwards from a point 2.6 m N of the entrance. It rested on a series of projecting foundation flagstones which themselves lay on rubble. Within the casing, which was poorly constructed, there was a remarkable slab 1.04 m by 0.43 m by 0.20 m, standing vertically like a pillar (Ill 36). There was no obvious explanation for this unless it were a relic marking the end of the north wall of the old Enclosure IV *a*.

ILL 43 : Structural complexity outside the broch on the E. The higher fragment of paved floor beside the ranging pole belongs to Enclosure II and is superimposed on the floors of Enclosures IV*b* and IV*a*

ADDITIONS TO THE SETTLEMENT LATE IN PERIOD THREE: ENCLOSURES I AND II

After the reorganisation of the broch entrance area was completed, another phase of building operations may be distinguished involving two adjacent structures, Enclosures I and II, which directly overlay Enclosure IV *b*. On the general plan (Ill 42) these later enclosures have been included with the structures of Period Four, but this was largely a matter of cartographic convenience though the outlines were probably still visible at that time. Enclosure I is of particular interest with regard to dating: additionally, a most unusual burial was found in the floor.

Enclosure II can be dismissed briefly, as the greater part of it had been destroyed by the robber trench. It differed but little in size from its predecessors IV *a* and IV *b* in the same area. However, a substantial corner of Enclosure II, paved with well-laid flagstones and delimited by dry-stone walling, surviving in the E, was clearly superimposed on the lower floors (Ill 43). No formal hearth was found and the only entrance which had survived linked Enclosure II with the adjacent Enclosure I. On the NW corner of this doorway, the walling had sagged markedly as though insufficent time had elapsed for the consolidation of its foundations. Perhaps this is evidence of the brief duration of the various building phases in this complex area of the settlement. From the S termination of Enclosure II at the extension of the entrance passage, where the little side passage was by now walled up (Ill 40), the overall measurement must have been some 6 m long by 2 to 4 m wide. It appears to have been no more than an annex to its neighbour.

Enclosure I was first encountered as a curving dry-stone wall jutting out from the main N/S baulk (Ill 44): to discover what was involved in this area, excavations were extended E and finally rather more than half of the floor space of an oval dwelling, 7 to 8 m in diameter, was uncovered. The wall was about 1.5 m thick on either side of the connecting doorway into Enclosure II, but on the E the outer face could not be found and the building may have backed against another characterised by vertical flagstones. Along the S sector where the main entrance lay, the walling

varied in thickness but disturbance may have occurred. In general, the rather rough dry-stone walling seemed to have formed the base for a superstructure, probably of turf, and it contrasted with the vertical slabs and dry-stone panels of the early enclosures. The main SW entrance was 1 m wide and was flagged: immediately outside there were two small steps downwards into what must have been the approach to the extension of the entrance passage. A rotary quern was built into the outer corner of the S side. This sector, however, had been somewhat modified and the little steps had been walled up in Period Four.

In excavating the interior of Enclosure I, the following stratigraphy was noted. Directly below the turf was a layer of brown earth containing angular stones and resting on slabs at its base. This was considered to be of medieval date. Stratified beneath this was a deposit of midden material, about 0.3 m thick, which contained much shell and some Late Broch sherds. These sherds included the greater part of a single pot (*234*) of which fragments were also recovered elsewhere, both on top of the Enclosure I wall and outside, to the S. The inner face of this wall on the E also produced a bronze pin (*412*), which had been thrust into the lower part of the stonework. Under the midden a layer of burnt organic material, 0.08-0.15 m thick, probably represented debris from a thatched roof. This rested directly on the reddened floor of the enclosure.

The floor of Enclosure I was of hard-packed earth with an occasional flagstone and with much ash. The hearth was centrally placed in the dwelling and consisted of a flat slab reddened with heat and surrounded by a very rough low kerb. Directly alongside, there was a narrow stone box with a lid, which was at first taken to be a collapsed slab tank (Ill 45). In fact a most unusual grave had been inserted into the floor ('Grave III' on Ill 42).

ILL 44 : Enclosure I (foreground): its SW, paved, doorway opens onto the much-extended entrance passage. Note the rotary quernstone built into the wall here. In the foreground, right, is the connecting door to Enclosure II

ILL 45 : The interior of Enclosure I: adjacent to the short scale (marked in inches) is the stone box which formed part of Grave III. The corner of the hearth lies directly behind this and floor slabs are visible elsewhere

GRAVE III: THE SEATED BURIAL IN ENCLOSURE I

The narrow stone box by the hearth rose 0.3-0-4 m above the earth floor of the enclosure and was about 0.6 m wide. It was formed of five slabs, two narrow side pieces and two wide ones which sloped up towards each other but were separated at the top by a narrow space capped by a stone 'lid'. Stretching across the floor near the box for a distance of about 1.25 m was an elongated group of slabs, which at first seemed to represent paving stones: these appear in the foreground of Ill 45. On removing the lid of the box, dark midden material with shells was seen in the interior, lying loosely as though it had drifted inside: then the upper end of a humerus, the first indications of a burial, was noted.

The grave in fact consisted not only of the box just described, but also of a slab-lined long cist which underlay the group of slabs. The grave was oriented NNE/SSW, with the skull of an inhumation burial at the latter end. The slab at the SSW side of the stone box, and those on either side of it, continued downwards to form the end of the long cist. Overall, the long cist was 1.32 m in length: its width varied from 0.46 m near the SSW end, to 0.66 m in the central portion, to 0.36 m at the NNE end. The slabs covering the long cist stood 0.43-0.48 m above the floor of the cist at the NNE end: at the SSW end, the box rose to a maximum height of 0.88 m above the cist floor, which was of earth. The sides of the cist were lined with rather rough and irregular flagstones on end (Ill 46).

The skull lay upside down on a heap of arm bones, vertebrae, and ribs. The long bones lay in order horizontally, but the bones of each foot were in a heap. The body had obviously been buried in a sitting position with its back to the hearth: it was facing seawards, precisely towards the Old Man of Hoy in Orkney. The skeletal report indicates that the bones showed considerable evidence

of arthritis: a cripple may have been laid to rest by the hearth of a dwelling which was then set on fire. The low circular walling around Enclosure I must have remained open for a considerable length of time afterwards, since midden material inside contained sherds characteristic of Period Four.

THE SEATED BURIAL: CHRONOLOGICAL CONSIDERATIONS AND COMPARANDA

Enclosure I was constructed above the remains of Enclosure IV which in its turn was built against the broch wall. A date for the floor of Enclosure I, and for the burial inserted into it, becomes of significance in dating the earlier settlement generally and relating it to the phases of the broch interior.

The seated burial was at first thought to be Norse. There is a reference which seemed to afford a parallel in Njal's Saga (translation by Magnus Magnusson and Hermann Palsson, 1960, 172): "They raised a burial mound for Gunnar and sat him upright in it". According to the translators, the saga was written in the last quarter of the thirteenth century but refers to events 300 years earlier. Dr Anna Ritchie also drew our attention to another record in the old *Statistical Account of Scotland* for Sandwick and Stromness, Orkney (Sinclair, 1794, 459), describing one of three cists in a mound at Skaill, as reported by Sir Joseph Banks and George Low:

> "In the second of these chests was found a skeleton in a sitting posture, as if seated on the ground, and the legs stretched out horizontally. To keep the body erect, stones were

Ill. 46 : Grave III: the seated burial in a long cist. The tall slab beside the inch scale is the vertical slab adjacent to the hearth in Ill 45

> built up opposite the breast, as high as the crown of the head. The whole was covered with a large stone".

It may be recalled, too, that a Pictish symbol stone is said to have been found at Crosskirk, and at the time of the discovery we were thinking in terms of the settlement having been occupied from about Roman times for a period of many centuries.

Old reports sometimes record burials in North Britain 'in a sitting position' dating to pre-Norse times, but most unfortunately, they are rarely in sufficient detail to make certain that a simple crouched burial is not in fact involved. Mr Humphrey Welfare has, however, drawn our attention to the account in Daniel Wilson's *The Prehistoric Annals of Scotland* (1857, 327), of a burial found:

> ". . . during the construction of a new road leading from Granton Pier to Edinburgh, in a small stone cist, distant only about twenty yards from the sea-shore. It contained two skeletons, which from the position of the large bones and the square and circumscribed form of the cist, appeared to have been interred in a sitting posture".

Mr Welfare indicated that the proposed Romano-British dating is not secure and that the Granton cist could be later. He also remarked that casual interments of this period may be disorderly and that no great significance attaches to the sitting position in this particular case where a cramped space had been utilised for two bodies.

A sample of charcoal was selected from the floor of Enclosure I from the area immediately W of the main baulk. Considerable care was taken to sample from the floor level. The date returned is 120 bc ±80. There is no significant difference statistically between this and the radiocarbon sample from within the broch giving 100 bc ±50. A sample from a rib-bone of the burial was dated to 150 bc ±100. Dr Harkness warned, however, that the date might be misleading: current research work suggested that a diet containing a large element of seafood might result in overold dates for skeletal material from individuals who had consumed such food in considerable quantity. A Norse burial, however, may be ruled out: these radiocarbon dates also undermined our early hypotheses concerning the period and duration of the settlement generally.

THE SETTLEMENT AT THE END OF PERIOD THREE

There is no clear evidence to show what exactly was the situation in the area between the broch and the external rampart, to the SW of the newly erected Enclosures I and II. The walled passageway, which led from the extension of the broch entrance to the gateway in the rampart, does not seem to have been constructed at this stage. Excavation in the area S of Enclosure I penetrated an irregular mass of midden material and discarded slabs overlying the enclosure of Area V.

To the S of the broch, overlying the site of Enclosure VII, there was a similar collection of refuse, except along the N side of the rampart itself, where a carefully defined walk-way (the 'Cross Passage') was traced W as far as the baulk (Ills 39, 47). It was well paved with flagstones and was just over 1 m wide; on either side there was a row of flagstones on end, each row inclined slightly outwards. The E end had been truncated by the insertion of a later extension to the already elongated entrance passage, but a collection of flat slabs may have been the remnants of rough steps leading downwards towards the old gateway. No obvious function for this passage can be suggested unless it led to the secondary entrance to the broch, at the stair-entry, which may have been in use late in Period Three.

Between the Cross-Passage and the broch wall, a mass of midden material and discarded slabs was covered with large but rather irregularly laid flagstones, the forerunners of a very well-built pavement dated to Period Four, which lay immediately on top. The slabs of this lower paving overlay the remnants of Enclosure VII and other walling of the same period, and to the N, they lapped against a thick buttress which had been built against the external face of the broch wall outside the intra-mural cell. A further casing was subsequently added, running over the top of the oval setting of flagstones adjacent to the broch wall, and along the face of the triangle of masonry forming the SW side of the extended entrance (Ill 42).

ILL 47 : The Cross Passage of late Period Three looking W. To the S of it, within the thickness of the wall, is Enclosure III*b*. In the foreground, left, is the original entrance through the rampart wall. On the right is the wall of the second extension to the broch passage dated to Period IV

In front of this casing, a pit-like structure about 0.25 m deep was found amid the flagging. It was only casually defined by slabs sloping slightly outwards to form a depression some 1.2 m by 1.05 m; there was no flagstone at its base (Ill 48). Particular attention is drawn to it because it was half filled with cobbles from the beach, 50-70 mm across; half a pailful was collected. They were mixed with clay flecked with carbon, but only one showed signs of being cracked by heat. No hearth had survived nearby. The evidence scarcely warrants interpretation as a cooking pit, but no other explanation can be offered.

The whole area S of the broch and Enclosure I appeared to lack an orderly arrangement. The approach to the broch from the gateway would seem to have been along a depression between

ILL 48 : The 'pebble pit' amid flagstones in the settlement area

accumulations of debris on either side: from this, the Cross Passage led W. By the end of Phase Three, the settlement had of course been in existence for a long time, perhaps a century or even two. The broch itself was now buttressed most of the way round and was still unstable. There were obvious indications of age and decay in the settlement as well. There seems little to show how long such a phase of decline might have lasted, but to stretch it out to the Antonine Period when the samian sherds occur on the site, would appear to be unduly long, so that a break in the occupation may well be involved.

Unfortunately, the typological and stratigraphic relationships of Enclosures I and II to the late phase of Period Three is not as satisfactory as a simple reliance on the radiocarbon dates might indicate. Enclosure I in particular is immediately noteworthy as being roughly circular instead of the sub-rectangular shape usual in the other domestic structures in the settlement during Period Three. Moreover, both Enclosures I and II were built on a broad stone foundation, unlike the slabs on end and panels of dry-stone walling used in building elsewhere on site. Both enclosures were slightly higher than the level of other buildings dated to Period Three. Finally, the presence of a rotary quern stone built into the walling of Enclosure I, with another embedded in the floor of the preceding Enclosure IV *b*, would seem to be surprisingly early for this type of artifact to appear on a site as far north as Crosskirk. All this might suggest a date as much as a century later than the two radiocarbon samples have given (150 bc and 120 bc) for these particular enclosures. With this in mind, Enclosures I and II might be regarded as decreasing the apparent gap between Periods Three and Four, and hence the cartographical expedient of including the two in the general plan for late Period Three and Period Four.

At this stage, further discussion of the precise date of Enclosure I and the seated burial must be postponed (see p 168), but the evidence in general indicates a very late phase in Period Three when perhaps the broch itself was already out of use.

7 THE LATER SETTLEMENT: FROM THE END OF PERIOD THREE

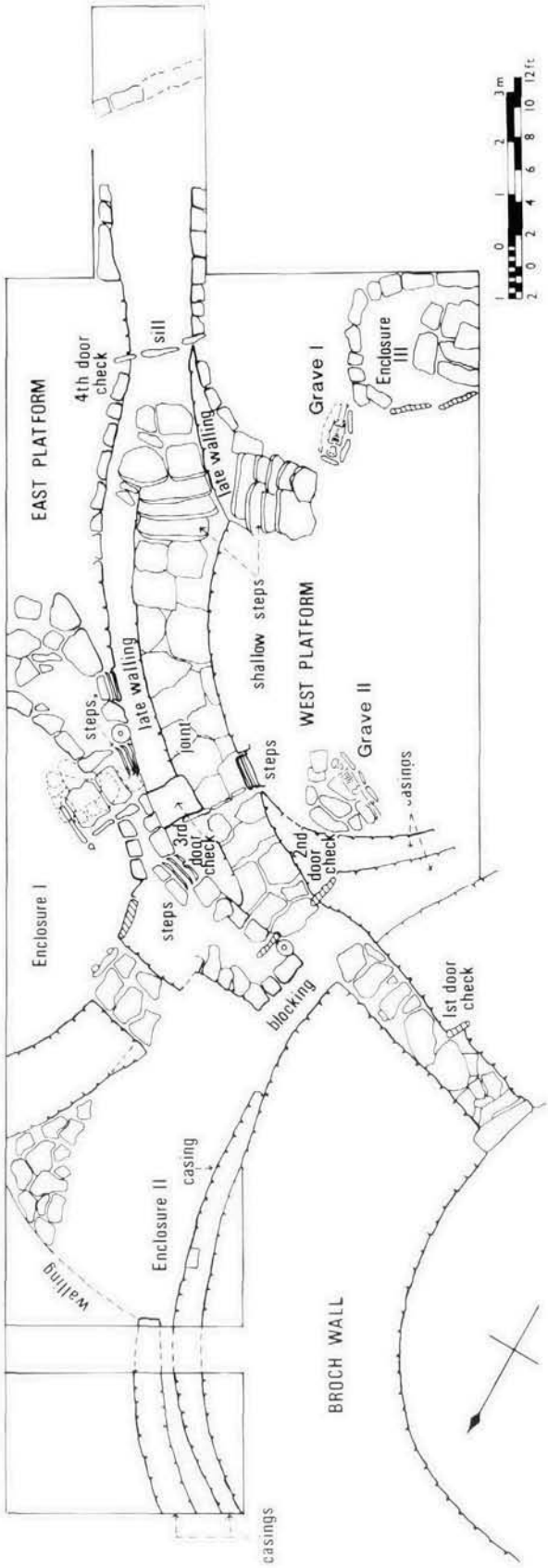
Reference has already been made to an extensive reorganisation in the settlement area during the final stages of its occupation (Ill 42). Much more was involved than a renewal of building activity after a period of decline, or even after a break in continuity of occupation, for a major change in function is evident. Moreover, the pottery associated with this period is recognisably different since the fabric became distinctly finer, although the shapes and the absence of decoration remained as before (see Ch 9). Taken by itself, this change might signify no more than a minor alteration in technique or a new source of clay, but for the fact that an occasional sherd of samian was recovered from this horizon. No radiocarbon date from the settlement itself is available for this period, but the new style of pottery occurred both in the settlement and in the reorganised broch of Phase Three. A precise correspondence cannot be proved but it seems safe to asssume that the structures in the settlement to be described below belong to Period Four of the Crosskirk site as a whole.

A FURTHER EXTENSION TO THE ENTRANCE PASSAGE IN THE SETTLEMENT AREA

The excavations uncovered a long passage connecting the first extension of the broch entrance to the ancient gateway in the external rampart (Ill 42). When first discovered, the entire passage was taken as a unitary construction, and therefore seemed all the more spectacular. However, it is clearly a composite structure. The original entrance passage in the broch was some 4.5 m long, the first extension added 3.5 m to this length, and the second extension contributed another 9 m. The Period One gateway, already ancient, added a further 3 m, making a total of about 20 m (Ill 49). Outside the rampart, a well-laid pavement, belonging to the same period, extended the floor of the passage: on this, marked out by single rows of stone blocks, was a three-sided enclosure which itself continued the alignment of the gateway SE for a further 2.5 m. Excavation showed that the well-flagged floor of the second extension of the long passage had a drain beneath and was built upon a great mass of carefully placed slabs. This drain began where the first extension of the broch entrance had ended. The foundation material increased in depth so that the floor of the extended passage passed through the gateway at the level of its bar-hole, as much as 1 m above the level of the flagstones of the original entry. The wide pavement outside was similarly underlain by a considerable depth of infill, consisting in this case of great blocks of stone such as might well have been employed in broch walling; they were carefully laid and three to four deep (Ill 50).

In passing, a wry comment may be made that in many a broch excavation in the past, this extraordinary combination making up the long passage might well have been planned and left intact as a primary feature. Certainly had our objective been the preservation and display of the Crosskirk site, the curious arrangement would have required much anxious consideration before dismantling: in fact, it provided one of the most intriguing aspects of the excavations. There is no doubt, however, that the long passage was composite and the final form belonged to a very late date in the occupation.

In detail, the second extension was somewhat involved and required close consideration. As the plans show (Ills 42, 49), the width was later reduced and the lay-out was simplified, but in its



ILL 49 : Plan of the composite entrance passage attributable to Period Four

Ill. 50 : The wide paving outside the external rampart wall, visible on the extreme right.

original form, the new passage was some 1.9 m in width and was floored with large slabs over a new drain (Ill 51). The bewildering aspect was the number of short flights of steps which led upwards and outwards from this passage, although the side walls of this extension were rarely more than 0.6 m high and a single long stride was all that was necessary to reach the adjoining surfaces on either side. The pavement itself was also interrupted by a short flight leading upwards towards the gateway in the rampart. In contrast to the quality of the masonry associated with this proliferation of exits, the side walls were rather roughly built and in part incorporated the walling of earlier structures. Certainly on the W, and probably on the E as well, the side walls of the second extension had been raised above the level of the adjacent surfaces, but the superstructure seems to have been no more than one slab, laid horizontally, in thickness. It can have had no real strength unless backed by sods or debris outside. Perhaps the fragility of the upper part of the side walls goes some way to explain the need for side steps from the passage, especially if it was originally provided with a low roof.

On the W, the passage wall formed a revetment to a low platform some 0.6-0.7 m above the level of the floor (Ills 49,53). This platform stretched from the broch S to the edge of the rampart and its flagstones directly overlay those of its predecessor which contained the pebble pit and the Cross Passage of late Period Three. The new platform had been carefully flagged with large slabs, around some of which thin stones on edge had been packed, as though to mark out the floor as of special significance. Excavation was far from simple, as a still later pavement, presumably of medieval date, directly overlay this second floor. The exact significance of a sherd of samian from below the level of the second floor, in midden material, cannot be precisely assessed.

Two flights of steps, of very different type, led up to the W platform. The first (Ill 52) seemed to mark the beginning of the second extension and was on the site of the S corner of the wedge of masonry built up against the broch wall in Period Three: the corner itself had apparently broken away. The stair consisted of four small, neat steps, about 0.3 m wide with a tread of 0.13-0.15 m and a rise of 0.09-0.15 m. In contrast to this steep narrow flight, the second, located about 4 m SE, was wide and gentle. It rose to the W along the inner-edge of the rampart, just where the Cross Passage had ended, and presumably it also led up to the area between the broch and the external rampart. Five steps survived in this flight: each was about 1.7 m wide, with a tread of at least 0.15 m.

ILL 51 : The second extension to the entrance passage in its original wide form, looking SE. The narrower set of steps which led to the W platform is on the right

ILL 52 : The entrance passage to the broch, looking SW, after the removal of the E passage wall. On the right is the first extension, with the wedge-shaped buttress added to the S wall of the broch behind it. On the left is the second extension, with steps leading up to the Period Four platform. The short scale is positioned in the 'pebble pit'

ILL 53 : A view SE along the secondary extension to the broch passage. In the background, the set of broad shallow steps marks the point where the passage traverses the Period One rampart on the line of its original entrance. Secondary walling, which served to narrow the passage is visible beside the vertical ranging pole. In the foreground is the 3rd door check shown on Ill 49

The steps were all a thick slab in height. These two flights seem designed to have served different functions: the wide shallow steps could have been negotiated easily by cattle, horses, or sheep, but the narrow steep set was exclusively for human use.

At the same point as the second flight, just discussed, rose westwards from the passage, a remarkably similar flight of four wide steps interrupted the run of the passage floor, here rising to the new level through the Period One gateway (Ill 53). These two flights were almost identical in construction. However, the flight on the line of the passage floor was not more than 1.7 m wide and did not span the entire passage which was here as much as 2.2 m across. On the E, the space between the SE steps and the side wall had been filled with secondary walling, which had been constructed at a later stage to reduce the width of the passage. Similar rough walling also completely blocked off the broad flight leading off at right angles to the W. From the foot of the steps in the main passage northwards, the later narrower passage had been repaved above the level of the flagstones of the wide passage. Faced with this set of observations, it was at first assumed that the steps along the line of the main passage were of the same period as the secondary side walling within it, and that an extension of the lower, primary paving would continue beneath the steps. No such pavement existed. These well-constructed steps are so much at variance with the character of the secondary side walling and resemble so closely the flight leading W out of the passage, that we are forced to the conclusion that the two are contemporaneous. The point is of significance in trying to establish the purpose both of the wide passage and of its later restricted form.

On the E side, the second extension was constructed by connecting the curving wall of Enclosure I to the inner corner of the Period One gateway (Ill 49). The wall of Enclosure I had been quarried

away somewhat to attain the requisite width, and its SW doorway had been walled up, this blocking overlying the two descending steps which had formerly provided access to the passage. At the same time, apparently, another flight of narrow steep steps, closely matching the set on the the opposite side of the passage, was constructed only a short distance S of the doorway. Presumably by this time the walling of Enclosure I must have been in a ruinous state. Further along the passage to the NW, towards the broch, yet another set of steep narrow steps could just be traced leading upwards and over the wall at the junction of Enclosures I and II just above the curious niche of Enclosure IV *b*. It was precisely over this extraordinary complex of walling that we had happened to open a pilot square in the excavations of 1969.

To the E of the E passage wall lay the low walls of Enclosures I and II, which by now had become ruinous, and within which refuse was collecting. To the S of Enclosure I as far as the external rampart, excavation revealed a great mass of slabs lying at all angles: this was mixed with large quantities of midden material containing much shell, and which dated to an earlier period. This mass had probably been levelled to form the counterpart of the platform W of the passage, but its significance was obscured by reflagging, which belonged apparently to the medieval period and lay just below the turf.

The excavation of the second extension to the passage and its platform on either side presented a most confusing set of problems, partly because of the re-use of old walling and of midden materials and slabs of previous periods, but also because the new passage itself was an improvisation to suit the pre-existing lay-out of the settlement area. The evidence gathered during the excavations was checked and re-rechecked in an effort to make the foregoing factual account as accurate as possible.

PERIOD FOUR AT THE RAMPART GATEWAY AND TO THE SOUTH

Where the new pavement passed through the Period One gateway, a long slab lay across between the door checks, forming a threshold flush with the flagstones on either side; it figures prominently in Ill 54 which shows how it penetrated into the underlying slab base. The precise purpose of this deep slab is obscure.

ILL 54 : Excavation of the gateway through the rampart wall showing the early door-checks, and the anomalous threshold slab of the Period Four arrangement

Beyond the gateway, the well-laid pavement was considerabely wider: it continued along the outer edge of the rampart to the limit of the excvations (Ill 42). The pavement extended S into the area of the narrow trench which had been opened to the E of the Cemetery wall. Here, there was a row of low flagstones on end, clearly marking the limit of the pavement just over 20 m S of the gateway. The flagstones were set on the lip of the outer of the two hollows which have previously been discussed (Ch 3). Unlike the inner hollow with its filling of slabs to pavement level, the outer one had an accumulation of what appeared to be topsoil, somewhat similar to that located in the hollow in front of the rampart in the trench further to the W. Although there is no specific evidence to support the view, it is probable that the filling of the two hollows was contemporaneous. One possibility is that a great volume of slabs and earth from either the broch wall or the rampart, or both, had been disposed of in this way after extensive dismantling operations. Whatever the reason, the effect was to eliminate such natural defence as the hollows afforded, and indeed to emphasise the non-military character of the site.

Westwards from the gateway, the pavement gave place almost immediately to a filling of earth, visible in the restricted excavation along the edge of the rampart. Further W, we uncovered part of what seemed to have been a roughly rectangular enclosure marked out by slabs on end; it measured 2.2 m across and appeared to extend some 6-7 m to the edge of the pavement in front of the gateway (Ill 42).

It would have been most desirable to have extended operations S over a wide area, both to investigate the nature of the structures just outside the line of the rampart, and to attempt to find the origin of the ancient topsoil appearing in the outer of the two hollows. Apart, however, from the limitations of time, the great difficulty was that in examining the immediate vicinity of the Cemetery, we would have become involved in an other issue, that of the deposits underlying St Mary's Chapel: moreover, there would have been a strong possibility of disturbing comparatively recent burials.

SUBSEQUENT ALTERATIONS TO THE ENTRANCE PASSAGE DURING PERIOD FOUR

In its original form, the passage was somewhat variable in width, exceeding 2 m in one section, and was in general too wide to have been spanned easily by stone slabs. By way of comparison, the lintelled entrance and the various doorways of the broch were never more than 1.15 m wide. At some later stage, but still within our Period Four, stretches of decidely poor walling were erected to reduce the width of the passage to between 1.07 m and 1.60 m (Ills 49, 53). The most strongly-built of this additional masonry was a solid block against the E wall of the original passage: it formed the check to yet another doorway—the fourth chronologically to have been inserted along the length of the passage from inside the broch to the gateway (labelled '3rd' on Ill 49). The new door check was located some 2.6 m SE from the doorway inserted in the first extension to the passage just outside the broch. The stonework forming the check was separate from both the original passage wall and the new restricting casing on either side. Across the floor of the passage at the check there was a sill of low flagstones on end against which the door, opening *inwards* towards the broch, would have fitted when shut. No corresponding check had survived on the opposite side of the passage but it would seem to have stood immediately on the inside or broch side, of the flight of narrow steps (Ill 53). Directly in front of the check, on the NW or broch side, there was a particularly shoddy stretch of walling which may have been even later in construction. It blocked off the little flight of steps leading NE, and seems to have been constructed against, or perhaps had spilled up to, the new door check, putting it out of action.

Abutting directly upon the outer side of the door check and built against the original side wall, a casing had been added along the passage stretching to the inner corner of the ancient gateway (Ill 49). It covered over the wall-up exit from Enclosure I and blocked the little flight of steps nearby.

On the opposite side of the passage, more rough walling also blocked the wide flight of steps leading W, as previously described (p 95). The restricted passage was then repaved over the 5 m stretch from the new door to the foot of the steps leading up to the gateway.

In general, the restriction of the passage was a minor building operation as compared with the construction of the wide passage, and only the additional door check was substantial. Unfortunately, there was no indication of the length of time during which either structure continued in use. Obviously, however, a new and different function had been found for at least part of the long passageway from the broch.

THE LAST PHASE OF PERMANENT OCCUPATION AT CROSSKIRK

Several unusual aspects, both of the extended passage and of the approaches to the external gateway during Period Four, remain obscure. Clearly, massive levelling operations had accompanied the construction of the wide passageway and the external pavement. There seems no reason to invoke some hostile action and a slighting of the defences, as the filling of slabs under the new floor and the pavement had been systematically laid. It is surely impossible to think in terms of planned defences when considering the passage with its curious flights of steps, given the extent to which the military aspect of the site had been obliterated. This was so much the case that, before dating evidence became available, it was tempting to think in terms of Early Christian occupation. However, no dwelling has been located of that period, although much ground remains unexplored within the settlement area. Within the broch itself, there is evidence of occupation at this stage in the second-third century AD, and it seems reasonable to assume that, in stablising and reconditioning the ancient structure, surplus slabs and earth from the wall might well have become available in quantity.

The outstanding difficulty in interpretation is the purpose behind the construction of the new passageway. There are other instances in Caithness, Orkney and Sutherland where extensions were built outside a broch entrance, but on the whole, these shed little light on the particualr problem at Crosskirk. Some of these extensions seem to have been haphazard, for example where buildings in an external settlement were constructed against the broch wall on either side of a passage to the outside, much as happened at Crosskirk during the earlier Phase Three. Examples occur at Nybster, Norwall (RCAHMS, 1911a, nos 518, 508), Gurness and Midhowe (RCAHMS, 1946, nos 263, 553). In other cases, the post-excavation plans are so vague that little or nothing can be inferred, as for instance at the Keiss brochs (RCAHMS, 1911a, nos 515, 516 and 517). Rather more comparable to the Crosskirk passage are the extensions to be seen at Carrol and Kintradwell (RCAHMS, 1911b, nos 27, 467) and at Westerdale (RCAHMS, 1911a, no 106), where a partial excavation was undertaken some years ago of which no published account is available. In these latter examples, the problem is as obscure as our own, and nothing is to be learned without further excavation. In general, it would seem that the various extensions are to be related rather to the growth of buildings in the external settlements than to additional broch defences.

In the case of Crosskirk, however, the first extension during Period Three can reasonably be explained as a defensive measure, although buildings against the broch wall and outside the original entrance had already come into being, and a second possibility of use for storage may also be advanced. It has already been suggested that instability developed early at the inner end of the original entrance passage and affected the guard cell, such that the bar behind the door could no longer be manipulated from inside.

Under these circumstances, the greater part of the broch entrance passage must have remained in its original form and would have connected directly with the first extension built outside to accommodate the new doorway. The connection would have given rise to a composite passage some 7 m long overall, with a width of 1-1.5 m and a height of perhaps 1.5 m in late Period Three. This structure would have been strongly reminiscent of a short souterrain such as were being used about this time in association with hut-circles, at least in E Sutherland (Fairhurst and Taylor, 1971). In the excavation of this older part of the passage, quantities of animal bones were found and were

thought to indicate kitchen midden material: it is just possible that they represent the storage of perishables.

Outside this passage including the first extension, a depression appears to have existed at the beginning of Period Four, between the ruinous Enclosures I and II, and the masonry abutting against the broch wall S of the original entrance. Perhaps the existence of this depression suggested an extension to the passage in what was eventually to be a partly subterranean structure leading outwards towards the original gateway in the rampart. The second extension was nearly 2 m wide and 7 m long, and seems to have been roofed over with perishable materials rather than covered with lintels. In Period Four, therefore, the total length of the covered passage from near the inner end of the original broch entrance as far as the wide steps leading up towards the old gateway, had increased to at least 14 m. Within the late, wide extension, there was comparatively little occupation material and only a few potsherds were noted. There was no sign of a domestic hearth: there was no refuse nor specialised tools from any industrial process. As a hiding place from an enemy or from Roman slavers, the second extension was also completely unsuitable: the passage was provided with a plethora of exits to reveal the presence of the inmates. Finally, it must be added that there were no obvious indications of ritual activities.

Perhaps this form of the passageway may be regarded as an outlandish form of souterrain in a region where normal types of souterrain appear to have been rare: however, the question still arises as to what possible use could have been made in particular of the outer, wider part. A clue would seem to be given by the extraordinary number of sets of steps leading down into the passage. They surely rule out any idea of military defence. The two sets of broad shallow steps, placed more or less at right angles to each other, may indicate that stock would have been driven down into the passage, either via the original gateway in the rampart, or round the S of the broch from the W. On the other hand, the three sets of steep narrow steps seem to indicate movement of human beings alone: allowing for narrow openings in a low roof, these could only have been negotiated in a more or less crouched position. It might be recalled that Wainwright (1963) when faced with a somewhat similar problem of a subterranean passage, at Ardestie and Carlungie in Angus, postulated a byre for cattle: the side walls of these souterrains, backed by earth, would have given greater strength against damage by penned stock, than a dry-stone free-standing wall above ground. A drain underneath the floor was another notable feature, as with Crosskirk.

At a late stage in Period Four, the passage was restricted in width by secondary walling, which also blocked off at least two sets of narrow steps on the E and the wide set leading W. Perhaps this was to facilitate roofing the whole passage with slabs to give a more normal form of souterrain—but why, then, should another doorway have become necessary part way along the second extension?

A storage place, if not a stock pen, seems to be the only solution we can offer. This extremely lengthy, composite entrance passage was viewed with astonishment by numerous visitors to the excavations who asked the inevitable question. It dominated the site almost as much as the broch and it certainly demanded a large share of our time and attention. It now figures as our most frustrating problem. It is hardly necessary to recall, at the end of this description of the prehistoric structures at Crosskirk, that freakish problems have not been rare.

8 THE POST-BROCH PERIOD AND MEDIEVAL TIMES

THE BEGINNING OF PERIOD FIVE

There is no method of estimating accurately for how long Period Four lasted. Although much change occurred in the settlement, few artifacts were recovered apart from the later Broch pottery and a prolonged occupation is not indicated. The radiocarbon date of 70 ad ±70 from the broch, and the samian sherds from both broch and settlement, would point to the second century AD as the terminal date for Period Four. However, while removing turf and topsoil from above the E part of Enclosure I, well away from the robber trench along the E side of the broch, a small fragment of Roman Castor ware came to light. Its significance is discussed by Dr Breeze (Ch 9). It is just possible that it indicates a lingering occupation into the middle of the fourth century AD, but the lack of supporting evidence makes it far more probable that the sherd represents merely casual resort to the site: Crosskirk continued to yield evidence of occasional usage long afterwards.

The broch itself may have continued to serve as a useful enclosure for stock, or even for defence in times of danger: the nail-headed bronze pin found inside the broch might be dated as late as the sixth to the ninth centuries AD typologically, but on stratigraphical grounds, it would appear to belong to Period Four.

In time, however, the broch and the ruins of the settlement must have weathered to a mound or series of mounds which would still have formed a prominent landmark on the headland, perhaps suggesting an ancient cairn. At any rate, there is a record of a Pictish symbol stone found on the site, and in the excavations, two long cists were encountered.

THE PICTISH SYMBOL STONE

The stone seems to have come to light over a hundred years ago, but the exact location is rather vague. In John Stuart's '*The Sculptured Stones of Scotland*' (1856), plate XXX is described as follows:

> "The drawing of the stone at Thurso Castle was made from a facsimile of it; the original having been presented by Sir George Sinclair to the King of Denmark. The stone is said to have been found at Libster, about seven miles from Thurso, in a Pict's house, but I have been unable to obtain a distinct account of the circumstances."

There are of course two other broch sites as well as Crosskirk, which could conceivably be referred to as 'Pict's houses' at Lybster.

Romilly Allen in *The Early Christian Monuments of Scotland* (1903, 30) copies Stuart's drawing but states that the stone was said to have been found 'just outside the enclosure of the burying ground attached to the ancient church of St Mary at Lybster in Reay . . . but nothing is known of it at the Museum in Copenhagen.' Romilly Allen's description is as follows:

> "It is a rectangular slab of Caithness sandstone 2 ft 3 ins high by 2 ft 2 ins wide, sculptured on one face with incised lines thus:—
>
> Front—At the top, the cresent and V-shaped sceptre symbol, and below it the horse shoe or arch symbol, both ornamented with curved lines. The arch symbol has a convex projection in the middle of the underside, a rather unusual feature."

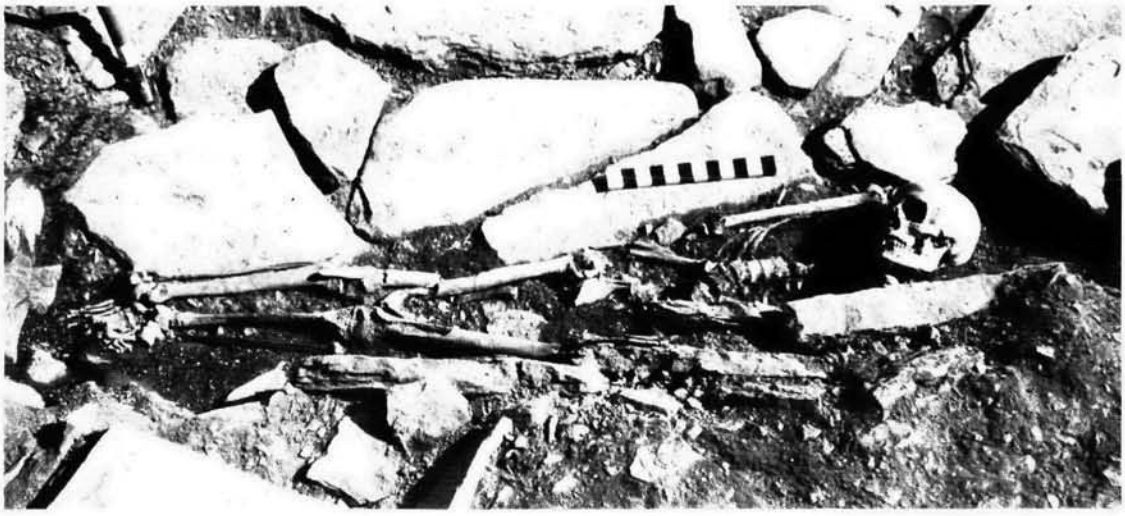
The Inventory (RACHMS, 1911a, no 405) lists a "Sculptured Stone found in Broch, Lybster" and quotes both Stuart and Romilly Allen, although neither author stated that it was actually found in the broch.

While on a visit to Denmark, Miss Dorothy Marshall made enquiries on our behalf but could learn nothing of the stone's whereabouts. Mr Eric Talbot also took an opportunity to ask Her Royal Highness Princess Margaret, now Queen Margaret, if anything were known of it in the royal collection. She said that much had been lost in a disastrous fire many years ago and probably the stone disappeared then. It seems safe to assume that the stone did come from the Crosskirk site, but it would have been very useful to know exactly where it was found. Broadly speaking, this type of memorial stone belongs to the period 650-800 AD (Stevenson, 1955a).

THE LONG CIST BURIALS AND THE SKELETAL DISCOVERIES

Human skeletons have been encountered on broch sites on the northern mainland and in the Northern Isles with a frequency unmatched in excavations of hill-forts and duns in Scotland. In the first place,

ILL 55 : Grave I; short scale = 12 in



Ill. 56 : Grave II: scale = 12 in

there are the remains of the broch people themselves, for example, the skeleton found above the entrance of the broch at the Ousedale Burn (Mackay, 1892) and the Crosskirk settlement has provided a notable example in Grave III, in the seated burial safely dated to Period Three in the site's occupation. Secondly, there are examples of graves which belong to a somewhat later period when a great mound of debris had formed over the broch. The curious alignment of the short cists reported by Anderson at the Broch of Burrian, is one of the best known (1901). The long cists at Crosskirk, to be discussed below, belong to this category, but here the significance of the human remains on the site generally was greatly complicated by the existence of the nearby burial ground at St. Mary's Chapel which continued in use until quite recently. The cemetery is now clearly bounded by stone dykes, but these are recent and the limits may not always have been so defined. Moreover, it was formerly the custom to deny rites of burial within the established limits of a cemetery to bodies such as those washed ashore and also of suicides, although these might be interred immediately outside it. Then again, stone robbers may have disturbed burials on the broch site and may have placed small deposits of human bones, in disarray, in shallow holes. One such deposit seems to have been encountered in 1966, in the robber trench immediately E of the broch.

Two other collections of human bones seem to require a different explanation; one set is described in the report by Dr Young and Dr Lunt as Burial Four (Ch 10). Both occurred in shallow depressions in close proximity: Burial Three was found to the S of the broch and involved a miscellaneous collection of bones from several individuals, together with coffin handles and a piece of wood which almost certainly came from a coffin. Burial Four was also composite and came from above the recess in the inner wall-face of the external rampart. A possible explanation for these is that gravediggers in the crowded cemetery had disturbed old interments and had reburied the bones outside: alternatively, workmen, when conserving St Mary's Chapel, may also have encountered old graves.

Two interments in long cists were found on the platform area W of the extended passage of Period Four (IIIs 42, 49, 'Graves I and II'). The interments have not been dated precisely but are certainly ancient. Neither was orientated E/W and neither contained any grave furnishings. The period somewhere around 600 AD may be very tentatively suggested.

Grave I was discovered during excavations above what later proved to be the slab-filled Enclosure III in the external rampart W of the gateway (III 55). The skull was only just below the turf and was tilted forward, as it had been placed resting on a flat slab, which acted as a pillow against the walling of the enclosure. The cist had been outlined by slabs on end, but it had been damaged and no capstones were noted. The upright slabs were traceable from the right side of the pelvis, running in an arc round the skull to cease level with the skeleton's left clavicle. The body had been inhumed fully extended, facing slightly E of S. The bones of the left hand, and nearly all the lower limb bones

ILL. 57 : Excavations in the external settlement showing the Period V alignments of flagstones superimposed on earlier structures

below the knee were missing as a result of the disturbance indicated by the damaged cist. The floor of the cist consisted of Period IV flagstones from the platform which were still *in situ*.

Grave II was undisturbed and was recognised for what it was before a single capstone had been moved (Ill 56). It lay within shelly rubble on the platform W of the extended passage and with its N end against an outer casing of the broch wall. The grave was covered by four thick flagstones placed roughly in a row. The W side of the cist was made up of four or five stones on end, but on the E, the edge of the grave was merely outlined by a large flagstone forming part of the pre-existing Period IV platform. The body had been laid at full length with the head at the NW. The burial was unaccompanied and it may date to a similar period to that just discussed.

CROSSKIRK IN MEDIEVAL TIMES

St Mary's Chapel, the Crosskirk, is at present a roofless structure nearly 40 m S of the site of the broch, within the quadrilateral of the cemetery wall. It is described in the Inventory (RCAHMS, 1911a, no 338), and the following brief note is made up from that account.

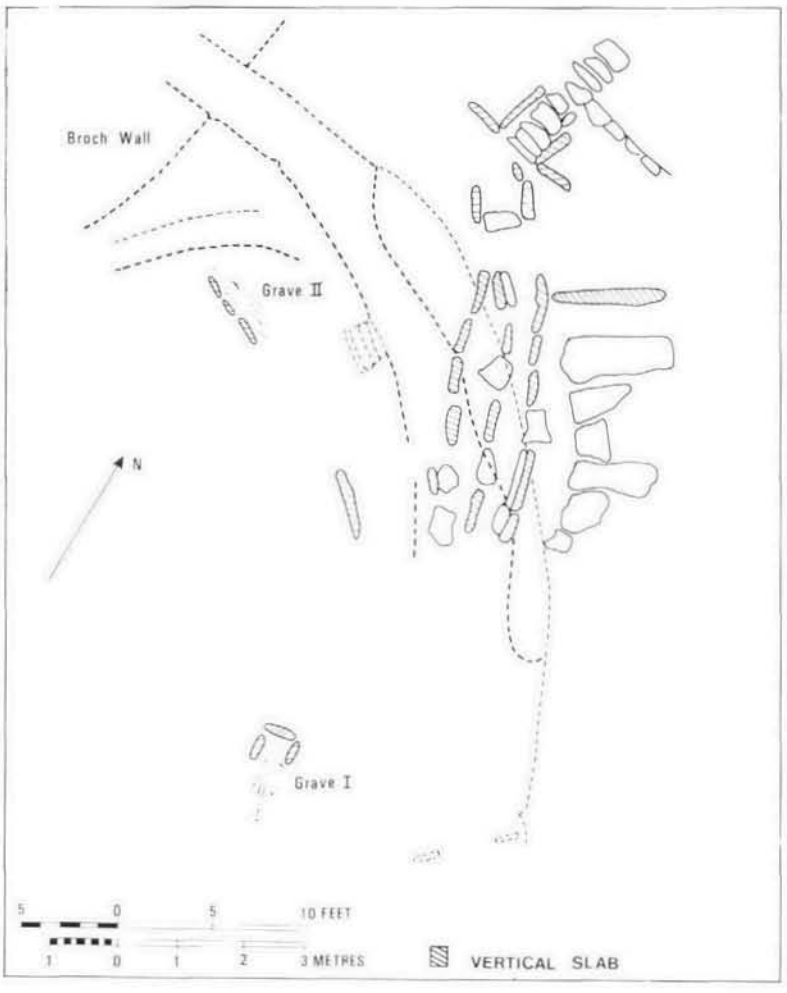
The remains of the nave measure 5.44 m by 3.33 m enclosed by a wall 1.22 m thick. The chancel, which is a reconstruction, measures 3.43 m by 3.28 m, and is entered by a doorway with inward sloping jambs and a horizontal lintel slab. The original entrance was in the W, again with inward sloping jambs and a lintel. There is no sign of a window. The chapel is said to have been dedicated to St Peter, and a date in the twelfth century has been suggested.

The wall surrounding the now disused cemetery resembles adjacent field dykes and would appear to be of the same age as them, probably the period of the enclosures early last century. The present gravel floor in the chapel and the general ground level of the cemetery outside are more or less indistinguishable topographically from the pre-excavation ground surface over the external rampart and the settlement. The excavations clearly demonstrated that the various structures of the prehistoric

period were built on an original surface as much as 2 m below turf and the present level of the ground indicates a purposeful levelling operation, presumably in medieval times. That such levelling has occurred is indicated by the consistent plane through the tops of the surviving prehistoric walls, the external rampart and the upper surface of the platforms on either side of the extended entrance passage. In the Inventory (RCAHMS, 1911a), the original floor of the chapel is indicated in the cross-section to be about 0.6 m lower than at present, but there may well be a depth of made-up earth below.

The artificial surface created by the levelling operations usually lay about 0.25 m below turf, where there was to be seen a more or less continuous layer of flat sandstone slabs of varying size, covered with brown, loamy topsoil (Ill 57). In two or three widely-separated places, a small socket made of four upright slabs was encountered, as though to support a stake. No medieval artifacts were recovered, but occasional sherds of the Later Broch pottery were sometimes found, apparently pulled up towards the surface by the levelling operations. The upcast from the robber trench around the E and S sides of the broch overlay this slabbed surface. Where the slabbing passed over the paved platforms on either side of the external passage, the position was apt to be very obscure.

Directly above the extended passage and continuing to the N into the area overlying Enclosure 1, there was a series of aligned, upright flagstones: they were usually about 0.25 m high but only a very few of them showed at turf level. They rose from the slabbed surface just described, and were firmly set into it (Ills 57, 58). The S part of the alignment consisted of three rows of flagstones

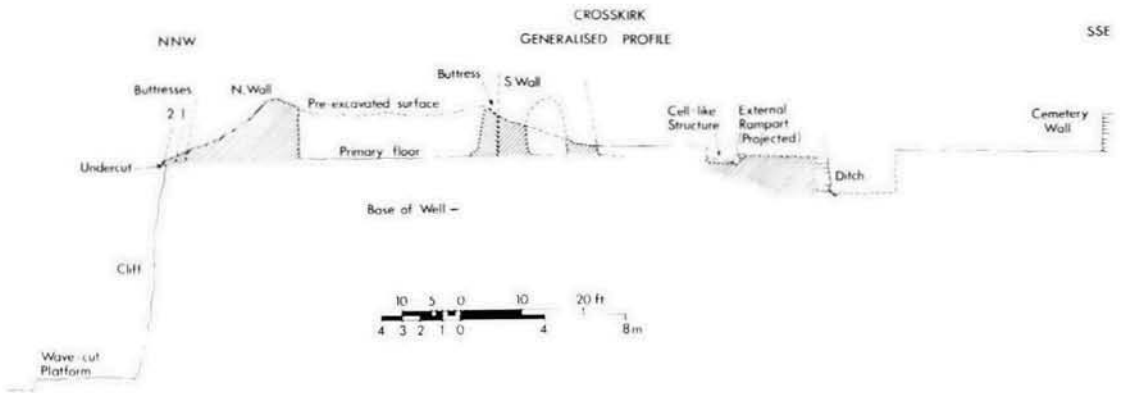


Ill 58 : Plan of the settlement area in Period V.

stretching over a distance of 4.3 m, separated from each other by an interval of 0.5 to 1 m. To the E of this series, there was a pavement made up of very large, horizontal slabs, set at right angles to the stone rows and ending at a neatly curved line on the outer side. One of these large stones was nearly 2 m long and suggested the capstone of a grave, but there was nothing in the way of a burial below any of them. To the N, beyond the limit of the three rows, there were two parallel slabs on end, somewhat isolated, and then, with a sudden change of alignment, came a series of horizontal paving stones forming a row 2.5 m long. Flanking this row at its SW end, there were two pairs of slabs on end, set at right angles as though to mark an entrance. Running from the middle of the row of paving stones for a metre or so towards ESE, were the clear traces of a wall face of which two courses remained.

Over the whole area of these curious alignments, there was a quantity of recent animal bones, occasional pieces being of large size. There was no sign of ash and no artifacts were recovered. It is just possible that it was the remnants of a builders' yard at the time of the construction of St Mary's, together with a chance deposit of animal bones. If so, the builders who aligned the flagstones must have been unaware of the remains of the extended entrance passage beneath. The whole assemblage provides one further baffling problem from the Crosskirk site.

A question posed early in this respect as to why St Mary's Chapel should be located on such an exposed headland cannot be satisfactorily answered, but the excavations might hint at a possible explanation. Even in the broch period, some ritual observances may be indicated by the curious

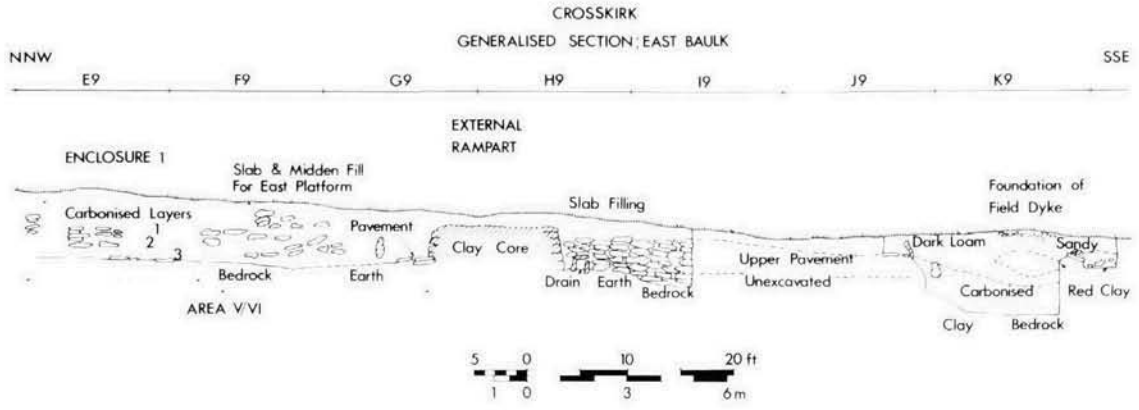


Ill. 59 : Generalised profile across the Crosskirk site

niche and pillar in the settlement (p 78): later came the use of the already ancient landmark on the headland as a ready-made cairn. The Pictish symbol stone too, came from somewhere in the area. It has been demonstrated, as pointed out recently by Charles Thomas (1971), that pagan burial sites and ritual centres were not infrequently adopted as Early Christian cemeteries. The excavations have shown that some considerable volume of earth seems to have been used to create a platform for St Mary's Chapel, and an Early Christian cemetery could have been buried beneath what is now the surface of the comparatively recent graveyard. A tradition of sanctity might well have been preserved through the period of the Norse intrusion. This may be pure speculation but we are convinced that the peculiar conditions indicated by the stratification between the broch mound and the chapel require some special explanation.

In conclusion, some remarks on the broad characteristics of the stratification at Crosskirk appear appropriate. The generalised profile across the site makes clear the initial configuration of the terrain, and indicates the depth of deposits within the broch itself. However the volume of man-made deposits underlying the near-level surface between the broch and the cemetery wall was unexpected at the outset of the excavations. Much of this report has necessarily been concerned with the elucidation of the evidence from a part of the external settlement(Ill 59).

The genereralised section of the E baulk of the excavations (Ill 60) gives an impression of the complexity of the evidence from that area. This has been schematized for presentation here. The



ILL 60 : Generalised section of the E baulk of the settlement area excavations

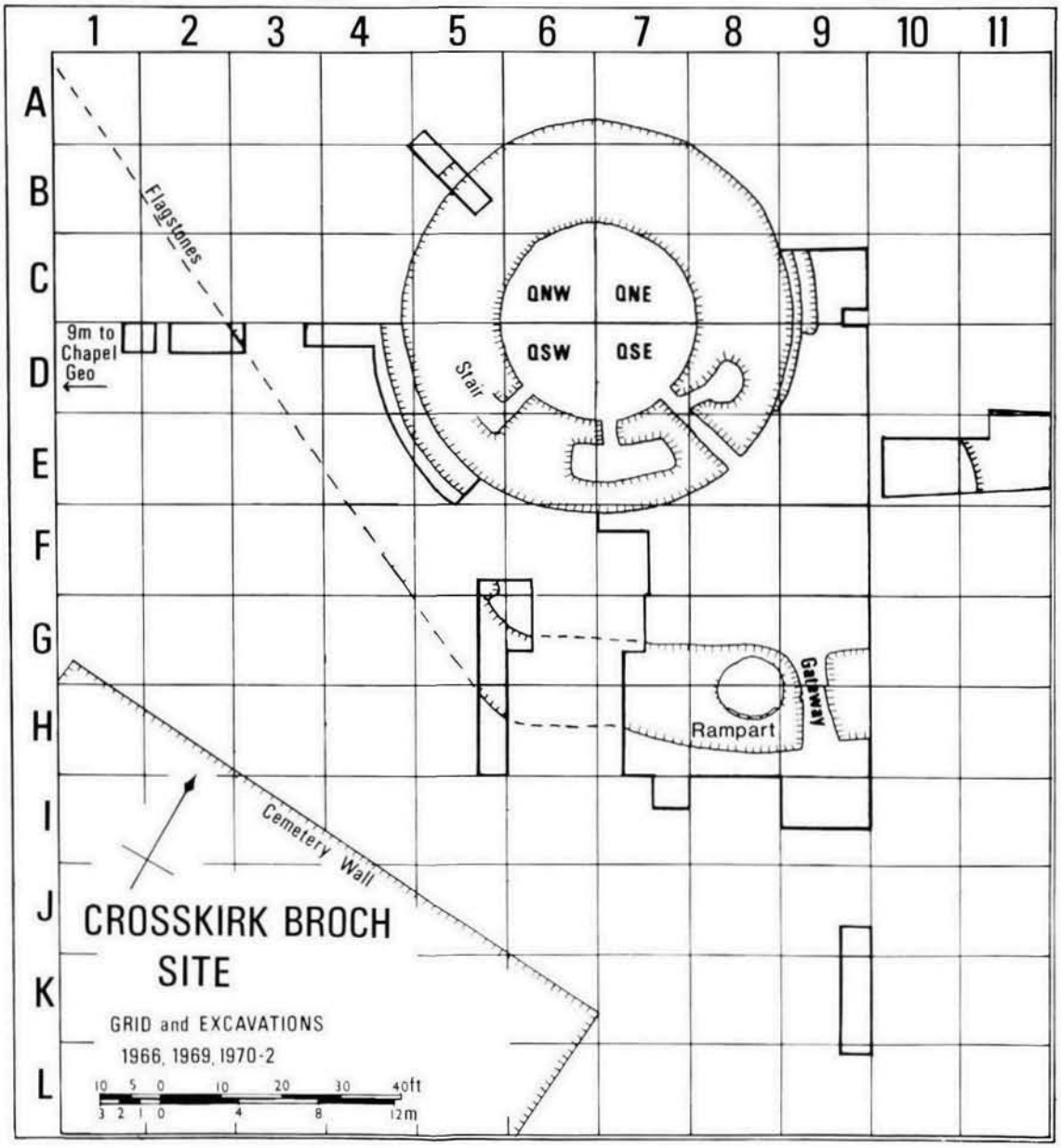
grid squares can be fixed by reference to the plan which accompanies the catalogue of small finds (Ill 61). From NNW to SSE, the principal features recorded are the walls of Enclosure I, datable to late in Period Three, underlain by the area where the fragmentary remains attributable to two enclosures, and here referred to as Area V/VI, were recovered. The slab and midden fill for the E Platform, which edged the extended entrance passage, may be attributed to Period Four. In contrast, the pavement which followed the inner margin of the Period One external rampart is of greater antiquity. The slab filling of the hollow immediately outside it is however to be considered in relation to the final extension of the broch passageway across the Period One rampart wall. To that period, too, belongs the fill of the hollow at the SSE, so markedly different in character. In retrospect, it is hardly surprising that the magnotometer survey proved unhelpful.

Thus, in considering the artifactual record from the site, it should be borne in mind that the stratification, which has here tended to take second place to a consideration of the structures, was complicated, as may be expected in view of the indications of the longevity of the use of the Crosskirk headland, and the intermittent disturbance the broch and settlement have subsequently endured.

9 THE SMALL FINDS: DISCUSSION AND CATALOGUE

WITH CONTRIBUTIONS BY D J BREEZE, W D I ROLFE AND E A SLATER

The discussion of the finds here is generally organised according to the materials from which items were made. Each section is accompanied by a catalogue which lists the bulk of the artifacts recovered



ILL 61 : Site plan showing the excavated areas in relation to the site grid

except in the case of the pottery, where a fully representative selection has been made. The code which completes each entry in the catalogue refers to the site grid and permits the approximate location of each find by reference to the plan (Ill 61). All entries consist of a letter and a number, identifying a square with a side length of 15 ft (4.56 m) except for finds from the interior of the broch, defined by a three letter code identifying the quadrant in which the discovery was made.

POTTERY

Owing to disturbances in ancient and recent times, potsherds were encountered at all levels below turf down to the original surface. As with other broch sites on the northern mainland, the quantity was considerable and about two thousand sherds were recovered: from these, the outlines of several pots can be reconstructed. The native wares are hand-made and are devoid of decoration in the great majority of cases. The firing of the pottery is relatively good by Scottish Iron Age standards. Except for the few Roman sherds, the pottery is difficult to date on purely typological grounds, but in spite of the proximity of St Mary's Chapel, neither early nor late medieval wares are apparently included in the assemblage. Three main classes of pottery have been distinguished:

Class 1, constituting about 5 per cent of the assemblage, consists of crudely decorated sherds with a gritty texture. These are found associated essentially with the early rampart, and can be allocated to the pre-broch period on the site.

Class 2 wares were the most frequently encountered during the excavations and form about 80 per cent of the assemblage. Sherds generally have coarser grits than in the other classes, and the dominant form appears to have been large storage jars. Decoration is rare and rims are simple. This class of pottery was recovered both within the broch and in the external settlement. It is referred to as Early Broch ware.

Class 3 wares (about 15 per cent of the assemblage) have a finer fabric with no very coarse grits. Rims are out-turned, rolled or beaded, and wide-mouthed basins are normal. Decoration is rare. This Later Broch ware was again found in both the broch and the settlement. It can be sub-divided into two sub-classes.

The percentages of the total given above are approximate because of borderline cases particularly between classes 2 and 3, but the figures are of the right order of magnitude. Two further small groups of sherds merit separate treatment:

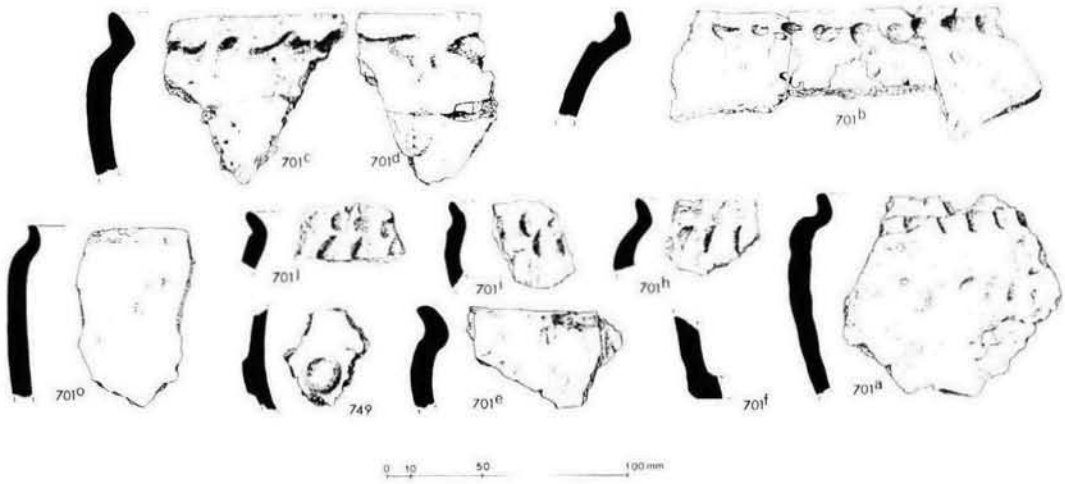
Group 4: A very small group of exceptions, some of which may be imports.

Group 5: About a dozen sherds of Roman pottery including a fragment of Castor ware.

THE PRE-BROCH POTTERY: CLASS 1

During the last few days of the excavations a group of nearly a hundred sherds which differed markedly from the usual wares of the broch and the settlement was found. These came from clay forming the floor below the hearth of Enclosure IIIa, and also from the cell-like recess in the inner face of the rampart immediately to the W. At least 8 different pots seem to be represented. Subsequently, a careful review of the pottery assemblage added several other sherds which may belong to the group, but even if all of them can be accepted, their number is relatively minute.

The pre-broch pottery is a darker buff-brown than that generally noted in the broch wares. The fabric is plentifully gritted and the temper even includes small pebbles and flakes of stone up to 4 mm across. However, the grits do not protrude externally as they do so often in the broch pottery in which, too, the individual grits may be larger. The joins in the pots are smoothed over but the surface has been left irregularly fingered. The rims are short, upturned slightly outwards and exhibit no sign of internal flanges. Below the rim, the pots swell sharply outwards to a small but distinctive shoulder, which is definitely not a carination. Their profile is that of a steep-sided basin with a wide mouth about 140 mm across: the few base sherds seem to indicate a similar diameter. The thickness of the wall varies considerably but is of the order of 10 to 12 mm. The characteristic feature is the coarse decoration which occurs in the hollow beneath the rim and on the short shoulder. It consists for the most part of a series of depressions made with a blunt tool rather than with the finger tips: these may be arranged in one row or two. One sherd, (*740* below), with a slight ridged band,



Ill. 62 : Class 1 pottery from pre-broch contexts

is suggestive of Hamilton's 'neckband ware' from Clickhimin (1968), while another (*749*) is decorated with an applied boss. No close parallels to the group of sherds as a whole can be given, although there is a vague likeness to some of the pre-broch wares from Jarlshof and Clickhimin. On the other hand, various traits of these Shetland wares—the distinctive carinations, the steatite backing, and the internal bevelling—are absent at Crosskirk. There seems nothing in common with the pre-broch wares reported by MacKie from Dun Mor Vaul on the W coast (1974).

In the catalogue below, a description of the characteristic sherds from the floor of Enclosure III*a* and from the cell-like recess in the rampart is given first. Later, the other possible pre-broch sherds are listed; several seem badly out of context and confusion with the broch wares could have arisen only too easily.

701 a Short, nearly vertical rim: just below, an abrupt shoulder: depressions in a row below the rim. From a wide-mouthed basin with an irregularly-fingered exterior.
Enclosure III*a*, in floor, H8, Ill 62

701b Three rim sherds from a bowl c 145 mm across the mouth: decoration as 701 a.
Enclosure III*a*, in floor, H8, Ill 62

701 c-d Five rim- and wall-sherds similar to 701 a-b but with more rounded shoulder: mouth 140 mm diameter.
Enclosure III*a*, in floor, H8, Ill 62

701 e Rim as 701 a-d but with shallow widely-spaced depressions: shoulder slight and exterior smoother.
Enclosure III*a*, in floor, H8, Ill 62

701 f Basal sherds slightly rounded at wall junction diameter 130 mm.
Enclosure III*a*, in floor, H8, Ill 62

701 h Squeezed, nearly vertical rim (resembling broch wares) but with depressions both in the hollow below and on the rather slight rounded shoulder. Fabric relatively fine and no large grits.
Enclosure III*a*, in floor, H8, Ill 62

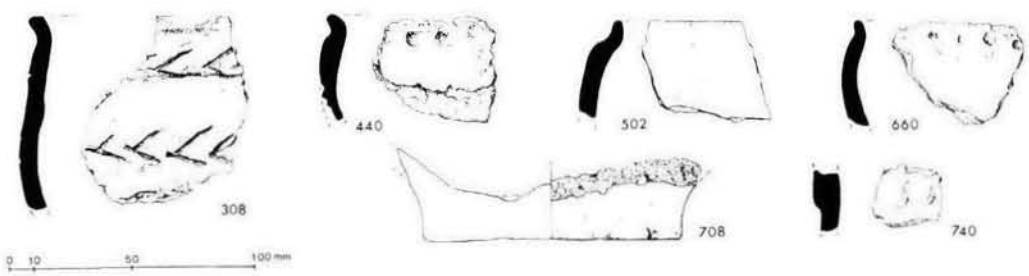
701 i-j Sherds from shoulder, decorated with double row of depressions.
Enclosure III*a*, in floor, H8, Ill 62

701 o Simple upturned rim above a marked rounded shoulder, but no depressions: gritty texture.
Enclosure III*a*, in floor, H8, Ill 62

749 Wall sherd in pre-broch fabric with an applied boss and central depression: found with 6 other sherds of similar fabric.
External rampart, cell-like recess, H5, Ill 62

308 Coarse gritty sherd as 701 series above: decorated with a double row of horizontal chevrons made with a blunt tool.
Under Phase Three flagstones in the broch, QNW, Ill 63

440 A Short slightly out-turned rim, reddish, with depressions in the hollow below, roughly fingered externally.
Period Four pavement, in the settlement, F/G 9, Ill 63



Ill. 63 : Class 1 pottery from later contexts

502 Squeezed rim with a very slight shoulder.
Enclosure III*a*, hearth, G8, Ill 63

660 Short out-turned rim with depressions below: fabric resembles broch wares.
Under turf external face of rampart, H7, Ill 63

708 Very thick (25 mm) gritty base, in a fabric suggestive of pre-broch wares. Three finger tip impressions inside. Diameter c 100 mm.
From the settlement E of Enclosure I, E11, Ill 63

731 Rim sherd with faint depressions below and a pronounced shoulder.
Below turf outside external rampart, H/I 7, not illustrated.

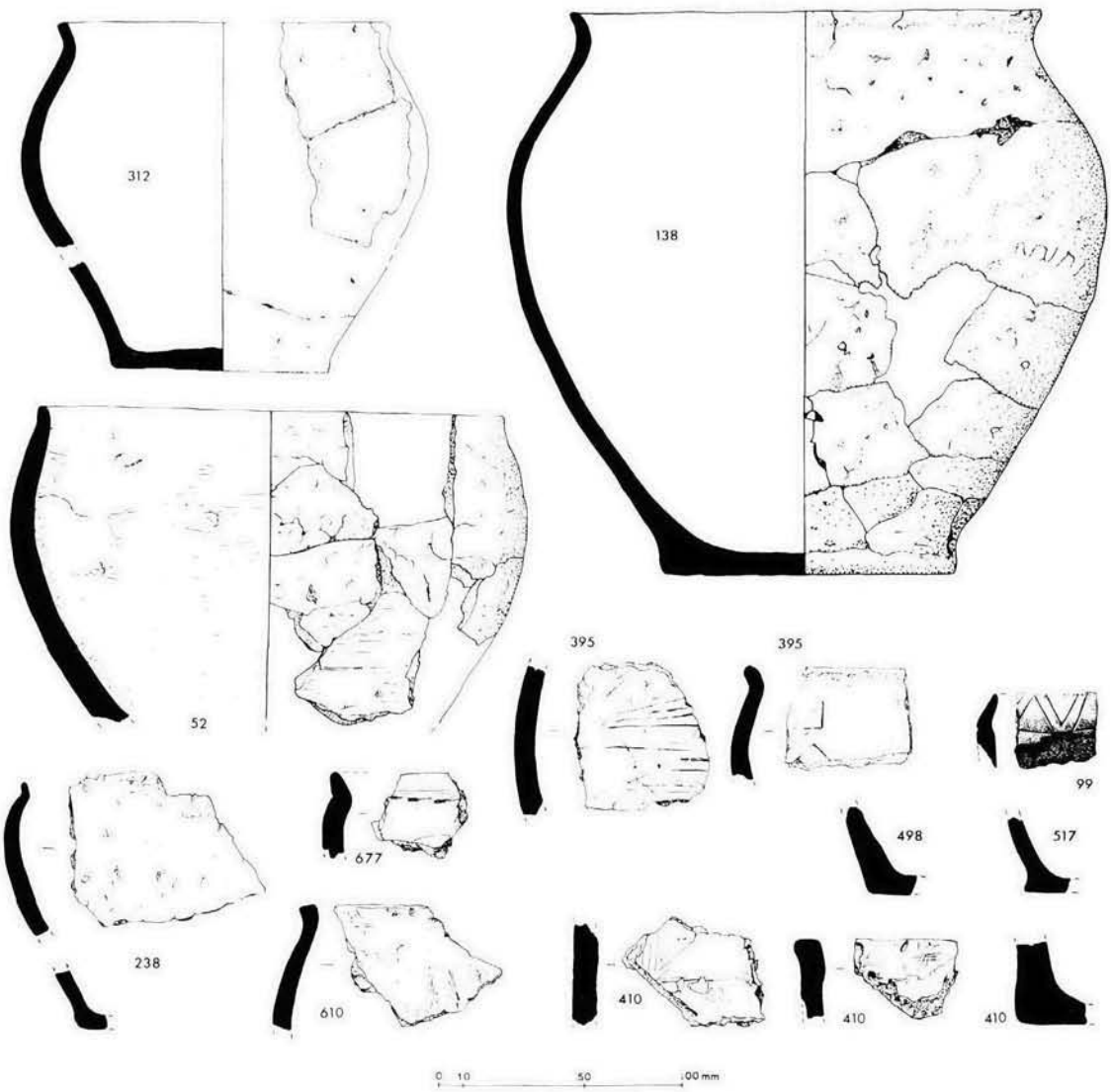
740 Wall sherd with a slight applied band suggestive of 'neckband ware'.
From the top of the natural, in the settlement, I-9, Ill 63

ILL 64 : Jar *138* in Early Broch ware, with associated flat stone. Height of jar: 240 mm

THE EARLY BROCH POTTERY: CLASS 2

The great bulk of the pottery from Periods Two and Three on the site is remarkably homogeneous. Due to extensive disturbance, comparable sherds were apt to occur at other levels although the total number not found in appropriate contexts was small in relation to the quantities from the main horizons. Decorated wall sherds are rare and the number included in the catalogue below, and in the illustrations, should not be allowed to give a wrong impression of their frequency in the assemblage.

The shape and size of the pots can be seen from the examples in which a considerable part has been reconstructed (*52, 312*). All appear to be large, standing between 200 and



ILL. 65 : Early Broch pottery of Class 2

300 mm high, with the maximum diameter of the body between 200 and 240 mm. Bases are relatively small, between 90 and 130 mm in diameter. Two shapes seem to occur exclusively, one a vase-like storage jar (*138*) and the other an open-mouthed basin (*52*). The rims, which are small for the size of the jars, are slightly out-turned and squeezed thinner than the main walls. The joins in these hand-made pots are normally well covered by wet-smoothing, but a very characteristic feature is the way in which the larger, very coarse, grits frequently show at the surface. The gritting in general is plentiful and often includes small pebbles and fragments of stone up to 4-6 mm in size. Signs of blackening by fire occur, but the normal colour is buff, sometimes pinkish and occasionally approaching red. Although the pots are well baked by Scottish Iron Age standards, the firing temperature has not been high enough in many cases to eliminate a dark grey interior to the fabric, giving a marked sandwich effect. One of the restored pots (*138*) is defective in being decidedly asymmetrical, but it was obviously in use for storage purposes when it was crushed into the floor of the broch. It and another pot of similar shape were both found to have been standing in holes in the earthen floor, at the inner end of radial compartments of the broch interior. Such holes must have been essential for the jars to remain upright on their narrow bases.

In general, the pots resemble others found on broch sites in Caithness and Orkney, although there are no parallels at Crosskirk to some of the immense jars which have been recovered within that region. There is no sign of the 'neckband' decoration which Hamilton regards as being distinctive of the broch builders (1968). No differences can be traced between the sherds from the broch and from the settlement at Crosskirk: nor is there much difference between those of Periods Two and Three, though the gritting from the later wares is apt to be less coarse. No grain impressions were noted.

As will appear later, differences in fabric and rim form occur enabling the typological separation of the Early from the Later Broch wares, but the distinction is not by any means clear-cut. For example, a sherd of the Later Broch ware was

reported from Enclosure VII which was one of the earliest structures in the settlement. Sometimes the pottery allowed the structural evidence to be placed in its correct context: for instance, only the early wares occurred beneath the wall collapse on either side of the cell mouth inside the broch. On the other hand, attempts to establish the sequence of events in the platforms on either side of the extended entrance passage between the gateway in the external rampart and the broch, proved abortive owing to the occurrence together of the Early and Later broch wares and also samian: that the platforms were a construction of later broch times must remain no more than a probability.

In the catalogue, no attempt has been made at an extensive list, as the Early Broch pottery was homogeneous and no point would seem to be gained by listing the many sherds which occurred in anomalous positions. Vessels whose profiles can be reconstructed with certainty are given first, and then follow the sherds which require special notice, in particular, the decorated black sherd *99*.

EARLY BROCH JARS AND BASINS

52 Fifteen sherds from a basin lacking the base. Its thick walls are 11 mm wide near the base, the squeezed rim is nearly vertical. Mouth diameter 190 mm: body diameter c 210 mm.
Intra-mural cell, E7, Ill 65

138 Nearly complete jar which is markedly asymmetrical around the mouth. This has a slightly out-turned rim which is not squeezed. Diameters: mouth 180-200 mm, base 110 mm, body 230 mm, height 240 mm, walls 8 to 10 mm, thickening to nearly 20 mm at the base. Amongst the sherds was a rounded flat stone 62 mm × 15 mm.
These sherds were found crushed flat in a hole outside the corner of the most N of the radial enclosures in the broch floor, QNE, Ills 64,65

312 About 50 sherds from a jar, including base and rim sherds, however the profile is incomplete. The out-turned rim is slightly squeezed. Diameters: mouth, 140 mm, base 90 mm. Walls 8-10 mm thick. Rather sandy fabric much blackened externally. Found on the broch floor, at the corner of a radial enclosure at the entrance, QSE, Ill 65

647 Part of a pot with rim and base missing, about twenty much blackened sherds, wiped externally to give a slightly ridged effect.
Set in a small pit in the hearth of Enclosure IV, not illustrated.

EARLY BROCH SHERDS

93 Three sherds 9 mm thick with faint grooves as from finger tips.
Broch, QSE, not illustrated

99 Unique on the site, a flaked sherd with a zig-zag pattern, in a black, very fine fabric slightly burnished externally.
Intra-mural cell, E7, Ill 65

238 Rim and body sherds, characteristic of Early Broch wares. From the settlement outside the broch entrance, E9.

319 Almost vertical rim with a flat lip in a dark fabric 6 mm thick.
Broch floor, QNW/SW, not illustrated

339-41 Three sherds all with a yellow glossy deposit not satisfactorily analysed.
Broch floor, near the walled depression, QNW, not illustrated

395 Three sherds, one a slightly out-turned rim, with incised decoration in chevrons. Two illustrated.
Intra-mural cell, E7, Ill 65

410 Six sherds including a slightly out-turned rim and part of a thick base decorated with faint incised lines. Three illustrated.
Period Three shell midden, G9, Ill 65

498 Nine sherds including two base and two sharply angled rim sherds. Base illustrated.
Enclosure III*b*, G8, Ill 65

517 Five base sherds with a sharp angle at the wall junction, very gritty (up to 4-7 mm) fabric; walls 8 to 10 mm thick. One profile illustrated.
Period Three settlement, F9, Ill 65

610 Rim sherd slightly out-turned with a flattened lip, decorated externally with faint vertical grooves: diameter 180 mm.
Enclosure III, early Period Three horizon, G8, Ill 65

677 Rim, out-turned and squeezed, with short horizontal incisions below.
S of external rampart, 19, Ill 65

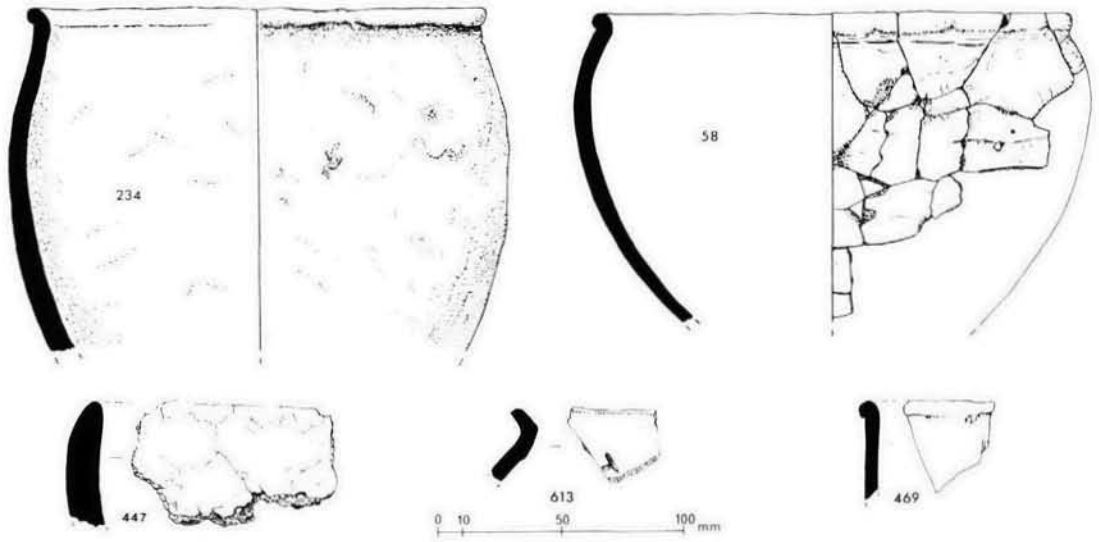
735 b Sixteen sherds including rim (diameter 130 mm) and part of base, 60 mm diameter and 5-10 mm thick (definitely Early Broch ware/Class 2).
Settlement, platform W of extended entrance passage, F8, not illustrated

LATER BROCH POTTERY: CLASS 3

The Later Broch pottery requires a longer description owing to the degree of variation represented in this class. When the sherds first began to be recovered in quantity, it was noted that shapes in general were characteristic of the northern area of the Atlantic Iron Age whereas the fabric was distinctly finer and reminiscent of medieval times. As the settlement was then thought to have continued in occupation for centuries after the period of the samian sherds, this later pottery was described as 'Early Medieval' in the field records: the radiocarbon results later made this assumption untenable.

About three hundred sherds were recovered and it has been possible to reconstruct substantial portions of two pots, both wide-mouthed basins (*58* and *234*). The pottery varies considerably from thin-walled sherds (3-5 mm), to thick fragments (10-12 mm), and the rim forms also differ. There is very little decoration though occasionally the pots have been lightly wiped apparently with a bundle of grass, after having been wet-smoothed to cover the joins. Again, there is no noticeable difference between the sherds from the broch and those from the settlement outside.

The fabric generally lacks the copious and very large grits of the earlier pottery, but with some of the coarser vessels, especially near the base, the gritting is more obvious and for such sherds it then becomes difficult to differentiate the two groups. The fabric is close-textured, slightly sandy and the individual grits rarely exceed 4 mm in diameter, but are usually much smaller. The sherds seem to have broken more cleanly than was usual in the earlier pottery. Under the microscope, these broken edges, except in the coarse posts, show minute cavities like tunnels, and on the surface these



ILL 66 : Later Broch pottery of Classes 3A and 3B

may appear as faint, short hair lines. They are too fine to be due to rootlets and it is as though chopped hair had been introduced into the fabric before baking. This feature was not noted in any of the earlier pottery.

Rim forms are also distinctive. Many sherds display a beaded rim, often made by rolling over a slightly squeezed lip—perhaps suggesting a derivation of this type from the Early Broch wares. Sometimes markedly out-turned rims occur especially within the broch: sherds of this group are not unlike some of the Hebridean wheelhouse pottery.

In spite of these differences from the Early Broch wares, and bearing in mind the nature of the other material from Crosskirk, there scarcely seems to be sufficient evidence to indicate any marked change in general material culture during the prehistoric use of the site. However, a break in the continuity of occupation has already been suggested on purely structural grounds, and certainly the appropriate radiocarbon dates would seem to indicate an inordinately long period for the Early and Later Broch pottery to have spanned.

The difficulty of recording horizons has already been emphasised but there is no doubt that the great bulk of the Later Broch pottery belongs to Period Four. Sherds occur within the broch either in, or immediately beneath the late paving around the central hearth which has been dated to 70 ad ±70. Sherds were also recovered in quantity at the higher levels within the settlement, especially just outside the broch entrance where the disused Enclosure II seems to have served as a midden. The pottery occurred both on, and underneath, the two platforms on either side of the extended entrance passage. It is also recorded 'from the floor' of Enclosure I. The precise level of this floor was not easy to determine and it is suggested that this ruined enclosure was also used as a midden, especially as the sherds of one of the pots (*234*) definitely occurred over the top of the walling, as well as outside this enclosure. Other sherds were recovered from beneath the wide steps in the extended entrance passage. In this connection, it is noteworthy that two of the samian sherds, the two whose stratigraphical horizon was most clearly defined (*103* and *641*), occurred at the level where the later pottery became predominant. One of these samian sherds is Antonine and a date for the first deposition of the Later Broch pottery in the middle of the second century AD would not conflict with the radiocarbon date, cited above, from the late hearth in the broch. Within the Later Broch pottery, several classes may be distinguished although no obvious chronological differences in their use could be detected. Sufficient sherds have been included in the catalogue to show the wide distribution of find spots over the site.

THIN WALLED VESSELS USUALLY WITH A BEADED RIM: CLASS 3A

Most distinctive is a group of thin, pinkish-buff sherds with an average thickness of between 4 and 6 mm. Nearly all are small pieces. The hair lines and minute cavities in the fabric are often clear. No certain base sherds occur and it is difficult to estimate the diameters of what was probably a bowl form varying between 80 and 170 mm across the mouth. The rims are normally rather crude beads, squeezed and rolled outwards, with the suggestion of a groove immediately below. One or two slightly out-curved rims also occur.

83 Basal sherd with wall junction, 4-8 mm thick.
Broch, QNW, not illustrated

155 Vertical rim.
Broch, Phase Three pavement, QSW, not illustrated

172 Four sherds and a beaded rim.
Broch, Phase Three, pavement, QSW, not illustrated

181 Rim squeezed and beaded, 140-160 mm in diameter.
Period Five slabs in the settlement, F9, not illustrated

358 Beaded rim, 6 mm thick.
Extended entrance passage, Period Four, F9, not illustrated

469 Beaded rim.
Under wide steps of the extended entrance passage of Period Four, G9, Ill 66

552 Out-turned rim.
Enclosure I, under turf, E10, not illustrated

609 Rim with a slight bead.
Fill in trench S of rampart, H5, not illustrated

635 Rim, 3 mm thick with a crude bead.
From the paving over Enclosure III*b*, G/H7, not illustrated

637 A rounded and slightly inturned rim, 150 mm in diameter. Period Four pavement outside external rampart, H8, not illustrated

760 Vertical rim 170 mm in diameter.
Settlement area: under Period Four slabs of the western platform, F8, not illustrated

COARSE WARES: CLASS 3B

About half of the total Later Broch pottery consists of rather coarse, gritty ware, often blackened with soot, and distinguishable from the earlier wares only with difficulty, although the rims of the Later Broch coarse wares are characteristically out-turned or beaded. Large parts of three pots are available (*58, 85* and *234*). These coarse wares exhibit considerable variety.

BASINS

58 Sherds of a basin-shaped pot lacking the base. A beaded rim defines a mouth 200 mm in diameter, widening below to 210 mm: the vessel walls, 8 mm thick, are grass-wiped externally. The fabric exhibits hair cavities.
Broch, QNW, Ill 66

85 14 sherds from what was probably a basin with a nearly vertical rim, 190 mm in diameter, with walls 10 mm thick.
Broch, QNE, not illustrated.

234 A basin complete except for its base. The beaded rim is 190 mm in diameter. The walls thicken downwards from 4 to 8 mm. The vessel is finger-marked internally and blackened with soot on both faces.
Settlement above and outside Enclosure I, Period Four, F9, Ill 66

SHERDS

54 Two rim and 6 wall sherds from a large basin with a squeezed rim turned markedly inwards. The vessel, buff in colour, has been blackened by soot. Diameters approx 220 mm at the mouth, 280 mm at the body.
Enclosure II, C9, not illustrated

71 A rim rolled over to a bead and then flattened, 108 mm in diameter. The outer surface is peeling as if the vessel had originally been slipped.
Broch, QNW, not illustrated

118 A rim, out-turned by 25 mm.
Broch, above Phase Three pavement, QNW, not illustrated

143 A squeezed rim, out-turned by 15 mm.
Broch, beneath Phase Three pavement, QSE, not illustrated

159 A complete base, 110 mm in diameter, coarsely gritted, and slightly hollowed underneath.
Broch, beneath Phase Three pavement, QSE, not illustrated

310 A rounded and slightly out-turned rim, irregularly scored internally.
Broch, under Phase Three pavement, QNW, not illustrated

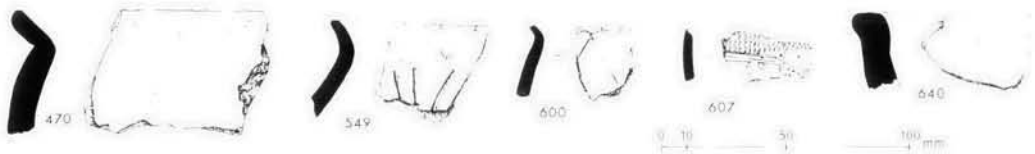
447 Thick (11 mm), gritty rim sherd from plain barrel-shaped urn with simple rounded rim. Buff coloured with blackening.
Context uncertain, Ill 66

480 Rim and body sherd in a sandy fabric. The rim, 120 mm in diameter, is markedly out-turned by 20 mm.
Settlement, western platform, G8, not illustrated

613 A squeezed rim, out-turned by 10 mm. It is decorated with a small L-shaped incision at the break. Rim diameter about 160 mm. (Could be Early Broch ware).
Settlement, western platform, G8, Ill 66

633 Base, three wall sherds and a beaded rim, much blackened but with faint external scoring. Fabric has grits up to 4 mm in size. Base, 120 mm in diameter and 5-6 mm thick, mouth 80 mm in diameter.
Settlement, western platform, G8, not illustrated

745 Sherd from a base 80 mm in diameter.
Settlement, western platform, G8, not illustrated



Ill 67 : Sherds of groups 4 and 5

ATYPICAL SHERDS: GROUP 4

408 Sherd 8 mm thick. The late Dr J X W P Corcoran reported: 'This is a small pinkish-red coloured sherd without surface features. It has a sandy texture and is tempered with small fragments of quartz and mica. Its closest parallels would appear to be with cinerary urns of the Bronze Age.'
From the well in the broch, QSW, not illustrated

470 A rim, squeezed and out-turned by 20 mm, from a vessel 230 mm in diameter and 10 mm thick, found with 7 body sherds. The fabric is close and compact with mica particles. Both surfaces are very smooth, and have been hard fired. The sherds are buff with soot blackening.
Enclosure I, Period Four, F/G9, Ill 67

549 A rim, out-turned by 20 mm in a fine fabric with some coarse grits, grey in colour with soot blackening. It is decorated by three incised radiating lines.

From the vicinity of the secondary door check in the Period Three broch entrance, E9, Ill 67

600 A rim in a gritty fabric, 5 mm thick, decorated below with incised chevrons (Early Broch ware?). Settlement, western platform, F7/8, Ill 67

640 Five beaded rim sherds, pinkish-buff in colour and very thick (12 mm), from a large vessel, in a close fabric but with some large grits (Later Broch?). From hearth of Enclosure I, E10, Ill 67

ROMAN POTTERY: GROUP 5

Samian sherds, often rubbed smooth one or more edges as though to provide a prized colouring matter, have been noted on many broch sites, but the fragment of rouletted coloured ware (*607*) is exceptional. Unfortunately, some doubt attaches to the precise context of almost all the samian sherds from Crosskirk, largely owing to stratigraphical disturbances, but it can be stated emphatically that all could have belonged to Period Four.

103 Red samian sherd footing, classified by Miss Felicity Pierce as Antonine, Central Gaulish.
Broch at Phase Two/Three transition horizon, QNW, not illustrated

110 Small red samian sherd rubbed at the edges, 5 mm thick.
Below turf outside broch entrance, E9, not illustrated

113 Small red samian sherd, 3 mm thick.
Edge of robber trench E of broch, E9, not illustrated

115 Minute samian fragment.
Edge of robber trench E of broch, E8, not illustrated

214 Dark red samian sherd, thick, rubbed at the edges, and decorated with a horizontal groove.
Broch at Phase Two/Three transition horizon, QSW, not illustrated

607 Sherd of rouletted coloured ware, from a Castor ware beaker. The significance of this piece is discussed below.
Under turf, over Enclosure I, E11, Ill 67

641 Thick red samian rim, with incised line. Rubbed on one edge.
Settlement, in midden on western platform, F8, not illustrated

767 Minute sherd of brownish red ware, comparable with *607*.
Below turf over extended entrance passage, F9, not illustrated

THE POTSHERD OF CASTOR WARE FROM CROSSKIRK (*607*) D J BREEZE

The sherd (*607*) is a small fragment of a Castor ware beaker in whitish grey fabric with a brown slip and white barbotine decoration (Ill 67). Traces of rouletting, presumably on the shoulder of the vessel, are visible. The sherd is quite sharp at the edges and shows no sign of secondary use. It is fourth century in date, probably early fourth, and was manufactured in the Nene valley.

Finds of fourth century Roman pottery on non-Roman sites in Scotland are rare, and indeed the discovery of any fourth century material on non-Roman sites in Scotland is unusual (Robertson 1970, 210-12 for references). A rim fragment of a wide-mouthed bowl in an orange fabric and an irregular roulette decoration probably dating to the fourth century comes from Keil Cave, Kintyre, and is the only reasonably certain example of a pottery vessel. The two sherds of white ware with smooth black metallic surfaces and white slip decoration found at Keiss broch in Caithness are usually considered to be Rhenish ware and as such ought to date to the third century; though they could have found their way to the site in the early fourth century. Two fragments of a black jar with white grit, probably a calcite-gritted fabric, and therefore probably dating to the third or fourth centuries, have been found on Eildon Hill North. The only other late Roman pottery from Scotland is from Traprain Law, a site which apparently enjoyed a unique relationship with Rome. Again excluding Traprain Law, the few other fourth century Roman objects from Scotland listed by Professor Robertson are: a crossbow brooch of gilded bronze from the Moray Firth, a gold brooch from Moffat dating to the early fourth century, six playing men from a burial at Tarland (Aberdeenshire) dating to the third or fourth centuries, and fragments of glass vessels of the same date from burials at Airlie (Angus), Kingoldrum near Airlie and Westray in Orkney. The paucity of fourth century Roman finds of all types on non-Roman sites in Scotland emphasises the importance of this sherd from Crosskirk.

Dr J C Mann (1974, 35) has drawn attention to the lack of late fourth century pottery north of Hadrian's Wall and reached the conclusion that far from the kingdoms of southern Scotland at that time being friendly towards Rome, they were in fact hostile (Mann 1974, 41-42). Yet it appears that the picture painted by Mann is a little oversimplified for not only is there no late fourth century pottery north of Hadrian's Wall, but very little of either the third or fourth centuries. Most Roman artifacts seem to have entered Scotland in the late first-mid second centuries. Thereafter there seems to have been little drift of Roman material into the area N of the Forth-Clyde isthmus as Professor Robertson's tables demonstrate (Robertson 1970, tables I-X). There seems in fact to have been relatively little contact between Roman and barbarian in Scotland in the third and fourth centuries, at least as witnessed by the results of trade.

There is of course no evidence that this particular sherd reached Crosskirk broch by trade or in the fourth century. Bateson (1973, 29-30) has drawn attention to the variety of ways in which artifacts could reach areas beyond the empire; by raiding, army veterans returning home, Roman invasion, trade, refugees, missionaries or adventurers. Of these trade or some such contact might seem to be the most likely. The possibility of post-Roman movement of sherds such as samian has been noted (Bateson, 1973, 26-7), although such movement seems to be rare. It is perhaps unlikely that a relatively anonymous sherd such as that from Crosskirk broch would be regarded as an item of interest and while it would obviously take some time for the object to travel from the Nene Valley to Caithness, it may be best to assume that the sherd was lost in the fourth century. The condition of the sherd would appear to support that conclusion.

GLASS

66 Small fragment, Roman.
Broch, Phase Two/Three transition horizon, QSE, not illustrated

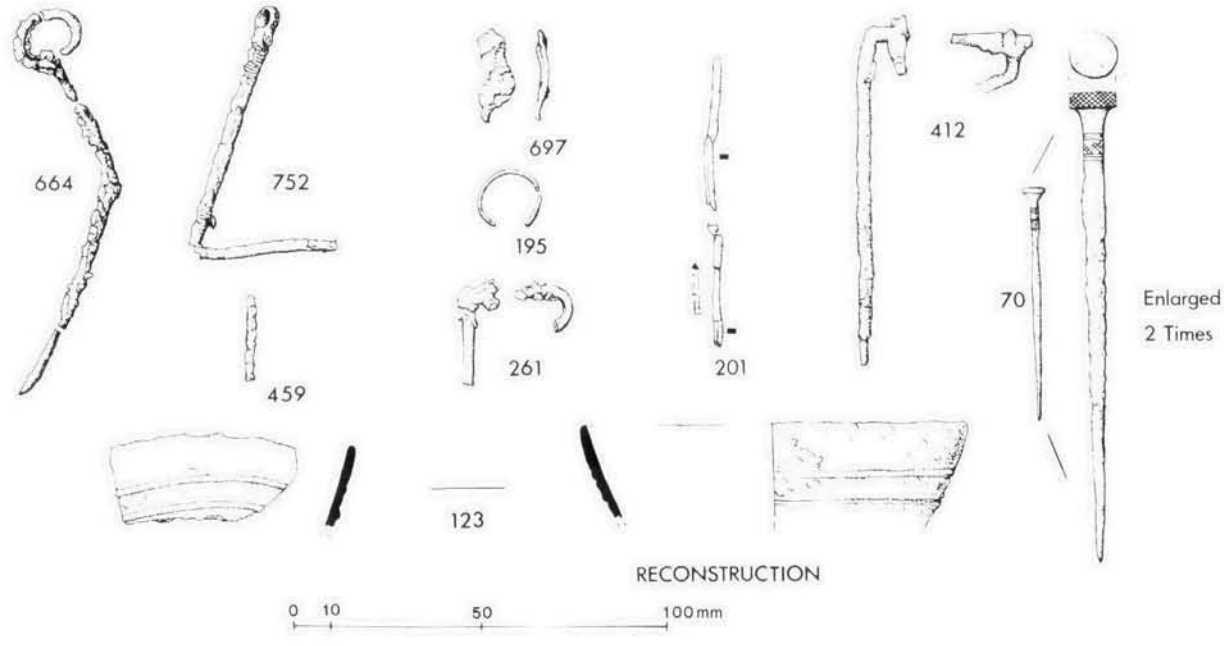
BRONZE

Most of the bronze objects from the site were badly corroded and in some cases only fragments were recovered. Conservation was carried out by Dr E W MacKie in the Hunterian Museum.

Numerically the most important elements in the bronze assemblage are pins, of which nine are represented, two having projecting ring-heads. The latter are made of round wire and the shafts of others may exist amongst the fragmentary remains. These ring-headed pins have been discussed by Clarke (1971, Appendix III) whose list shows that one or more examples came from at least nine other broch sites, out of the fifteen findspots recorded. One of the two from Crosskirk (*261*) was found in midden material behind a refacing of the SW quadrant of the inner wall face of the broch: it clearly belongs to Phase Two and a date in the second century BC can be suggested. The second (*664*) probably belongs to the same period. Since Clarke wrote, an earlier date has been proposed for this type of object at Dun Mor Vaul, where two ring-stamped sherds from pre-broch levels were found for which a date in the fifth or sixth century BC was postulated (McKie, 1974, 128).

One pin (*412*) appears to have had a projecting crutch-head, but it was so badly corroded that it may be the base of another ring-head. This pin was found thrust into the inner face of the dry-stone wall of Enclosure I, near the base. In itself this would suggest a date late in Period Three, but the pin might have been hidden there at a later date. Another pin (*752*) with a bent shaft, has traces of parallel lines around, some 20 mm below the head. The head is bulbous and there is a small cup-shaped depression in it. This pin was found immediately S of the outer face of the rampart W of the gateway, amongst filling material originally of Period Three but laid down in Period Four.

The nail-headed pin (*70*) was found inside the broch relatively early in the excavations before a definite Phase Two/Three distinction had been recognised, but it undoubtedly came from the horizon of a samian sherd and a fragment of Roman glass (*66*) found about the same time. The position was a little N of the late hearth amid irregular stones and slabs. The pin was corroded making it difficult to assess the amount of swelling on the shaft. During treatment, the diagonal cross-hatch became indistinct and the decoration of the shaft now suggests the lines as indicated on the drawing by Mrs Scott (Ill 68, left). Before treatment, however, Dr McKie drew the pin showing the diagonal cross-hatching both around the head and on the shaft between double lines (Ill 68, right). MacGregor (1974, 70 and 99-100, no 304) has discussed a similar nail-headed bronze pin from the Broch of Burrian in Orkney. It has ornamental hatching round the head and linear decoration midway around the expanded shaft, although there is a slight constriction just below the head which is absent on the Crosskirk example. Pins comparable to that from Burrian are known from Buston Crannog in Ayrshire (Munro, 1882, figs 242-3), from Kildonan in South Uist (NMAS GS 203) and from the Broch of Burray in Orkney (Stevenson, 1955b). Following Stevenson (1955 b), MacGregor notes that bone and metal round- and nail-headed pins occur widely but seem to cluster round the seventh to the ninth century AD, and draws attention to the nail-head of a bronze pin with diced decoration on the flat head, which came from what Hamilton states were 'broch levels' at Clickhimin (1968), though he does not give the exact



Ill 68 : Bronze items

find spot. MacGregor suggests that the pin in question may be a very early representative of the series. Although the pin from Crosskirk may have been lost during casual use of the site in Early Christian times, and became incorporated in the stratification subsequently, the context itself seemed secure and would suggest a chronological horizon close to that of the Clickhimin example. Certainly the Crosskirk pin is the only portable object from the site as a whole to which a date as late as the eighth century AD could possibly be ascribed.

The two spiral finger rings (*59, 195*) were both found inside the broch in a deposit apparently of Phase Two, although in both cases at positions where the Phase Two/Three horizon was not clear. Clarke has again provided a list for Scotland (Clarke, 1971) which includes five other broch sites.

Unfortunately, the segment of a small bronze bowl (*123*) came from loose rubble in the ramp created by stone robbers in the relatively recent past. It is of tin-bronze, cast, and decorated with two encircling ribs.

PINS

70 Nail-headed pin, 63 mm long, with a flat head, 5 mm in diameter. The shaft is slightly thickened midway. The pin is decorated with diagonal cross-hatch around the head and with horizontal lines and cross-hatch around the shaft below it.
Broch, amid slabs of Phase Three, QNW, Ill 68

201 Three fragments of a pin shaft, 42, 35 and 10 mm long respectively. They are 2.5 mm square in cross-section. The fragments are of leaded bronze.
Broch, under late pavement, Phase Two, QSW, Ill 68

256 Fragment of pin shaft, 12 mm long made of leaded bronze. Outside broch entrance, Period Four (?), F9, not illustrated

261 Part of the shaft, 34 mm long, and of the damaged projecting ring-head of a pin. The ring was about 10 mm in diameter and 2 mm thick. Tin bronze.
Broch, behind casing, Phase Two, QSW, Ill 68

412 Pin, broken at the tip, with shaft length of 82 mm, and a corroded (?) crutch-head, 20 mm by 5 mm.
In external wall face of Enclosure I, Period Three (?), E11, Ill 68

459 Two fragments of a pin shaft badly corroded.
Under the floor of Enclosure I, Period Three, E9, Ill 68

520 Traces of a pin shaft.
Enclosure IV*b*, Period Three, E9, not illustrated

664 Elements of a projecting ring-headed pin, including 60 mm of the shaft, and two parts of the head, 9 mm in diameter, offset by 5 mm.
Settlement outside broch entrance, probably Period Three, F9, Ill 68

752 Pin, 105 mm long, with a bent shaft and with traces of parallel lines 20 mm below the head. This is bulbous with a small cup-shaped depression.
External face of rampart W of gateway, in Period Four filling, H7, Ill 68

SPIRAL FINGER-RINGS

59 Two twists of a wire ring.
Broch, foot of north wall face, probably Phase Two, QNE, not illustrated

195 One twist of a wire ring, of leaded bronze.
Broch, under upper pavement, Phase Two, QSW, Ill 68

BOWL

123 A segment 42 mm by 22 mm, and 2-3 mm thick, of a small bowl 80-90 mm in original diameter at the rim, and decorated with two encircling ribs. It has been cast from tin bronze.
From rubble in stone robbers' ramp, E6, Ill 68

FRAGMENTS

203 Small fragment 8 mm by 4 mm of bent plate, made of leaded bronze.
Broch, under upper pavement, Phase Two, QNE, not illustrated

697 Flat fragment, 25 mm in length.
In the wall S of Area V, Period Three, F9, Ill 68

METALLURGICAL STUDY OF THE CROSSKIRK BRONZE MATERIAL

E A SLATER

The excavations at Crosskirk yielded only fourteen bronze objects, thirteen of which are ascribed to Period Three or Four, with the fourteenth coming from a more recent context. When submitted for study they were all extensively corroded, despite some conservation treatment, and this limited the information that could be obtained.

The technical study of metal objects falls into two main areas—metallographic and analytical. A metallographic examination involves the interpretation of the microstructure revealed by observation of a polished metal surface under a microscope. The microstructure is characteristic of the metal and a guide to the manufacturing and working processes that it has undergone. The most useful surface for study is a cross-section through the object, perpendicular to the direction of casting. Several of the objects from Crosskirk were broken and thus a suitable surface was available at the broken end. Unfortunately, the degree of mineralisation made the preparation of a polished (and thus useful) surface impossible.

The range of analytical techniques currently available allows both general and detailed analyses to be carried out, with the method used and the scope of the investigation depending on the purpose of the analytical programme. A general, semi-quantitative analysis enables classification into the main metal types—for example, copper, tin bronze and leaded bronze. Dr H McKerrell, formerly of the National Museum of Antiquities, Edinburgh, had examined some of the Crosskirk material and his results are incorporated in the catalogue above (*195, 201, 203, 256, 261; 123*). A more detailed analysis, to give the percentage composition in terms of some selected elements, is usually undertaken to determine any significant similarities, or differences, in composition between objects of one site or period or to chart impurity patterns against a chronological or geographical framework.

There are a number of problems associated with the interpretation of such analyses, centering on the assumption that the composition of a metal object, as currently determined, is representative of its composition at the time of manufacture. Additionally, any comparison of analytical data rests on the premise that similarities in composition reflect similarities in the source material, in this case the original

ore. However, the purpose of the smelting process to which an ore is subjected is not just to produce the metal but to modify its composition. These changes have to be considered in any discussion, with the main factors in the interpretation being the accuracy of the analytical techniques, segregation within the object, subsequent corrosion and any other effects liable to have produced variability in the composition since the transition from ore to metal.

All analytical methods have associated errors. This has been starkly demonstrated in a study by Chase (1974), involving the analysis of similar samples by a number of laboratories, with considerable variation in the reported results. Thus, the generally quoted method errors, of the order of 10 per cent, based on replicate analyses, may be a considerable under-estimate, and objects should not be rigidly classified on the basis of this type of data. Additionally, segregation within an object produces inhomogeneity in composition and therefore the content of a small sample may not be representative of the entire object. Lead and bismuth are known to segregate in copper but this effect can be minimised by taking a sample of the whole cross-section, and it is unlikely to be of significance in the small, thin objects from Crosskirk. A far more important problem in this case is the degree of corrosion. Metals corrode at different rates and even the relative percentages of elements within a corroded layer are not a reliable indicator of the original composition. Moreover, a sample for study should be taken from well underneath the corrosion layer, as the metal immediately in contact with the visible corrosion may have been subject to changes caused by differential leaching. The selection of samples of such good quality from the Crosskirk material was not possible.

Variations in composition from ore to metal depend on the ore type and the smelting process it must undergo. Copper ores are of two main types, oxide and sulphide. Oxide ores are smelted under reducing conditions and the only major elements that are not likely to be carried over to the metal are zinc and iron: zinc is volatile and some iron enters the slag. Sulphide ores, by contrast, are subject to both oxidising and reducing conditions and elements that form volatile oxides, such as arsenic and antimony, may also be lost. The arsenic content can be further reduced by any subsequent hot-working and the overall analysis can be affected by any impurities introduced by alloying with tin or lead.

Despite their low quality, samples from six of the bronze objects from Crosskirk were analysed—three by atomic absorption spectrophotometry and three by neutron activation analysis by Dr A McKenzie of the Research and Reactor Centre, East Kilbride. The samples were taken from the objects showing the least corrosion and three had previously been studied by Dr McKerrell. The results are given in Table 2. The neutron activation results are given as relative, not absolute, values as the necessary calibrations were not available and, to the time of writing, it has not been possible to repeat the analyses. The results for *59* and *201* are given as the ratios for each element to those for *123*, with the values for *123* assigned the arbitrary value of 1. Although this is the same for each element, it does not mean that their absolute values are the same, as demonstrated by the arsenic/antimony ratio which, because they have similar activities, was calculated on the basis of peak heights. The technique of neutron activation analysis was selected as it can detect elements at very low levels of concentration, and trace element concentration 'finger-prints' may be diagnostic. However, only caesium and cobalt were present in significant quantities. The lead content cannot be determined using this method. As absolute values could not be obtained in this way, the other three samples were analysed using atomic absorption spectrophotometry. In this method the elements to be measured have to be selected in advance. Tin and lead were chosen to determine the degree of alloying; silver and gold as they are resistant to corrosion and unaffected by smelting; arsenic, antimony and nickel as they can be diagnostic of certain types of copper ores, the Fahlerz ores, although it is generally supposed that the pyrites ores were the main copper source in the Iron Age. The arsenic/antimony ratios are given, since these elements have similar chemical properties and thus their relative, rather than absolute, concentrations may be unaffected by corrosion.

Table 2 Analytical results on Crosskirk bronzes

(a) Neutron activation

	123	*59*	*201*
Arsenic	1	0.1	0.2
Antimony	1	0.7	0.7
Tin	1	0.3	0.3
Gold	1	5.6	9.3
Zinc	1	8.3	7.0
Silver	1	1.2	1.5
Cobalt	1	0.5	n.d.
Caesium	n.d.	1.0	1.2
As/Sb ratio	0.5	0.1	0.2

(b) Atomic absorption

	412	*203*	*752*
Arsenic	0.3%	0.4%	0.2%
Antimony	2.6%	0.6%	1.4%
Tin	7.3%	3.7%	6.8%
Lead	2.1%	1.7%	1.9%
Gold	0.001%	n.d.	n.d.
Silver	0.5%	0.04%	0.3%
Nickel	0.06%	0.1%	0.07%
As/Sb ratio	0.11	0.66	0.14

CONCLUSIONS

Leaded bronze is a common feature of the Late Bronze Age and later periods, with lead improving the casting properties of the metal. The analyses given in Table 2 do not suggest any deliberate selection of materials for specific types of objects. Allowing for analytical errors, there is some similarity in composition between objects *59* and *201* and between *412* and *752*. On the slender evidence of the arsenic/antimony ratios, a similarity could be proposed amongst all four objects.

It would be tempting, but unwise, to compare these analyses with those for other Scottish material: unwise, because all these limited results reflect is the composition of the objects today—any statement as to their original detailed composition would be speculation.

IRON AND IRON-WORKING

Very few iron objects were recovered from the site and of these, only two (*198* and *227*) can be regarded as other than recent. There is clear evidence of iron working on site, as was stated by Dr Hugh MacKerrel after examining a piece of slag (*223*). Four masses of cindery slag coming apparently from the bottom of small iron smelting hearths were found

in various parts of the site: all probably belong to the period when Early Broch pottery was in use. Soil conditions at Crosskirk seem to have been unfavourable to the preservation or iron, and this unfortunate circumstance appears to have been the case on many broch sites.

198 Much corroded piece, 60 mm long.
Broch, under upper pavement, Phase Two, QSW, Ill 69

227 Nail (?) 58 mm in length, corroded, and in two pieces.
Settlement outside broch entrance, Period Four, F9, Ill 69

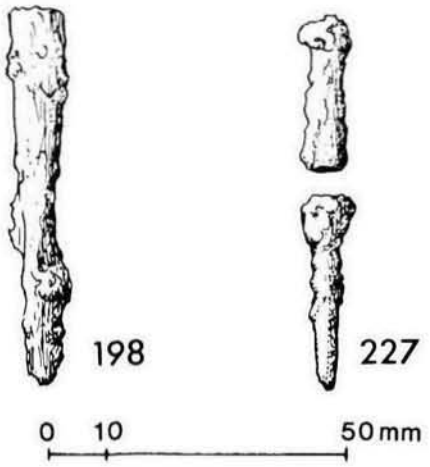
SLAG

114 Mass of slaggy residue, 90 mm by 50 mm, coming apparently from the bottom of a small hearth.
From the rubble filling of the broch, QSW, not illustrated

135 Similar mass, 50 mm in length.
From the broch floor in Phase Two, QNW, not illustrated

223 Fragment of slag.
Settlement, Period Four, F9, not illustrated

505 Fragment of slag.
Enclosure III in external rampart, Period Three, G7, not illustrated



Ill. 69 : Iron objects of Periods Two and Three

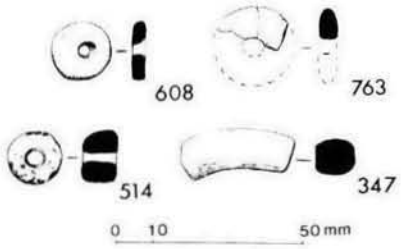
CRUCIBLES

Two fragments of crucibles from the site merit publication. One at least may be attributed to Period Three. These appear to be the only direct evidence of bronze-working on site.

566 Part of a spout, cracked by heat and grey in colour. The object has a greenish vitreous glaze.
From the late pavement above Enclosure I, E10, not illustrated

707 Part of a spout, with exterior covered with vitreous material.
Found in walling in Area V/VI, Period Three, F9, not illustrated

DECORATIVE OBJECTS: BEADS, PENDANTS AND BRACELETS IN VARIOUS MATERIALS



Ill. 70 : Decorative objects in various materials

72B Small cylinder of stone, 16 mm by 13 mm in diameter: possibly an unperforated bead.
Broch, Phase Two, QNW, not illustrated

347 Fragment of a ring of fine grained sandstone, 30 mm long by 10 mm in diameter: original diameter of entire item about 80 mm. Possibly a small bracelet.
Broch, behind buttress edging S wall, Phase Two, QSE/SW, Ill 70

384 Fragment of a lignite bracelet 38 mm long by 10 to 12 mm thick, D-shaped in cross section: original diameter of entire item about 90 mm.
Settlement, in walling of extended entrance passage, Period Three or Four, F9, not illustrated

514 Bead of baked clay with suggestions of a dark reddish brown glaze, 10 mm by 15 mm in diameter, with a bore of 4 mm.
Rubble, below turf, E of Enclosure I, E11, Ill 70

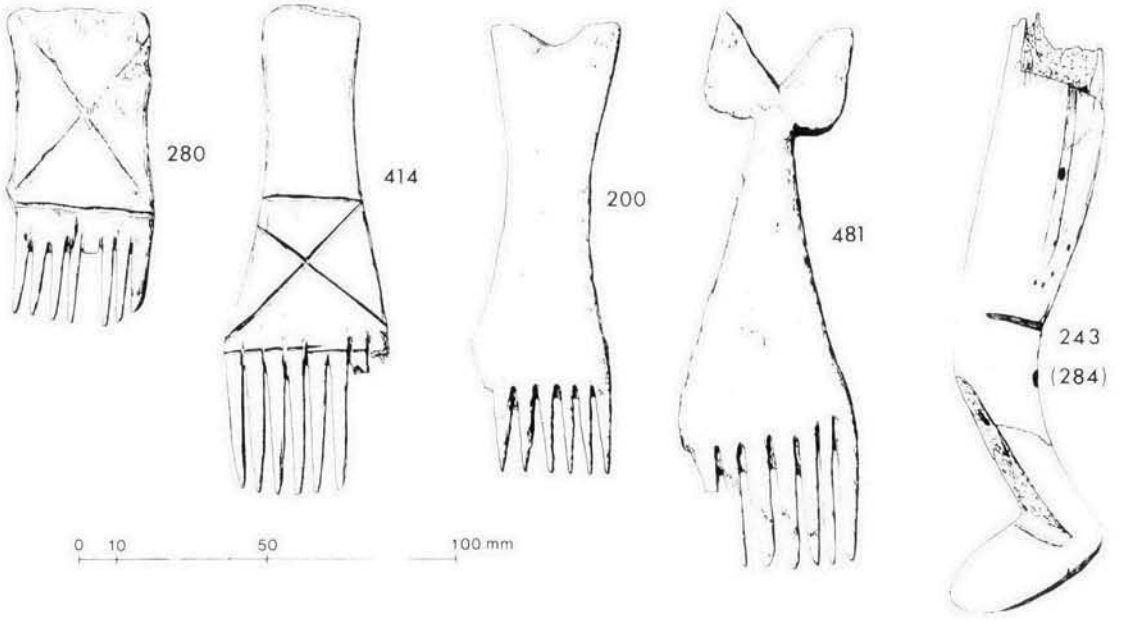
608 Well-finished bead of lignite, 15 mm by 3 mm, with off-centre perforation.
On slabbed paving S of broch, Period Four or Five, F7, Ill 70

763 Two fragments of an amber bead or pendant, 20 mm wide, 3 to 5 mm thick, broken across the perforation. The original diameter (if the object were circular) would have been 20 to 25 mm.
In a shell deposit in the broch, Phase Two, QNB, Ill 70

Dr David Clarke, National Museum of Antiquities, reported (on *763*) that "The best parallels are two from the Whitegate Broch at Keiss. Other brochs producing amber beads of roughly this form are Dun Fhiadhairt and Edinshall" (pers comm).

BONE AND ANTLER

Soil conditions undoubtedly favoured the preservation of bone and antler as is shown by the fresh appearance of so many artifacts and of the bulk of the animal bones. Nevertheless, the Crosskirk collection of pins, tools and pieces which showed signs of wear, is not large compared with assemblages from some other broch and various wheelhouse sites, in particular with the Broch of Burrian (MacGregor, 1974). Although not rich, the Crosskirk collection is a representative one for the broch period: what is obviously lacking compared with some other sites and in particular Burrian, are objects from the post-broch period, especially the ball- and nail-headed pins and those with expanded shafts which seem to belong to Early Christian times. At Crosskirk, too, there is comparatively little decoration except on the combs, most of the specimens being plain utility tools. However, part of a fine toilet comb (*632*), several long-handled weaving combs, neatly finished long pins sometimes with spatulate ends, and needles, all show skilful workmanship; one of the pins was found inside its bird-bone case (*451*). Antler was used commonly, especially for weaving combs, but although plates of whalebone were found during the excavations, there are none of the characteristic tools made therefrom such as are found on some northern sites. Four femur heads, of which one at least was human (*597*), were pierced for whorls or toggles. There were sundry awls and points of a generalised type, made from splintered bone and showing only slight evidence of wear.



Ill. 71 : Long-handled weaving combs

COMBS

Long-Handled Weaving Combs

74 A plain, straight-sided antler comb, with five prongs all broken. Length 110 m by 38 mm wide.
Amongst broch foundations S of the intra-mural cell, Phase One, E7, not illustrated

140 A badly-abraded bone comb, 114 mm long by 45 mm wide with five out of eight short prongs surviving. There is a suggestion of a shallow fish tail.
Broch floor, Phase Two, QNW, not illustrated

200 An antler comb, 120 mm long by 35 mm wide, with six out of seven or eight short prongs remaining. The sides are hollowed and this comb has a shallow fish tail.
Broch: under upper pavement, Phase Two, QSW, Ill 71

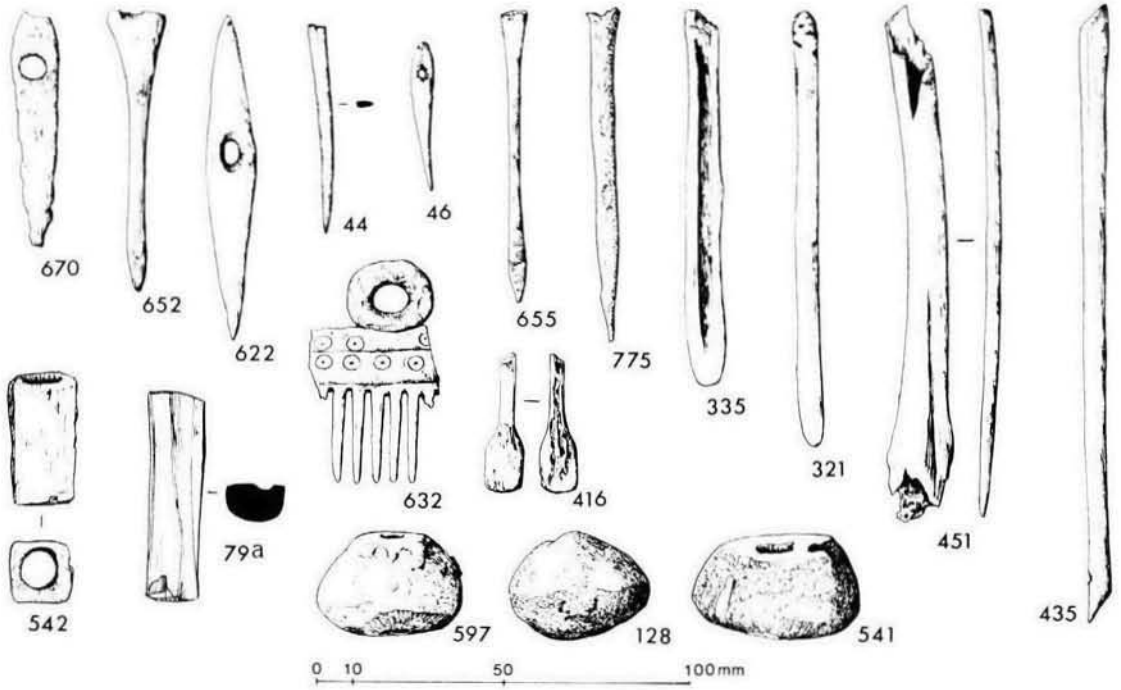
243 & 284 An angled length of antler, 160 mm by 50 mm, with a plate at one end, broken at the other, and found in two parts separately. It is decorated with deep cuts and irregularly spaced pits. A comb broken in manufacture?
Broch, under upper pavement, Phase Two, QSE, Ill 71

251 Length of antler, 120 mm by 40 mm wide, with straight sawn ends: apparently intended for a comb.
Broch floor, Phase Two, QNW, not illustrated

280 An antler comb 80 mm long by 35 mm wide, with one or two prongs broken out of eight or nine. It is very short, with straight sides and is decorated with an incised cross between horizontal lines.
From the broch floor, Phase Two, QNE, Ill 71

414 An antler comb 130 mm long by 43 mm wide, with six out of eight long prongs remaining, and decorated with an incised cross between horizontal lines. The sides are hollowed: the teeth and decoration are saw-cut.
Enclosure IV, Period Three, E9, Ill 71

481 An antler comb, 144 mm long and 44 mm wide, with six out of seven or eight prongs remaining. It has a markedly asymmetrical deeply-cut fish-tail end. The item is carved, apart from the teeth which are saw-cut. The underside lacks wear except at the tip of the prongs and is cellular in appearance.
Enclosure IV, Period Three, E9, Ill 71



ILL 72 : Decorated comb, needles, fish gorges, pins, awls, spatulate pins and tools, whorls, toggles and possible dice

Almost all the above objects were of antler and all belong to Period Three except that *74* might conceivably date to Period One. Six were found inside the broch itself and two from early levels just outside. The oldest (*74*) was a very simple flat-ended comb with prongs; the later examples had shaped handles with a fish-tail end and long prongs. All had been discarded after two or more prongs had broken. Traces of wear could be seen especially on *200*, between the prongs on the upper surface suggesting usage downwards at a steep angle, presumably to lessen breakages.

Decorated Comb

632 Part of a toilet comb of antler, 60 mm by 33 mm, with teeth 25 mm in length. The comb is embellished with a ring above, 19 to 24 mm in diameter, decorated with rings and dots on either side of a horizontal line.
In disturbed midden under a platform, S of the broch entrance, Period Three, F8, Ill 72

The domestic refuse in which this comb was found almost certainly belongs to Period Three. The ring and central dot pattern is a common one on Iron Age combs in particular, for example, those from Burrian (MacGregor, 1974). The decorative ring above the comb is uncommon.

NEEDLES AND FISH GORGES

46 Needle, 40 mm long by 5 mm wide at pierced end, with an eye 2 mm across.
Upper steps of the broch stair, Phase Two, D5, Ill 72

622 Needle or fish gorge, pointed at both ends, 84 mm long by 13 mm wide with a 5 mm perforation: one end is polished.
Settlement, E of broch entrance, Period Three (?), E9, Ill 72

670 Needle or fish gorge, 60 mm in length and pointed at one end but broken at the other, with a 6 mm perforation.
Enclosure III, Period Three, H8, Ill 72

774 Four fragments of a needle (?) of horn core: 50 mm long by 9 mm wide: it has been broken at both ends.
Settlement, in filling of extended entrance, not illustrated

775 Needle, 88 mm long, broken at the eye: the point is smooth.
Broch, QNE, Ill 72

PINS AND AWLS

44 Pin smoothly pointed at one end, broken at the other, 50 mm long by 4 mm wide.
Against outer wall of broch, E5, Ill 72

179 Awl 110 mm long by 12 mm wide, one end pointed, the other rounded.
Filling of the broch entrance, E8, not illustrated

183 Awl 78 mm by 11 mm.
Broch, under upper pavement, Phase Two, QSW, not illustrated

304 Awl 57 mm long by 8 mm at wide end.
Broch, under upper pavement, Phase Two, QSW

421 Pin, 62 mm long, carefully smoothed.
S of Enclosure I, Period Three (?), G9, not illustrated

435 Hair (?) pin 165 mm long by 5 mm wide ending at slanted cuts, and with a notch near one end, in a worn condition.
Enclosure II, Period Three, E9, Ill 72

451 Hair pin found inside its bird-bone case. Pin 135 mm by 4 mm, smooth, pointed at one end, the other flat with slight groove. The case, 135 mm long, is broken at both ends.
Enclosure II, Period Three, E9, Ill 72

538 Pin, 122 mm long by 6 mm wide, with a polished point: the other end is broken.
Filling of guard cell in broch, Phase Two, D8, not illustrated

652 Pin, 75 mm long by 15 mm wide, with finely made flattened head.
Enclosure III, Period Three, H8, Ill 72

655 Pin, 76 mm long, slightly flattened at its expanded, pointed ends.
Settlement, between Period Four flagstones W of pebble pit, E8, Ill 72

746 Awl (?) 61 mm long, with one pointed end, the other broken.
Enclosure VII, Period Three, F8, not illustrated

768 Pin, 89 mm long by 6 mm wide, with a smooth point; the other end is irregular and flat.
Broch, Phase Two, QSE, not illustrated

771 Pin 75 mm long by 7 mm wide, narrowing to a rough point showing wear.
In rubble outside broch wall. Not illustrated

SPATULATE PINS AND TOOLS

Several of these, with one end pointed and one spatulate, had been carefully polished and were suggestive of hair pins, but others were rough. Two of the finest came from the shallow-walled depression on the W side of the broch. All of them may belong to the earlier broch period.

285 Tool 110 mm long by 11 mm, widening to 15 mm, irregular surface but smooth at the spatulate end.
Broch floor, Phase Two, QSW, not illustrated

289 Antler tool, 76 mm long by 14 mm wide at the spatula; the other end is worn.
Broch, behind refacing wall, Phase Two, QSW, not illustrated

321 Spatulate pin 115 mm long by 5 to 7 mm wide, finely worked and polished.
Broch, walled depression, Phase Two, QW, Ill 72

335 Tool, 100 mm by 9 mm wide, of split bone with a spatulate end, broken at the other end but with some wear.
Broch, walled depression, Phase Two, QW, Ill 72

337 Thick spatula, 90 mm long by 11 mm wide, with a slender point.
In the buttress against S wall of the broch, Phase Two, QSW, not illustrated

338 Antler spatula, 92 mm long by 10 mm wide broken at the spatula and much worn, almost identical with *337*.
In the buttress agianst S wall of the broch, Phase Two, QSW, not illustrated

416 Spatulate end of broken pin, 37 mm by 10 mm wide at flat end.
Against E wall of extended entrance, Period Four (?), F9, Ill 72

WHORLS OR TOGGLES

Four femur heads were found of which one (*128*) was an unpierced ball. The others had been bored vertically as for a toggle rather than a spindle whorl. Similar objects have been reported from other broch sites. At least one of the Crosskirk examples has been identified as human, by Miss Pamela Macmorran MB, ChB, and another is similar.

128 Ball-shaped toggle, 38 mm in diameter, black and polished over one half: probably human.
Broch occupation Phase Two, QNE, Ill 72

348 Toggle or whorl 30 mm by 35 mm in diameter, drum shaped, perforated off-centre.
Broch floor by walled depression, Phase One, QNW, not illustrated

541 Toggle or whorl with upper and lower surfaces flattened and measuring 32 mm by 25 mm high. The perforation, 8 mm wide narrowing to 5 mm, is off-centre.
Enclosure III, Period Three, H8, Ill 72

597 Pierced human femur head, 35 mm by 25 mm high, identified by Dr Macmorran.
On platform W of extended entrance, possibly Period Four, F7/8, Ill 72

POSSIBLE DICE

A carefully-shaped rectangular length suggested a die (*542*) and another was not dissimilar in shape (79 a) but there were no traces of numbers on their faces.

79 a *Smooth bone piece, 55 mm long by 14 mm wide,* rectangular in cross-section and cleanly cut at both ends.
Broch, Phase Two/Three, QNW, Ill 72

542 Bone die (?) 35 mm by 15 mm, rectangular in section, and bored through longitudinally; it is abraded.
Enclosure III, Period Three or Four, E12, Ill 72

POINTED TOOLS

51B Bone point, 37 mm long by 3 mm in diameter.
Broch, intra-mural cell, Phase Two, E7, not illustrated

259 Curved bone or horn tool 170 mm long by 25 mm wide. It is pointed at both ends, and much abraded.
Broch floor, Phase Two, QSW, not illustrated

615 Bone point, 87 mm long, with a rough surface.
S of the broch, below turf, F7/8, not illustrated

617 Bone point, 79 mm long.
Enclosure III, Period Three, F7/8, not illustrated

769 Ox horn tool, 150 mm long. It has been clean-cut at the base, which is 30 to 40 mm in diameter. A secondary cut runs into the base as a deep groove.
Broch floor, Phase Two, QSW, not illustrated

772 Roe deer horn 170 mm long. This has been clean cut at the base, 16 mm across. Two tines have been cut off and smoothed; there is wear at the point.
Enclosure IV, Period Three (?), Ill 73

MISCELLANEOUS BONE AND HORN ARTIFACTS

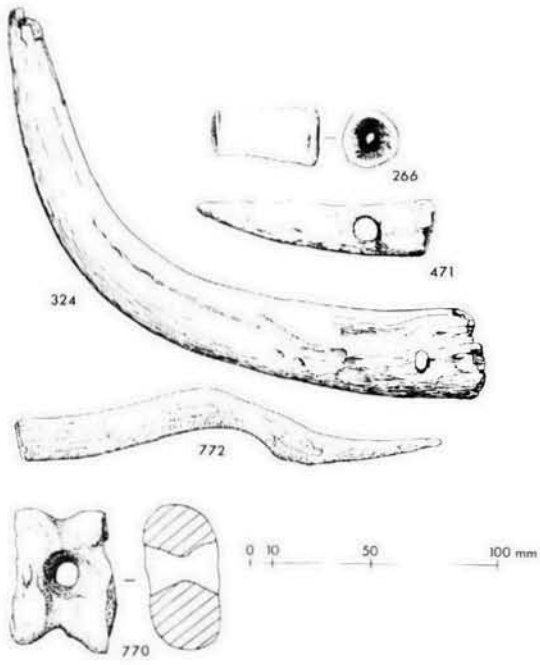
Most of the following items were difficult to classify.

324 Horn item, curving to the point, with a broken tip. It is 215 mm long by 28-32 mm wide, with an oval perforation 25 mm from its basal end.
Broch, on floor of peripheral enclosure at inner end of entrance, Phase Two, QSE, Ill 73

471 Antler artifact, 95 mm long overall, pointed at one end with the other end cut, 22 mm across and smoothed, with a perforation 9 to 12 mm across. Childe (1935, 229) reported others from six northern brochs.
Enclosure IV, Period Three, D9, Ill 73

488 Antler handle, 140 mm long, with one end cut square, and one end slanted. The item is rough, with a longitudinal bore of 3 mm.
Enclosure III, G8, not illustrated

755 Antler handle (?), 125 mm long, lacking a bore hole. Comparable to *488*.
Enclosure III, Period Four (?), F8, not illustrated



Ill. 73 : Small finds *324, 471, 770,* and *772* and antler waste *266*

770 Ox astragalus, 60 mm by 38 mm, bored centrally, and countersunk on both sides. The bore is 6 mm wide.
Broch, behind wall refacing, Phase Two, QSW, Ill 73

ABRADED PIECES OF BONE AND HORN

Five rough bone tools, varying in length from 6 to 14 cm, showed wear at a tongue-like end as though they had been used as scrapers or spatulae: all came from the broch, Phase Two. About a dozen pieces of bone were noted which showed slight signs of wear as though they had served as temporary tools, mainly as borers or rubbers. Two small, light rings of bone, possibly used, were also recovered. Further information is available in the archived version of the report.

LENGTHS OF ANTLER AND HORN

Three antlers, sawn off at the base, were recovered (*57, 274, 275*). The first of these, found in 1966, appeared to be exceptionally large and was submitted to Dr Ian Rolfe; his special report follows. About a dozen small lengths of antler and two of bone were found, mainly inside the broch, Phase Two. These included sawn-off times, short cylindrical fragments and longitudinal strips, all of which were presumably waste material. One has been illustrated (Ill 73). Further information is available in the archived report.

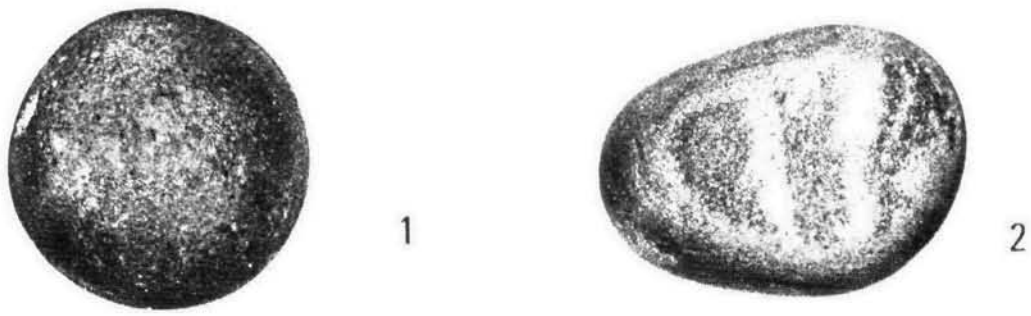
REPORT ON AN ANTLER FRAGMENT (*57*)
W D IAN ROLFE

The left? antler fragment from Crosskirk broch (Hunterian Museum, accession no V.5961) is probably of a red deer, *Cervus elaphus*. It is imperfect and only the (abraded) burr, the base of the brow tine and a short length of the beam is preserved, making determination difficult. It is less complete than the Hunterian Museum Pleistocene antler (V.5194) formerly regarded as the giant deer but which Reynolds and Bate (in Gregory and Currie 1928, 7) suggested was *C. elaphus*. The criteria for differentiating red and giant deer given by Reynolds can be applied to this specimen with some difficulty, and suggest the present identification.

The antler has a circumference above the burr of 8.56 in (215.4 mm), slightly greater than that of 8.25 in (209.6 mm) for V.5194 from Cowden Glen. Measurements of five subfossil antlers suggest that the burr: beam circumference ratio lies between 1.18 and 1.50, suggesting an original beam circumference for the present specimen of 6.4 in (163 mm). Millais (1906, 96) notes that the best Pleistocene and subfossil antlers have a beam between 5 in and 9 in (c. 130 to 230 mm). Recent wild deer may attain a beam of 7.25 in (184 mm), although the Record British Stag has a lower beam circumference of 18.4 in (468 mm) (Whitehouse, 1964, 65). From this it can be seen that although the present specimen is quite large by modern British standards (although nowhere approaching the record), it is not so by prehistoric and Pleistocene standards. Ritchie (1920, 335-8) and others have commented on this inferiority in size (by about one-third) of the modern Scottish red deer compared with those of past times, and attribute it to the destruction of forests; where the forests survive, as in parts of central Europe, red deer of great size are still to be found (Reynolds 1933, 5).

The present specimen lacks the bez tine. This tine appears in the fourth year so that it is possible this animal was younger than that. However, the bez tine is occasionally lacking in adult red deer (wrongly stated by Cornwall, 1956, 69 to be a diagnostic character of the "Scotish red deer *C. e. scoticus*."). Attempts have been made to differentiate subspecies of red deer upon minute differences in the antlers, and some authors have identified these large deer which occasionally lack the bez tines (Lydekker, 1915, 127) with the western Asian maral or with the wapiti. The intraspecific variability is high though, and Azzaroli (1953, 33) has questioned the value of recognising subspecies.

The red deer was formerly distributed over practically the whole of Scotland. Indeed, Ritchie stated that "there is scarcely a settlement where Neolithic man or his early successors dwelt that does not contain its remains". Thus, it has been found abundantly in Neolithic sites, Bronze and Iron Age middens, hillforts and earth-houses, brochs and Roman settlements (1920, 333). The following other brochs in Caithness have yielded red deer: Hillhead, Keiss, Thrumster (Reynolds, 1933) and Cogle, Freswick Links (Whitehead 1964, 151).



ILL 74 : Stone ball (no 1: diameter 31 mm) and painted pebble (no 2: max length 40 mm)

FLINT

50 Flake, 24 mm by 15 mm.
Broch, intra-mural cell, Phase Two, E7, not illustrated

89 Worked flake, 35 mm long, pear-shaped to a point.
Broch floor, Phase Two, QNW, not illustrated

169 Orange coloured chip, 12 mm long.
Broch, under upper pavement, Phase Two, not illustrated

PAINTED PEBBLE

Painted pebbles have been reported from broch sites at Keiss, Burrian, Jarlshof and Clickhimin, although one has been reported from Buckquoy, Orkney.

292 A fine-grained water-worn pebble 40 mm by 28 mm by 15 mm, with three ill-defined brown markings on one side, the reverse side being indistinct.
Behind refacing of the broch wall, Phase Two, QSW, Ill 74

ILL 75 : Stone lamps (1 = *366*: 2 = *764*: 3 = *209*)

STONE BALL

These have occurred on forts in southern Scotland and four are illustrated from Clickhimin (Hamilton, 1968, 86). They have been variously interpreted as slingstones or marbles.

82A A sandstone ball, 31 mm in diameter, very smoothly rounded, and apparently a marble.
From the floor of the broch, QN, Ill 74

STONE LAMPS

Three possible examples were recovered from Crosskirk: two (*209, 764*) are so rough as to be doubtful, but a cup-shaped specimen (*366*) belongs to the well-known type with a stub handle. The handle in this case is so rudimentary as to have little practical value; there is no sign of decoration. The lamp was found neatly fitting into a niche in the internal wall-face of the broch immediately N of the stair at the level of the threshold. There is no doubt that it belongs to Phase Two. Another stub-handled lamp is reported from the pre-broch Iron Age farmhouse at Clickhimin (Hamilton, 1968, 21). The main concentration of these cup-shaped and handled lamps appears to be in Aberdeenshire as shown by Steer's map (1958, 244), but they have occurred on several broch sites in Caithness.

209 Lamp (?) of roughly rounded sandstone 130 mm by 45 mm thick with a hollow 45 mm in diameter, reddened on the upper face as though with burning, the base being flat.
At hearth level, in Enclosure IV *b*, Period Three, E9, Ill 75, no 3

366 A cup-shaped item of micaceous sandstone, 100 m in diameter by 50 mm high, with a hollow 70 mm in diameter, and a rounded lug. The lamp is rather roughly worked with no decoration, but with a slight nick in the rim as for a wick, and the hollow is blackened.
In a niche in the broch wall, Phase Two, QSW, Ill 75, no 1

764 Sandstone lamp (?) 105 mm by 25 mm, largely natural but reddened within and smooth below.
Broch, no further details. Ill 75, no 2

HONES

About thirty were recovered, although of these a third were little more than naturally smooth stones or pebbles showing some signs of wear. The total seems high in view of the complete absence of edged metal tools and the scarcity of iron objects. Two-thirds of the hones came from inside the broch and although there may be some slight doubt about the early finds (up to 100*b*), nearly all appear to belong to Phase Two. The finer specimens were between 75 mm and 125 mm long (when not broken), rectangular in cross-section and tapering towards the ends; all seem to have been made from fine grained sandstone or mudstone from the local Old Red deposits.

65 Hone of light micaceous sandstone, 108 mm long by 17 by 10 mm; neatly made with flat ends and slightly curved sides.
Broch, QNW, Ill 76

ILL 76 : Hone (65: length 108 mm)

67 Fine grey mudstone hone, 90 mm long by 10 by 20 mm; rectangular in section with rounded ends.
Broch, QSE, not illustrated

72a Hone of fine-grained stone, 50 mm long by 13 by 8 mm, rectangular in section: broken.
Broch, QNW, Ill 77

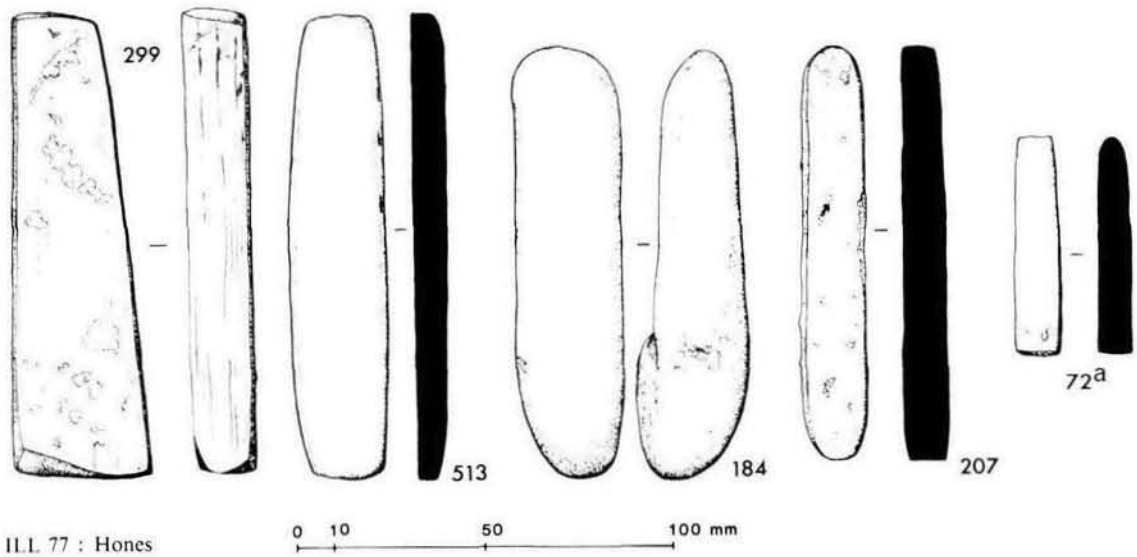
80 Grey sandstone hone, 75 by 15 mm, square in section, and rough at both ends.
Broch, QNW, not illustrated

95 A mudstone hone, 117 by 37 by 15 mm, very largely natural in shape.
Broch, QNW, not illustrated

100*b* Sandstone hone, 85 mm long by 25 by 24 mm. It is roughly rectangular but very largely natural in shape.
Broch, QSE, not illustrated

134 Hone or small pounder, 130 by 40 by 35 mm, abraded at both ends.
Broch floor, Phase Two, QSE, not illustrated

168 Grey sandstone hone, 80 mm long, by 30 by 13 mm, rectangular in section.
Broch upper pavement, Phase Three, QSW, not illustrated



ILL 77 : Hones

184 Water-rolled stone, 118 mm long by 28 by 25 mm.
Broch, under upper pavement, Phase Two, QSW, Ill 77

185 Sandstone hone, broken at both ends, 55 mm long by 18 by 12 mm: well used.
Broch, under upper pavement, Phase Two, QSW, not illustrated

207 Black mudstone hone, 110 mm long by 15 by 10 mm. It is very well-shaped, with flat sides and edges, and rounded ends.
Broch, under upper pavement, Phase Two, QSW, Ill 77

208 Light grey sandstone hone, 85 mm long by 22 by 17 mm, with edges and ends flattened.
Broch, under upper pavement, Phase Two, QSW, not illustrated

220 Sandstone hone, 68 mm long by 25 by 13 mm, probably shaped. It is roughly rectangular.
Broch floor, Phase Two, QSE, not illustrated

257 Water-rolled stone, 123 by 35 mm, with signs of use.
Broch floor, Phase Two, QNW, not illustrated

267 Sandstone hone, broken at one end. A length of 40 mm by 14 by 10 mm, rectangular in section, and well finished, survives.
Broch, behind refacing, Phase Two, QSW, not illustrated

299 Mudstone hone, 125 mm long, by 35 by 17 mm, well shaped and rounded at both ends.
Broch floor, Phase Two, QSW, Ill 77

300 Pebble, 110 mm long, by 30 by 25 mm, with signs of use on one face.
Broch floor, Phase Two, QSW, not illustrated.

354 Sandstone hone, 100 mm long by 35 by 25 mm; roughly rectangular, with rounded ends, and one side smoothed.
Broch floor, Phase Two, QSW, not illustrated

388 Smooth pebble, 72 mm long, worn on one side.
Broch floor, Phase Two, QSW, not illustrated

461 Sandstone hone, broken at one end, and roughly rectangular. The surviving portion is 83 by 25 by 15 mm, well used.
E of extended entrance, probably Period Three, F/G9, not illustrated

495 Water-rolled sandstone 95 mm long with one side used.
Settlement, above Enclosure I, E11, not illustrated

504 Sandstone hone, broken at one end, 65 mm long and D-shaped section.
In drain of extended entrance, Period Three or Four, G9, not illustrated

513 Mudstone hone, 124 mm long by 25 by 6 mm, rectangular in section and very well made.
In floor of extended entrance passage above drain, Period Four, Ill 77

529 Fine-grained sandstone hone, 65 mm long by 15 by 10 mm, broken at one end and rounded at the other.
Enclosure III, Period Three, G9, not illustrated

663 Water-rolled pebble, 80 by 20 mm, with one side smoothed.
Platform W of passage, F8, not illustrated

696 Sandstone, broken at one end: 85 mm long by 11 by 7 mm: possibly a hone.
Enclosure III, Period Three, G/H8, not illustrated

PERFORATED STONE DISCS

These comprise a miscellaneous group which cannot readily be differentiated into whorls or toggles. The quantity is not large by the standard of Clickhimin, and the weaving combs are better evidence for textile industry.

60 Spindle whorl or toggle, 28 mm in diameter, by 8 mm thick with a flat edge, and an asymmetrical perforation, 6 mm across.
Broch, Phase Two or Three, QSE, not illustrated

149 Fine-grained sandstone spindle whorl, 32 mm in diameter by 12 mm thick, well made with flat edge; asymmetrical.
Broch, Phase Three, QSE, not illustrated

286 Sandstone spindle whorl 35 mm in diameter by 11 mm thick with a rounded edge.
Broch, Phase One, QNW, not illustrated

297 Spindle whorl, split in half, 44 mm in diameter.
Broch, Phase Two, QSW, not illustrtated

422 Well-shaped spindle whorl, 42 mm in diameter by 20 mm thick, with an off-centre perforation.
Broch, Phase Two, QSW, Ill 78

ILL 78 : Spindle whorl (*422*), diameter 42 mm

621 Small whorl (bead?) 22 mm in diameter by 7 mm thick, irregular, sandstone.
Enclosure III *a*, by hearth, Period Three, G8, Ill 79

291 Water-rolled stone, pear-shaped and flat, 52 mm long by 12 mm thick, wih a small pecked hollow on either side, but not directly opposite each other: possibly a hand-guard for a bow-drill.
Broch floor, Phase Two, QSW, not illustrated

357 Rounded stone, 42 mm by 18 mm, with a deep hollow either side, not quite opposite each other: possibly a hand-guard for a bow-drill.
Broch floor, Phase Two, QNE, not illustrated

STONE DISCS

Thin stone discs have frequently been reported from Iron Age sites, especially brochs, but no close statistical analysis seems to have been made. The discs are usually grouped loosely into 'counters' and 'pot-lids', although other, possibly industrial uses may be involved. Some 35 examples were noted at Crosskirk, varying in diameter from 26 mm to 230 mm, excluding items classed as 'baking stones' (see p 128). Without much conviction as to its value, a threefold classification has been adopted:

Group 1 (counters)

The smallest size ranges between 26 mm and 43 mm and is normally less than 10 mm thick. Most examples show at least some sign of rubbing or wear, but several may be beach pebbles and there was some uncertainty as to which should be retained; in the selection, no attention was paid to any size classification. Eleven are listed below and of these, nine lie between 26 and 32 mm in diameter. These very small discs

appear to represent counters for some game resembling draughts or Nine Men's Morris.

Group 2 (small discs)

Next comes a group of thirteen items with diameters between 52 mm and 100 mm. They are again normally less than 10 mm thick and are often carefuly made and rubbed smooth: some have vertical edges. Again, a concentration of six has diameters which fall in the very restricted range between 90 mm and 100 mm.

Group 3 (pot-lids)

Finally, there is a series between 120 mm and 230 mm in diameter and distinctly thicker, between 10 mm and 20 mm. These are normally chipped to shape and judging by the diameters of the mouths of storage jars found on the site, they can justifiably be classed as pot-lids.

In each case, the first measurement cited is the diameter, and the second is the thickness of the item.

Group 1: counters

61a Sandstone worked at the edge, 31 mm by 10 mm.
Broch, Phase Two, QSE, Ill 79

61B Pebble, 26 mm by 8 mm.
Broch, Phase Two, QNW, not illustrated

79A Flat pebble, 37 mm by 8 mm.
Broch, Phase Two, QNW, not illustrated

79B Mudstone, 30 mm by 6 mm.
Broch, Phase Two, QNW, not illustrated

96 Rounded pebble, 28 mm by 6 mm, slightly rubbed at the edge.
Broch, Phase Two, QNW, not illustrated

97A Mudstone, 31 mm by 4 mm.
Broch, Phase Two, QNW, not illustrated

171 Water-rolled pebble, 28 mm by 8 mm, showing some polishing.
Broch, by stair, Phase Two, QSW, not illustrated

306 Two identical flat pebbles, 32 mm in diameter.
Broch, behind refacing N of the stair, Phase Two, QSW, not illustrated

624 Very thin shale disc, 32 mm by 2 mm roughly rounded.
Platform W of extended entrance, Period Four, G7, Ill 79

732 Shale, 43 mm by 3 mm, roughly trimmed.
Enclosure III, Period Three, G/H7, not illustrated

Group 2: small discs

14 Flat stone, 73 mm by 15 mm, smoothed.
Broch, in rubble, not illustrated

24 Sandstone, 92 mm by 5 mm, rough finish.
Broch wall, on casing to E, D9, not illustrated

64 Mudstone 92 mm by 5 mm, smooth with vertical edge.
Broch floor, Phase Two, QNW, not illustrated

133 Fine grained sandstone, 98 mm by 5 mm, with both faces smoothed and a flat edge.
Broch floor, Phase Two, QNW, not illustrated

141 Shale, 95 mm by 5 mm, chipped to shape but not well rounded and showing no wear.
Broch entrance, in rubble, D7, not illustrated

186 Sandstone, 93 mm by 8 mm, neatly chipped to shape, showing no wear.
Broch, under upper pavement, Phase Two, QSW, not illustrated

204 Mudstone, 65 mm by 5 mm, roughly chipped.
Broch, under upper pavement, Phase Two, QSW, not illustrated

228 Fine sandstone 86 mm by 8 mm, chipped with no smoothing.
Enclosure IV, Period Three, E9, not illustrated

265 Sandstone, 100 mm by 7 mm, chipped to shape and exhibiting slight smoothing on both sides and the edge.
Broch, behind refacing by stair, Phase Two, QSW, not illustrated

298 Sandstone, 80 mm by 10 mm, carefully chipped but not smoothed.
Broch floor, Phase One or Two, QSE, not illustrated

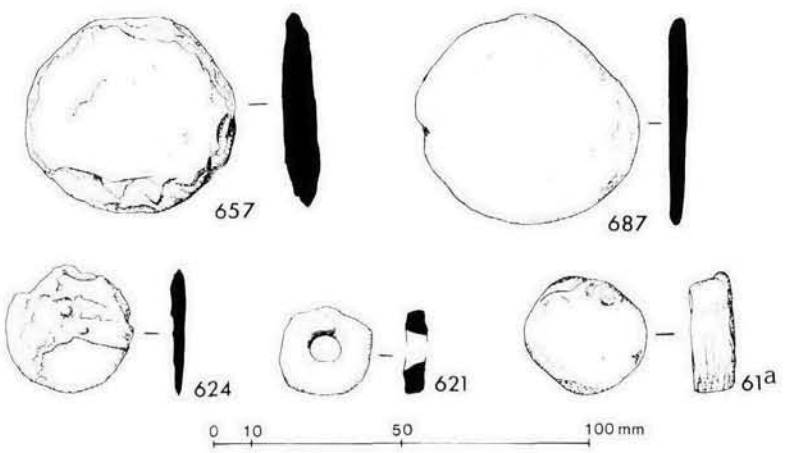
553 Sandstone, 52 mm by 10 mm, roughly rounded.
In 'pebble pit' on platform W of the extended entrance, Period Three, F8, not illustrated

657 Shale, 52 mm by 5 mm.
Enclosure III, Period Three, G8, Ill 79

687 Micaschist, 58 mm by 3 mm, roughly rounded.
Settlement E of broch entrance, Period Three, E9, Ill 79

Group 3: pot-lids

86B Sandstone, 230 mm by 17 mm; neatly made, but incomplete.
Broch floor, Phase Two, QNE, not illustrated



ILL 79 : A perforated disc and stone discs of groups 1 and 2

ILL 80 : A stone disc of group 3 (*765*), diameter 145 mm

206 Very rough, About 180 mm.
Broch, under upper pavement, Phase Two, QSW, not illustrated

262 Sandstone, 120 mm by 7 to 15 mm, roughly shaped.
Broch, behind refacing by stair, Phase Two, QSW, not illustrated

301 Fine sandstone, 175 mm by 14 mm, possibly shaped.
Broch floor, Phase Two, QSW, not illustrated

302 Sandstone, 210 mm by 16 mm, carefully trimmed.
Broch, under upper pavement, Phase Two, QSE, not illustrated

374 Sandy shale, 205-220 mm in diameter: incomplete, but well-shaped
Broch, near cell entry, Phase Two, QSE, not illustrated

525 Sandy shale, 160-180 mm in diameter: roughly chipped round the edge.'
Enclosure III *a*, Period Two or Three, G8, not illustrated

656 Shale, 130 mm by 6 mm, carefully shaped.
Enclosure III *a*, Period Two or Three, G8, not illustrated

691 170 mm by 25 mm roughly trimmed.
S of gateway in external rampart, 19, not illustrated

692 Shale, 130 mm by 16 mm: incomplete.
In rubble from broch wall, not illustrated

765 Sandstone, 145 mm by 15 mm, carefully chipped, one side smooth, one rough.
Rubble inside broch, Ill 80

BAKING STONES?

The following larger shaped stones may have been used for baking.

522 Sandy shale, 320 to 335 mm in diameter, by 23 mm thick, with smooth surfaces but edge slightly chipped.
Enclosure III *a*, Period Two or Three, G8, not illustrated

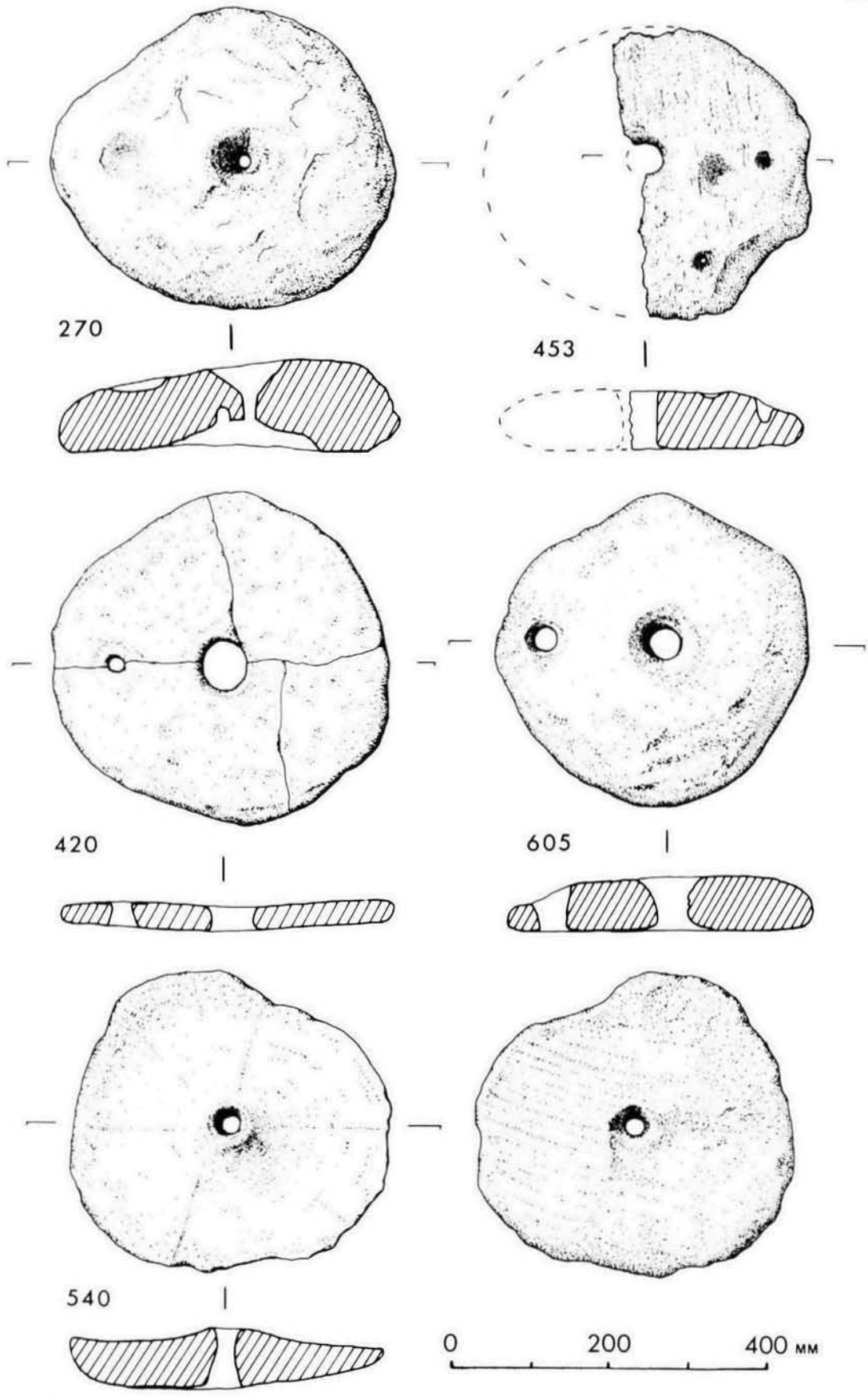
689 Sandy shale, 330 mm by 18 mm, well-shaped with a chipped edge.
Outside broch entrance, Period Two or Three, E8, not illustrated

SADDLE AND ROTARY QUERN STONES

Three saddle and fourteen rotary quern stones were recorded. Most of them were broken and even fragmentary, and all had been incorporated into pavements or walling so that their dating is by no means clear. As might be expected, the saddle querns appear to be early, though none can be associated with the pre-broch fort. Two of these were found within the broch, one being built into the kerb of an early peripheral enclosure. This might indicate that the form continued in use until at least the period of broch construction, but the saddle quern seems soon to have been superseded. Two rotary querns were recovered from Phase Two deposits in the broch; two more were incorporated in the repaving of Period Three. This latter pair may well also belong to the earlier period, and in fact no querns can be specifically associated with the later broch occupation, when the samian sherds occur.

One lower stone of a rotary quern (*672*) is typologically very much at variance with the rest. Its diameter is only a third of the normal range: the working surface, which was clearly used for rotary grinding, is convex but appears to have been surrounded by a ridge. This example was found beneath the widespread upper slabbing which occurred in the settlement area S and E of the broch. It would seem to be medieval in date and in that case would be the only find contemporary with St Mary's Chapel.

Most of the stones have been manufactured from the Old Red Sandstone, similar to that appearing in the flagstones



ILL 81 : Rotary quernstones

of the Crosskirk headland. Occasionally, as with the possible medieval quern, a coarse red sandstone has been utilised, but a grey sandy shale is characteristic. The occurrence of coarse grained schist in *331*, may indicate the use of an erratic. Otherwise the local stone has been employed, although it is not particularly suited for the purpose.

The typology of the thirteen rotary quern stones attributable to the broch period warrants closer examination as a very early date can be postulated for some of them. As far as can be seen from the more complete examples, there appears to be little variation in their general form. An exception occurs in *420* which is an upper stone: this is quite flat, is unusually thin but has an outsize handle-hole going through to the underside. It was found in four parts embedded in the floor of Enclosure IV *a* which was built up against the broch wall, and may be the earliest specimen of a rotary quern from Crosskirk.

The other upper stones (seven in all) appear to have been pear-shaped in outline, the projection accommodating the handle-hole. Their circumferences are distinctly irregular and the stones in their original form must have had a rough and ready look. The upper surface is somewhat convex in cross-section to the rounded edge, the projection for the handle being somewhat thinner than the main body of the stone. The lower surface is slightly concave to match the convexity of the lower stone. When present, the handle-hole is vertical and smooth, implying a loose handle. The feed arrangement varies: in some examples, it is a simple hour-glass perforation, but in others it narrows downwards to a vertical tube-like hole;

One example, *540*, is particularly instructive. It also came from Enclosure IV against the broch wall. It is made from a coarse red sandstone which might be expected to have produced a gritty meal. In outline it is shaped as for an upper stone but there is no handle-hole in the slight expansion which had apparently been left for the purpose. On the other hand, the central spindle hole resembles a feed upside down, but it is not vertical. The grinding surface is scored and is concave as if to accept a lower stone, and it has a slight ridge around the spindle hole. Six radial lines at evenly-spaced intervals have been pecked into the surface, perhaps to increase efficiency. The explanation would seem to be that the stone was intended for use as an upper stone but was converted to function as a lower one. The underside is uneven but is crossed by numerous parallel grooves produced by pecking. It is noteworthy that another three of the thirteen stones from the broch period do not appear to have been completed.

In general, and bearing in mind also the use of rather unsuitable local stone, some lack of expertise is possibly involved, especially as the finished products would seem to have had a 'home-made' appearance. The very early date which might be inferred is of particular interest in this respect.

Two of the rotary querns from the broch were recovered in Phase Two deposits from which a radiocarbon sample gave a date of 100 bc ±50. Two other rotary querns from Enclosure IV against the external face of the broch wall were in a pavement below the floor of Enclosures I and II for which a radiocarbon date of 120 bc ±80 was obtained. Purely from this evidence it is possible to regard all four examples as being in use not much, if any, later than 100 bc, although in each case, no direct association occurs between the samples and the stones. This very early date for the use of rotary querns in the far north of Scotland would appear to strengthen Dr MacKie's claim (1974) that the rotary quern was in use on the Dun Mor Vaul site by about 50 BC.

Saddle quern stones

37 Fragment.
Rubble in broch, QNE, not illustrated

314 Coarse mica-schist, 305 mm long by 200 mm by 60 mm: working surface smooth.
Set upright in paving of peripheral enclosure against broch wall. Possibly Phase One, QSE, not illustrated

494 Rectangular portion of a saddle quern, surviving length 280 mm by 300 mm broad by 75 mm thick with a smooth working surface.
Enclosure IV *b*, E/F9, not illustrated

Rotary quern stones

126 Half of an upper stone in mica-schist: 150 mm in diameter, feed 110 mm narrowing to 24 mm.
Broch floor, Phase Two, QNE, not illustrated

270 Sandy shale upper stone broken in manufacture, 460 mm by 390 mm by 120 mm thick, decreasing to 90 mm in thickness in the projecting sector. Feed, 105 mm, narrowing rapidly to 20 mm. Underside broken away but another perforation has been started near the feed for no obvious purpose. No handle hole but a cup-shaped depression 80 mm by 12 mm near the feed may imply secondary use as a socket.
In upper pavement of broch but probably of Phase Two, QSW, Ill 81

271 Close-grained sandstone quadrant of quern stone: radius 230 mm, perhaps broken in manufacture.
Broch, in upper pavement, probably Phase Two, not illustrated

331 About half of a coarse mica-schist, 350 mm in diameter, thin: the handle-hole goes through to the lower side.
Broch floor, Phase Two, QNE, Ill 82

420 Grey sandstone upper stone in four pieces, flat and thin, with a diameter of 410-435 mm, and 36 mm thick. Feed 90 mm narrowing to 67 mm half-way down, and then widening to 68 mm. Handle-hole 25 mm increasing downwards to 31 mm in diameter. Probably an upper stone later reversed to function as a lower stone.
Enclosure IV *a* on floor, E8, Ill 81

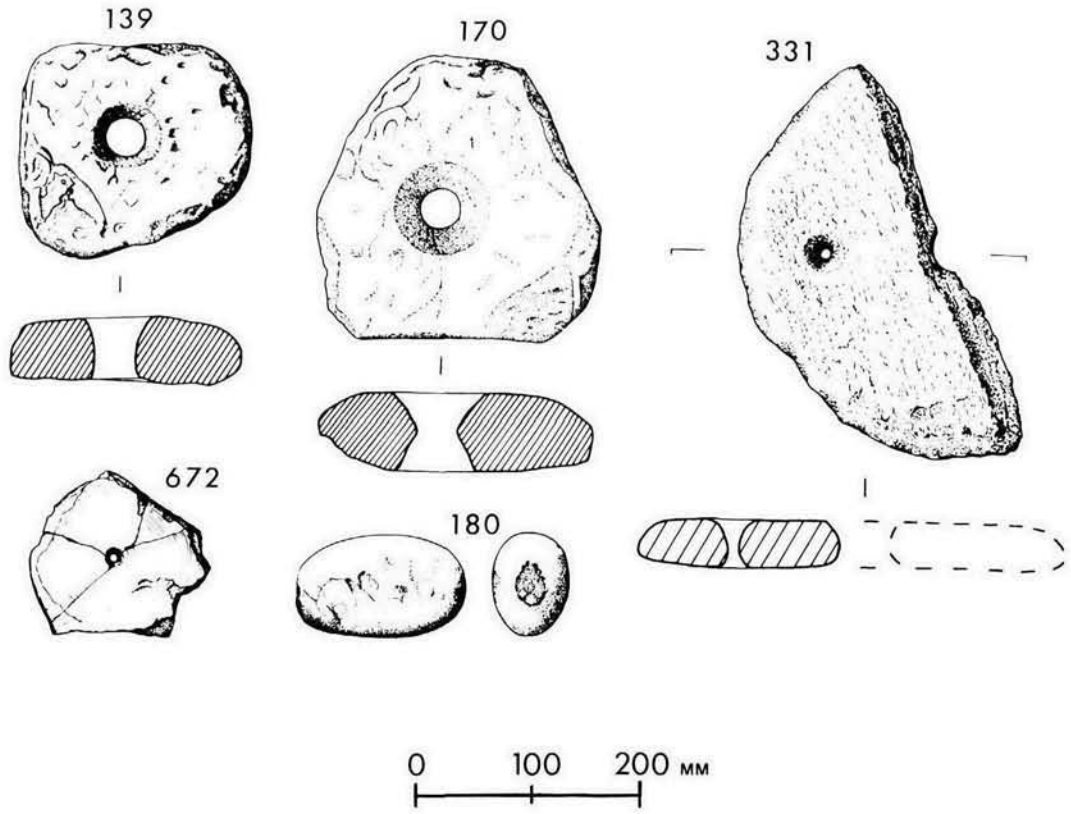
453 Rather more than half of an upper stone in sandstone, 390-400 mm in diameter, 84 mm thick decreasing to 40 mm at the handle-hole. Feed 80 mm narrowing to 40 mm near the under surface, smooth and grooved. The handle-hole, 25-30 mm in diameter, narrows to an oval on the lower face, and is smooth. A second handle-hole, at ninety degrees to the first, is 20 mm in diameter and 37 mm deep. A cup-shaped hollow, 60 mm across and 20 mm deep is located near this. Possibly re-used as a socket stone.
Settlement area, under upper slabbing, F/G9, Ill 81

540 A complete stone in coarse red sandstone, 385-420 mm in diameter, thick at the centre. One surface is concave and scored, the other irregular and grooved. A central perforation, 60-65 mm in diameter, is off vertical.
Enclosure IV, probably *b*, E10, Ill 81

543 Upper stone, 355 mm in diameter and 70 mm thick, with a rough upper surface, and a concave and smooth underside. The feed and handle-hole are both smooth.
N side of extended entrance, outside broch wall, E9, not illustrated

558 Part of a quern stone, diameter probably about 400 mm.
Enclosure I below turf, E11, not illustrated

605 Complete sandy shale upper stone 380 mm to 420 mm in diameter and 70 mm to 85 mm thick at the handle-hole. The upper surface is uneven, convex to the rounded edge. Grinding surface smooth and convex. Feed, 90 mm in diameter, narrows quickly to 55 mm, with distinct grooves.



ILL 82 : Rotary quernstones (*331*) and (*672*), weights (*139* and *170*) and pounder (*180*). *672* is probably medieval

The handle-hole is 60 mm in diameter narrowing to 34 mm on the lower face.
Extended entrance passage above drain, F9, Ill 81

606 Slightly more than half of a flat stone, 430 mm in diameter and 75 mm thick.
Platform, S of the broch by the (?) cooking pit, F8, not illustrated

672 Red sandstone quern stone, possibly medieval, discussed in the text above. In four pieces, lower stone only 140 mm in diameter and 10 mm thick. Scored on the grinding surface.
Under the upper slabbing S of the broch, Period Five, F8, Ill 82

688 About half of a lower stone, 550 mm in diameter and 115 mm thick. The central hole, 45 mm in diameter, does not appear at the lower surface.
In rubble by the gateway of the external rampart, G9, not illustrated

690 About quarter of an upper stone, with a feed 90 mm in diameter, narrowing to 25 mm.
In rubble, K9, not illustrated

STONE TROUGH

452 Part of a stone trough, surviving to a length of 480 mm by 300 m wide by 300 mm deep.
Found set in the primary broch floor just in front of cell entry, Phase One, QSE, not illustrated

The trough may possibly represent a prehistoric 'knocking stone' for grinding barley with either a stone or a wooden mallet. Similar items in the form of a drum-shaped stone with a rounded hollow in the upper side were in use in Scotland until last century (Fenton, 1976).

STONE SLAB WITH A GROOVE

464 A slab, 150 mm by 115 mm by 82 mm, with straight sides, has a slot 80 mm long by 14 mm wide and 12 mm deep in one smoothed side.
Settlement area, D9, not illustrated

STONE LID FOR A TANK

332 A stone slab, 760 mm by 560 mm, was found resting by a slab-sided tank. It has a perforation, 45 mm by 35 mm in diameter, plugged with a pebble at the time of discovery.
By the shallow depression against the W broch wall, QSW/NW, not illustrated

SOCKET OR SWIVEL STONES

Eight small slabs were recorded which appear to have been, or to have formed part of, stone sockets in which a door could turn, presumably on an iron spike. Most were broken across the cup or perforation, which was 60 mm to 75 mm in diameter. The slabs seem originally to have been 150 mm to 300 mm across. A complete specimen was recovered from the primary floor of the broch (*269*). Some of the rotary quern stones may have been re-used for a similar purpose.

269 Socket stone, 300 mm by 230 mm by 90 mm thick: the shallow cup was 75 mm in diameter.
From the primary floor of the broch at the foot of the N wall, Phase One, not illustrated

STONE WEIGHTS

These may have been either loom weights or net sinkers.

69 Oval stone, 90 mm by 60 mm, very largely natural, but with an extremely rough perforation.
Broch, QNW, not illustrated

139 Triangular stone with rounded corners, 185 mm by 170 mm by 50 mm thick, with an hour-glass perforation.
Broch, Phase Two, QNW, Ill 82

170 Roughly triangular stone with rounded corners, sides approx 220 mm in length, made of sandstone, with an hour-glass perforation narrowing to 30 mm.
Broch, in pavement, Phase Three, QNE, Ill 82

216 Half of an oval stone, now 60 mm across, with an hour-glass perforation, narrowing from 40 mm to 7 mm.
Broch, under upper pavement, Phase Two, QSE, not illustrated

HAMMER-STONES AND POUNDERS

Cobble stones, selected for their convenient shape, were frequently encountered at all levels. The following few specimens indicate the range of sizes: only those with obvious abrasion have been included. The great majority of such stones were elongated with signs of use at one or both ends. Only *180* is figured (Ill 82).

2 Pounder, 110 mm by 40 mm, with one end abraded.
Broch interior, below turf, QSW

146 Pounder, 220 mm long, abraded at both ends.
Broch, in stones above upper pavement, Phase Three, QSW

148 Pounder, 170 mm long, abraded at both ends.
Broch, in stones above upper pavement, Phase Three, QSW

180 Pounder, 140 mm long, abraded at both ends.
Broch entrance, in rubble

187 Small pounder, 90 mm long, abraded at both ends.
Broch, under upper pavement, Phase Two, QSW

258 Sandstone hammer stone, 115 mm long by 62 mm wide, rounded in section and well worn at both ends. It may have been used as a pestle.
Enclosure II, F7

303 Pounder, 230 mm long, slightly abraded at one end.
Settlement, outside broch entrance, E9

323 Pounder, 120 mm by 60 mm, abraded at both ends.
Broch floor, possibly Phase One, QSE

396 Pounder, 103 mm by 42 mm, abraded at one end: one side appears to have been used as a hone.
Broch, in cell, Phase One or Two, E6

693 A water-rolled cobble, 110 mm by 40 mm, with slight abrasion at both ends.
Enclosure IIIA, Period Three, G8

757 Hammer stone, 150 mm long, abraded at both ends.
Enclosure VII, above paving, Period Three

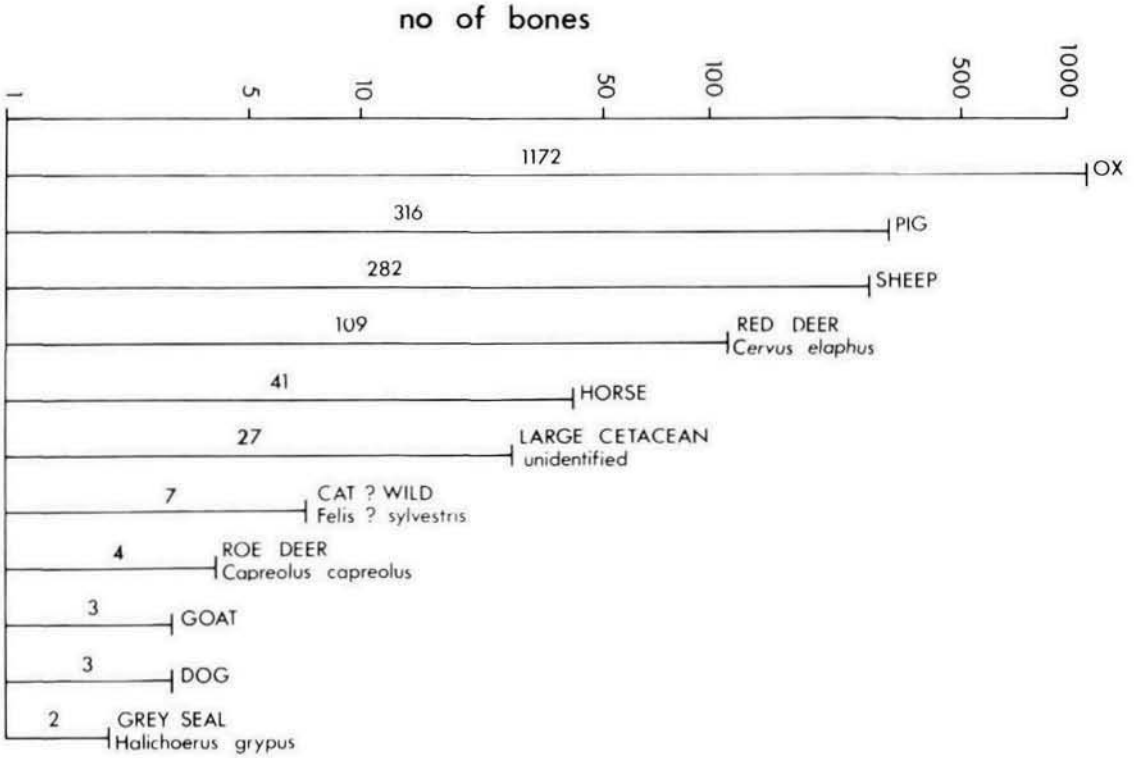
10 CONSIDERATION OF THE NON-ARTIFACTUAL MATERIAL FROM CROSSKIRK

The reports presented here concern aspects of the material recovered from Crosskirk and are thus considered at this juncture, rather than as appendices after the general consideration of the site. The faunal report, as initially submitted, was considered too long for full publication; the version presented here has been edited (by IBMR), but the full version may be consulted in the site archive at the Hunterian Museum (Ed).

ANALYSIS OF FAUNAL REMAINS E MACARTNEY

EARLIER REPORTS ON SCOTTISH IRON AGE FAUNAL REMAINS

Very little work has been done on Iron Age faunal remains in Scotland and most of the reports are tantalisingly short. The publication of the excavations at Jarlshof, Shetland (Hamilton, 1956) included a faunal report compiled, after her death, from the notes of Margery Platt. This included



ILL 83 : Total bone counts of selected species

comments on the animals but does not add to the measurements offered in an earlier publication (Platt, 1934). The publication of Clickhimin Broch, Shetland (Hamilton, 1968) included a very brief faunal report by Professor T Grahame on a "large collection received", but he states that only 92 fragments were determined, which suggests that the large collection was in very small pieces.

It was nōt until the excavation by Dr E W MacKie, at Dun Mor Vaul, on Tiree (1974), that the first really extensive and thorough faunal report on a Scottish Iron Age site appeared. This was by Barbara Noddle of Cardiff Anatomy Department (University College of South Wales and Monmouthshire). This report gives not only statistical information on many aspects of the animal remains but also an interpretation of their significance.

MATERIAL — EXCAVATED AND COMPARATIVE

The material examined consisted of all faunal remains received from the site with the exception of bird bones, determined by Dr Arthur Clarke and his assistant Ms C Howdle, at the Royal Scottish Museum: the fish bones, determined by Dr G Howes and Mr A Wheeler, Ichthyology Section, British Museum (Natural History). A small number of mammal bones was studied by Dr J Clutton-Brock and Mr P D Jenkins, Mammal Section, British Museum (Natural History).

Comparative material came from a variety of sources, but was mainly from the author's own collection. Loans were received from the Royal Scottish Museum (mammal bones—wild spp.), Hunterian Museum Geology Section (Mammal bones—Pleistocene and Iron Age) and use was made of the Zoology Section of the same museum.

METHOD

Abbreviations

frag.	fragment
L.f/nn	Late foetus or neonate
Juv	juvenile
Sub-A	sub-adult
Young A	young adult
Mature A	mature adult
R	right
L	left
L	length
W	width
Prox	proximal
Dist	distal
PW	proximal width
DW	distal width
SD	midshaft width = von Driesch's smallest diameter
Max	maximum
Min	minimum

MEASUREMENTS

Unless otherwise stated, all figures are in mm, and where there was a choice of dimensions, represent maxima, as at the extremities of long bones. Only occasionally were estimates used and these are indicated by either "approx" or "circa" or "estimate". The minimum width, where quoted, is the equivalent of von der Driesch's "smallest diameter" (1977).

TOOTH NUMBERING

The following comments apply to hoofed mammals. The numbers of teeth of each type normally present vary. The pig produces the full formula, both deciduous and permanent. Deer, sheep and ox lack upper incisors and canines, both deciduous and permanent; the deciduous canines in horse are now mere spicules and do not erupt, and the horse, sheep and ox have only 3 deciduous molars (Table 3).

Table 3 Tooth numbering formulae

Deciduous dentition				
Maxilla	$_{i}1,2,3$	$_{c}^{max}$	$_{dm}1,2,3,4$	
	Incisors	Canines	Molars	
Mandible	$^{i}1,2,3$	^{c} mand	$^{dm}1,2,3,4$	
Permanent dentition				
Maxilla	$_{I}1,2,3$	$_{C}^{max}$	$_{PM}1,2,3,4$	$_{M}1,2,3$
	Incisors	Canines	Premolars	Molars
Mandible	$^{I}1,2,3$	^{C} mand	$^{PM}1,2,3,4$	$^{M}1,2,3$

The dimensions of teeth quoted below are as follows: length = mesial/distal distance, not occlusal/radical; width = lingual/buccal distance.

In general, the system outlined by Angela von den Driesch, has been followed here.

NOMENCLATURE

The International Council of Archaeozoologists has set up working parties to examine problems of concern to archaeozoologists and to recommend solutions in order to arrive at a set of standards for the profession. One of these working parties will examine the question of standardised nomenclature for domestic animals. Until this is done, naming can only continue to be arbitrary and confusing.

For example, the domestic ox well illustrates this problem. The modern European domestic ox is referred to as *Bos taurus*: its remote ancestors were most probably *Bos taurus primigenius*, the aurochs and possibly other sub-species of *Bos taurus*. The early domestic ox, the Celtic shorthorn, is known variously as *Bos brachyceros, Bos longifrons, Bos taurus brachyceros* and *Bos taurus longifrons*. Because of this lack of standardisation, all domestic animals will be referred to by their English names in this report.

GENERAL COMMENTS

Faunal material examined was much less than the total material found on site, the excavators selecting only such bone and tooth material as was considered potentially identifiable and only a representative sample of the shells. The bone collection amassed during the excavation was recovered by hand: no sieving was carried out. Splinters of bone, and rabbit bones, were discarded on site. The sheer volume of shell refuse was very great. The only exception was the fish refuse; the small quantity examined was all that was found. The total bone counts of selected species are shown in Ill 83.

Iron oxide staining was noted on many bones. Calcined bones were, by contrast, very few. Approximately a dozen bones exhibited signs of charring: these were from oxen and pigs.

Disease

From the entire time span of occupation only four items showed any trace of bone disease. One ox tibia exhibited osteoarthritis, and three cattle maxilla presented traces of peridontal disease. None of the other domestic animals, nor the deer, showed any sign of disease, either of bones or teeth. One pig phalanx 3, digit III or IV, showed considerable lateral exostosis, but, with the joint surfaces themselves unaffected, this was thought to be more probably due to injury than disease. Four cases of dental malocclusion, one in sheep, three in oxen, were noted.

Evidence of butchery and other practices

One red deer antler, attributed to Period Three, and found in the Settlement, bore parallel knife marks for 5 mm along its surface. Knife marks were also observed on an ox scapula from Period Two, found in the broch and on a pelvic fragment from a Period Three context in the Settlement. Contrastingly, possible Carnivore tooth marks were observed on a sheep pelvic fragment from Period ?2 in the broch and on an ox metatarsal from Enclosure I in a Period Three context.

PARTICULAR ANALYSIS OF ANIMAL GROUPS OR INDIVIDUAL SPECIES

MOLLUSCA

The samples submitted were bulk samples from selected contexts: the numerical analyses of this material may be considered of dubious significance: 39 per cent of limpets, for example, come from lots marked 'unstratified'. Of the 9 species represented at Crosskirk, only the Common Limpet and Common Periwinkle, easily collected from the intertidal zone, are found in significant numbers, reflecting the character of the coast near the broch—cliffs, rocks and pebble beaches. There were either no mussel beds or none accessible and there were none of the mud- or sand-dwelling molluscs. Limpets graze on acorn barnacles and vegetation found on rocks whereas periwinkles feed on seaweed. Seaweed will be mentioned again in connection with livestock diet.

Table 4 Total molluscs identified in all samples at Crosskirk

Patella vulgata Common limpet	444
Littorina littorea Common periwinkle	205
Thais lapillus Dog winkle	11
Mytilus edulis Common mussel	6
Helcion pellucidum Peacock limpet	1
Arctica islandica	1
?Littorina neritoides Dwarf winkle	1
Helix nemoralis	1
Buccinum undatum Common whelk	1
TOTAL	671

Of the mollusc samples taken from the site, 50 per cent of limpets and winkles were from contexts attributable to Period Two or the Period Two/Three transition, whereas Period Three, which produced most animal remains, accounted for only 9 per cent of limpets and winkles. Period Three or Four contained 17 per cent winkles. No other period has numbers of any consequence. These proportions may have no significance in terms of the use of molluscs made in the diet at different times, since they represent such a small fraction of the total number of molluscs discovered (Table 4).

FISH

Apart from the wrasse bone (*Labrus* sp) from Period ?2, Broch, and the 14 pollack (*Pollachius pollachius*) bones from the Settlement in Period Three or Four contexts, most fish bones were small or even tiny vertebrae and are unidentified. The average diameter of vertebrae was 9.3 mm, but this mean figure was distorted by a really large one of 49 mm and a quite large one of 30 mm. The total of 63 fish bones/fragments recovered, most of them very small, permits several possible explanations. For example, it may be suggested that the broch people, although living on a coastal site, made very little use of fish, or that they took particular care to remove and/or burn fish debris. It is conceivable that there were many cats (although there is no evidence for these) to eat the refuse. A final possibility is that the bones were used on cultivated land, since they break down more quickly than mammal bone which is much more dense. The absence of salmon bones is remarkable since there is, at the present time, a fishing river 0.5 km away and the bay immediately to the E of the site is fished commercially for salmon.

BIRDS

It is not surprising that over 50 per cent of all bird bones found belong to seabirds, some 82 out of the total of 124 determined bones (Table 5). Of the remainder, only one example, the blackbird, is a woodland species. The black grouse, usually found in open, hilly moorland country near trees, cannot be described as a typical woodland bird. The absence of such birds from the remains at Crosskirk supports the botanists' evidence that this area of N Scotland was

Table 5: Bird bones recovered from Crosskirk

Sula bassana Gannet	23
Corvidae (?)	16
Alca impennis Great Auk	12 (+?1)
Phalocrocorax aristotelis Shag	8 (+?22)
Puffinus puffinus Manx shearwater	7
P. carbo Cormorant	6
Alca torda Razorbill	5
Lyrus tetrix Black grouse	5
Alca torda or *Uria aalge* Razorbill or Guillemot	4
Larus ?argentatus ?Herring gull	5
L. argentatus Herring gull	3
? Numenius phaeopus Whimbrel	3
Fulmaris glacialis Fulmar	2
P. aristotelis or *carbo* Shag or cormorant	2
Uria aalge Guillemot	2
Sturnus vulgaris Common starling	2
Vanellus vanellus Lapwing	2
Domestic fowl	2
Anas ?platyrhynchos Duck ?mallard	1
Anser sp. Goose ?domestic	1
Anser ?anser Goose ?greylag	1
?Buteo buteo Common buzzard	1
Cygnus sp. Swan	1
G. gallinago Snipe	1
?Gallinago gallinago Snipe	1
Gavia immer Great northern diver	1
Lagopus lagopus Red or willow grouse	1
Numenius arquata Curlew	1
Turdus merula Blackbird	1
Lark or thrush	1

already far from thickly wooded by the Iron Age. The presence of domestic fowl is interesting. These are considered to have been introduced into Britain in pre-Roman times by Belgic tribes (Bate, 1934), although the available evidence in the 1930s was very slight. The Crosskirk fowl bone belongs to Period Four, and was found in the settlement passage. Period Four appears to post-date the main periods of Roman occupation in Scotland and since the domestic fowl is found often on Roman sites we cannot tell whether the Crosskirk fowl were the result of pre- or post-Roman radiation.

WHALE

All 27 bones recovered belong to very large whale species, and represent only a small proportion of the skeleton. The animals caught or found stranded must have been dealt with to a great extent at a location other than Crosskirk itself. The plural "animals" is used deliberately, for the bones are found throughout the site and in all periods.

Dr Arthur Clarke (in MacGregor, 1974) in considering the evidence from the Broch of Burrian, Orkney, puts forward the interesting theory that active whaling may well have been carried out at this time. The evidence he offers for this is the degree of standardisation of tools made from the bones of whales at Burrian, such a stage being difficult to reach without a supply of raw materials more reliable than the occasional stranding could afford. The small finds catalogue however shows that whale bone was not used for the manufacture of artifacts at Crosskirk.

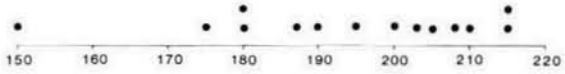
RED DEER

Large quantities of antler fragments were present and some of these indicate antler size equal to Pleistocene Red deer antlers, that is, very large indeed. However, dogmatic assertions of animal size based on antler measurements cannot be made as exact ratios do not exist. Antlers vary greatly, in size and points number, under the influence of many factors including age, individual variation, feeding and state of health. Estimates of animal size have to be based on bone dimensions and here the amount of material from Crosskirk, although not great, indicates Red deer on average larger than a modern specimen from Rhum but probably not as large as Pleistocene examples. Some indications of the size of the Crosskirk deer are presented in Ill 84 and Table 6.

Deer are by preference forest or woodland animals. The botanists' report leaves no doubt that the North of Scotland, by the Iron Age, was very far from heavily wooded. When deer adapt to poorer moorland feeding their size decreases, hence the small Red deer in Scotland today. Perhaps in the Crosskirk material we see an intermediate stage in this process of adaptation. What influenced the deer to leave the extensive forests covering much of Scotland and come to the sparsely wooded and poorer habitat of the north? Alternatively, had they arrived when the area was well wooded and merely lingered on in a deteriorating environment?

Table 6 Red deer phalanx 2 from Crosskirk Periods Three and Four compared with a 20th century specimen (mm)

	L	PW	DW	SD
	66.0	23.0	21.0	18.0
	47.0	25.0	20.5	15.5
	47.0	23.0	20.5	14.5
	42.0	21.0	17.0	14.5
modern:	37.0	17.0	15.0	13.0



Ill. 84 : Burr circumferences of stratified red deer antler from Crosskirk (in mm)

CARNIVORA

Very few carnivore bones were found. With only 2 items of Grey Seal, it is clear that seal were of no significance in the Crosskirk inhabitants' diet, in contrast to the situation at Jarlshof, Shetland, where seal bones were very plentiful (Platt, 1956). A few bones of ? wild cat were recovered, and bear comparison with modern examples (Table 7).

If the majority (3 out of 5) of Canidae bones from Crosskirk represent domestic dogs, they imply, taken as a whole, a dog rather smaller than a modern adult male Labrador, which stands 22 ins (56 cm) at the withers. There is reasonable agreement in size between the Crosskirk dogs and the complete skeleton found at Jarlshof, Shetland (Platt, 1934).

Table 7 Measurements (in mm) of ?Wild cat *(Felis sylvestris)* bones from Crosskirk with comparanda

		Unstratified	Modern adult domestic	Wild cat, Royal Scottish Museum
R. humerus	L	102.0	89.0	96.0
	PW	16.0 (1)	15.0	16.0
	DW	20.0	16.5	22.0
	SD	7.0	7.0	7.0
		West platform (Period Four)	Modern adult, domestic	Wild Cat
R. femur	L	108.0 (2)	95.0	104.0
	DW	19.0	17.5	21.5
	SD	8.0	8.0	8.0
L. mandible	L	60.0	58.0	
Cheek tooth row		19.0	18.0	
Axis total	L	28.0	25.0	
centrum	L	23.0	22.0	
crest	L	25.0	22.5	

Notes: (1) damaged, not maximum
(2) damaged, estimate

HORSE

The quantity of horse bones (41) and teeth is small. The bones are from various parts of the skeleton: femur, tibia, vertebrae, tarsus and phalanges. Specimens of varying ages were represented, from 'young' upwards. Dental evidence indicated the presence of old or very old horse.

Horses of the pre-Roman Iron Age in Britain are said (Herre, 1969) to have reached only 120-125 cm withers height (12 hands). A very rough estimate from Crosskirk measurements would seem to give withers height of around this figure. The small quantity of equid bones among what is otherwise food refuse suggests that horse was not used primarily for food, and that most probably a small herd was bred and kept for traction and transport. Measurements of horse bones and teeth are given in Tables 8 and 9.

Table 8 Measurements (in mm) of selected horse bones from Crosskirk

	Max W		Dorso-ventral L		Period
Astragalus	60.0		58.0		?2
Astragalus	52.0		53.0		3
	Collum W		L (less tuber)		
Os calcis	37.0		86.0		3
	L	PW	DW	SD	
Phalanx 1	86.0	58.0	50.0	34.0	?2
Phalanx 1	—	44.0	—	—	3
Phalanx 1	—	43.0	—	28.0	3
Phalanx 1	70.0	47.0	40.0	31.0	modern comparison (12 hands)

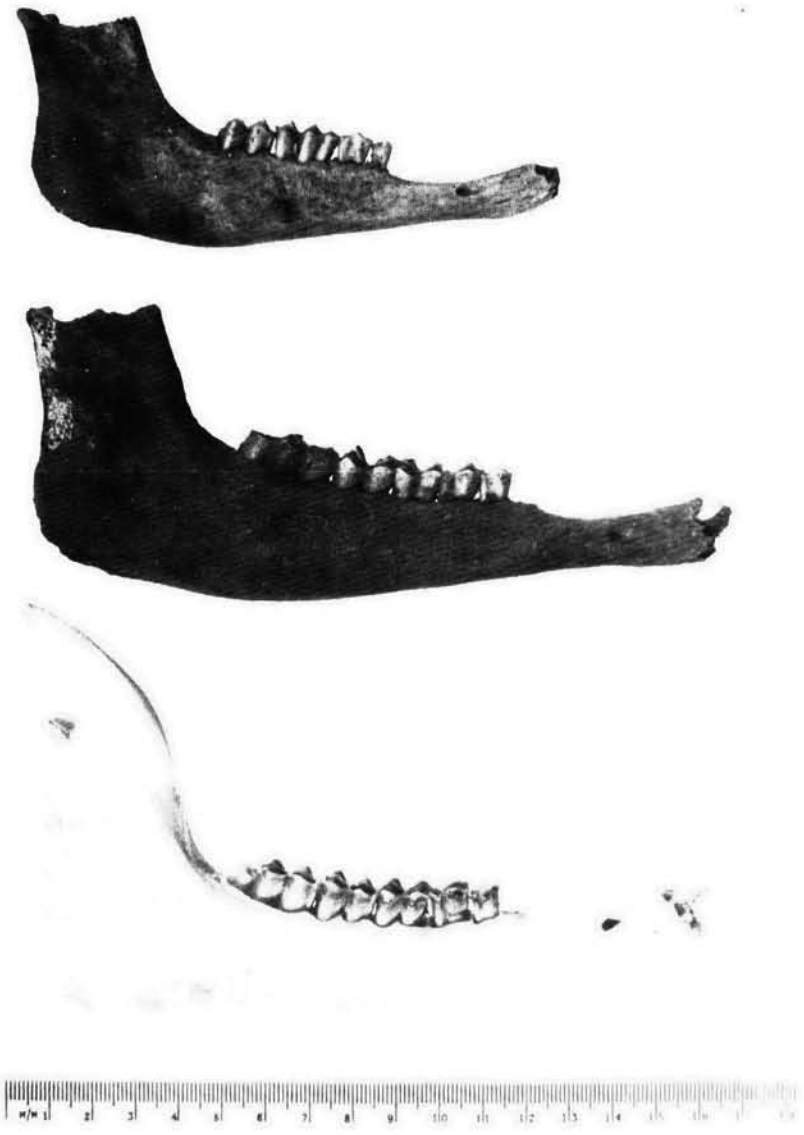
	DW	*Period*
Tibia	60.5	?2
Tibia	58.0	3
Tibia	65.0	modern comparison (12 hands)
Tibia	61.0	Jarlshof LBA/EIA
Tbiia	65.5	Shetland pony, Royal Scottish Museum

Table 9 Measurements (in mm) of horse teeth from Crosskirk with comparanda from a modern pony of circa 12 hands

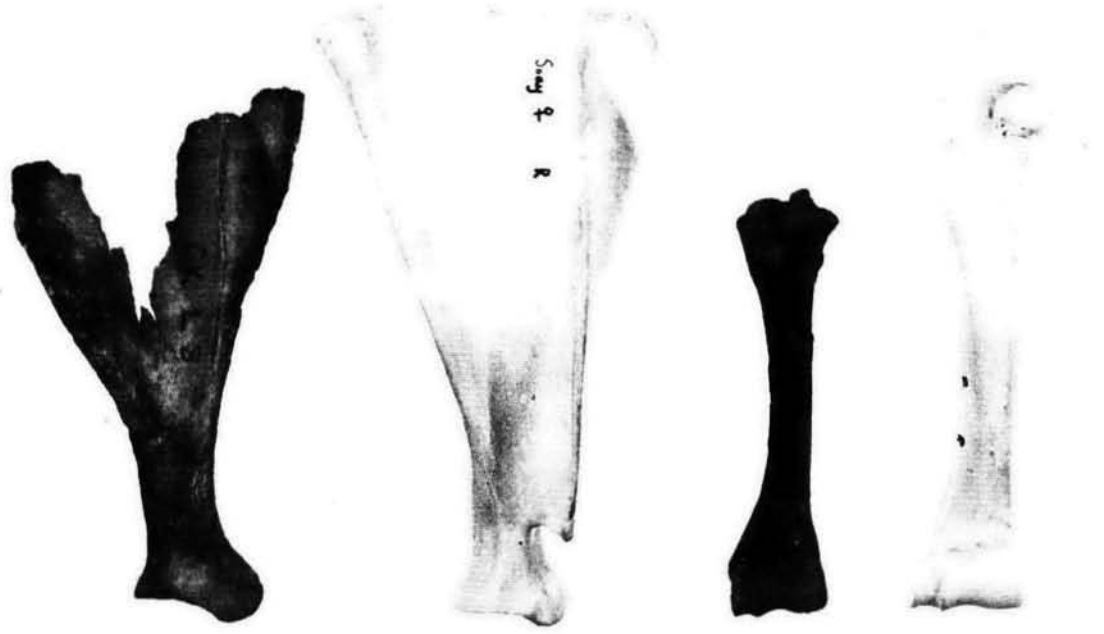
Period	Tooth	L	W	L	W
2/3?	dm	26.0	24.0	—	—
3	PM_3	25.0	14.5	28.0	16.5
3	M_2	25.0	10.0	30.0	15.0
3	M_3	29.0	16.0		
3	M_3	35.0	13.0		
4	$?M_2$	27.0	15.0	25.0	15.0

SHEEP

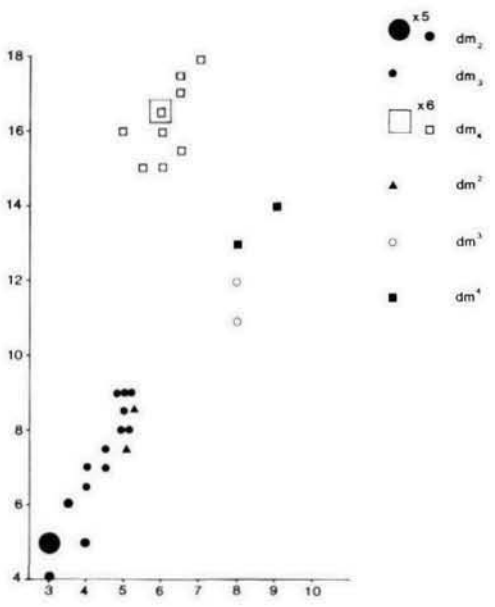
The varied contributions of the original wild ancestors to the characteristics of the W European early breeds are impossible to sort out precisely. Nonetheless, there is at least agreement that these wild ancestors were the Mouflon (*Ovis musimon* Pall. or *Ovis ammon musimon* Schreiber, 1782), with heavy-horned males, hornless females, a short tail with 12 caudal vertebrae and, on the other hand, the sheep of the Urial group (*Ovis orientalis* various subspp and *Ovis orientalis vignei*) with heavy-horned males and straight-horned females, longer metapodials and longer tails. The Crosskirk horn-cores show the Urial type, represented in Scotland by the Soay. Further evidence in support of the Soay type at Crosskirk are the



ILL 85 : *Ovis aries*/domestic sheep R mandibles: Period Two-Four, broch stair, juvenile; Period Three, settlement, adult; modern Soay female, aged 7 years

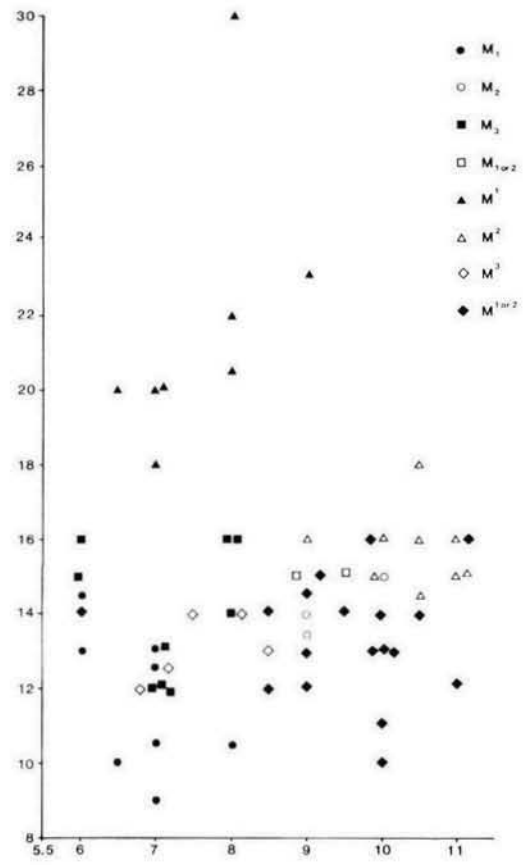


ILL 86 : *Ovis aries*/domestic sheep R scapulae and R humeri: Period Three, settlement; modern Soay female, aged 7 years; Period Three, broch; modern Soay female, aged 7 years

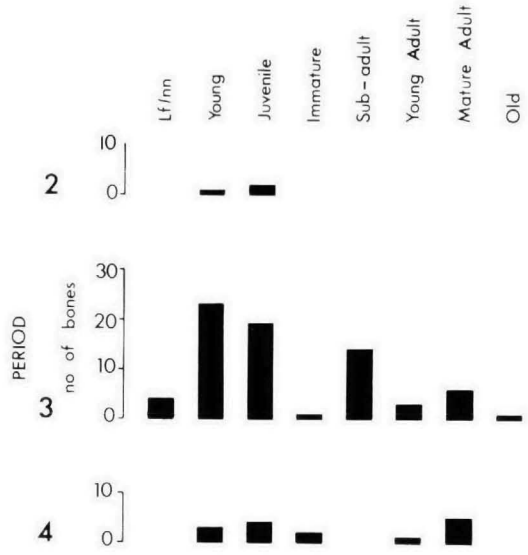


ILL 87 : Measurements (in mm) of deciduous sheep teeth

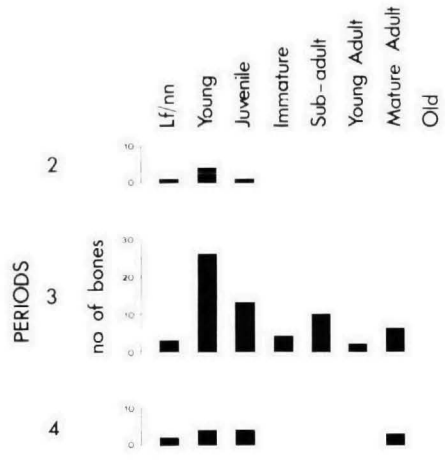
general size of the sheep, (larger than the Shetland) and the scapula proportions demonstrated by the ratio of the collum width to the distance from the edge of the glenoid cavity to the proximal edge of the spine, in which the latter is always the greater (Noddle, *pers comm*, 1975). Three examples from Crosskirk produced ratios between 1 : 1.11 and 1 : 1.22, whereas a modern Soay had a ratio of 1 : 1.18. It should be noted that, since domestic sheep are blends of the two ancestral types, characteristics of one group, for example,



ILL 88 : Sheep molar sizes (in mm)



ILL 89 : Sheep bones from Crosskirk: ageing



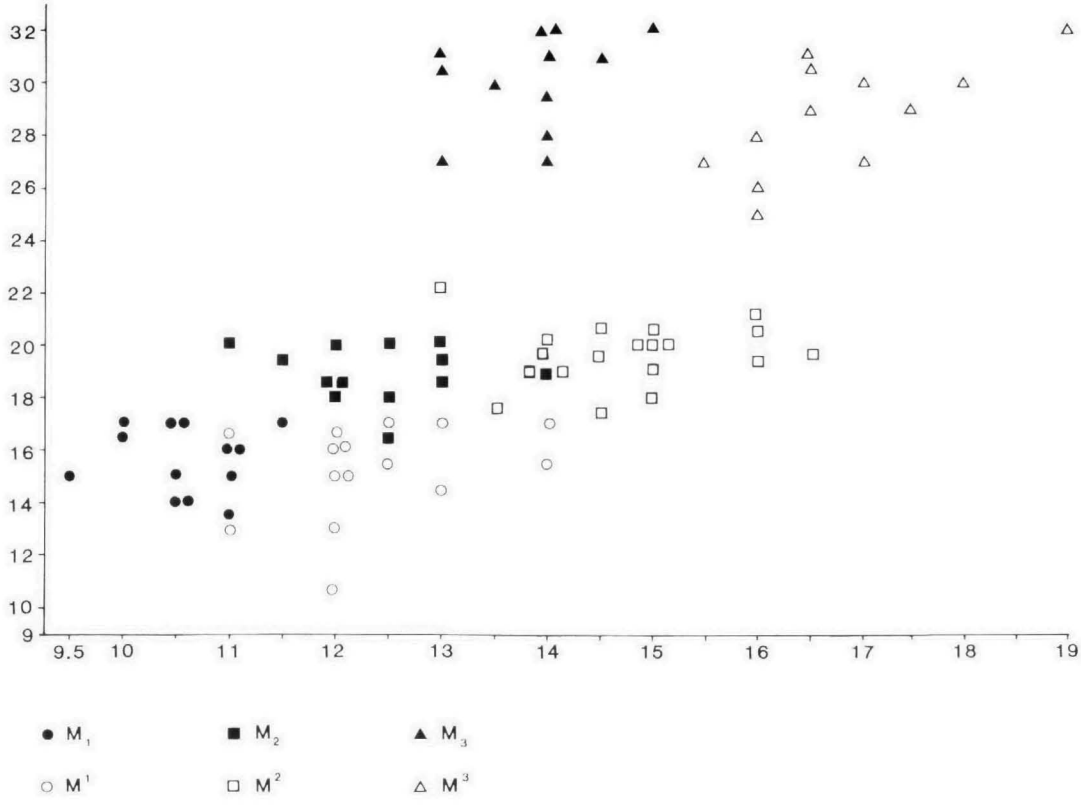
ILL 90 : Pig bones from Crosskirk: ageing

hornlessness in female Soay, may appear in a breed which owes most of its features to the other type (Ewart, 1913-4).

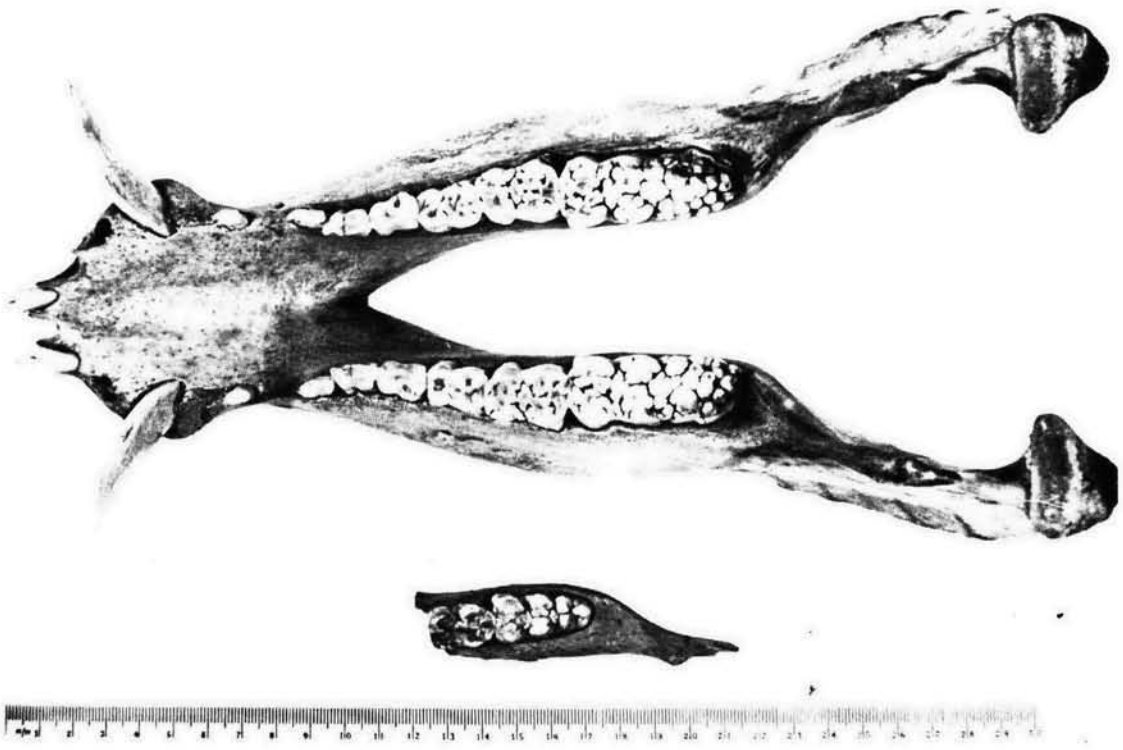
Although most of the Crosskirk bones agree with the dimensions of the modern Soay, attention is drawn to the metacarpal measurements, where the few complete (adult) bones are the same width as modern ones but noticeably shorter; the same applies to the metatarsals with one exception, where all measurements correspond. Comparisons with Soay bones are illustrated in Ills 85 and 86. The withers height of Crosskirk sheep is estimated at circa 23 ins (58.5 cm), while 24 ins (61 cm) is a fair average height for modern adult Soay.

A long and exceptionally slender tibia illustrates a tendency found in castrates (Noddle, pers comm, 1975). In one femur, the nutrient foramen is located posteriorly, whereas the normal location is anterior.

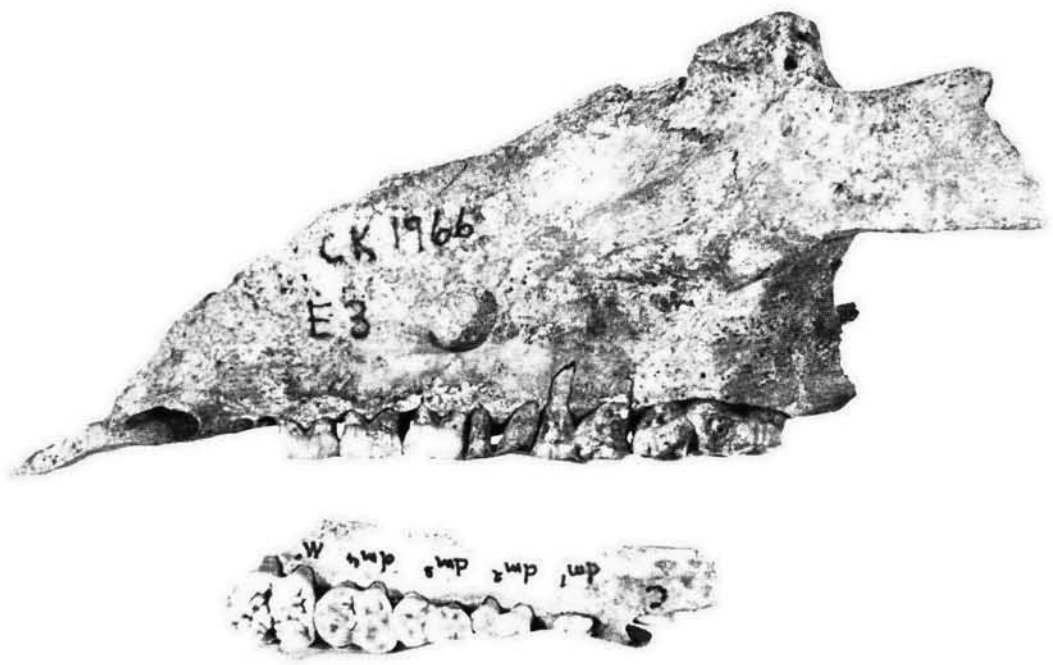
Comparison of the Crosskirk sheep with such measurements as are given in earlier reports on Iron Age sites in N



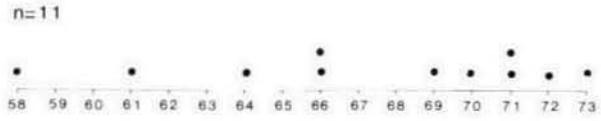
ILL 91 : Size range (in mm) of permanent molars of pig



ILL. 92 : A comparison between a complete adult mandible of *Sus scrofa scrofa*/European wild boar from the Hunterian Museum (above) and a fragment of left mandible of *Sus scrofa domesticus* from Period Three or Four at Crosskirk



ILL. 93 : *Sus scrofa domesticus*/domestic pig: comparison between L. maxilla, showing deciduous dentition and 1st adult molar, from the settlement (bottom) and worn adult dentition in a maxilla from a mature female recovered from a Period Two or Three context in the broch (top)



Ill. 94 : Withers height of Crosskirk pigs, to the nearest cm

Scotland, further confirms that they are of Soay stature and type (except for the reservation regarding metapodials). The main distinction made by Miss Platt in her various reports was between "the typically small Shetland" and a much larger animal which she matched in some respects with Soay Sheep. Correspondence between horn cores and general limb size was good, except at Jarlshof in the Late Bronze/Early Iron Age where the metapodials were even longer and proportionately more slender. Where comparison is possible, Crosskirk sheep sizes are similar to those of Dun Mor Vaul (Noddle, 1974). Measurements of sheep teeth are summarized in Ills 87 and 88.

The Age Group diagram shows (Ill 89) a very low number of late foetus/neonate and of old individuals. Since the difference in age concentrations between broch and settlement in the same Periods can be assumed to have no significance, we may consider them together. The greatest concentrations are in groups young and juvenile followed by sub-adult and mature adult, suggesting a preference for young meat and a willingness to eat mature meat culled from the breeding stock when this was appropriate. There is nothing to suggest an imported meat supply.

PIG

Pig bones were only slightly more numerous than those of sheep, a total of 316 bones having been recovered as opposed to 282 of sheep. 61 per cent of pig bones and teeth belonged to young or juvenile individuals (Ill 90).

The evidence presented below leaves little doubt that the pigs at Crosskirk were domestic and not wild. They were quite large, in a linear sense, for pre- and early historic pig, but with slender bones, and are likely to have been a much more active animal than our ponderous modern breeds.

The ancestors of the domestic pig (Epstein, 1971a) were the various subspecies of *Sus scrofa*, including the European Wild Boar, *Sus scrofa scrofa*, *Sus scrofa vittatus* and *Sus scrofa cristatus*, the latter two originating in SE Asia. Epstein states that size variation in the European pig is very great and depends on habitat; largest from swamps, a middle range from dry forests and the smallest from mountainous regions. Including the extreme limits, rarely found, his weight ranges for modern examples are 75 to 200 kg for males and 35 to 150 kg for females. This means that size alone is not a completely reliable test for wild or domestic, when examining bone or tooth remains.

Cornwall (1974, 102) gives the shape of male C_{mand} cross-section as significant. Domestic pig are said to show *cristatus* type, quite consistently, but Epstein (1971b) quoting Pira (1909) says that in domestic pigs with weak tusks, such as the turbary pig, it is difficult to determine whether the triangular cross-section is of *scrofa* or *cristatus* type. This casts some doubt on the value of this criterion. However, following Cornwall's guidance, the male C_{mand} cross-section was used: at Crosskirk it certainly seems to be of *cristatus* shape. This is offered as an indication of the domesticity of the Crosskirk pigs, not as proof.

The length of M_1 has been suggested as a reliable indicator between wild and domestic pigs, although there is presumably a measure of overlap, (Noddle, pers comm, 1974). Lengths in excess of 40 mm may be taken to indicate wild pig. At Crosskirk, the maximum length recorded was 32 mm, which falls well within the domestic range (Il 91). However, Professor Epstein (pers comm, 1977) has questioned such generalised rules for the determination of the wild or domesticated state in pig. An indication of the dental condition of various specimens from Crosskirk is given in Ills 92 and 93.

Tooth crowding and displacement are phenomena which have been recorded sometimes from wild species of different locations and eras (Clutton-Brock, 1969). They are however on the whole indicative of a semi-domestic or a domestic state. Four examples of this condition, primarily from Period Three contexts, and involving lateral displacement, indentation and crushing of PM_4 or M_1, were noted at Crosskirk.

Age and sex range can give some indication of domestication. The presence of late feotal or neonate pigs as well as individuals of other age groups is of note. Although most bones are from younger pigs, mature females as well as males were represented. This suggests a picture of domestication rather than of the results of hunting.

Teichert (1969) has carried out a thorough survey of bone lengths in calculating withers height of modern improved and unimproved breeds of early prehistoric pigs and of European wild boar. In the course of this he has produced tables (p 285 especially) giving the size gradient from smallest early pigs through an overlap zone to largest wild pig.

Using his figures and considering adult bones only, the results for Crosskirk were plotted (Ill 94). The withers height range at Crosskirk emerges as c 58 to c 73 cm. The withers range given by Teichert for the early adult domestic pig is from 50 cm to 79 cm and the overlap zone with wild pig is 80 cm to 90 cm, indicating that the Crosskirk pigs are all domestic and come within the mid to upper height range for pre- and early historic pig. However, Teichert stresses that the best estimates of withers height come from using many bones from the same individual, which was not possible on the Crosskirk material. If it is necessary to use single bones, the most reliable is the femur; but there were none from adults at Crosskirk. These figures should thus be taken as merely an approximate guide to the height range of the pigs at the site. Some other measurements of Crosskirk pig bones are summarized in Tables 10 and 11.

Table 10 Measurements in mm of Astragalus bones of pig from Crosskirk

Period	L	PW	DW	SD
3	34	18	20	15
3	36	20	22	15
3	40	22	24	18
4	37	—	—	—

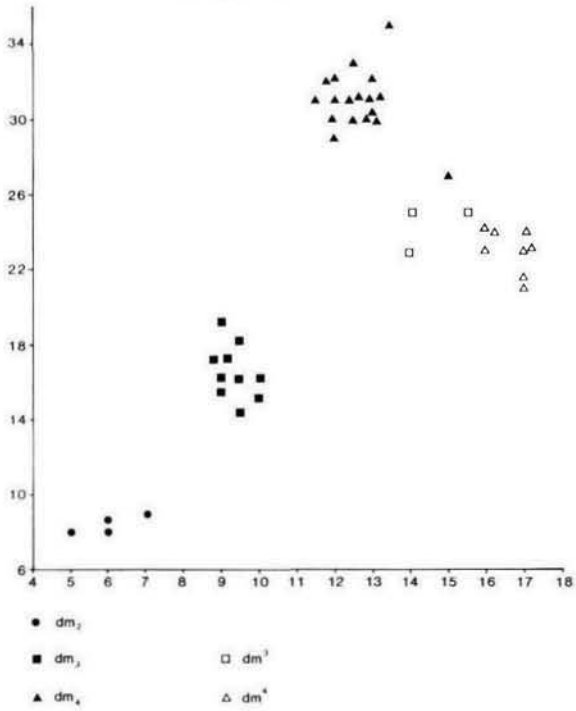
Table 11 Crosskirk: Pig Phalanx 1 (digit 3 or 4) measurements (in mm)

L	PW	DW	SD
34.0	16.0	14.0	12.0
35.0	14.0	12.0	11.0
35.0	14.0	13.0	11.0
35.0	14.5	13.5	11.0

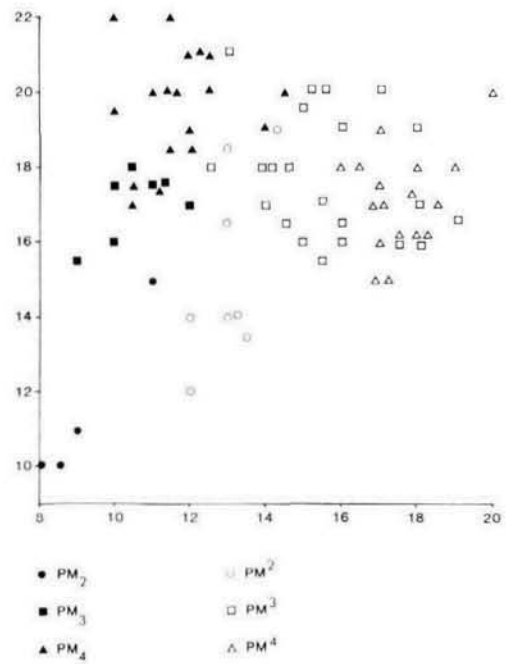
OXEN

The numbers of ox bones far exceed those for the other two main food animals, sheep and pig. Considering that this numerical superiority represents a disproportionately greater quantity of meat, it is clear that beef represented the staple source of protein from domestic livestock. This, taken with the numbers of mature bones, stresses the adequacy of winter feed for stock at Crosskirk.

Since fragile skull and limb bones (rabbit, vole etc) have remained almost intact in the excellent soil conditions of Caithness, the finely broken up state of domestic animal skulls and limbs implies the use of marrow and brains for food. The bones which survived in a complete state at Crosskirk are those not used in this way—tarsus, carpus, phalanges and to a lesser extent metapodials.



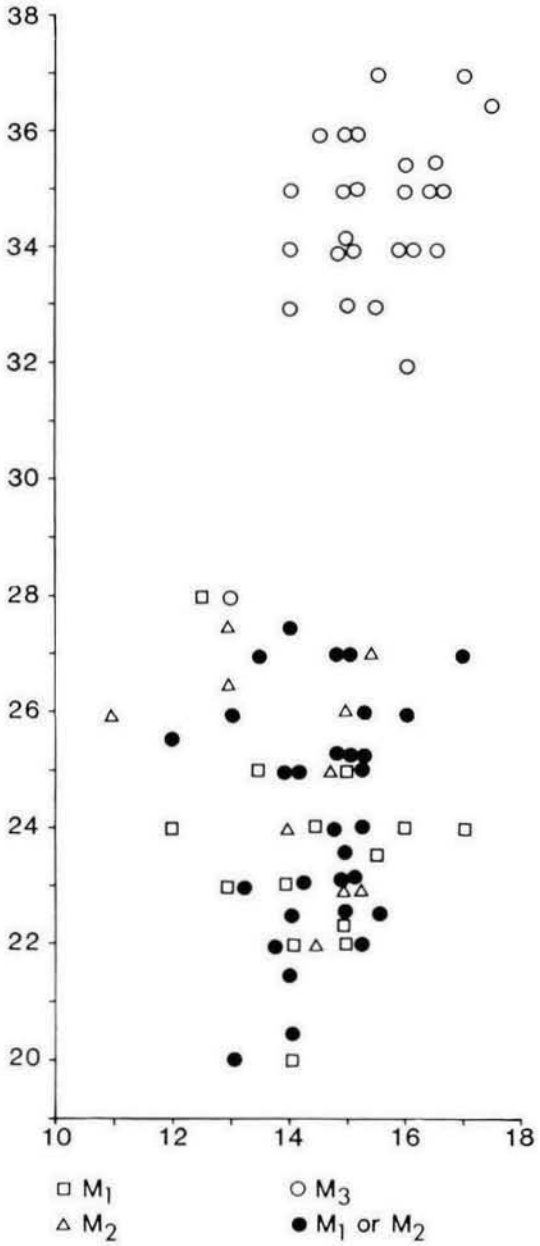
ILL 95 : Measurements (in mm) of deciduous molars of cattle



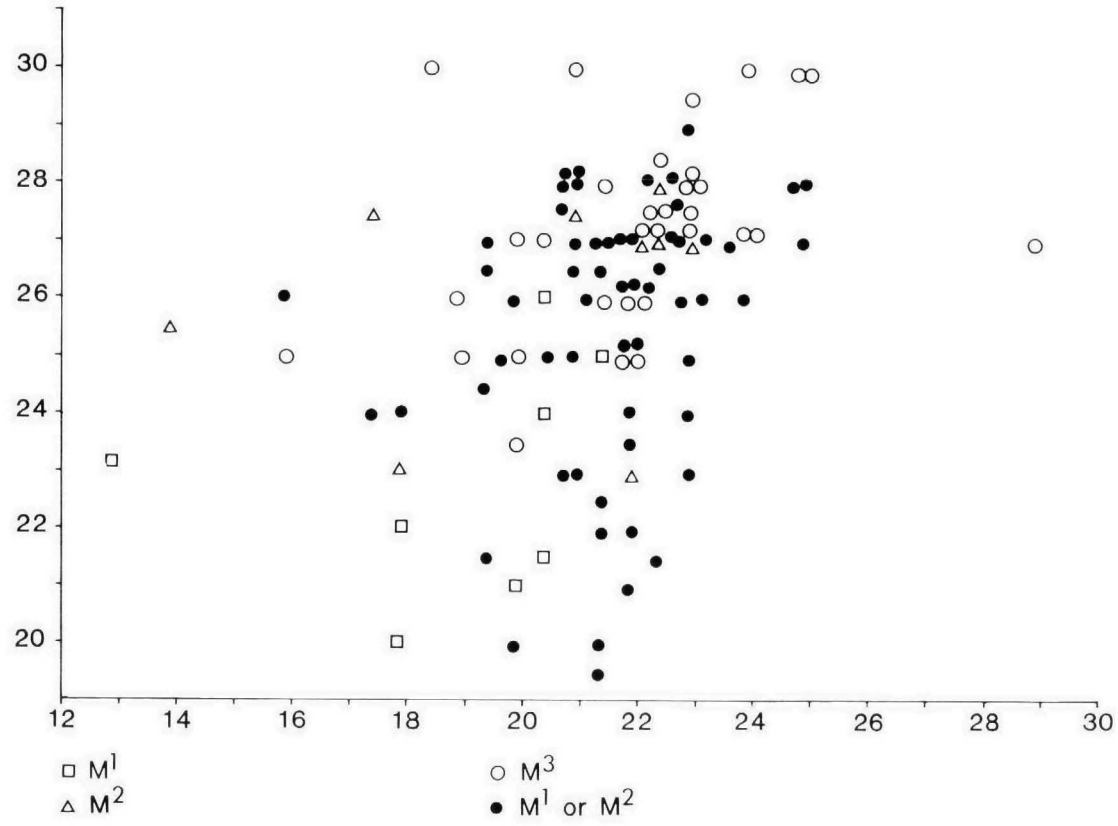
ILL 96 : Measurements (in mm) of cattle pre-molars

The number of cranial bones and vertebrae longitudinally bisected shows that lengthwise halving of a carcass as a first step in the butchering process is an ancient custom. Both adult and immature bones were thus treated: they came from Period Three and later deposits.

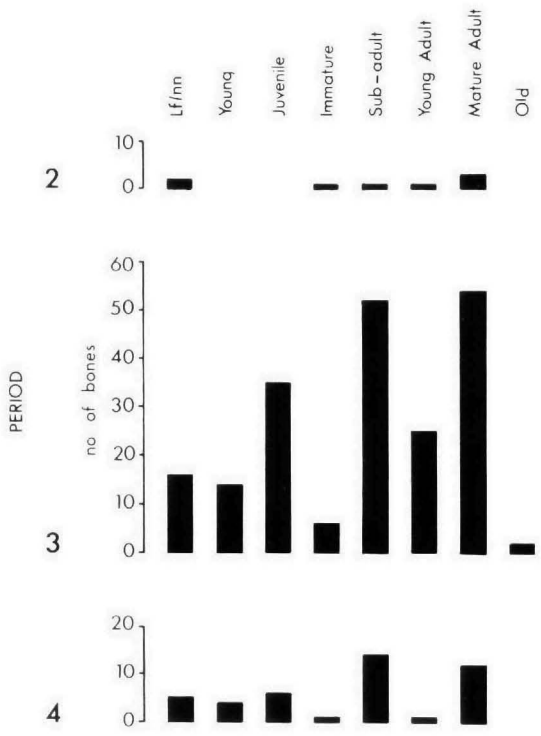
The ox bones, teeth and horn cores are compatible with those of the Celtic Shorthorn, first introduced into Britain in the Bronze Age (Epstein, 1971). Sometimes the Celtic Shorthorn has been found in association with bones of a larger type of domestic ox. However, at Crosskirk there are only 7 extra large bones (equalling in width those of a modern Aberdeen Angus cross steer), suggesting that perhaps they indicate the upper size limit of the Celtic Shorthorn, (probably very large males or mature castrates) rather than another type. Such horn cores as were present in the collection indicated castrates and females. A cranial fragment bearing a non-horn



ILL 97 : Size range (in mm) of cattle molars (mandible)



ILL 98 : Size range (in mm) of cattle molars (maxilla)



ILL 99 : Ox bones from Crosskirk: ageing

Table 12 Crosskirk: Dimensions (in mm) of cattle horn cores

Period	Basal circumference	Inner length	Outer length
?2	117.0	—	—
2	129.0	—	—
?3	120.0	70.0	120.0
3	100.0	40.0	55.0
3	100.0	80.0	110.0
3	110.0	40.0	50.0
3	135.0	88.0	110.0
3	140.0	—	—
3 or 4	135.0	—	—
4	110.0	68.0	105.0
4	115.0	100.0	130.0
4	130.0	—	—

bud indicates the presence of a polled individual (Noddle, pers comm, 1975).

The quantities of material from Crosskirk offer one of the first sizeable sets of measurements on Iron Age cattle from northern Scotland. A selection of the more comprehensively represented material is presented in Tables 12-16 and Ills 95-98.

Table 13 Crosskirk: dimensions (in mm) of cattle Astragali

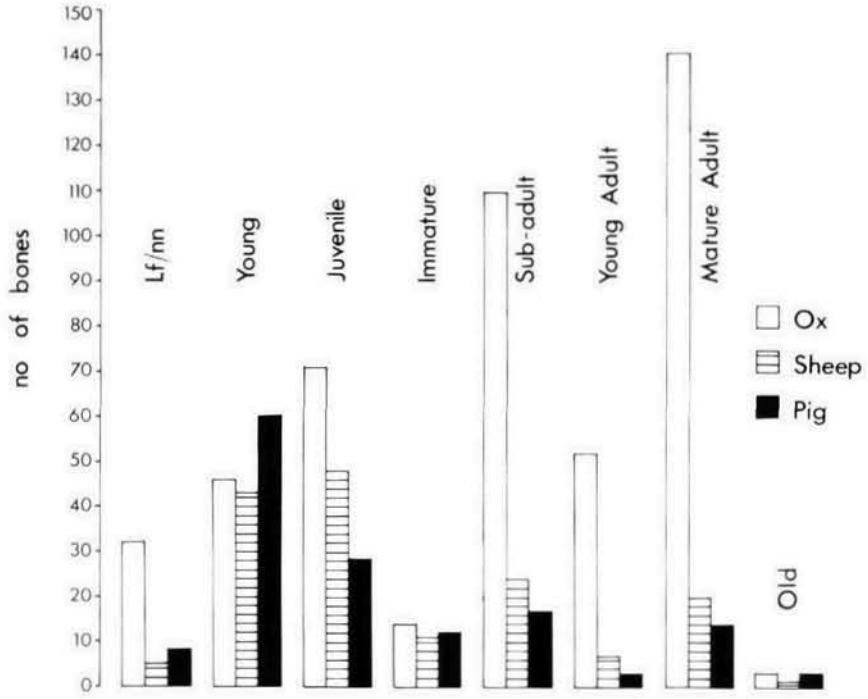
Period	L	PW	DW	SD
?1	60.0	44.0	37.0	30.0
?2	60.0	40.0	—	—
2	60.0	41.0	39.0	33.0
2 or 3	57.0	41.0	42.0	35.0
?3	60.0	47.0	43.0	36.0
3	56.0	40.0	38.0	30.0
3	56.0	42.0	37.5	35.0
3	57.0	38.0	37.0	32.0
3	57.0	41.0	39.0	36.0
3	57.0	42.0	38.0	32.0
3	58.0	39.0	37.0	30.0
3	58.0	43.0	37.0	30.0
3	59.0	39.0	35.0	28.0
3	59.0	45.0	42.0	38.0
3	60.0	41.0	37.0	35.0
3	61.0	42.0	38.0	30.0
3	65.0	47.0	40.0	34.0
3 or 4	59.0	43.0	39.0	—
4	54.0	39.0	39.0	30.0
4	57.5	41.0	39.0	—
4	58.0	41.0	39.0	34.0
4	58.0	42.0	39.0	34.0
4	59.0	41.0	37.0	32.5
4	62.0	42.0	39.0	33.0
4 or 5	58.0	38.0	35.0	30.0
4 or 5	62.0	45.0	40.0	28.0

Table 14 Crosskirk: Ox scapulae measurements (in mm) of collum width (A-A) and distance from edge of glenoid cavity to proximal edge of spine (B-B)

Period	A-A	B-B
?2	46.0	—
2	50.0	—
2	47.0	45.0
2 or 3	—	55.0
?3	52.0	50.0
?3	49.0	43.0
?3	46.0	43.0
?3	37.0	—
?3	41.0	40.5
?3	50.5	47.0
3 or 4	48.0	40.0
4	48.0	47.0
5	43.0	44.0

Table 15 Crosskirk: measurements (in mm) of Ox Phalanx 1

Period	L	PW	DW	SD
?1	—	24.0	—	—
?2	—	26.0	—	—
?2	50.0	26.0	26.0	19.0
?2	56.0	26.0	26.0	23.0
2	56.0	23.0	—	20.0
2	57.0	25.0	25.0	20.0
?3	49.0	—	25.0	22.0
?3	60.0	33.0	30.0	25.0
3	—	—	24.0	22.0
3	—	—	26.0	24.0
3	—	25.0	25.0	21.0
3	—	28.0	—	—
3	51.0	24.0	23.0	20.0
3	51.0	26.0	25.0	21.0
3	52.0	27.0	25.0	23.0
3	53.0	—	23.0	20.0
3	53.0	27.0	26.0	21.0
3	54.0	27.0	25.5	22.0
3	55.0	27.0	24.0	23.0
3	56.0	25.0	23.0	20.5
3	56.0	25.0	24.0	20.0
3	56.0	25.0	24.0	20.0
3	56.0	26.0	25.0	21.5
3	56.0	28.0	24.0	22.0
3	56.0	29.5	29.0	24.5
3	56.5	27.5	26.0	25.0
3	57.0	27.0	26.0	20.5
3	57.0	28.0	29.0	24.0
3	57.5	24.0	25.5	22.0
3	58.0	25.0	24.0	21.0
3	58.0	27.0	24.0	21.0
3	58.0	28.0	28.0	22.0
3	60.0	26.5	26.0	22.0
3	60.0	33.0	29.0	26.5
3	61.0	28.0	26.5	24.0
3	61.0	29.0	27.0	25.0
3	62.0	29.0	32.0	25.5
3	64.0	30.0	29.0	27.0
3	65.0	31.5	28.0	24.0
3	65.0	32.0	29.0	26.5
3 or 4	—	18.0	20.0	16.0
3 or 4	53.0	27.0	25.0	23.0
3 or 4	53.0	28.0	26.0	25.0
3 or 4	54.0	26.0	25.0	22.0
3 or 4	59.0	28.0	28.0	24.0
?4	63.0	35.0	32.0	28.0
?4	64.0	32.0	30.0	25.0
4	—	21.0	25.0	20.0
4	52.0	—	25.0	—
4	53.5	28.0	25.0	25.0
4	55.0	26.0	25.0	20.5
4	55.0	26.0	25.0	22.0
4	59.0	26.0	25.0	21.0
4	60.0	27.0	27.0	23.0
4	63.0	31.0	28.0	21.0
4 or 5	48.0	—	23.0	21.5
4 or 5	55.0	24.0	25.5	20.5
4 or 5	59.0	—	28.0	21.0
4 or 5	60.0	27.0	25.0	22.0
4 or 5	60.0	29.0	27.0	25.5



ILL 100 : Ageing of all pre-recent bones of ox, sheep and pig

Table 16 Crosskirk: measurements (in mm) of Ox Phalanx 2

Period	L	PW	DW	SD
?1	37.0	28.0	22.0	20.0
?2	34.0	22.0	18.0	16.0
?2	35.0	24.0	21.0	20.0
?2	37.0	28.0	—	—
2	41.0	27.0	22.0	20.0
?3	35.0	27.0	23.0	20.0
?3	37.0	29.0	24.0	21.0
?3	38.0	23.0	20.0	18.5
3	—	—	25.0	22.0
3	30.0	25.0	20.0	17.0
3	34.0	26.0	23.0	20.5
3	36.0	26.0	20.0	18.0
3	36.0	28.0	21.5	21.0
3	36.5	26.0	21.0	19.0
3	37.0	25.0	22.0	18.0
3	37.0	28.0	22.0	19.0
3	38.0	28.0	23.0	20.0
3	39.0	28.0	24.0	20.5
3	40.0	27.0	24.0	22.0
3	42.0	30.0	25.0	23.0
3	42.0	31.0	25.0	25.0
3	43.0	31.0	23.0	22.0
3 or 4	34.0	24.0	—	18.0
3 or 4	35.5	27.0	—	19.0
3 or 4	37.0	29.0	25.0	21.5
3 or 4	38.0	27.0	20.0	20.0
3 or 4	38.0	28.0	27.0	22.0
4	33.0	28.0	23.0	22.0
4	36.0	—	20.0	20.0
4	36.0	26.0	21.0	20.0
4	39.0	24.0	20.5	19.0
4 or 5	37.0	25.0	20.5	20.0

One mandible from Period Two, Broch, stair showed an unusually long slanting mental foramen, that is, much less nearly circular than the normal. Four mandibles, one from the same batch, and three from Period Three contexts in the broch, were entirely lacking a socket for PM_1. In ox, PM_1 rarely occurs, but PM_2 is usually present. These, it is stressed, were not cases of tooth loss and subsequent socket filling-in but of non-appearance of the tooth. This is unusual and may be related to congenital factors, for example as a result of in-breeding.

Several mandibles, all from Period Three contexts in the external settlement, exhibited a strikingly broad (lateral/mesial distance) sub-orbital part of the malar bone. This measurement exceeded that of a modern Shorthorn in the Hunterian Museum Zoology section. An explanation offered by W D I Rolfe was that these fragments may be from mature horned males. However, as a potential indicator of sexual dimorphism, this trait could only be established if material were available having malar bone and horn core present in the same fragment from many individuals.

Whereas for sheep and pig the principal ages indicated by the surviving anatomical evidence were young and juvenile, followed by sub-adult and mature adult, for ox the largest categories are mature adult followed closely by sub-adult and then juvenile and young adult (Ill 99). Although there were very few old individuals amongst the cattle, the general age pattern is surely further evidence in favour of regularly reliable sources of winter feed, whether in the form of grown and stored fodder or of all-year grazing, or of gathered seaweed or indeed, any combination of these three food sources.

GENERAL REMARKS ON THE CROSSKIRK LIVESTOCK

Consideration of the differing food needs of the three animals, pig, sheep and ox, may cast light on the probable food supply at Crosskirk (Ill 100). Unless there is quite dense deciduous woodland available, the pig, being neither a grazing animal nor able to feed on seaweed, has to be fed almost entirely by the farmer. We can quite confidently assert that this would have been so at Crosskirk. Sheep on the other hand, are grazers and can use poorer natural feed than cattle, especially if they are either hill sheep or not highly bred. If, in addition to modest supplies of grass and good supplies of stored fodder, there was also available seaweed, on which both sheep and cattle browse very willingly, then the capacity to maintain healthy and quite large breeding stocks of both would have been assured. Seaweed is found in greater quantities in winter than in summer, and thus offers the possibility of an all-year grass/seaweed balance. If the foreshore at Crosskirk was not accessible to livestock, and this is very doubtful, the seaweed could have been gathered for them.

The differing age proportions of pig, sheep and ox may also reflect their various breeding characteristics (Ill 100). Multiple births are normal in pigs, their gestation time is the shortest and when feeding is very good this may allow the birth of two litters per annum. Pigs reach breeding age sooner than cattle. Therefore it is not necessary to keep a large breeding herd for a good pork supply.

Gestation time is longer in sheep and allows once yearly reproduction only. Modern hill sheep normally have one lamb per ewe, and twins usually survive only with help in the form of extra feed for the ewe. We might have assumed this pattern to have been the case with primitive breeds; however, observation of the North Ronaldsay sheep living "wild" on Linga Holm (Alderson, 1977) shows that twins are much more common among them, giving an average litter size over 3 years greater than 1.5. These sheep are an old and unimproved breed and feed primarily on seaweed. If this larger litter size prevailed at Crosskirk, then the breeding stock needed for a good lamb supply may have been smaller than one would expect, although of course larger than the pig stock. With sheep, however, there is the added asset of wool.

Cattle have the longest gestation time, and produce no more than one offspring per birth per annum. These factors, combined with a much slower growth rate, mean that they need to be kept in much larger numbers as breeding adults to produce satisfactory supplies of beef. Thus the mature adult category at Crosskirk may well represent culling from the breeding herd, of individuals past their breeding usefulness, but still acceptable as beef.

THE BOTANY OF THE CROSSKIRK BROCH SITE C A DICKSON AND J H DICKSON

INTRODUCTION

The excavation of the Crosskirk site, yielding plant remains from all stages of the long occupation, has provided a welcome insight into the ethno-botany of the Iron Age inhabitants of northern Scotland—a topic about which very little is known.

Though there are many accounts of the excavations of brochs, botanical remains are usually unmentioned or given brief treatment. Prior to the 1950s there is almost nothing. Callander (1921) records "rye or oats" and peat ash from Dun Beag, Isle of Skye. Callander and Grant (1934) record no plant material from the large broch at Midhowe, Orkney, but found a quern implying cereal cultivation. Querns were found at the broch of Skitten, Caithness, by Calder (1948) but no plant debris apart from peat ash was noted. Decayed wood and peat ash were recorded by Curle (1921) from Dun Troddan, Glen Elg. MacGregor (1974) describing the nineteenth century excavations at Burrian, Orkney, lists six-row barley, probably Scottish bere, and two types of charcoal. It is unlikely that there are any more detailed botanical reports in the old literature written before botanical science was regularly and thoroughly applied to archaeology.

By the time of Piggott's excavations at Torwoodlee, Selkirkshire (1953) and of Hamilton's studies of Jarlshof (1956) and Clickhimin (1968), both in Shetland, more attention was being given to botanical remains. Alder wood and bowls of birch and oak were found at Torwoodlee. Jarlshof produced carbonised bere, and charcoal of birch, spruce and willow; wood/charcoal of five types, mosses and heather "thatch" were noted at Clickhimin. The excavation of Dun Mor Vaul on the Hebridean island of Tiree marked an advance. Not only are cereals (six-row barley) recorded by Renfrew (1974) and charcoal of five types by Pilcher (1974) but the latter worker carried out numerous pollen analyses which revealed both agricultural activity and the scarcity of trees during the period of the site's use.

The Crosskirk botany is by far the most comprehensive especially in regard to the detail of seeds, mosses and other macroscopic remains recovered: charcoal, wood and cereals were also noted. Plant

debris taken directly from archaeological contexts can elucidate such topics as which crops were grown, which wild plants were gathered for food and for bedding and litter and what timber was used for construction. That the answers are often partial and tentative is true for Crosskirk. Further excavations of brochs will provide fuller conclusions.

THE CAITHNESS ENVIRONMENT ABOUT 2000 YEARS AGO

To reconstruct some aspects of the Caithness vegetation at the time of the broch culture we are now fortunate in having a radiocarbon dated pollen diagram from peat and detritus mud at the Loch of Winless (ND 293545) about 30 km SE of Crosskirk (Peglar, 1978). This diagram shows that between about 2200 and 3000 years ago tree pollen dropped from 20-30 per cent to 5 per cent or less of total pollen: prior to this, tree pollen had never been more than 50 per cent of total pollen and usually less. After this decline, *Calluna* (heather) reaches 40-60 per cent, Gramineae (grasses) and Cyperaceae (sedges) 30-60 per cent and *Plantago lanceolata* (ribwort plantain) and cereals are consistently present.

Broadly similar patterns, although pollen grains of cereals and weeds are not distinguished, are seen in diagrams from Braehour (ND 093532) about 18 km south of Crosskirk and other sites W and E of Braehour (Durno, 1958). Durno's stratigraphic columns show moderately humified peat with *Sphagnum* (bog moss), *Eriophorum* (cotton grass) and *Trichophorum* (deer grass) as main components.

It may be that in Caithness, as a result of man's activities or deteriorating climate, or both, the scrubby woodland cover, never having been great (Birks, 1977), was largely destroyed by the early Iron Age and was being replaced by grassland, heath and blanket bog. These vegetation types, especially blanket bog, still cover much of Caithness today. At present, native trees and tall shrubs are sparse. Birch, hazel, aspen, rowan and juniper still grow in calcareous flagstone gorges in SE Caithness (Crampton, 1911) and to a lesser extent in other steep-sided valleys. Birks (1977) mentions oak, elm and alder growing in sheltered ravines. Crampton (1911) briefly described alder swamps on sandy alluvia of the Langwell and Berriedale waters in the SE of the county. Such occurrences can be seen as modified remnants of the natural woodlands of Caithness prior to the Iron Age.

The very low pollen values for trees and shrubs suggest that wood for fuel or building was not readily available in any quantity near the broch. Then, as now, salt-laden winds would inhibit tree growth on the cliff tops and only prostrate shrubs such as *Salix repens* (creeping willow) could freely survive these. Regeneration would take place in valleys sheltered not just from the wind but from the depredations of herbivorous animals. Possible alternative sources of wood would have been bogwood, submerged forests and driftwood.

The widespread occurrence of bogwood in Caithness needs modern investigation, especially with regard to pine (Crampton, 1911; Penny, 1973). Birks (1975) gives no localities of bog pine but Crampton (1911) mentions occurrences in central Caithness and in coastal submerged forests. However, even if pine grew in central and eastern Caithness after the last Ice Age it had very probably vanished by 2000 years ago in view of its well-established, widespread decline in the NW Highlands around 4000 BP (Birks, 1975).

POLLEN ANALYSES

Twenty-eight of the more organic samples were prepared for pollen analysis in the standard way, using dilute alkali, acetolysis and hydrofluoric acid. However, the pollen was too sparse to count in all but four samples in two of which, reference numbers *449* and *327*, only 126 grains were counted because of poor preservation and scarcity. Delicate grains, such as *Salix* and *Urtica*, may well have been destroyed, whereas thick-walled, distinctive grains such as Compositae and *Calluna* remain recognisable when partly destroyed and may therefore be over-represented. The results are expressed as percentages of total land pollen (Table 17). Spores of pteridophytes and *Sphagnum* are excluded from the total land pollen count but are expressed as a percentage of that total. The four samples analysed are as follows:

Sample 590 is a brown clayey mud with charcoal and fragments of mussel shell. It comes from the footing of the south side of the external rampart of the pre-broch promontory fort.

Sample 449 is a dark brown mud rich in plant remains with brown clayey lumps. It comes from beneath a slab at the base of the small, walled radial depression under the broch floor in the W quadrant.

Sample 385 is a dark, fine organic mud from the bottom of the broch well and attributed to Phase One of the use of the broch.

Sample 327 is ash containing cereal chaff with unidentifiable charcoal and marine shell fragments from the filling of a tank in the broch interior and can be attributed to Phase Two.

A striking feature of the results given in Table 17 is the very low total tree pollen in all four samples. Non-arboreal pollen makes up 93 per cent or more of the total in each case. The single pollen grain of *Picea* (spruce), not a British native tree in Post-glacial times, has certainly been transported for long distances, probably from Scandinavia. The sparse *Pinus* (pine) pollen in all likelihood came from outside Caithness, a comment which need not necessarily apply to *Betula*, *Alnus*, *Corylus*, and *Salix*, which still grow in Caithness and may have been growing in sheltered valleys such as that of the Forss Water less than 1 km away from the site. The *Salix* pollen could be that of *S. repens*, a low growing shrub, the leaves of which were found in *sample 449*.

In *sample 590*, which possibly represented an old land surface, pre-dating the construction of the broch, trees are represented by a solitary pine pollen grain: in stark contrast, there are 55 per cent grasses, 14 per cent Compositae, 11.5 per cent *Plantago lanceolata* and 10.5 per cent *Rumex*. Cereal pollen (1.3%) was of *Hordeum* type (identified using the criteria of Beug, 1961). This points strongly to agriculture of both pastoral and arable type. The very low value of *Calluna* (0.8%) differentiates this sample from the three others.

In *sample 449* the high values of *Plantago* are similar to those in *sample 590*. However, the higher values of cereal and *Calluna* are more in keeping with those for *samples 385* and *327*.

Table 17 Pollen analyses, expressed in percentage terms

Sample references	*590*	*449*	*385*	*327*
Sum of identified pollen grains	450	126	474	126
Betula (birch)	—	0.8	0.4	1.6
Pinus (pine)	+	—	0.8	0.8
Ulmus (elm)	—	—	0.4	—
Quercus (oak)	—	—	—	0.8
Alnus (alder)	—	0.8	+	0.8
Picea (spruce)	—	—	0.2	—
Corylus (hazel)	—	—	2.7	2.4
Salix (willow)	—	—	0.2	—
Gramineae (grass family)	55.0	17.4	37.1	22.4
Cerealia	1.3	6.3	7.4	8.8
Cyperaceae (sedge family)	—	4.7	2.5	0.8
Artemisia (mugwort or wormwood)	—	1.6	1.9	2.4
Calluna (heather)	0.8	38.4	24.2	27.2
Caryophyllaceae (pink family)	0.2	0.8	1.3	1.6
Centaurea cyanus (cornflower)	—	—	0.2	—
Chenopodiaceae (goosefoot family)	0.4	2.4	1.0	0.8
Compositae (daisy family)				
Tubuliflorae	14.0	6.3	2.3	14.4
Liguliflorae	1.1	0.8	+	3.2
Cruciferae	—	0.8	6.8	8.0
Erica (heath)	0.2	—	0.2	—
Filipendula (meadowsweet)	—	—	1.0	0.8
Labiatae (thyme family)	0.2	—	—	—
Leguminosae (peaflower family)	—	—	0.2	—
Plantago lanceolata (ribwort plantain)	11.5	6.3	2.5	0.8
P. major (ratstail plantain)	+	0.8	—	—
P. maritima (sea plantain)	—	—	0.2	—
Plantago spp.	2.6	7.1	—	—
Potentilla (cinquefoil or tormentil)	—	—	1.3	0.8
Ranunculaceae (buttercup family)	0.4	—	0.8	—
Rubiaceae (bedstraw family)	0.4	—	0.2	—
Rumex acetosella (sorrel)	—	—	0.2	0.8
Rumex (dock)	10.6	—	—	—
Scabiosa/Succisa (scabious)	+	0.8	0.2	—
Umbelliferae	—	+	0.2	—
Urtica (nettle)	—	—	5.0	—
Equisetum (horsetail)	—	—	0.2	—
Filicales (fern)	—	—	0.2	—
Ophioglossum (Adder's Tongue)	—	+	0.2	0.8
Polypodium (common polypody)	—	1.6	—	—
Sphagnum (bog moss)	—	1.6	0.2	1.6
Unidentified (crumpled or corroded) as percentage of identified grains	22.6	78.5	14.0	20.0

In *sample 385* pollen of *Centaurea cyanus* (cornflower) was found. This is a strong indication of cornfields in the vicinity and is supported by 7.4 per cent cereals , again mainly of *Hordeum* type.

Sample 327 is of exceptional interest in being cereal ash (described below). Although the pollen is sparse and badly preserved the spectrum is broadly similar to that of *sample 385*. A striking feature of both is the very high values of *Hordeum*: barley is a self-pollinating cereal, the pollen of which is found in low values (a few per cent of non-arboreal pollen) in surface samples immediately adjacent to cereal fields (Vuorela, 1973). Our speculation to acount for these high cereal values is that the pollen was detached from ears of barley, threshed in the broch, and incorporated in the cooled ash.

A similar explanation may pertain to the high heather values in *samples 449, 385* and *327*; the pollen may have been transported into the broch on the leafy twigs of heather, the most consistently represented species in the macroscopic fossil analyses (Table 20).

Sample 590, with the lowest values of cereals and heather, may be uninfluenced by man-induced over-representation, and may indicate more closely the vegetation surrounding the broch. All four samples are fundamentally similar in pointing to agricultural activity in an essentially treeless landscape.

WOOD AND CHARCOAL

Wood or charcoal was recovered from all periods of habitation at Crosskirk (Table 18). Most of the samples examined for plant remains, including those from hearths, contained wood or charcoal often too small for easy identification. There were no signs of use as artifacts or of boring by marine molluscs (an indication of driftwood) on any of the pieces we examined.

The charcoal was examined by snapping each piece cleanly in the transverse plane and longitudinally along radial and tangential planes. Badly decayed wood was first

Table 18 Wood and charcoal identifications (× = wood; + = charcoal)

		Juniperus (Juniper)	Pinus (Pine)	Conifer	Alnus (Alder)	Betula (Birch)	Corylus (Hazel)	Populus (Aspen)	Populus or Salix (Willow)	Sorbus (Rowan)
Pre-broch contexts										
712	Settlement, Area V: P1?				+					
725	External rampart midden: P1?		+							
449	Below primary paving of broch: P1			+						
SW quadrant of broch										
370	Amongst paving stones: Ph 1				+				+	
197	?post-hole in paving: Ph 2				+					
273	On paving: Ph 2	+								
330	In tank: Ph 2		×					×		
363	Under paving: Ph 2		×							
383	Intra-mural cell: Ph 2			×						
Settlement										
489	Enclosure IIIa: P2							+		
387	Enclosure I, floor: P3			+						
669	Enclosure IIIb: P3				+	+				
705	W of entrance: P3?						×			
254	E of entrance: P4?							+		
508	Paving around Grave II: P4				+					
699	E of Enclosure 1, in rubble?: P4?				+	+	+			
711	E of Enclosure 1, in rubble: P4?					+	+			+
Other										
713	Trench N of cemetery wall: P3?				+					

carbonised to facilitate identification. Modern reference charcoal was used for comparison and the charcoal was observed with internally illuminated objectives. Clifford's key in Godwin (1956) and Jane's descriptions (1970) were aids in making the identifications.

Juniper charcoal has not, to the authors' knowledge, been recorded previously from Scottish archaeological contexts. Perhaps juniper wood was used for fuel. From *sample 330* came the largest single piece of wood. It was of partly burned pine, measured 0.18 m × 0.10 m × 0.06 m, and may have been a post. Determinations given merely as "conifer" concern samples lacking characteristics necessary for greater precision.

Only one fragment of coniferous charcoal was recovered from the settlement area. This may indicate that readily accessible supplies of bogwood or drift wood were becoming exhausted during the life of the site, although in view of the contemporaneity of settlement and broch this is perhaps unlikely.

With the exception of pine, all the trees and shrubs identified from charcoal samples are native in Caithness at present and would certainly have grown in the region during the time span represented on the site. None of the wood or charcoal is necessarily driftwood, which is however an obvious source, as is wood preserved in bogs.

OTHER MACROSCOPIC FOSSILS: NOTES ON THE IDENTIFICATION OF CEREAL GENERA AND FLAX

Avena fatua L. (wild oat) (Ill 101)

Two carbonised spikelet fragments were recovered from *sample 327*. One fragment contains two florets, the lower of which consists of the lower half of the lemma showing the upper part of the oval articulation scar, 0.7 mm in diam. The upper floret shows the oval scar in a better state of preservation. The complete rachilla is preserved, straight, flattened and almost 3 mm long with dense hairs evenly spread along the whole of one face.

The rachilla of *A. sativa* (cultivated oat) has only a few hairs at the base of the lemma, that of *A. strigosa* Schreb. (Black Oat) has two small tufts at the apex but the rachilla seem sufficient to distinguish *A. fatua* from these and from other European species described by Renfrew (1973).

The second spikelet fragment, more poorly preserved and containing an immature hairy grain, is also taken to be *A. fatua*.

Avena sp. (oats)

Four carbonised grains, narrower than those of *Hordeum*, were found (Table 19): one came from a pre-broch sample (*725*), two from the primary broch floor (*370*), and one from the tank filling dated to the main occupation (*327*). The grain

Ill. 101 : *Avena fatua:* carbonised floret with hairy rachilla, length 5.9 mm

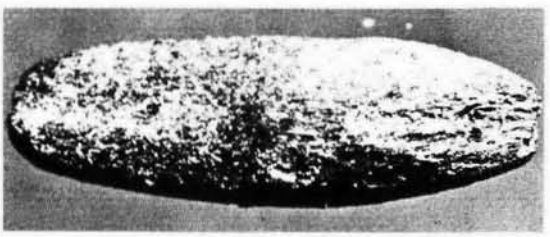
Table 19 Seeds and macroscopic remains of crops and weeds

	Type of Remains	*675*	*723*	*725*	*448*	*449*	*385*	*437*	*370*	*247*	*436*	*327*	*562*	*627*
Avena fatua L. (Wild Oat)	fl											2		
Avena sp. (Wild or Cultivated Oat)	a											2		
Avena sp. (Wild or Cultivated Oat)	g			1					2			1		
Chenopodium album L. (Fat Hen)	s	1				2		3	3		1			1
Galeopsis speciosa Mill. or G. tetrahit L. s.l. (Hemp-nettle)	f							1						
Hordeum vulgare v. mudum (Naked Barley)	g			1					4			1		
Hordeum vulgare L. emend Lam. (Barley)	a										+	++		
Hordeum vulgare L. emend Lam. (Barley)	r								10	2	3	20	1	
cf. H. vulgare	g		1	14					6	1	1			
Linum usitatissimum L. (Cultivated Flax)	s							1						
Plantago major L. (Rat-tail Plantain)	s											1		
Spergula arvensis L. (Spurrey)	s								1				1	
Stellaria media (L.) Vill. (Chickweed)	s			1			7	3	5				8	
Urtica dioica L. (Stinging Nettle)	n				6			85						

Note: Sample contexts on Table 20; *675* was taken outside the external rampart. See key below for types of remains.

Key to Tables 19-21
a = awn; bs = bud scale; c = caryopsis: f = fruit; fl = flower; g = grain; l = leaf; ls = leafy stems; m = megaspore; n = nutlet; r = rachis; s = seed; P = period; Ph = phase; + = sparse fragments; ++ = abundant fragments.

from *sample 327* (Ill 102) is fairly well-preserved (5.3 × 1.8 mm) and is rounded in cross-section but the embryo is broken off at the base. Several long stiff hairs are still attached to this grain and also to a less well-preserved incomplete grain from *sample 370*. The other grain from *sample 370* is 5.0 × 1.8 mm, and rounded in cross section; the surface is longitudinally ridged but the epidermal cells



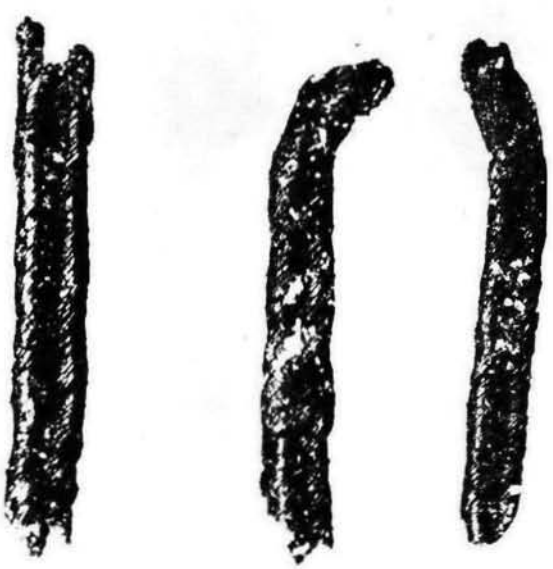
Ill. 102 : *Avena sp*: carbonised grain, 5.3 mm long

have partly disappeared revealing the characteristic polygonal starch cells. The grain from *sample 725* is also incomplete; the ventral groove is visible but the surface is worn.

These four grains compare well with recent carbonised grains of *Avena* but it does not seem possible to make specific identification on these few grains in varying states of preservation.

Six carbonised fragments of the basal part of awns were recovered from *sample 327* (Ill 103). They are up to 2 mm long, 0.25-0.3 mm in diameter and spirally twisted forming hollow cylinders. That the awns were originally geniculate is shown by two of the fragments having broken at the bend. There is a strong resemblance to awns of both *A. fatua* and *A. strigosa*. However, other *Avena* spp have similar awns (Renfrew, 1973).

The only previously recorded find of an *Avena* awn seems to be the base of an awn attached to a lemma of *A. sativa* of Roman age from the Forth and Clyde canal (Jessen and Helbaek, 1944, fig 22c). Grains of both wild and cultivated oats were recognised from this deposit. However, *Avena* has not been certainly recorded previously from the Iron Age in non-Roman Scotland with the possible exception of a discovery given as *Avena* or *Secale* (rye) from a broch on Skye (Callander, 1921). Early Iron Age sites in England have yielded all three oats, *A. fatua, A. sativa* and *A. strigosa* (Godwin, 1975).



Ill. 103 : *Avena sp*: carbonised spirally-twisted awn fragments

Hordeum vulgare L. emend. Lam. (barley)

Five of the carbonised *Hordeum* grains are of naked barley. They come from the same samples as the *Avena*, namely *725* and *370*. The single grain from the Phase Two occupation of the broch (*sample 327*) is also probably naked.

Carbonised rachis internodes, one with a rachilla from barley spikelets have been recovered from five samples in the broch (Table 19). All are heavily pubescent and are about 1 mm wide and 2.5 to 4.1 mm long. Lax-eared barley (bere) has rachis internodes more slender than those of the dense-

eared type (Van Ziest, 1970). All the fossils from Crosskirk seem to be of the bere type (Ills 104 and 105).

ILL 104 : *Hordeum vulgare*: carbonised rachis segments with hairy rachilla

cf *Hordeum vulgare* L. emend. Lam.

Some of the grains from five of the samples (Table 19) have become swollen, damaged and distorted by carbonisation. Sizes are from 4.2 to 5.1 mm long, by 2.6 to 3.7 mm wide by 2.0 to 2.3 mm thick. These dimensions are similar to the size range quoted by Van Ziest (1970) for swollen carbonised barley from several Dutch sites. However, the slight possibility that some grains are *Triticum* (wheat) cannot be entirely excluded.

Silica skeletons of cereals

Sample 327, from a tank filling in the radial depression in the broch floor, produced an abundance of delicate silvery grey fragments of plant material, among amorphous ash: this material was examined before pre-treatment of the sample. The plant fragments consist of silicified epidermis and all are broken pieces of longer structures. Some are flattened with parallel sides, up to 2.8 × 0.8 mm, and the margins are barbed. There are several similar carbonised fragments. There is a prominent midrib on one face forming a rounded keel (which sometimes becomes detached) with two rows of stomata on either side: the long narrow cells are interspersed with short squarish ones.

These fragments can be matched in the strongly-keeled lemma awns of *Hordeum vulgare* which are about 50 to 60 mm long, each awn tapering to a trigonous point. Silicified fragments from the tip of an awn, as well as hairs and glume-like fragments seem likely to be those of barley but lack characteristics necessary to distinguish them from other species of *Hordeum*, *Triticum* (wheat) and *Secale* (rye).

Identical fragments can be produced by heating the chaff of a barley spikelet in an open vessel: after a few minutes, the chaff carbonises and turns partly to ash leaving the parts with heavily silicified walls intact. Silicified remains of grasses and cereals have been found with ash in Mediterranean regions (Helbaek, 1969) and in Bulgaria (Dennell, 1976) but not in Britain prior to this report as far as we are aware.

Linum usitatissimum L. (cultivated flax)

A single seed of flax was found in *sample 437*, collected beneath the large slab-lined tank in the west centre of the broch. The seed measures 3.7 by 2.2 mm. There are records of flax seeds in England from the Neolithic (Godwin, 1975): the only certainly dated record in Scotland before historic time is of a seed impression from a Food Vessel found in Fife (Jessen and Helbaek, 1944).

ILL 105 : *Hordeum vulgare*: three carbonised rachis fragments

Table 20 Seeds and other macroscopic remains of plants of heath, mire, grassland and pasture

	Type of Remains	*590*: P1 Midden, external Rampart	*723*: P1 Midden, external Rampart	*725*: P1 Midden, external Rampart	*714*: P1 trench N of cemetery wall, – 190 cm	*448*: P1 Primary paving, W half of broch	*449*: P1 Primary paving, W half of broch	*385*: Ph 1 Well in broch	*437*: Ph 1? Under large tank in broch	*370*: Ph 2 Among paving stones in broch	*247*: Ph 2 On paving stones in broch	*436*: Ph 2 In a tank	*327*: Ph 2 In the radial depression	*562*: P3 Area VI	*627*: P3 Area VI	*604*: P3 Enclosure III	*642*: P3 Enclosure III	*715*: P3? Trench N of cemetery wall, – 160 cm	*531*: P4 Under Grave 11
Calluna vulgaris (L.) Hull (Heather)	l, ls	1	4	2	2		23	6	1	3	4	4	2	14	12	1	1	3	1
Cardamine pratensis L. (Lady's Smock)	s								5										
cf. Carduus sp. (Thistle)	f												3						
Carex sp. (Sedge)	n						2		1					1					
Empetrum nigrum L. (Crowberry)	l									1				2					
Erica cinerea L. (Bell-heather)	l, s				1			1		1				4					
E. tetralix L. (Cross-leaved Heath)	l			2			80	12	3	7	6	2	4	7	1			1	1
Eriophorum sp. (Cotton-grass)	l						+												
cf. Galium sp. (Bedstraw)	f							1	1										
Gramineae (Grasses)	c						4	2	3	1				2					
Juncus squarrosus L. (Heath Rush)	s								1									2	
Linum catharticum (Purging Flax)	s						5												
Potentilla erecta (L.) Raüsch (Common Tormentil)	f						65		2										
Pteridium aquilinum (L.) Kuhn (Bracken)	l						+	+											
Rhinanthus sp. (Yellow-rattle)	s						2												
Salix repens L. (Creeping Willow)	l						+												
Selaginella selaginoides (L.) Link (Lesser Clubmoss)	m	6		1		1	4	1	3	3	5				1				
Sieglingia decumbens (L.) Bernh (Heath Grass)	c						14												
Vaccinium microcarpum (Rupr.) Hook F. or oxycoccus L. (Cranberry)	l						1												

INFERENCES

PERIOD ONE

Of five samples attributed to this period (*590, 675, 714, 723,* and *725*) only *725* has more than two species recorded. Samples *723* and *725* are similar, in that they were taken from midden deposits of grey-brown mottled silt. Apart from numerous limpet shells and two fish vertebrae, *725* contained wood fragments, *Pinus* charcoal, carbonised leafy twigs of *Calluna*, (Table 20) one grain of *Avena*, one grain of *Hordeum* and 14 grains tentatively identified as the latter cereal. This substantiates the evidence of *Hordeum*-type pollen from the external rampart (*sample 590*) and shows that the inhabitants of the promontory fort grew barley.

PERIODS TWO TO FOUR

Eight samples may be considered to be the most informative for these periods (*247, 327, 370, 385, 436, 437, 448* and *449*) (Tables 19-21). *Samples 448* and *449* were removed from beneath the primary paving of the depression in the NW quadrant of the broch. *449* consists of clayey soil with an admixture of wood fragments, conifer charcoal, leaves of monocotyledons and dicotyledons, fruits, seeds and moss fragments. Plants of heaths or mires are strongly represented: *Calluna, Erica tetralix, Eriophorum, Hylocomium splendens, Hypnum cupressiforme, Potentilla erecta, Pteridium aquilinum* and *Sieglingia*. *Salix repens* is characteristic of

clifftop vegetation in Caithness at present. Such species as *Calliergonella, Fissidens adiathoides, Linum catharticum, Selaginella* and the *Thuidium* may derive from base-rich wet rocks, the sides of streams or flushes or springs in the flagstone areas.

Table 21 Seeds and other macroscopic remains of miscellaneous plants

	Type of remains	*449*	*436*	*531*
Atriplex sp (Orache)	s		1	
Sagina sp (Pearlwort)	s			5
Salix sp (Willow)	bs	12		
Unidentified	s	1	2	
Unidentified (monocotyledon and dicotyledon)	l	+		

All the mosses (Table 22) from *samples 449* and *385* are widespread, and in many cases abundant species, which have occurred in archaeological contexts (Dickson, 1973). *Hylocomium splendens*, with a robust, much-branched habit, could have been useful in minor ways such as packing and stuffing. However, the sparseness and small size of the moss fragments may indicate their accidental incorporation with deliberately gathered heather or other plants.

The seed of *Chenopodium album* in *sample 449* and six achenes of *Urtica dioica* in *sample 448* are at first sight anomalous. However, the pollen count for *sample 449* with 2.4% Chenopodiaceae and high values for Compositae and *Plantago* spp suggests that nearby agricultural land was a source for these two species (Tables 17 and 20).

Some of the plants recorded in these two samples grow in the vicinity of the broch at the present time including *Calluna, Linum catharticum, Potentilla erecta, Sieglingia, Salix repens* and *Urtica dioica*. In fact most of the plants the remains of which were found still grow on peaty clifftops in Caithness (Crampton, 1911, 64).

Whilst the plants represented in these two samples seem too diverse in their soil requirements to have grown as part of the original vegetation cover on the small area subsequently covered by a paving stone, they could have originated from suitable habitats on the cliff top. One would expect a similar assemblage if plants were collected from the headland for litter or animal bedding and this is a possible explanation for the presence of the plant debris.

The other broch samples, from the early and main occupation, contain debris of plants which could have been growing in heaths around the broch. Leaves of *Calluna* (heather) and *Erica tetralix* (crossleaved heath) are absent only from *sample 448* and are the most consistently present remains in all the periods for which samples were examined. Heather may have been used for bedding or thatch or both purposes.

Sample 437, from under a tank, contained seeds of *Juncus squarrosus* and achenes of *Potentilla erecta*, species which could have been gathered with heather. This seems a less likely explanation for five seeds of *Cardamine pratensis*, a plant of damp grasslands and streamsides.

Megaspores of the dwarf pteridophyte *Selaginella selaginoides* occur in six samples from the broch, and four samples from other contexts at Crosskirk. Hence, although in small quantity, it occurs in half the sample examined (Table 20); we know of no other occurrence in archaeological contexts.

The sample from the well (*385*) yielded heather and commonly associated species including four mosses and a pinnule fragment of bracken which otherwise only occurs in *sample 449*. Bracken, with multifarious uses including litter and thatch, (Rymer, 1976) may have been absent from windswept clifftops as it is today.

The samples from the broch floor, *370* and *247*, and the large slab-lined tank (*436*) and the radial depression (*327*), contain a mixture of barley spikelet fragments, a little grain and weed seeds. Only the latter occurred in *437* under the stone slab at the foot of the large tank.

It is possible that weeds such as *Avena fatua, Chenopodium album, Galeopsis, Plantago major, Spergula arvensis* and *Stellaria media* were accidentally gathered with the barley and, with the rachis fragments, discarded after winnowing. However, as Helbaek (1969) points out, reaping with a sickle would not collect weeds of varying stature. Could it be that the weeds were gathered as food as Scandinavian evidence seems to indicate? The carbonised remains of a meal consisting of barley and weed seeds including *Chenopodium album, Spergula arvensis* and *Stellaria media* were found in a pot of pre-Roman Iron Age date at Gørding Heath (Helbaek, 1951 and 1954). In addition there are several discoveries of pure collections of weed seeds from Danish Iron Age settlements (Helbaek, 1954) and also the famous last meals of the bog corpses containing cereals, all the weeds mentioned here, as well as flax seeds, rich in oil. A single seed of flax was found in *sample 437*, perhaps pointing to cultivation for food. Thus, at Crosskirk, wild plants may have been cooked as vegetables: the use of *Chenopodium album* and *Urtica dioica* is well-known in this respect.

However, there is also the possibility that animal bedding or fodder was the source of the weed seeds. *Spergula arvensis* has been used as a forage crop in NW Europe, including England (Jessen and Helbaek, 1944).

The plant remains from *samples 449, 437* and *385* are not carbonised: the first two originate from under paving and the last from the bottom of the well. In these situations they would not be exposed to desiccation which may destroy delicate structures. This may account for the greater variety of species and better preservation of the mosses in *449* and *385*.

Much of the other plant debris from the broch and settlement is carbonised and consists of robust leaves and seeds. Therefore too much must not be read into these small numbers, fortuitously preserved, as an index of diet. There is also the possibility that some or all of the weeds were just that—opportunist inhabitants of enriched, disturbed soils around the habitation areas.

Table 22 Mosses (all leafy stems)

	Pre-broch *449*	Broch *385*
Calliergonella cuspidata (Hedw.) Loeske	45	—
Drepanocladus sect. Warnstorfia	3	—
Eurhynchium sp	1	—
Fissidens adianthoides Hedw.	1	—
Hylocomium splendens (Hedw.) B.S. & G.	16	3
Hypnum cupressiforme Hedw.	11	—
Pleurozium schreberi (Brid.) Mitt.	—	2
Sphagnum sect. Acutifolia	—	1
Thuidium tamariscinum (Hedw.) B.S. & G.	—	1
T. delicatulum (Hedw.) Mitt. or T. philibertii Limpr.	1	—
Unidentified stems	9	2

Notes:

449, from below the primary paving in the W half of the broch, is attributable to Period 1. *385* comes from the period of use of the broch. *Pleurozium* was identified on the basis of leaves.

Carbonised stems with leafy bases were also found in samples *562* and *717*.

Nevertheless, the presence of *Chenopodium album* and *Stellaria media* from Period One and later contexts may be an indication of consistent use. The lack of Compositae weeds, which are abundant inhabitants of arable fields, may support the notion that the limited number of weed species represented at Crosskirk were used as food. The Compositae have resistant fruit walls, and therefore ought to have survived: but they have little history as food plants.

Of the few plant remains from the settlement area little can be said other than that there is a general similarity to the species recovered from the broch. The only species represented on the settlement but not in the broch itself was *Sagina sp*, of which 5 seeds were identified.

THE ORGANIC DEBRIS IN ASH—FILLED TANKS

In *sample 327*, from the shallow radial depression in the W quadrant, the bulk of the deposit is a pale grey ash containing not only abundant burnt *Hordeum* and *Avena* chaff described above but also one grain of each of these genera, a few carbonised leaves and seeds, *Populus* (aspen) charcoal fragments and a partly burnt post of *Pinus*. In addition there were several fish vertebrae and small fragments of shellfish.

Hordeum chaff was also present in *sample 436*, a large slab-lined tank in the broch floor, but in small quantity: one cereal grain, was found with a few carbonised leaves, seeds, charcoal, silt and one barnacle fragment.

A possible parallel is a sealed stone cist filled with ash found in the broch at Burrian, Orkney (MacGregor, 1974). Quoting Scott (1947), MacGregor suggests that the ash-filled tank was used to preserve seafood, birds' eggs and seal meat as carried out until modern times in St Kilda and the Faroe Islands. Perhaps such an explanation applies to the Crosskirk tanks.

COMPARISONS AND CONCLUSIONS

Dun Mor Vaul excepted, little can be made of the botanical evidence from broch excavations hitherto. Cereals were grown, six-row barley being the only certainly identified crop. Apart from construction and utensils wood, sometimes driftwood, was used for fuel, as was peat if unsubstantiated claims of "peat ash" are accepted. Heather may have been used as thatch.

From Dun Mor Vaul Renfrew's (1974) discovery of cultivation of hulled and naked six-row barley was supported by cereal pollen found by Pilcher (1974). Renfrew argued for efficient winnowing not just becase of the lack of weed seeds in the small carbonised cereal sample but becasue of the absence of weed seed impressions on pottery fragments. She was puzzled by the lack of wild oats. Pilcher thought the charcoal of five species could have derived from trees and shrubs grown locally, apart from spruce which probably drifted from North America. His 30 pollen analyses, mostly from samples within the site, pointed to open vegetation with no trees near the broch and a high level of agricultural activity on Tiree in the Iron Age.

The Crosskirk pollen samples are very similar to those from Dun Mor Vaul but with even lower tree and shrub values. Essentially similar conclusions result. At least near the broch treelessness prevailed. There is abundant evidence of both pastoral and arable agriculture.

Six-row barley was grown, with oats if only as a weed and may have been threshed in the broch. Flax may also have been a crop. Ash-filled tanks may have been used to store food. Several "weeds" notably *Chenopodium album, Spergula arvensis, Stellaria media* and *Urtica dioica* may have been exploited as food. Heather was often brought to the site perhaps for thatch, perhaps for bedding. The same may have been true for bracken. None of the wood and charcoal was necessarily driftwood. Local shrubs and trees and ancient bog wood are other possible sources.

IDENTIFICATIONS OF THE HUMAN SKELETAL MATERIAL FROM CROSSKIRK A YOUNG

WITH COMMENTS ON THE SKULLS AND TEETH D A LUNT.

THE BURIAL FROM GRAVE I

This burial, discussed above (p 102 and Ill 55) was recovered from a long cist in square G8 of the settlement. A number of pieces of non-human bone and teeth were represented in the collection from this context. The human material would appear to be from one adult individual, about 167-169 cm tall if male, or 164-167 cm tall if female.

Excluding the skull, the following bones were present or were represented by recognisable fragments:

Vertebrae:

cervical: body and odontoid process of C2.

thoracic: 1-6 are much damaged, 7-12; though eroded, are more complete.

lumbar: these are more or less complete.

Sacrum: this is damaged, consists of 6 segments and is possibly male.

Innominate bones: both are present.

Sternum: the manubrium and body were both much eroded on one surface.

Ribs: there are many fragments of varying sizes. There are posterior ends (head and/or neck and tubercle) of possibly 9 R and 7 L. A feature is the considerable number of ventral ends which have survived though only one rib (?R 7 or 8) is more or less intact. Neither first rib is recognisably present.

Clavicles: the R lacks the lateral third. The L one is almost complete.

Scapulae: the glenoid, coracoid and a little adjacent part of the root of the spine from the R side; from the L side the glenoid, coracoid, spine (less acromion) and the vertebral border, plus some small fragments of blade, are present.

Humeri: the R one is almost intact (322 mm); the L one has damaged extremities (approx length 317 mm).

Radii: the R one was reconstructed from a number of pieces to give an approximate length of 238 mm. The L one was represented by the head and the lower three-quarters of the bone.

Ulnae: the R one was in two pieces, damaged at mid-shaft; and the L one was almost complete, with a physiological length of 233 mm.

Hand: only one damaged carpal bone was recognised—? a human R lunate.

metacarpals: R 2, 3, 4 and 5 (all damaged) and L 2 and 3 (more or less intact). Ten assorted, more or less complete, phalanges, plus fragments of two more, were found.

Femora: the R, after reconstruction, still lacked its great trochanter but measured 442 mm. The L one was much broken up but after reconstruction measured 443 mm approximately.

Patella: the L one, in two pieces, was noted.

Feet: only the R navicular and one proximal phalanx were found.

THE SKULL AND DENTITION

This was received still embedded in a mass of soil, which could be seen filling the interior of the cranium. The cranial vault was quite severely comminuted, some of the fracture lines being old and filled with soil, while others were fresh breaks.

At first it seemed as though the whole base of the skull was missing. However, when clearing of soil from the interior of the vault was begun, some displaced fragments of the cranial base, including portions of both temporals, were found in the soil mass. The position of these fragments suggested a crushing blow applied vertically to the skull after death, driving the fragments of cranial base into the cranial cavity. The appearance of the facial bones corroborated this hypothesis: the zygomatic processes and body of the maxilla had been driven up through the more delicate bones of the orbit and had come to rest against the frontal bones. The soil within the cranial cavity also contained a number of small pebbles of a shaley rock, the largest being roughly 5 by 3 by 2 cm. The glabellar region of the skull is moderately developed, suggesting that the individual may have been a slightly-built male.

The jaws were recovered in a number of fragments, and a small portion of the maxilla was found in a separate packet. The tooth-bearing area of the maxilla is incomplete, small portions having been lost on both sides. The mandible is of moderate size, though the muscular attachment areas are quite well developed. Altogether 22 permanent teeth are present, and there are sockets for a further 8 teeth which have been lost post-mortem.

The evidence concerning the age at which the individual died is conflicting. The roots of the third molars are complete and the apices are well closed, which suggests an age of over 21. The mandibular third molars have erupted, but the maxillary left third molar has failed to erupt. It is embedded quite high in the alveolus and the occlusal surface is partially covered by bone in a way which suggests that this state of affairs has existed for some time. Because the upper third molar is unerupted, the lower third molar on the same side has over-erupted and again the degree of over-eruption indicates that this situation has existed for some time.

There is evidence of generalized horizontal resorption of alveolar bone, and clear signs of periodontal disease may be seen in the areas of the mandibular second and third molars. The amount of bone lost would suggest an individual in his thirties, or even older.

However, the degree of attrition of the molars is very slight, and would be consistent with an age at death of c 20-22 at the oldest. Thus we are dealing here either with an individual in the early twenties with unusually advanced periodontal disease, or with an individual in the thirties with exceptionally little wear of the teeth. A compromise solution would be to suggest that the age at death was perhaps 25-30. Unfortunately the calvarium is fragmentary and few of the sutures can be studied, but signs of early closure in the sagittal and coronal sutures would suggest that this estimate may be reasonable.

There are early superficial carious lesions on the buccal surfaces of the mandibular right first and second molars.

GRAVE II: THE BURIAL FROM THE SECOND LONG CIST

This collection of bones and bone fragments consists almost entirely of the skeleton of one individual (probably female) adult, and about 157-165 cm in height, together with one piece of rib from an animal (probably bovine).

The following bones were present:

Skull: this was almost complete. The mandible was intact and the L maxilla was present although separated from the rest of the skull. The teeth present appeared to be:
x765x3xx/xx3xx678.
876543x1/1234567x

Vertebrae: all are represented and most are complete. S4 and S5 have separated neural arches—either evidence of old fractures or of a congenital malformation (spondylolisthesis). The bodies of T6 and T10 are narrower in vertical height anteriorly than posteriorly, possibly evidence of old compression fractures.

Ribs: it is possible to identify 9 left ribs (including 1-7) with heads present and 8 right ribs are represented (including 5 heads) and 12 other fragments.

Sternum: only the body is present.

Scapulae: a pair are represented, each by the head (glenoid fossa) and adjacent parts of the body and spine.

Clavicles: the R one is almost intact, except for some damage to the lateral end. The L one lacks its medial third. Both are of slender build.

Humeri: there are a pair, slightly damaged. Both show a supratrochlear foramen. R is 310 mm long, L is 300 mm.

Radii: the L one is intact (208 mm); the R one is almost complete but in three pieces.

Ulnae: the L one is intact, with a physiological length of 217 mm; the R one is in two pieces and lacks its head.

Hand:

carpals: there are seven assorted carpals showing varying amounts of damage.

metacarpals: these are represented by L 1, 2 and 3 and five other shafts (damaged).

phalanges: five proximal phalanges (including L 1) are present.

Sacrum: the upper two-thirds are present but damaged.

Innominate bones: both lack much of the iliac part and are broken into two pieces.

Femur: the L one is in one piece but lacks the head and neck, and the lower part of the shaft and the condyles are damaged. The R one is in four pieces—the head and neck are missing and the lower end is badly crushed.

Tibiae: the L one has suffered some damage at each end, while the R one is in two pieces with some damage to the head (R = 334 mm (approximately), and L = 334 mm).

Fibulae: the L one in two pieces with a damaged lower end, and the R one is complete, but in two pieces.

Feet: Tarsal bones are:

a pair of *calcanei*—damaged.

a pair of *tali*—L is slightly damaged.

a pair of *naviculars* which have prominent tuberosities and appear to show extension of ossification into the spring ligaments (plantar calcaneo—navicular ligaments).

cuboid: only the L one.

cuneiforms: both sets of three are present.

metatarsus: two complete sets are present.

phalanges: proximal phalanges are complete and also the terminal phalanges of both big toes are present.

There were also a few unidentified bone fragments.

THE SKULL AND DENTITION

This skull is complete except for small portions of the left orbital rim and left zygomatic arch. It is small, and its delicate build suggests that it may be female.

The maxillae and mandible are intact. Twenty-two permanent teeth are still *in situ*, as noted above, and the remaining 10 teeth were lost from their sockets *post mortem*.

The teeth show considerable attrition, the first permanent molars having been worn down to the extent that dentine is exposed over the entire occlusal surface. Secondary dentine can be seen filling the pulp chambers of the lower first molars, but the formation of secondary dentine seems to have been deficient in the upper first molars and the pulps of these teeth were exposed during life.

Comparison of the degree of attrition exhibited by this skull with the attrition scale constructed by Miles from a series of Anglo-Saxon skulls might suggest that the individual was aged c 40-50 at death. However, the differential in wear between first, second and third molars is somewhat greater than that in the Anglo-Saxon population, suggesting that attrition may have progressed at a more rapid rate in this skull. The individual may therefore have been rather younger at death, but by how much is impossible to estimate.

There is no evidence of dental caries, but this individual suffered from periodontal disease, with resorption of some of the supporting alveolar bone, and slight lipping of the bone at the openings of the sockets. Deposits of tartar may be seen on most of the teeth. The exposure of the pulps of the upper first permanent molars, due to severe attrition, has already been mentioned. In the case of the L molar, the openings into the pulp are wide, and the resulting pulp infection has led to the formation of abscesses on the distobuccal and palatal roots. These abscesses have broken through the outer cortical plate and are visible on the surface of the bone. They have not yet involved the maxillary sinus.

THE SKELETAL MATERIAL FROM GRAVE III

This section consists of a report on the skeleton from Grave III, recovered from beneath the floor in Enclosure I in the settlement. The disposition of the bones, as commented on in Chapter 6, indicates that the body had been interred in a seated position.

This is a most extraordinary set of bones. Principally they comprise the almost complete skeleton of a fairly heavily-built elderly male who suffered from poor dental health and widespread severe osteoarthritis. There are also a few pieces of animal bones and teeth. This man, in health, may have been about 5 ft 7½ in-5 ft 8½ in tall (171.3-174.5 cm) if one uses the armbone measurements. The femora suggest a slightly lower height and, using the tibiae, his height may have been about 5 ft 4 in (163.5-163.9 cm). It is to be noted that all long bones show good muscular markings. He was probably a very well-built muscular man until his osteoarthritis became dominant.

The symbols "A" and "+" will be used respectively to indicate the presence, and the severity, of arthritic changes noted on various bones.

Skull: This is virtually complete. The atlanto-occipital joints are involved in the arthritic changes (L: A + + + R: A +). The hyoid bone (less the minor cornua) is present as is the partially ossified R half of the thyroid cartilage.

Vertebrae (Ill 106):

cervical: the joints between the articular processes, facets show varying degrees of arthritic changes:

C1/2 R: A + +

C2/3 R: A + + +; L: slight A

C3/4 R: slight A; L: A + + +

C4/5 R: slight A; L: A + + + +

C5/6 R: slight A; L: A +

C6/7 Both sides only slightly affected.

The intervertebral discs above and below the body of C6 vertebra seem to have almost completely disappeared, and the vertebral bodies are eroded and show marked arthritic lipping.

thoracic: there are only eleven obvious thoracic vertebrae. Numbers 10 and 11 have only a single complete facet on each side of the body for the heads of their ribs. Arthritic lipping and osteophytes with loss of I/V disc space are marked, especially from T3/4 centrum joint downwards. The 12th thoracic vertebra has been "lumbarised". Its R transverse process shows a half obliterated costo-transverse joint but the L costal process is completely fused.

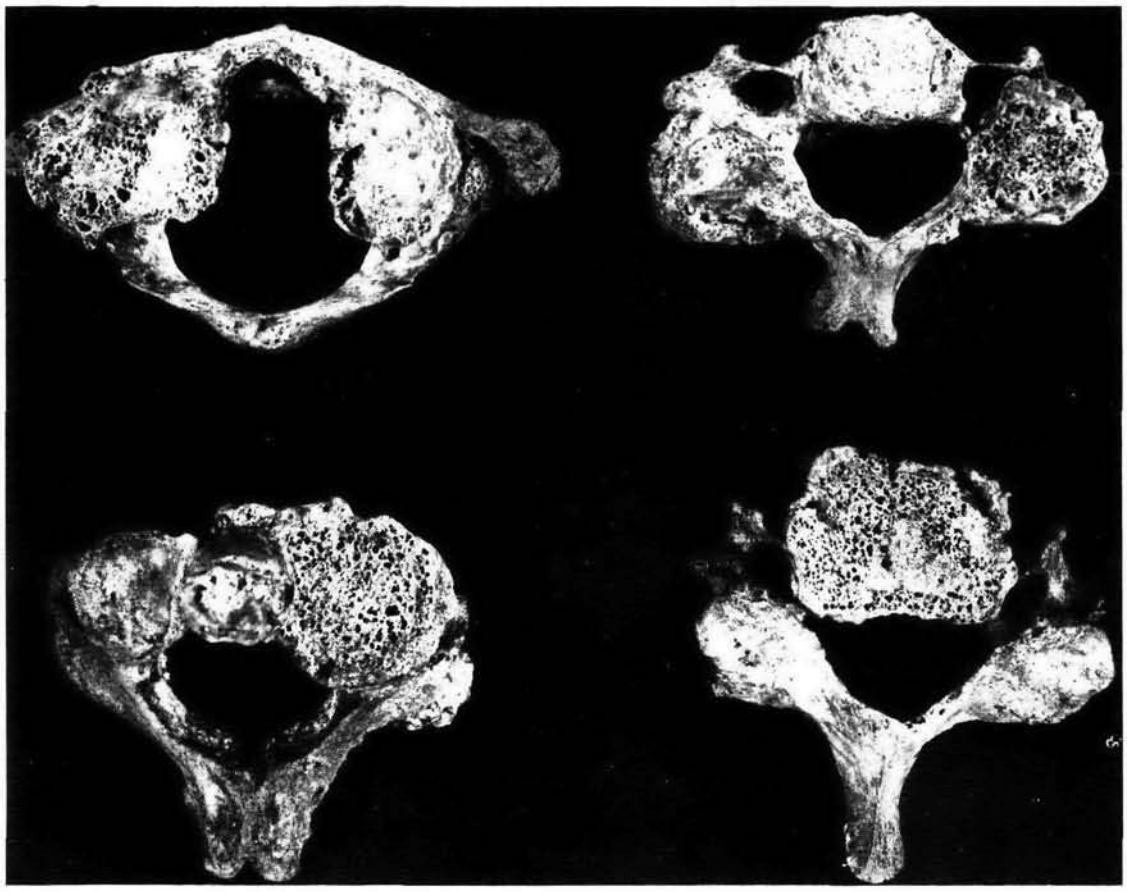
lumbar: there follow four fairly typical lumbar vertebrae with some arthritic changes. The posterior articular facets between the true L4 and L5 are asymmetrical—that on the R being more curved, and elongated vertically, rather than flattened and circular as on the L. The true 5th lumbar vertebra has been "sacralised", with more complete ossification of the ilio-lumbar ligaments and bony fusion on the R side than on the L.

Sacrum: the "true" sacrum of 5 segments is rather gynaecoid in shape. The coccyx was found separate.

Innominate bones: the two innominate bones are of heavy build with deep acetabular fossae, and osteophytes at various bony margins eg around the acetabula, ischial tuberosities, pubes, and along the pectineal lines. The R acetabular notch is completely closed over by ossification of the transverse acetabular ligament while the L notch is deep and open.

Ribs: eleven R ribs, mostly complete, and ten L ribs are present. These numbers agree with eleven rib-bearing thoracic vertebrae, the use of one rib for radiocarbon assay, and the lumbarisation of the 19th vertebra (12th thoracic). The heads of several ribs show arthritic changes, such as enlargements, flattening and eburnation of the formerly cartilage-covered facets.

Sternum: the manubrium and two pieces of the body are



ILL 106 : Evidence of osteoarthritis in vertebrae from the skeleton in Grave III

present. Arthritic changes are present at the sterno-clavicular joints.

Clavicles: both clavicles show marked arthritic changes at their medial ends.

Scapulae: the L one is more or less normal. The R one presents a remarkable glenoid region. The dorsal half of the original glenoid fossa is partly overgrown by osteophytic depositions which spread across it from the posterior margin of a new glenoid surface. This new glenoid surface consists of the anterior 5/6ths of a shallow saucer-like cavity which is directed more anteriorly than a normal glenoid by about 60 degrees. The new articular surface is eburnated with many perforations through the surface into the underlying cancellous bone.

Humeri: the L one is more or less normal. The R one is longer (R = 34 cm, L = 33 cm), of a rather heavier build (especially the head), and with an upward tilt, medially of the transverse axis of the inferior condyles. The main area of articulation with the scapula seems to have been the posterior part of the former articular surface lying adjacent to the anatomical neck. Here, too, the surface is eburnated. Flattened osteophytes adorn the margins of the head and have extended over that part of the former articular surface superomedial to the lesser tuberosity. The bicipital groove between the tuberosities is almost obliterated by osteophyte growth both in the groove and superior to it. It seems probable that some considerable time (years rather than months) before his death, this man suffered a dislocation of the R shoulder. He refused to accept the disability and persevered in using the arm. This led to the formation of a new false joint, with reorientation of the humerus at both ends to give as nearly normal function as possible.

Radii: these show no special features: R = 251 mm; L = 249 mm.

Ulnae: the dorsal surfaces of the proximal third of the shafts are somewhat more convex than normal. Both bones show osteophytic invasion of the triceps tendon and a little lipping of the margin of the head. The R ulna is of a rather heavier build than the L one.

Hand:

carpus: the only carpal bones missing seem to be the trapezium of each hand.

metacarpus: all ten metacarpals are present.

phalanges: twelve assorted phalanges—mainly proximal ones—are present.

Femora: both are intact, with arthritic changes around the margins of the head and both distal articular surfaces: R = 453 mm; L = 450 mm. The fossae for ligamentum teres are deep.

Patellae: comb-like bony osteophytes project up into the quadriceps tendon on each side and also slightly down into the R patellar tendon.

Tibiae: there are osteophytes on the tuberosities of both bones and "squatting facets" at the distal ends: R = 344 mm; L = 342 mm. Joint surfaces are more or less normal.

Fibulae: the proximal end of each bone is expanded and deformed beyond the actual joint surface for the tibia: the R fibula is more affected than the L one, and also has some small spurs along the shaft.

Feet:

tarsal bones: a complete set is represented, apart from the R medial cuneiform and L cuboid which are missing. Both calcanei show marked osteophytic invasion of the tendo calcanei (Achilles tendon). The R calcaneus, in addition, shows two unusual features: (a) a small bony ridge, rather like a sustentaculum tali, protrudes from the lateral surface—forming a "pulley" for the peroneal tendons and (b) a considerable lip of bone (26 mm wide by almost 10 mm long) which overhangs the dorsal margin of the calcaneo—cuboid joint.

metatarsals: a full set for each foot is present.

phalanges: all proximal phalanges are present, as well as the second phalanges for the big toes. There are also three more intermediate and three distal phalanges which are unallocated to a definite foot.

Sesamoid: one is present.

THE SKULL AND DENTITION

The skull and mandible are virtually complete. From the development of the glabellar area and other features it would seem that the skull is probably male.

The dentition is in an extremely unhealthy state: some of the teeth are heavily worn, others are encrusted with huge masses of calculus (tartar), and there has been severe periodontal disease with the loss of some teeth and the shortening or distortion of the sockets of others. As a result, it is impossible to be certain whether or not all the teeth associated with the skull belonged to the individual, and it is difficult to estimate age.

Some thirteen permanent teeth definitely belong to the skull and four more teeth possible belong to this individual. There remain three root stumps which cannot be identified with certainty, nor can they be fitted to the remaining sockets in the skull.

The gross deposits of calculus on the maxillary right premolars and molars, and the relatively unworn state of the teeth beneath the calculus, show that there had been virtually no function on this side of the mouth for some considerable time. The mandibular right molars had all been lost *in vivo* and the presence of a fairly large residual abscess indicates that there had been gross periodontal infection before the teeth were lost.

By contrast, the first molars on the left side appear still to have been functioning at death, though they must both have been loose. The lower tooth is severely worn, almost to the bifurcation of the root, while secondary dentine is exposed in the upper molar. The degree of attrition of this tooth is such that it might suggest an age of about fifty for this individual, if the occlusion had been normal. However, the occlusion was grossly abnormal and the two molars on the left appear to have been carrying all the functional load that was still possible in this dentition. They may therefore have been worn down rather faster than usual.

In view of all the pathological complications present in this skull, it seems impossible to say more than that the individual was probably middle-aged or elderly. Pathological conditions in the dentition have already been described. There is no evidence of dental caries. In view of the extensive arthritic changes found elsewhere, including the occipital condyles of the skull, it is interesting that there is no arthritic change in the temporo-mandibular joints.

BURIAL IV

This collection includes bones or bone fragments from at least three adults, one adolescent and at least three children as well as one infant. The burial appears to represent a secondary deposition, possibly of individuals originally buried in St Mary's churchyard. There was little admixture of non-human bone: only one rib, probably bovine, was recorded.

SKULLS AND DENTITION:

These are best considered as follows:—

1 Parts of a child's skull including one half of a sphenoid, the frontal, two parietals, the occipital and two temporal bones and some other very thin fragments deriving from this skull.

2 Parts of one or more adult skulls: the external surfaces of some of the fragments were very eroded, suggesting the presence of a second skull.

3 The articular eminence and root of the zygomatic process of a L temporal bone: this could have belonged to the same individual as (2) above.

4 Mandibles: the symphysial region of two individuals.

5 Maxilla: L with sockets for 12345; R fragment with incisor sockets.

6 A number of separate teeth.

DR LUNT COMMENTS AS FOLLOWS:

The bone fragments include two small pieces of mandible, both including the mental region (ie at least two individuals present) and a fragment of L Maxilla with sockets for central incisor to second premolar. All three fragments have suffered post-mortem damage, but there is some evidence of *in vivo* resorption of alveolar bone which suggests that the individuals were not young.

The 12 isolated teeth may be grouped as follows:

1 A heavily worn maxillary L central incisor; a heavily worn mandibular R canine probably belonged to the same individual.

2 A moderately worn maxillary L central incisor; a maxillary L lateral incisor may have belonged to the same individual.

3 A slightly worn maxillary L central incisor; a maxillary R lateral incisor almost certainly belonged to the same individual.

4 A virtually unworn maxillary R lateral incisor, with faint traces of wear on the enamel surface, indicating tooth eruption shortly before death. Post-mortem root loss precludes a closer age estimate. However, it seems probable that a developing mandibular R first premolar may belong to the same individual. The stage of root development of this tooth gives an age of 9-10 years at death.

5 A very heavily worn mandibular R first molar. The degree of attrition corresponds to an age of c 44-48 on the scale compiled by Miles for Anglo Saxons.

6 Slightly worn mandibular R second molar, with a large distal attrition facet; the degree of attrition suggests an age of c 24-26 on Miles' scale.

7 Unworn mandibular R third molar but with roots completely formed. Lacks occlusal attrition, but a small wear facet, just visible on the mesial surface, suggests that the tooth

had been in function only a very short time before death. The age of the individual at death may have been c 19-22. Not the same individual as (6).

8 A slightly worn maxillary R third molar with occlusal attrition, possibly from the same individual as (6) or, less likely, from (5), but not (7).

The anterior teeth demonstrate the presence of at least four individuals: the molars indicate at least three. Although molars and anterior teeth cannot be matched, each molar could belong with one of the groups of anterior teeth: otherwise more than four individuals may be represented.

Vertebrae:

cervical: adult C1 and C5; two sub-adult, from mid-cervical region; one much damaged child's vertebra, probably a low cervical vertebra.

thoracic: 7 more or less complete adult specimens and the body of another.

lumbar: 2 of adult size.

Ribs: 10 L and 6 R adult ribs and some fragments; fragments from probably two sizes of child.

Clavicle: 1 R sub-adult, lacking the medial epiphysis.

Scapulae: 1 L scapula, sub-adult, reconstructed from fragments; glenoid fossa of 1 R scapula; inferior angle of an infant scapula.

Humeri: 1 L lacking medial epicondylar epiphysis, length c 280 mm. Probably from an individual of c 18-19 years of age, estimated to have been 5 ft-5 ft 2 in (1.52 m-1.57 m); parts of shafts of probably 3 individuals, aged 7-12 years; infant shaft, age considerably less than one year; also the lower epiphyseal mass of a humerus, from an individual possibly aged 15-18 years.

Radii: R adult, intact, length 215 mm, suggesting an individual 5 ft 1.5 in-5 ft 2.25 in tall (1.56 m-1.58 m); L adult, lacking both ends, possibly from a different individual.

Ulna: R adult, lacks lower end, matches R radius; upper half of shaft of R adult, lacking upper processes suggesting fairly heavy build; L upper half, lacking olecranon process and lower end—? adult.

Hand: Fragments of 3 metacarpals, including ? L 1st and 3rd; 2 phalanges.

Pelves:

(1) A pair of innominate bones, lacking pubic portions. The epiphyses of the iliac crest and the ischial tuberosities are not quite fused, suggesting an age at death perhaps as late as 25 years. The L bone has a rounded perforation,c 15 mm in diameter, through the middle of the iliac blade. Apparently the blow was struck slightly upwards and backwards from the outer surface on the left. It may have been caused by a pick during excavation, but a spike or a bullet are possibilities.

(2) Part of a L innominate bone with part of the acetabulum, from an adult.

(3) Part of a R innominate bone with part of the acetabulum, from a large individual but probably not over 17 years old.

(4) A fragment of a L innominate bone with the auricular surface.

(5) A fragment of a L innominate bone with the auricular surface, probably the same bone as (4).

(6) A fragment of a R innominate bone near the acetabulum: (4), (5) and (6) are possibly all from the same pelvis.

(7) R ilium and L ischium from a child of perhaps 7 years of age.

(8) Numerous other fragments of innominate bones.

Femora: The following list includes 7 femoral heads, indicating that at least 4 individuals are represented.

L adult, complete, length 403 mm, suggesting a height of 5 ft-5 ft 2.5 in (1.55 m-1.59 m); R femur lower condyles, possibly a pair with the above; R femur head and trochanters of heavier build than the L example above: 3 femoral heads, probably all adult; head, neck and upper shaft of L femur, with absence of trochanters and size suggesting an individual of c 18-20 years; part of a femoral head, possibly a pair with the last mentioned.

6 mid segments of shaft, not easily attributable to side, represent 3 (or more) individuals, probably all adult. Two fragments exhibit damage which may have been caused by a pick or spike. Some other fragments may also be from femora.

Tibiae: adult pair, length 310 mm, probably from the same individual as the complete L femur, and suggesting a height of 4 ft 11 in-5 ft 1.25 in (1.50 m-1.56 m); L upper half; 2 mid segments of shaft, one with indications of post-mortem damage by a pick or spike.

Feet:

calcaneus: probably 2 pairs, one adult and the other sub-adult.

talus: 1 L, more or less complete, matching L adult calcaneus; 1 fragment.

cuboid: 1 L, damaged.

cuneiforms: 1 L and 1 R medial cuneiform, adult, possibly not a pair; 1 damaged ? medial cuneiform from a child.

metatarsals: R and L (damaged) 1st metatarsal; portions of 3 or 4 others.

phalanges: 1 1st proximal, probably L.

AN EVALUATION OF THE RADIOCARBON DATES MEASURED FOR THE CROSSKIRK BROCH INVESTIGATION D D HARKNESS

A total of seven radiocarbon age measurements were made, at the NERC Radiocarbon Laboratory, in support of the Crosskirk broch investigation. The age reports for these samples, in conventional (*Radiocarbon*) format, are contained in Table 23.

It is now a well-recognised fact that the conventional radiocarbon time-scale should not be directly interpreted in terms of absolute calendar dates i.e. by the simple subtraction of 1950 years, although until recently the encouragement of this practice was countenanced by the editors of *Radiocarbon*. Any objective attempt to establish the contribution of radiocarbon dating to Crosskirk or, for that matter, to any other archaeological site demands an appreciation of the pitfalls and potentially false trails which must be negotiated in age interpretation. The pathway is certainly hazardous for the unwary but fortunately it is by no means uncharted.

Table 23

SRR-266	Organic detritus under flagstones of primary floor in broch	2380±45 $\delta^{13}C = -26.8‰$
SRR-267	Charcoal from reconstruction hearth	1880±70 $\delta^{13}C = -28.0‰$
SRR-268	Charcoal from hearth in rampart cell, Enclosure III	2120±50 $\delta^{13}C = -26.1‰$
SRR-269	Charcoal on floor of Enclosure VII	2770±100 $\delta^{13}C = -27.1‰$
SRR-270	Protein fraction of rib-bone from seated burial, Grave III	2100±100 $\delta^{13}C = -22.0‰$
SRR-271	Charcoal on floor of Enclosure adjacent to broch entrance	2070±80 $\delta^{13}C = -27.8‰$
SRR-272	Charcoal from occupation deposit on broch floor	2050±50 $\delta^{13}C = -26.8‰$

Notes:

The above ages are calculated using the original Libby half-life value (5570 years) for ^{14}C decay i.e. they are expressed as conventional radiocarbon years BP and at the $\pm 1\sigma$ level of analytical confidence.

All ages have been normalised to compensate for isotopic fractionation effects both natural and laboratory-induced, via the measured $\delta^{13}C$ as quoted.

RECOGNISED SOURCES OF UNCERTAINTY IN AGE INTERPRETATION

A compilation of all uncertainties associated with the sample itself, its analytical age assessment and, where appropriate, age calibration must be considered as defining the true confidence warranted in archaeological interpretation. The recognised areas for error, both potential and inherent, can be grouped into three categories viz., those which are (1) largely avoidable by physio-chemical treatment of the sample prior to radiocarbon analysis; (2) unavoidable, but which can be quantified in a mathematical sense; and (3) unavoidable or unrecognised, and which cannot be truly quantified.

In the first category is sample contamination. Almost all samples submitted for radiocarbon age measurement contain, irrespective of their composition, varying amounts of carbonaceous material which is foreign to the original sample matrix. Such contaminants, having been introduced after death or deposition of the sample, are therefore likely to be non-contemporaneous with its true age context. Clearly, erroneously young or old ages could result, depending upon the source and/or chemcial composition of the foreign carbon, if this was not recognised and removed before radiocarbon measurement. The appropriate decontamination procedure for a given sample must be based on its chemical composition and prior knowledge of the natural preservation environment—the Crosskirk materials presented no particular problem in these respects. Five of the samples submitted were wood charcoal and, while not generously sized, there was sufficient raw material to allow a stringent decontamination in each case. The main concern for charcoal is that due to its physiochemical properties it is an excellent retention filter for those soluble organic compounds transported in percolating groundwater. Consequently it was necessary to leach each sample by successive digestion in dilute caustic solution (2M KOH) until all traces of soluble humic substances had been removed. As an additional precaution the charcoals were then digested in mineral acid (2M HCl), washed in distilled water and dried under vacuum. Where necessary, larger pieces of charcoal were ground to pass a $\frac{1}{8}$" (3 mm) mesh sieve and then examined under magnification. All remaining suspect materials, for example rootlet fragments, were removed by hand picking.

In the case of the rib-bone from the seated cist burial (SRR-270) the prime objective was to avoid any mineral carbonate in the structure. The component protein (collagen) was isolated using controlled acid hydrolysis and this product further refined and recrystallised as gelatine. Unfortunately this decontamination procedure invariably results in a marked reduction in sample size which is in turn reflected in the poorer than hoped for analytical precision achieved in conventional age measurement i.e. (±100 years). The remaining sample, organic debris underlying the flagstones of the primary floor in the Broch, was the most thought-provoking with regard to the best decontamination method. There was every likelihood that caustic digestion, as employed for the charcoal samples, would have totally destroyed this material. It was therefore decided to apply the basic method as developed for the decontamination of lake sediment and soil samples. The sample was simply digested overnight in dilute acid (2M HCl) washed with distilled water and dried under vacuum. This treatment should have been effective in the removal of the more soluble humic matter which could have derived from inwash through the overlying strata. Again this sample was examined under magnification and suspected rootlets removed by hand picking. In view of the somewhat stringent decontamination procedures it is highly unlikely that the radiometric ages as measured were influenced by carbon foreign to the original sample materials.

Quantifiable uncertainties encompass those incurred in radiometric analysis and any subsequent conversion from conventional radiocarbon years BP to a calendar time range. It is essential from the outset to recognise the true definition of a conventional radiocarbon age: this is nothing more than an expression, in terms of time (years) prior to AD 1950, of

Table 24 Crosskirk radiocarbon ages with calendar date conversion

Laboratory number	Sample description	Conventional radiocarbon age (68% confidence)	Corresponding dendro-based calendar ranges (after Clark 1975) (68% confidence)	(95% confidence)
SRR-267	Charcoal	1880± 70	AD 45 to AD 225	95 BC to AD 275
SRR-272	Charcoal	2050± 50	180 BC to AD 20	360 BC to AD 110
SRR-271	Charcoal	2070±80	215 BC to AD 35	405 BC to AD 115
SRR-270	Bone protein	2100±100	380 BC to AD 10	430 BC to AD 140
SRR-268	Charcoal	2120± 50	360 BC to 95 BC	405 BC to AD 40
SRR-266	Organic detritus	2380± 50	600 BC to 430 BC	770 BC to 400 BC
SRR-269	Charcoal	2770±100	1155 BC to 880 BC	1320 BC to 780 BC

the measured residual $^{14}C/^{12}C$ content in the sample material. Unfortunately, such radiometric measurements cannot be made with absolute precision—a fact which is reflected and quantified in the error (±) component of each radiocarbon age evaluation. This notation, e.g. A±B years BP, implies that the radiocarbon age must therefore be regarded purely as a statistical expression of probability viz. where the 1σ confidence criterion is used, as in conventional ^{14}C age reporting, there is a 68% probability (2 chances in 3) that the true radiometric age of the sample lies somewhere within the range defined by the appropriate ± limits. Doubling the age range results in a 95% probability (19 chances in 20) but obviously in radiometric dating absolute confidence is unattainable. Clearly one has no way of knowing whether any individual age measurement produced is within the 1σ or 2σ confidence band or for that matter totally outwith the 95% confidence limit.

Where it is considered necessary to convert conventional radiocarbon ages to a calendar time interval then this can only be achieved by correlation with bristlecone pine dendrochronolgy. This calibration method is in itself subject to a very real level of uncertainty which, although quantifiable, must in turn reflect to the detriment of the ultimate confidence which can be placed on calibrated, or as they are sometimes called 'corrected' dates. In recognition of the inherent deficiencies of the calibration data I have applied the Clark (1975) approach, as the most objective yet available, in calendar conversion of the Crosskirk ages (Table 24).

Finally, the possibility of non-quantifiable uncertainties must be considered in any dating exercise. For the most part these arise from the familiar question of sample context, that is to say the assumed relationship between the sample material selected and the event to be dated. At Crosskirk the most obvious question concerns the charcoal samples. Since radiocarbon analysis can only provide an assessment of when the organic material died is there a possibility that already aged wood, eg bog-preserved, was used as a fuel source? Attention must also be drawn in the case of the human bone sample to the possibility of a more subtle form of misrepresentation. This concerns dietary pattern in the case of those prehistoric peoples who may have depended to a significant extent on seafood as a source of primary protein. It has become recognised in environmental ^{14}C studies that marine carbon is depleted in ^{14}C relative to the terrestrial biosphere and as a result of the finite mixing time for near surface and deep (old) ocean water. This phenomenon is reflected as an 'apparent age' at death for marine organisms which ranges between 350 and 450 years in the coastal waters off NW Europe. Therefore, had a prehistoric man derived his total protein requirement from seafood then it is highly probable that his body tissue would evidence a positive 350 to 450 year age discrepancy. Likewise the skeletal remains of humans who had depended on a mixed terrestrial and marine diet would show apparent radiocarbon ages in the intermediate range viz., 0 to 450 years before death.

CONCLUSIONS

It seems appropriate to summarize the significance of the radiometric ages obtained for Crosskirk broch purely from the point of view of a radiocarbon chronologist and without the benefit of supporting or, for that matter, conflicting archaeological evidence. Within the limitations of avoidable and quantified uncertainty, radiocarbon dating would appear to have been successful in that:

1. The conventional radiocarbon ages (Table 23) indicate a maximum period of occupation, at the 95% (±2σ) confidence level, covering the age range 2970 to 1740 years BP. Within this span, and subject to the availability and selection of datable material, there appears to be represented at least three if perhaps not four periods of occupational activity, represented by the groupings (a) SRR-267; (b) SRR-268, -270, -271 and -272; (c) SRR-266; (d) SRR-269.
2. Conversion to calendar years increases the possible occupational span to some 1600 years, covering the period 1230 BC to AD 275 (Table 24). Apart from the possible merging of groups (a) and (b) above, the retained independence of SRR-266 and SRR-269 would again support discrete variations in the level of human activity during the latter part of the site's use.
3. A major period of occupational activity is indicated between 405 BC and AD 110. It is perhaps tempting to consider these (group (b)) dates as not only defining the maximum limits for this occupational phase but, when taken individually, as an indication of the rate of site development. This latter contention is, of course, only warranted where additional independent evidence can be cited in support since the radiocarbon ages overlap and are therefore by definition identical. In

other words, a cautionary distinction must be drawn between the level of interpretation which can be placed on samples of the varied composition and range of contexts of those comprising group (b) and a suite of similarly overlapping ages obtained for samples from a well-defined stratigraphical situation eg a peat profile or sediment column. For the latter statigraphical grouping there would exist clear structural evidence to support, as being real, any suggested trend in age variation, although the analytical precision of the radiocarbon dating alone would be insufficient to warrant this assumption.

Finally, the limitations of sample context, ie non-quantifiable error, must be considered. There is, as discussed previously, a distinct possibility that the radiometric records of the bone and charcoal samples may exhibit a bias towards early dating. With the skeletal remains this factor would be less than 450 years. In the case of the wood charcoal the potential range is of course much greater and consequently these dates are perhaps best regarded as providing a *terminus post quem* for actual use of the timber as a fuel source.

NOTES ADDED IN PROOF

Since this appendix was drafted, progress in the high precision ^{14}C dating of tree-rings has afforded the opportunity for a more accurate and precise calibration than carried out here, and on which Dr. Fairhurst's assessment of the chronology of the site is based. The interested reader is referred to Stuiver (1982), Pearson *et al* (1983), Pearson and Baillie (1983) and Ottaway (1983).

Consequently, the following calendar age ranges (assessed at the 95% confidence level) may now be proposed to supersede the corresponding Crosskirk values listed in Table 24:

Laboratory code	Calendar age range (95% confidence)
SRR-267	AD 5 to AD 340
SRR-272	340 BC to AD 60
SRR-271	380 BC to AD 130
SRR-270	400 BC to AD 30
SRR-268	370 BC to AD 5
SRR-266	760 BC to 380 BC
SRR-269	1260 BC to 790 BC

D D Harkness
May 1984

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11 GENERAL REVIEW OF THE INVESTIGATIONS

DATING THE SITE

The immediate objective must be to co-ordinate the dating evidence for the site as a whole. In the first place there is the record of the various artifacts found during the excavations. The total number is not great in comparison with some other broch sites, for instance the Broch of Burrian (MacGregor 1974), Clickhimin (Hamilton 1968) and Dun Mor Vaul (MacKie 1974), but the assemblage for Crosskirk is broadly representative for the Caithness-Orkney region. The following finds from Crosskirk may be regarded as normal recoveries for a broch site in this area: the largely undecorated pottery from storage jars, samian sherds, bronze ring-headed pins and spiral finger rings, the painted pebble, the cup-shaped stone lamp, rotary querns, whetstones, spindle whorls, weaving combs, small stone discs and the bone tools in general. In recent decades, a date for the beginning of the broch building period, when one has been given at all, has been around 70-50 BC (Piggott 1966, 9; MacKie 1974, 103), and none of the above types from Crosskirk would in themselves indicate any necessity for re-dating. Perhaps the most suggestive discovery on the site from this point of view was that of the Roman coloured sherd of the fourth century AD; it will be recalled that it was found in the settlement area under the turf and may belong to the time after regular occupation had ceased. More unusual forms such as the amber bead and the decorated toilet comb unfortunately cannot be dated with accuracy, but do not conflict with current views on the duration of the broch period.

However, the structural evidence that has emerged from the Crosskirk investigations does seem to conflict with current views to some extent. Both broch and settlement pre-date by some considerable time the occupation in which the samian sherds appear. The settlement began to grow up long before the broch became obsolete and Hamilton's generalisation (1962) that the external settlements came into being when the brochs became ruinous in about the second century AD does not apply at Crosskirk. Again, the structural evidence suggests that a not inconsiderable gap preceded the occupation of Romano-British times and that the broch itself was becoming ruinous before the break in continuity; moreover, the change in the fabric of the pottery at this time should also be borne in mind. There are indications that the broch itself was structurally of an early form, and in the broch and settlement alike, several phases of building can be recognised before the apparent gap in occupation. In other words, the structural evidence is suprisingly complex if the broch-building period in general commenced no earlier than 70-50 BC.

Additionally, there are the radiocarbon datings from Crosskirk which have been referred to briefly in the discussion of the excavations, and which seem to suggest a date earlier than the first century BC for the construction of the broch. The seven dates obtained must now be considered together. The dates are given in the table (Ch 10); a second table offers conversions to calendar years. In the discussion which follows, the radiocarbon dates are given without any conversion, unless otherwise stated.

The seven radiocarbon dates comprise three from within the broch and four from the settlement area. Immediately, four divisions are indicated by taking together those where there is an overlap in terms of the single standard deviation given for each. All of the samples with one exception consisted of small fragments of charcoal, minimising the risk of the use of wood from very old trees, and were often chosen from a much larger number, some of which had proved to be of somewhat doubtful stratification on this complex site. The exception came from the rib-bone of the skeleton found in a seated position in a cist grave inserted into the floor of Enclosure I. Dr Harkness has pointed out that according to current research, a diet involving large amounts of sea-food might give an

exceptionally early date when bone is being used. At Crosskirk, as will appear later (p 170, the normal diet was obviously varied and any such effect could only have been marginal. If any adjustment were to be made, it would seem to result in a closer approximation to the date from the floor of Enclosure I which statistically is centred slightly later than the rib-bone from the same context. However, in strict mathematical calculations, the latter date must be considered as suspect on account of the material used for dating.

The first of the Crosskirk samples, 1880 bp ±70 (70 ad) was taken from the hearth in the reconstructed floor of the broch in Period Four. It is interesting that even taking the corresponding calendar range (Harkness) at the 95% confidence level, the range does not extend as far as the period of the Roman Castor ware. Together with the relatively small amount of pottery of the Later Broch period generally, this may well indicate that the sherd was in fact incidental, representing occasional resort to the site in Period Five, and not a continuity of occupation from the later second century AD (calendar years) as indicated by the samian sherds from both broch and settlement.

Next comes the very suggestive group of four:—

2050 bp ±50 (100 bc) Late Period Three, broch occupation debris.
2070 bp ±80 (120 bc) Late Period Three, floor of Enclosure I.
2100 bp ±100 (150 bc) Late Period Three, rib-bone in Enclosure I.
2120 bp ±50 (170 bc) Early Period Three, hearth in Enclosure IIIa.

This is a remarkably consistent group and the individual dates are mutually self-supporting. It might be noted in passing that from this evidence, various critical objects associated with the brochs, about which there has been controversy in the past, are now virtually certain to have appeared in northern Britain before the Roman invasion of 43 AD. These include the stone cups with a stub handle, the bronze ring-headed pins and spiral finger rings, the painted pebbles and rotary querns. It is a striking fact, however that all four radiocarbon samples from Period Three deposits, when both the broch and settlement were in occupation, have been dated as far back as the second century bc. The marked difference between the group as a whole, and Period Four when the samian sherds were deposited, seems to emphasise the need for a break in continuity such as has already been envisaged on structural grounds.

Before the presumed break occurred, the broch had already become a partial ruin buttressed most of the way round the outside, and several phases of reconstruction had taken place in both the broch and the settlement. Under the circumstances, the evidence of the four consistent radiocarbon dates extending Period Three back into the second century bc must be regarded as providing at least a reasonable hypothesis. The earliest of the four datings, 170 bc, came from a deposit in Enclosure III*a* which was stratigraphically early in Period Three. The dendrochronologically-based calendar range for the sample (at the 68% confidence level) is 360 BC to 95 BC, so that Period Two, that of the construction of the broch, could begin at 200 BC or even earlier.

The two remaining samples are both widely separated from the sample just considered, and from one another. One is dated 2380 bp ±45 (430 bc). It was taken from directly beneath the slabs of the primary floor of the broch in the hope that it might throw light on the period of construction, but the main reason for its selection for radiocarbon dating was because the litter-like material had been found to be particularly rich in plant remains and a dating was desirable on botanical grounds. The result is so far removed from those of the broch occupation just considered that this sample seems more likely to be associated with the earlier promontory fort, perhaps coming from the ground surface on which the broch was subsequently built. This in fact seems in accordance with the botanical content. SRR-269 is even more remote in date from the broch period. It consisted of small fragments of charcoal taken from the surface of the pavement within Enclosure VII and gave a result of 2770 bp ±100 (820 bc). This structure has been built more or less on bedrock and had been regarded as perhaps the oldest in the settlement: nonetheless, such an early date was unexpected. Only one artifact was obtained from Crosskirk which suggested comparison, that of the potsherd from the bottom of the well, with a fabric reminiscent of that of the late Cinerary Urns. Some activity on the site early in the first millennium must remain a possibility.

THE STRUCTURAL SEQUENCE

PERIOD ONE

The structural sequence begins at Crosskirk with a length of clay-cored wall across the E part of the neck of the promontory. Through the wall, there was a gateway widening outwards, with a well-laid pavement and a drain underneath. W of the gateway, there was a cell-like structure within the rampart, resembling the corbelled wall-chamber in a broch, and beyond that was a recess in the inner face of the wall. Immediately outside, the ground level was interrupted by two natural hollows somewhat deepened artificially, which merged westwards. With rising bedrock, the wall became more of a terrace-like feature overlooking the shallow ditch, and that in turn passed into a line of flagstones on end, reaching to the cliff at Chapel Geo. The gateway section of the rampart, with the nearby cell, formed a stout defence to the headland and was somewhat suggestive of broch walling, but it was incomplete in itself. Any comparison with the 'Forework' at Clickhimin, the Ness of Burgi or the Loch of Huxter, may be premature, but the same lack of a continuous defensive wall there is obvious. It might be that there was some counterpart on these sites to the row of upright flagstones at Crosskirk.

If the period of the fifth-fourth century bc was indicated by the radiocarbon date of 2380 bp ±45 (430 bc), the defences would be rather later than the period suggested for some of the timber-laced forts in Scotland (Cunliffe, 1974), but somewhat earlier than the currently accepted date around 300 BC for stone-walled fortifications generally. This date at Crosskirk would also apply to the coarsely decorated pottery found deep in the wall cell by the gateway and in the recess. While resort to the rocky headland which in itself formed a natural fortress might have begun as early as the first half of the first millennium BC, the promontory fort was sufficiently substantial to indicate that it was at least used regularly in times of danger. Evidence of occupation within the defences, however, was so vague that nothing can be certain, and the absence of the pre-broch pottery on the site generally seems to emphasise the lack of continuous occupation at this early stage. The entire headland was not investigated however, and erosion from the sea may well have reduced the area of occupation available in prehistoric times.

PERIOD TWO

A social or political change seems to have brought a need for fortified living quarters within the older promontory fort. The broch may have been sited with a view to covering the weak flank at the old barricade of flagstones, but more probably because it would provide an imposing feature within the existing defences and give an overwhelming impression of strength. This phase of development probably occurred around 200 BC. The first phase of the broch and the occupation immediately associated with it constitutes Period Two on the site. From this point on, the site was inhabited for a long period, and although there was no break after the construction of the broch, the early occupation has been differentiated in view of the particular interest attaching to it.

In plan, the broch appears to be normal for the Caithness-Orkney region, with guard-cell, intra-mural chamber and stair entrance at ground level, and with no ground gallery within the relatively thick wall. Three reasons may be advanced, however, for regarding the Crosskirk broch as an early form typologically. In the first place, there are indications of an early date in the radiocarbon determinations. Secondly, there was no definite evidence for either a gallery or a scarcement, although parts of the wall stood to a height closely approaching the normal upper limit of these features. Thirdly, the wall with its core of earth, rubble and boulders, rapidly became unstable and obviously would have formed an inadequate base for a high tower such as Mousa. If we think in terms of an early experimental stage in broch construction, it might be possible to understand a number of puzzling features such as the crowding of the intra-mural structures and the well, all confined to a small sector of the broch wall, the unusual shape of the guard cell, the stone ladder and the insertion

of the flag-lined depression almost under the W broch foundations. We would suggest that the Crosskirk broch was never intended to rise to a height of more than five or six metres, and even so, experience in building high walls had been too short for stability to be achieved. On the other hand, so many features of a fully developed broch were present that it would be absurd to describe Crosskirk as anything else, even as a 'galleried dun'. The word broch is an old-established descriptive word and cannot be restricted to examples which may be shown to have reached a highly sophisticated form.

Internally, the arrangements may also reflect some uncertainty in design. A partition of vertical flagstones crossed the enclosure on the diameter from the main entrance. To the SW, apart from the cell and stair entries, there was a space with the rock-cut well, and against the western wall, the curious shallow depression, with several slab-lined tanks around the dry-stone walling which delimited the feature. To the NE of the main partition, there were two slab-lined tanks, a large hearth and various alignments of supports for vertical flagstones which marked off radial divisions along the perimeter. There was no sign of a range of timber buildings around the interior of the broch wall, such as Hamilton postulated for Clickhimin (1968). Evidence for a roof covering the interior could not be found, though domestic occupation was obvious everywhere and the radial compartments around the periphery in the N and E, strongly suggested beds and working places as in a wheelhouse. Perhaps the interior was only partially covered, with an open space in the SW around the well, and it is always to be remembered that the relatively high wall of the broch would give protection from the wind on that exposed site.

The actual erection of such a monumental structure, even though the wall reached to no particularly great height, must have taxed the resources of the locality to the uttermost. Rather than visualise the employment of some peripatetic band of professional builders, it seems more probable that the local community itself was responsible for the construction and the near-contemporaneous occupation of houses in the settlement immediately outside the broch seems to indicate the existence of such a group. Perhaps when numbers tended to increase in a small community of this type, and to press on the local resources, a hiving-off process may have been involved, resulting in the clustering of brochs within the more habitable areas of Caithness, as discussed in the introductory section of this report (p 21).

PERIOD THREE

The construction of the broch was followed by a period which the structural details and the radiocarbon dates suggest may have lasted for as long as two centuries. Domestic occupation is clearly involved, but whether continuous or intermittent, it is hard to say. Considerable changes took place in the internal arrangement of the broch. The original radial pattern was lost and a drain was inserted through the entrance passage. Reflagging occurred in many places and both the well and the sunken depression in the west were covered up, but the large central hearth seems to have functioned for a long time. Now, however, instability became manifest in collapses of the facing stones to the broch wall with its clay and rubble core, and this at an early date in the period. One catastrophe led to the construction of a great buttress walling off the intra-mural cell; this did not solve the problem as further buttressing in the same sector became necessary later. The guard cell had to be filled in and a new doorway was built just outside the entrance passage. Refacing once, twice and even three times became necessary on the seaward side of the broch, and along the whole W sector the external face had to be shored up along its foundations. By the end of the period, the broch was becoming ruinous.

With greater safety to be found outside, except when raiders appeared, and presumably with some natural increase in the community, the exterior settlement became increasingly important. Enclosure IV*a* against the broch wall at the entrance, and Enclosure VIII just outside the outer rampart, were amongst the earliest, but traces of others were noted to the E of the broch entrance. Somewhat later, Enclosure IV*a* was replaced by IV*b* when the new doorway with its checks and bar-hole had to be constructed. The curious niche and the pillar, E of the entrance, belonged to this period. Another change took place in the outer rampart W of the gateway. Perhaps to strengthen

the old gateway, the circular Enclosure III*a* was partly walled off over the top of the hearth and filled in, but at the same time it was extended westwards to produce the large oval of Enclosure III*b*. Little evidence is available for the method of roofing the enclosures in the settlement but they appear to have been built partly of turf with a facing of stone slabs on the inside. Generally they were sub-rectangular in plan, with markedly rounded corners.

Some levelling of the older buildings in the settlement took place during Period Three. In the area to the E of the broch entrance (with the new doorway outside), the former structures were replaced by the large and roughly circular Enclosure I with its annexe II up against the broch wall. Enclosure VII to the south was also obliterated with slabs and midden material. At the outer, southern, end of this filling, a carefully outlined cross-passage now ran westwards along the inner side of the old rampart as though to give access to the open area W of the broch. With decay and purposeful levelling, the settlement probably sprawled further and further eastward towards the cliff edge where traces of foundations could be seen but were not excavated. There was no indication, however, of any extension beyond the external rampart to the S.

At a very late stage in Period Three, the seated burial was inserted into the floor of Enclosure I. Decay had set in generally and the broch was in a half-ruinous state. How long life continued under these conditions cannot be determined precisely, but a break in continuity over a period of one or perhaps even two centuries must be envisaged.

PERIOD FOUR

The partly ruinous broch must have appeared to be a serviceable enclosure in the second century AD when it was reconditioned. A new floor level was established with a central hearth which happened to be directly above the capping stone of an old slab-lined tank. The major change was in the settlement where a structure suggestive of a wide passage ran all the way from the broch entrance out through the gateway in the already ancient rampart. This extraordinary feature had been provided with two and probably three sets of narrow steps as well as two broad sets, each leading upwards and outwards. With its new doorway facing the broch entrance, it may have been used to house stock, but storage is a possibility also. The passage had been constructed through old refuse and ruined enclosures of earlier periods, and at the outer end had been brought up to the right level by masses of carefully laid slabs filling the old gateway and the hollow in the ground outside. Presumably these slabs came from the broch and rampart walls. This extended passage with its numerous steps could have had no military significance and indeed the old defences seem to have been deliberately obliterated. After a time the need for this passage seems to have passed and its width was restricted by secondary walling; the result was something resembling a short souterrain. No domestic enclosure of the period was encountered in the excavations and the bulk of the occupation debris was much smaller than for the earlier broch period.

PERIOD FIVE

During the many centuries between the reorganisation of the site in the second century AD and the construction of St. Mary's Chapel, no domestic refuse was left behind. There is the evidence, however, of the two long cist burials inserted into the mound of debris from the broch, perhaps around 600 AD. When St Mary's was built in about the thirteenth century, levelling operations were undertaken in the area S of the broch; traces of paving were found together with an alignment of slabs set on end for which no function can be suggested. The occurrence of some stone robbing in the broch mound in recent times, perhaps for material for the present field dykes, may also be mentioned.

ENVIRONMENT AND FOOD SUPPLY

In reviewing the specialists' reports on the botany and zoology of the Crosskirk site, and bearing in mind the comparative material from Dun Mor Vaul on Tiree, it is now possible to write with some confidence about conditions during the Iron Age on the Atlantic fringe of Scotland and especially in Caithness. There is of course a twofold aspect to these studies: the specialists are concerned with a scientific approach to the plant and animal life of the period, while here the results in terms of environmental conditions and the food supply of the broch's inhabitants are the main consideration.

The evidence from these reports makes it abundantly clear that Caithness was a relatively treeless area even in the Early Iron Age, as was the W coast around Tiree. At Crosskirk, the general appearance would not have been dissimilar from the present-day uncultivated area lying immediately W of the site, with heather, grasses and sedges dominant on the peaty soil. In the immediate vicinity of the broch, the absence of trees and all but low-growing shrubs must have been complete as a result of the winds from the sea. The fauna was one of an open environment and the deer, which must have been present in some number, were surely descended as a relict population from the earlier period before about 1,000 BC when woodland was more common. Whether the absence of trees was due to climatic conditions, or to human interference, the latter must must have been important for there is ample evidence on a regional scale of widespread cultivation. Obviously the broch-builders were very short of a local supply of timber for scaffolding, roofing and boat-building, and the absence of evidence for all three is noticeable in the excavation record.

Wood for fuel may have been available in the Forss glen where trees grow to-day, and some driftwood and peat may well have been used. Whale's bone was obviously brought into the broch but there is no evidence for the use of ribs or jaws for roofing purposes; stranded whales seem to have been dealt with on the spot. The method of roofing the broch with its flagstone partitions, and the structures in the settlement with their vaguely defined walls, remains an exasperating problem.

Agriculture, indicated by the numerous quern stones, is clearly attested by plant remains in the soil samples. What is unfortunately obvious from the field investigations is the lack of evidence for ancient cultivation which might be associated with the broch period. This of course is true for the brochs in general; perhaps the fact that so much of the ground near so many of the sites in Caithness and Orkney has been subjected to intensive cultivation for so long, has made the chance of survival of such remains remote. The evidence for the cultivation of six-rowed barley at Crosskirk is convincing enough, as at Dun Mor Vaul, but the slight indications of wild oats and flax at Crosskirk are tantalisingly obscure. The occupants' diet might be expected to have included edible plants from the wild; the botanical report draws particular attention to *Chenopodium album* (Fat Hen) and *Stellaria media* (Chickweed) from Periods One to Four. Plants for fodder and bedding were also carried into the broch and it might be added that dyeing was probably undertaken with natural dyes obtained from such plants as heather tops (purple) and tormentil (red or crimson).

The suggestion from Dr and Mrs Dickson that the low-walled depression in the W sector of the broch in Phases One and Two, with its various slab-sided boxes, could have been used as a threshing floor, is one explanation for this puzzling structure, although this activity may not have been its primary use. Another suggestion, that the same 'boxes' could have been filled with ash and used for the storage of perishable foodstuffs, is also to be remembered, although the clay luting and the fact that one tank still held water at the time of excavation, seems to reinforce the zoological evidence for shellfish receptacles.

In general, the widespread nature of cultivation is shown by the occurrence of the remains of barley over the whole range of samples, and also in the clear evidence of weeds of cultivation. A well-established agricultural technique seems to be indicated as well as a reliable supply of cereal food. It is tempting to contrast conditions with those found at the Early Iron Age hut-circle settlement at Kilphedir in Sutherland, where the extraordinarily poor soils, the short-lived period of cultivation involved, and the minute area of improved ground, all pointed to a form of agriculture which was of minor significance in the economy of the local community.

Equally suggestive of successful farming is the zoological evidence for varied husbandry at Crosskirk. Ellison Macartney's results show that cattle corresponding to the Celtic shorthorn were reared, and beef was the most important form of meat produced. Some of it came from older animals and there was no evidence of an autumnal slaughter of the young beasts. Sheep of the Soay type and apparently some goats were reared; perhaps during Period Four, they were housed in the long extended structure in front of the broch entrance, the interpretation of which has exacted so much otherwise fruitless effort and thought. A supply of wool was obviously indicated by the spindle whorls and weaving combs from the site. The tenderest meat, or at least the youngest, came from the domesticated swine which were reared in some numbers. Horses, which seem to have been used for traction, may have drawn carts, sleds or ploughs, though the small finds throw no light on this particular problem.

It would be interesting to know whether the winter feed was conserved by sending the flocks and herds, but not the swine, to rough grazing some distance away during the summer months. Shieling sites, generally of much more recent date, are distributed in great numbers in the Highlands and Islands of Scotland generally, but so far little excavation has been attempted and there is no detailed survey for Caithness. It is not inconceivable that the few large hill-forts in Caithness such as Beinn Freiceadain (ND 060558) had something to do with transhumance in those days.

Miss Macartney has suggested the use of seaweed for winter feed at least for the sheep. It is an interesting point in itself, but it emphasises the fact that beachcombing also contributed to the food supply. Great quantities of shells from the shore were in evidence during the excavations, so much so that no attempt was made to take more than samples. Limpets and periwinkles were numerically the most important, with some whelks; none is a delicacy and some may have been stewed for animal food. Fishing is attested, but only a small quantity of bones was found. Salmon, which now occur in number both in the Forss River and in Crosskirk Bay, are absent. Rapid decay may account for the general lack of fish bones, and pigs grubbing in the midden may have helped in this process. Seal bones too were rare. It is noticeable that the evidence for fishing equipment amongst the artifacts is not plentiful although two possible fish-gorges and two stone weights which might have been used for anchors have been recorded.

A further contribution to the diet came from hunting and fowling, but its exact extent cannot be determined. Deer bones seem to occur only in small numbers although use was made of antler for weaving combs and other objects. Fowling along the cliffs nearby might have been expected on a large scale, but it is not easy to interpret the list of bird bones present on the site. The variety of species is considerable but the number from any one is not great. The occurence of occasional bones such as those of starling and blackbird may be accidental, but the higher frequency of gannet and great auk bones, widely scattered on the site, must have some significance. Remains of goose and duck were rare, but the appearance of one authenticated domestic fowl bone in a Period Four context is most interesting.

Individual human bones identified by Miss Macartney amongst the animal material are perhaps not particularly significant: relevant material has been archived (Ed). The disposal of a foetus in the midden is not meaningful in itself, and the few other examples cannot be regarded as other than stray specimens from disturbed interments such as 'Burials' IV and V.

Reviewing the situation as a whole, the Iron Age occupants of the Crosskirk site would seem to have had at least a broadly-based food supply with livestock, cereals and wild produce, together with a contribution from hunting, beachcombing and fowling. It was a matter of subsistence farming and food gathering, with no indication of imports from outside. There is no positive proof, however, of a fully adequate food supply and it seems reasonable to suppose that famine would have occurred in bad seasons. The one human skeleton which has been recovered from the broch period, was of an elderly person crippled with arthritis and with badly-diseased teeth, and can hardly be typical. In spite of the problems, however, it is tempting to think of the occupants of the Crosskirk broch and settlement having not only a broadly-based food supply but also one which allowed life at a level well above that of mere existence, at least under normal conditions.

THE BURIALS

The specialist reports on the human bones and teeth (Ch 10) need no summary here as they contribute rather to the study of prehistoric human remains in Scotland generally than throw light on the particular problems at Crosskirk. One comment must, however, be made. The seated burial of the early broch period in the floor of Enclosure I, has inevitably attracted much attention and Dr. Young's analysis seems to offer an explanation for the unusual position of the skeleton which was that of an arthritic cripple. Dr Lunt's description of the diseased condition of the mouth and the very restricted possibilities of mastication throw further light on the extreme discomfort and inability to lead a normal life of the individual sufferer concerned in his latter days. It seems to follow that existence had been possible only with the ministration of others. Perhaps this elderly and very infirm person, whose upkeep would have been a strain on a small community, had exercised special powers and had received exceptional treatment, culminating in burial in the floor of the house which then may have been set alight as the last event in our Period Three.

ASPECTS OF MATERIAL CULTURE

The assumption that an adequate and relatively secure food supply existed at Crosskirk seems also necessary for the broch-building people in lowland Caithness generally. The labour intensive construction of a great number of brochs in the restricted habitable area defined in Ch 1 must indicate a high density of population, even though the sites were not all constructed at the same time. Even taking into account the early date suggested for Crosskirk, the broch-building period was not by any means sufficiently prolonged to suggest that individual examples of this type of monument were constructed only at wide intervals. It seems an attractive hypothesis that these monumental structures were developed within a community with a secure food supply and able to spend considerable time in economically unproductive labour. In some ways, the most intriguing problem is the reason behind the need for these monumental buildings, especially at Crosskirk itself where the headland was naturally strongly defended and where the promontory fort was already in existence. Clearly, there must have been a growing need for defences in the Early Iron Age on the northern mainland of Scotland, but who were the enemies? Social factors may also have lain behind the developing need for impressive fortifications. At Crosskirk too, these cultural changes were accommpanied by another, marked by the growth of a settlement huddled within the rampart and against the broch wall. This again is a most interesting aspect in what seems to indicate a changing mode of life, radically different from, for instance, the loosely-grouped roundhouses which comprise the typical 'hut-circle' settlements on the moors of Sutherland and adjacent areas. Even larger and more complex external settlements appear on other broch sites in Caithness and Orkney, with Gurness as an outstanding example. Perhaps co-operation in group farming should not be entirely ruled out on these relatively productive lowland soils.

Turning now to the assemblage of artifacts from Crosskirk, the various structural alterations on the site covering a span of at least half a millennium, must have been accompanied by other changes in material culture. Unfortunately, the amount of disturbance and general lack of sealed deposits makes it difficult to detect these variations from a study of the small objects themselves. With the exceptions of pottery evidence, Periods One and Four are very sparsely represented. Consequently, much that can be said about the culture of the community inevitably reflects the state of affairs in the early broch period. Behind such minor differences as can be detected, however, the local Northern Iron Age appears to have continued with little basic change throughout the span of use of the Crosskirk site.

As might be expected from the remote situation, the community at Crosskirk seems to have been largely self-sufficient, although the presence of the various fragments of Roman origin and perhaps the amber pendant show that there was contact with the outside world, however indirect.

The bronze pins and spiral finger rings could indicate local trade or the work of some travelling craftsmen, as some slight evidence of bronze-working on the site has been noted. It is possible that at least some of the Early and Later Broch pottery was produced elswhere, as no direct evidence of potting on the site was found. However, the presence of the very lop-sided storage jar which had been crushed while standing in a hole in the primary floor, does not suggest a long distance import. On the whole the pottery is well-made and a professional on a nearby site may have been responsible. To make barter possible, surplus cloth may have been produced, for there is ample evidence from the spindle whorls and the weaving combs of textile manufacture. Iron was certainly worked on the site, as shown by the furnace residue and some slag, while the number and variety of whetstones clearly points to the use of metal tools. The almost complete lack of iron objects throughout the prehistoric sequence is almost certainly due to adverse soil conditions. It has often been noted that weapons of war do not appear on northern broch sites, but in the case of Crosskirk, this can scarcely be attributed to the peaceful nature of the native society in view of the massive defences which were erected. The bonework, most of which is exceptionally well-preserved, is not quantitatively important compared with that from other broch excavations, and few of the individual pieces are of any great merit in themselves, with the exception of the broken toilet comb. The use of bone and antler for such everyday objects as pins, awls, handles and even a pin-case hardly suggest that metal was very plentiful.

In general, then, the Crosskirk material is neither large in amount nor particularly distinguished, but it is representative at least for the Caithness-Orkney region in the earlier broch-building period. A prime interest of the Crosskirk assemblage must be that its duration is anchored by radiocarbon dates. Unfortunately, the Early Broch pottery is largely undecorated and has little variation in form, so that its value typologically is limited; on the other hand, the pre-broch period can only be given the vaguest of dates from the Crosskirk evidence. Even so, the assemblage as a whole would seem to have value in assessing the validity of MacKie's scheme for dating the culture of the builders of the northern brochs and wheelhouses, since he worked on the assumption that the brochs of Caithness were late in relation to those of the West which he placed as late as 70 BC. Above all, there would seem to be insufficient evidence to support an invasion hypothesis to account for the brochs and any 'broch culture'; MacKie in this matter rightly stressed that we are dealing with an aspect of the culture of the Northern Iron Age in general.

Undoubtedly, much had changed since the old days of the Bronze Age in Caithness, but internal contacts within the northernmost mainland of Britain and Orkney, brought about by trade, travelling craftsmen, cattle- and slave- raiding, as well as short-range tribal contacts which must have occurred, would surely account for such developments as took place. Long established local traditions, a strongly characterised local environment, perhaps stubborn native preferences, and sheer distance from communities in the south of Britain, must all be taken into account in viewing the culture under consideration.

Exceptional problems were common in the interpretation of the excavated material at Crosskirk, although some of them might appear more commonplace with better comparative material. Nonetheless, these ancestors of the Picts in the far north would in fact seem to have practiced some peculiar habits foreign to the cultures of the south of Britain.

Finally, it may be remarked that neither the results from Crosskirk nor from other broch sites in Caithness and Orkney would seem to suggest the existence of a cultural community capable or desirous of making a formal submission to Claudius and his legions on their landing in southern England in 43 AD.

12 CROSSKIRK AND THE PROBLEMS OF THE BROCHS

THE SIGNIFICANCE OF THE CAITHNESS-ORKNEY REGION

The brochs attracted a great deal of attention in Scotland during the earlier days of archaeological excavation, and a considerable number of sites were opened in the late nineteenth and the beginning of the twentieth centuries, by enthusiasts such as Tress Barry, Dryden and Traill. The great majority of the excavations were on the northern mainland and in Orkney, and were conducted at a time when labour was cheap. At that time, little attention was paid to what are now considered to be invaluable details. Mention has frequently been made in this account of the very inadequate reports which were published. In desperation, one imagines, Joseph Anderson attempted to keep at least some record and on one occasion was reduced to notes on no less than nine sites in a single paper (1901).

In recent years, the region of Orkney, Caithness and eastern Sutherland has been almost completely neglected as far as broch excavation is concerned, although over half the total number of broch sites is located there. The result has been that the contributions made by Hamilton after excavating in Shetland, and by MacKie after working on the West Coast, have inevitably lacked modern data from the main area of concentration. The absence of information has been particularly unfortunate as many writers, including Hamilton, have looked to this area as the homeland of the fully developed broch. Apart from the frequency of broch sites in this region, the excellent building slabs provided by the Old Red Sandstone, which would seem almost to have encouraged experiment in dry-stone walling, may be considered to have been a significant factor.

The excavations at Crosskirk have provided some unexpected results in addition to the radiocarbon dates; the structural details of the broch suggest an early form typologically and the settlement was built soon after the broch. The relatively good food supply in the sandstone plains of the northern mainland and Orkney has also emerged as a possible factor contributing to the development of the brochs in this area. In the final section of the general report, it is proposed firstly to examine the repercussions of the data on the theories of Hamilton and MacKie, which have received wide publicity and are tending to be regarded as established doctrine, and then to review the question of the brochs in general.

RECENT HYPOTHESES—A CRITICISM

Basically, MacKie believes that the brochs emerged rather suddenly after the stimulus of an invasion of the W coastal area around Skye by emigrants from Wessex, somewhere about 70 BC. He regards certain D-shaped fortified enclosures occurring in that region, which he has called 'semi-brochs', as the immediate predecessors of the brochs. These duns are provided with galleries in the walling and a broch-like entrance; they are sited so as to back against a precipitous slope. The contention is that the earliest brochs developed from these forts and were characterised by relatively thin walls and a gallery at ground level. As the idea of the broch spread subsequently to the flatter lands of Caithness and Orkney, it is suggested that a stronger, solid-based type was evolved to suit local conditions. Graham had previously drawn attention to the fact that two strains of brochs were involved in the two regions (1947). MacKie has emphasised the sophistication of the best preserved of all

the brochs, Mousa in Shetland, with its inordinately thick walls and absence of a basal gallery, and has maintained that this peripheral example is to be regarded as the final stage of development (1965).

MacKie has also attempted the long overdue task of classifying the artifacts from the brochs and wheelhouses (1965). His typology accords with his idea on the dates and origins of the brochs. He was able for the first time to utilise radiocarbon determinations, the samples for which he obtained by excavation, although the total number was still very small (1969). It is impossible to do justice to his work in a short summary concerned with one aspect, but several papers have explained his views and the reader is referred to one or other of these.

Serious doubts over MacKie's ideas about the origins of the brochs arise from several general considerations. The radiocarbon determinations are quite inadequate to date with any degree of precision the various sites which have been used to develop the theories, least of all to prove that the brochs first emerged on the W coast. Questions immediately arise as to why or how a small group should migrate from Wessex to such an obscure and isolated area as Skye, and, in any case, why should it be necessary to invoke an invasion to account for the emergence of the broch? Again, it might be assumed alternatively that the solid-based broch type, with a distribution concentrated in the northern area, is *less* developed typologically than the thin-walled examples with a ground gallery of the W. It might also be suggested, that the possibility of tying down an event in the prehistoric period, like the emergence of a complex structure such as a broch, to one small area at a particular date, must be remote. We cannot help adding that it is inappropriate to resurrect that unfortunate hybrid term "semi-broch", which seems to pre-suppose the argument, and which had been used with a different meaning by Erskine Beveridge (1903), before eventually being discarded (Jones and Piggott, 1952).

The evidence from Crosskirk indicates that the broch there was in existence as much as a century and a half before the supposed 'Wessex invasion' in the west. The Crosskirk broch indubitably had a so-called solid base of great thickness, but it would appear to be typologically early and cannot possibly be described as being particularly strong, in view of its earthern core. True, only one site is being considered, but the evidence for dating is based on more radiocarbon dates than were available to support MacKie's thesis as a whole, and one securely dated broch in the north is sufficient to refute the alleged pre-eminence of the west.

Hamilton's contribution to the broch problem is based primarily on his results from the excavations at Clickhimin (1968, but see also 1956, 1962, 1966). The pottery which he described as Iron Age A from the (pre-broch) Iron Age farmstead, is not unlike the pre-broch pottery from Crosskirk which seems, however, to lack the diagnostic carination at the shoulder noted at the Shetland site. There was also the 'ring fort' at Clickhimin, which Hamilton regarded as pre-dating the construction of the broch, together with the well-known 'Forework', located inside the encircling wall but not integrated with it. Mention has already been made of this massive structure incorporating a passage through the centre very similar to a broch entrance, corbelled cells in the thickness of the wall, together with a scarcement on the inner side and a stair leading to the top from one end. It has been suggested that the outside rampart at Crosskirk is not altogether dissimilar from this 'Forework' and from other related structures in Shetland at the Ness of Burgi and the Loch of Huxter. These works, as Hamilton obviously believed, would seem to have foreshadowed the brochs, and he subsequently states his view that the perfected brochs emerged in the north, probably in Orkney (1968, 98) as a development from the earlier 'galleried duns' of the west (see below, p. 175). He goes on to suggest that invaders, the producers of his so-called 'neck-band' ware, introduced the broch to Shetland. However, at Crosskirk, the broch certainly produced none of this pottery, and there seems nothing to indicate any important contact with Orkney in particular.

One of the most serious doubts which may be expressed about Hamilton's persuasive arguments is the idea that timber ranges of dwellings encircled the interior of the brochs. In Hamilton's reconstruction the floors were level with the scarcement, with support on their inner margins being obtained from a ring of posts rising from the broch floor. Careful consideration of these hypotheses from the beginning of operations has led us to reject such ideas in the case of Crosskirk. In fact, the evidence from Clickhimin itself is very slender: Hamilton's arguments in favour of the presence of such timber ranges in forts generally, supported by references to ancient Irish legends, have evoked no enthusiasm from scholars competent to assess their value.

Undoubtedly Hamilton is one of the few writers who has tried to give due weight to the settlements which occur immediately outside many of the brochs on the northern mainland and in the Northern Isles. He believed that the settlements developed for the most part as the brochs became obsolete, after the battle of Mons Graupius, as he would have it, when the Caledonian confederacy was broken and the far north subsequently entered an era of peace (1962). At Crosskirk, the situation is clearly much more complex, with the settlement beginning at more or less the same time as the primary broch occupation. Its subsequent reconstruction during the period of the Roman occupation of southern Scotland, might be more in line with Hamilton's broad generalisation of structural change consequent on the appearance of Agricola's legions. The Crosskirk broch, moreover, was becoming obsolete well over a century before the battle of Mons Graupius was fought.

BROCH ORIGINS AND GALLERIED DUNS—AN HISTORICAL ASSESSMENT

Although Hamilton thought that the brochs emerged in their perfected form somewhere in the Orkney area, he suggested that they had been derived from a type of small fortified enclosure, with a gallery in the thickness of the wall, which is to be found on the W coast of Scotland. Such sites are referred to as 'duns'. In particular, he drew attention to Dun Ringill and Dun Grugaig on Skye (1962). MacKie's 'semi-brochs' are a variant of the same type. Hamilton's hypothesis for the origin of the brochs goes back to the days of the RCAHMS Inventory for the Outer Hebrides and Skye (1928), in which there is a diagram showing a typological progression for these 'galleried duns'. It begins with Sron an Duin, a promontory fort on Barra Head in the Outer Hebrides, where defence across the neck of the headland is provided by a thick wall, in which there is a broch-like entrance, a ground gallery and an internal scarcement. Then comes the type of Dun Ringill, on Skye, again with a broch-like entrance, but with an intra-mural cell and traces of a gallery at a higher level, within a thick wall which is horse-shoe in plan. Finally, there are circular structures, of which Dun Beag, and Dun Fiadhairt, both on Skye, may be cited as examples. These are indistinguishable from a broch in plan and are now classed as such. In the late nineteen twenties, there was no dating evidence to support the idea of a progression on these lines.

Childe, in his *Prehistory of Scotland* (1935), developed the idea in a wider setting. He postulated an invasion led by Celtic chieftains, moving northwards along the Atlantic coastlands of Scotland and on to the Northern Isles. The migration gave rise to a large number of small dry-stone forts which he called 'castles', and he spoke of a 'castle culture'. The minute forts included some simple, thick-walled structures, small enough to be roofed over either partially or completely and normally provided with door checks and a bar-hole at the entrance. A more complex form had intra-mural features such as a gallery, a corbelled cell and, in some examples, a stair. The final stage in Childe's series was represented by the brochs, for which a plan and section were given of Dun Troddan; with regard to their place of origin, he states: 'The broch castle, created in the far north, was carried south . . .' (1935, 205). A small map (Childe, 274-5) showed a major concentration of the 'galleried duns' in the coastal lands from Skye to Loch Crinan, with a clustering of the brochs in Sutherland, Caithness and Orkney, where they predominated almost exclusively.

Shortly after the publication of his *Prehistory*, Childe encouraged the writer to embark on the excavation of a 'galleried dun' at Kildonan Bay, Kintyre, in the expectation that it might throw light on the problem of the brochs generally (Fairhurst, 1939). Very little dating evidence was obtained, particularly for the earliest occupation, but a battered sherd of samian was found under the primary floor. The view expressed in the excavation report was that this structure could best be interpreted as a derivative from the brochs, not a forerunner. Whatever its full implications, the Kildonan excavation raised the whole problem as to whether the galleried duns could possibly be treated as being related to the brochs in a simple one-way progression. Later, Alison Young published a report (1955-6) on another dun site, Dun Cuier, on Barra which she also regarded as either the equivalent of a broch, or a derivative, but not as a prototype.

THE BROCHS AND 'COMPARABLE STRUCTURES'

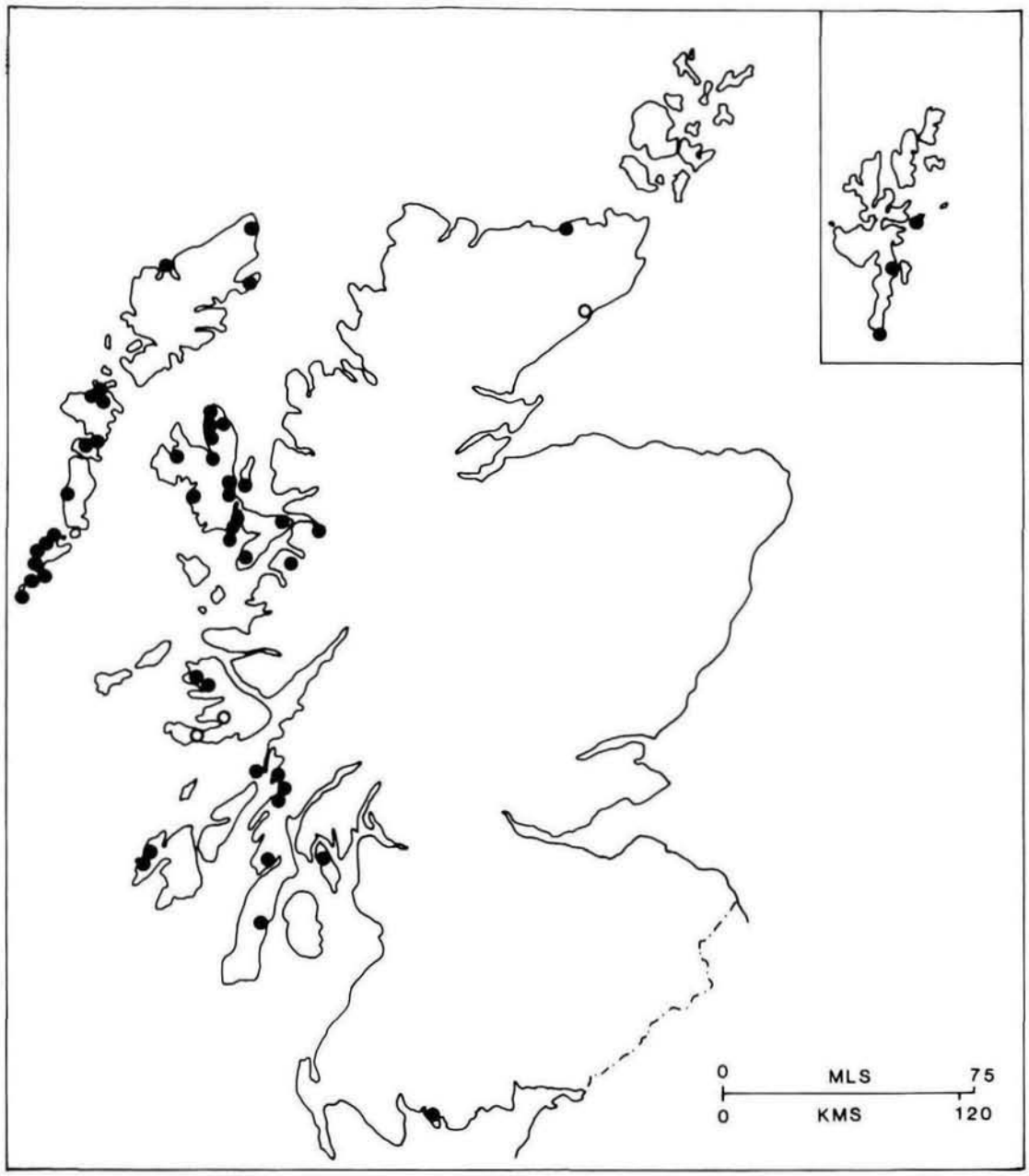
Since World War Two, a fresh attitude has developed towards the problem of the emergence of the brochs. A few, but only a very few, radiocarbon dates have become available through MacKie's excavations. A sceptical attitude developed towards what are now recognised as the old, out-dated invasion and diffusion hypotheses, of which Childe had made so much use. In two controversial papers, published as long ago as 1947 and 1948, Lindsay Scott denied that there was evidence to support Childe's thesis of a Celtic invasion northwards along the Atlantic coast-lands. It has become increasingly clear that no invasion from abroad can be invoked to explain the distribution of the brochs in Scotland. As MacKie has emphasised, it is not possible to regard the culture of the occupants of the brochs as being basically different from those of the duns and wheelhouses of the Northern Iron Age (1965b). Graham's most important paper (1947), in which he indicated the need to recognise two strains of brochs, provided a mass of detail showing the degree to which individual brochs could vary within the general pattern, although he made no attempt to formulate a typological sequence from his evidence.

Moreover, this paper was notable for a list of broch sites and of what Graham called 'comparable structures', a category which was rather wider than Childe had used in compiling his map showing the 'galleried duns'. The list was subsequently revised by Hamilton (1968) and further additions could now be made particularly after the publication of some of the Inventories for Argyll (RCAHMS, 1971, 1975). However, many broch sites, particularly in Caithness and Orkney, are little more than grass-grown mounds, the categorization of some examples is uncertain and still other sites are now destroyed. There may well be other 'comparable structures' especially amongst the mounds in the area of the Old Red Sandstones. Obviously, however, these 'galleried duns' and other 'comparable structures' must be regarded as of the utmost interest in looking for the ancestry and development of the brochs. So far, the list has never been examined in detail, and before discussing further the implications of the Crosskirk evidence, some attempt must now be made to assess the significance of these sites.

The distribution map of the 'comparable structures' (Ill 107) includes several which from personal examination deserve to be added to those cited by Hamilton, bringing the total up to 53 examples. It is at once remarkable that the distribution is largely confined to the western coast and islands with a marked concentration within the area northwards from Loch Tarbert, Argyll, to Mull, Skye and the southern Outer Hebrides. Southwards, there are occasional outliers as far as a peculiar site at Castle Haven in Kirkcudbright. Northwards the distribution includes three in Shetland and we have added one in Caithness which appears to have similarities (see below p 178). It might be added that Hamilton's list of 'uncertain broch sites' gives no less than 14 in Shetland, 42 in Orkney and 33 on the northern mainland.

Even a superficial examination of these comparable structures in general at once reveals that several different elements are involved. At one end of the scale, some examples are but little removed from the numerous small, thick-walled duns which occur in western Scotland generally. They have no obvious intra-mural structures but usually exhibit a gate with door checks and bar-hole. In spite of their relatively thick walls, the builders of these sites could not have attained the wall heights reached in the brochs, since the cores of the dry-stone walls consisted of a filling of loose stone and rubble which would have exerted an outward thrust on the inner and outer revetments sufficient to burst the wall had it been carried too far upwards. This class of dun is common along the southern part of the Atlantic coastlands from Loch Etive southwards to Wigtown. Eastern extensions to the distribution pattern include the so-called 'ring-forts' of Perthshire (Watson, 1915) and the duns of Stirlingshire (Feachem, 1957). This type is excluded from the 'comparable structures' but some may require reconsideration if excavation is undertaken at them.

Druim an Duin, which attracted Childe's attention, is an interesting case as it is relatively far removed architecturally from a broch but has broch-like features sufficiently obvious to warrant inclusion in Hamilton's list (Christison, Anderson and Ross, 1905; Childe, 1935). It is located on a precipitous ridge of rock in the Crinan area of Argyll, and has two entrances, one at either narrow end: a single guard cell is also represented. Along one long side is a ledge or scarcement which Childe



ILL 107 : Distribution of 'comparable structures' after Hamilton, 1968, with additions (open circles)

suggested was to support a veranda. It is very low for this purpose, however, and the steeply sloping rock rising to the opposite side calls to mind the very irregular rock surface upon which Kildonan was built. At this site, subsequent filling operations with stones and rubbish provided a level floor. The ledge at Druim an Duin would thus have been used, presumably, to support a wooden floor. Other examples, architectually close to simple duns, could be quoted from the 'comparable structures' list, particularly from Mid-Argyll which was surveyed in detail by Miss Campbell and Miss Sandeman (1962).

At the opposite extreme, the 'comparable structures' include sites which closely resemble brochs in such constructional details as are available, but which cannot be classed as brochs with certainty. Dun Aisgain in Mull is a good example; it is a most impressive monument, which rises to the height

of a gallery above the entrance, but it is decidedly oval in plan. It appears to be simply a misshapen broch. There are technical difficulties in building a strictly circular enclosure on irregular or sloping ground where the foundations would need to depart from a circle, as at Crosskirk itself (p 4). Thus, particularly in the rugged west, suitable sites with a strictly level rock surface may not always have been available, and the conventional circular plan may either have been abandoned or not achieved in practice. Consequently, variation in shape may not be regarded as critical.

Other examples in the list have circular plan and broch-like features, but seem never to have attained a height much above that of the lintels in the entrance passage. This point is of course very difficult to verify when so many monuments are badly ruined. Lindsay Scott provoked much controversy when he maintained that most brochs had been fortified farmhouses which never rose to tower height, and that brochs such as Mousa should be regarded as exceptional (1947). However, his ideas received little support. Erskine Beveridge originally classified as 'semi-brochs' several sites on Tiree which he thought had never risen to any great height (1903) and Childe included them amongst his 'castles'. Subsequently, these sites were reclassified as brochs (Jones and Piggott, 1952). Further circular sites bearing strong resemblances to the brochs include Ardifuar, in the Crinan area (Christison, Anderson and Ross, 1905), and Dunburgidale in Bute (Hewison, 1893). Ardifuar has an intra-mural stair, a guard cell and a scarcement, while Dunburgidale, which has been excavated only very superficially, has clear traces of a ground gallery. Both, however, have an exceptionally large internal diameter of 20-21 m, together with a very wide entrance passage, which set them apart from the average broch dimensions quoted by Graham (1947). Nonetheless, these two sites could be regarded as low-level brochs such as we believe Crosskirk to have been.

Another distinctive element in the list of structures comparable with the brochs, occurs in the form of Hamilton's 'blockhouses', resembling the so-called 'Forework' at Clickhimin (1968). These include in particular the Ness of Burgi and the Loch of Huxter. The fort at Barra Head, Bernaray, is also included in the list but is in fact a simple promontory fort (RCAHMS, 1928). Again, another example, Sgarbach in Caithness, seems to have no more than a broch-like entrance to recommend it and is another promontory fort (RCAHMS, 1911a).

Amongst the diversity of archictectural types covered by the term 'comparable structures', one large group has still to be considered. This consists of small, thick-walled enclosures, closely resembling brochs in size and pattern and containing at least one gallery, but which can never have risen to tower height and are in many cases decidedly oval in plan. MacKie's D-shaped 'semi-brochs' fall into this category; for example, Dun Ardtreck, on Skye, provided a radiocarbon date as early as 2005 bp ±105 (55 bc). MacKie clearly regarded the fort as a prototype broch (1971). The site is on the edge of a cliff along which are the remains of slight walling, in contrast to the thick outer wall with its included gallery. Curiously, the fort rests on a lower dry-stone platform which might suggest an earlier construction on this site, although no evidence of this was found in the excavation. Kildonan (Fairhurst, 1939), which must be included in this particular category, was a small pear-shaped fort with a very short gallery in one part of the wall; around most of the circuit, however, an inner face was found within the thickness of the wall, suggestive of what Hamilton has called a *murus duplex* (1968). There was no doubt that this walling faced inwards and that it was a primary feature, and thus was not a form of casing such as had been added to the broch at Crosskirk. There was also an intra-mural cell and a double stair giving acces to the wall-head. Castle Haven, an outlying galleried dun on the coast of Kirkcudbright, is given as an example of the type by Childe (1935): it is a complex structure which was excavated many years ago (Barbour, 1907). This site has two main elements. A larger enclosure is defined by a simple wall, within which sits a galleried dun with two entrances, one leading as a sea-gate down to the shore. Seen from the beach, at least in its present reconstructed form, it is reminiscent of a Medieval castle. Dun Ringill and Dun Grugaig in Skye, upon which Hamilton focusses attention (1968), are oval in plan, but clearly have traces of a gallery above the level of the lintels of the broch-like entrance, from which side the structures must have been very imposing.

Since Hamilton amended Graham's list of 'comparable structures', other examples have been noted in the Mid-Argyll Survey (Campbell and Sandeman, 1962) and in the Argyll Inventory volumes of the Royal Commission (1971 onwards). Mrs Ursula Betts has also found several fine examples in Mull, of which Dun Finnichen (NM 499285) is on an island site approached by a causeway. Dun

nan Ceard (NM 405188) is on the sharp crest of a high steep-sided headland. It is oval in plan with an entrance through thick galleried walling at either end, whereas the side walls, overlooking cliffs, are relatively thin. It is noteworthy that all the new discoveries have emphasised more and more strongly the marked concentration of these small galleried structures upon the area more or less corresponding to Mid-Argyll and Mull, as well as Skye and the southern Outer Hebrides. This region is not much different in extent from the Dalriada of Early Christian times, but there is no reason to attribute the duns to the Scots, although Kildonan was re-occupied about this period.

Finally in this matter of the 'comparable structures', we would draw attention to one site which has not so far been included in the list. This is the oddly-named Wag of Forse in southern Caithness, which was partially excavated by Curle (Curle, A O, 1941 and 1948). It is a composite monument, one element of which resembles a broch with a stair and an entrance with checks and a bar-hole, but apart from these two features, much of the walling around the small circular enclosure is narrow. In spite of Curle's description in his first report, there is no gallery in the accepted sense, but the site is far more reminiscent of a broch, when viewed from the outside, than the plan would suggest. At present, it seems to be unique, but it does raise the possibility that other, similar, structures might be concealed amongst the grass-grown mounds of Caithness.

This survey of structures comparable to the brochs has shown that a wide range occurs both in plans and in the character of their walling. While some of the sites along the western seaboard of Argyll could be ancestral forms of the fully developed broch, it would seem that many could be better interpreted as either broch derivatives like Kildonan, or as broch equivalents, such as Ardifuar, where there have been divergencies from the normal pattern. Some obviously misshapen brochs, such as Dun Aisgain, could be the result of ineptitude or the lack of building slabs of the necessary quality, but such sites equally might reflect the loosening of the desire to reproduce the regular broch form. Additionally, there is the difficulty of building a strictly circular enclosure on anything other than level ground. Many sites exist on the fretted and fragmented west coastlands, which provide natural strongpoints which were attractive to dun builders: the utilisation of convenient rock faces might result in a considerable economy in walling, but also in an oval or D-shaped structure appropriate to the configuration of the location. Perhaps too, on such sites, the builders might neglect to carry the walling much above the level of the entrance. Moreover the similarity in material culture represented at brochs, galleried and simple duns, as well as the wheelhouses of the west, would seem to group them together, reflecting the idea that normal and modified brochs, broch derivatives, 'semi-brochs' and 'galleried duns' could all belong to one period. There seems no logical reason to give priority to the western coastlands as the obvious homeland of the brochs in either an early or developed stage, though these areas might well be included in a much larger region within which experiment in the appropriate building techniques was taking place.

THE PURPOSE OF THE BROCHS

Before attempting to put forward any alternative views to those which have been criticised, one other complex question as regards the brochs in general must be faced. This concerns the purposes for which they were built and the reason for their characteristic structural features.

Brochs were meant to be lived in, as the amount of domestic refuse recovered from so many of the excavated sites clearly demonstrates. It cannot be shown, however, whether this domestic occupation was continuous or intermittent, or how many people lived there. It may have been the case that a broch often formed a refuge in times of danger for a larger group than might have been found there normally. Linked with this difficulty is the absence of evidence as to how brochs were roofed, or indeed, whether they were roofed at all, though the domestic rubbish would seem to imply that they were.

As regards the objective and construction of the high walls characteristic of the best preserved of all the brochs, Mousa, some progress has been registered since the early days when the galleries could be described as storage places. In fact, much importance may be attached to the reason why

galleries within the thickness of the wall were found necessary in the brochs and galleried duns. A broch such as Mousa would of course have been difficult to penetrate through its one low, narrow entrance, and its high walls would have been very difficult to scale. Firebrands and other missiles could not easily have been thrown into the interior, particularly as the high wallhead would increase the killing range of missiles thrown by the defenders. We are doubtful, however, about the resistance of the thick wall to a battering ram. At Crosskirk, for example, a battering ram team which successfully dislodged the outer wall face would inevitably have been deluged with unconsolidated material from the wall-core. Whether the advantages of high walling cited here amount to an adequate explanation for the great height reached in at least some of the brochs is another matter, in view of the immense amount of labour involved in their construction. That type of question, however, can be asked concerning the defences of very many forts and duns, for example from the vast ramparts at the Brown and the White Caterthuns in Angus, to a minute fortified pinnacle of rock in Mull. The answer must surely lie in the significance of prestige in the Iron Age, of the *appearance* of strength, and of the impulse to outdo the achievements of neighbours. A more grim, inaccessible and awesome-looking edifice than a broch must have been difficult to imagine in those days.

It is now generally accepted that the high walling in the brochs was made possible by the galleries, but their exact significance is somewhat controversial. Forty years ago, the evidence from Kildonan (Fairhurst, 1939) seemed to show that the short and very narrow gallery confined to one stretch of the walling, together with what was called the 'median face' in the sections of the wall where there was no gallery, were both features designed to strengthen and hold the relatively loose stone core. In the case of the brochs, the tiers of galleries would presumably lighten and strengthen the high walling, but it might be suggested that the builders of the earliest brochs would hardly have realised this possibility on theoretical grounds: the structural advantages of galleried construction would surely have been appreciated only with experience. It would also seem doubtful whether economy of labour in construction could be an explanation for the galleries, as much carefully selected stone would be necessary to build the two inner faces, thereby minimizing the saving that could have been achieved in labour through the use of a rubble-filled core.

The true significance of the broch galleries must lie in the fact that, in conjunction with an intra-mural stair, the walling could be built to higher and higher levels in tiers, each gallery in turn serving as a platform to raise the structure stage by stage. It was this discovery which made it possible to reach tower height without scaffolding. The achievement of the northern broch builders, raising on a comparatively narrow base higher walling than had ever been seen before, was indeed most remarkable, but it cannot have been a brilliant and sudden tour de force. So far, however, little attempt has been made to trace a sequence of development which, we would suggest, began with the use of an intra-mural stair simply to give access to a wall-head. To visualise the invention of the broch tower in the west, complete with a 'labour-saving' ground gallery, and to regard the brochs of the Caithness-Orkney region with their solid bases as being secondary and stronger, is surely an inversion of the probable course of development.

Turning now to the evidence concerning the function of the brochs in general, many writers have sought inspiration from a study of the siting of individual examples. This issue has in fact appeared profoundly puzzling, and a number of contradictory suggestions are on record. Many brochs occur on comparatively level land suitable for farming, sometimes with several grouped closely together, as for instance, three at Crosskirk. Others undoubtedly occur in splendid isolation, often on coastal sites, and Dun Mor Vaul is an excellent example. Some appear to guard strategic routes, as Dornadilla in Sutherland bestrides the route southwards from Loch Eribol. Some brochs seem to stand alone, dominating clusters of hut-circles as at Kilphedir and other sites along the Strath of Kildonan. Castle Cole in eastern Sutherland would seem to be hidden away in the hills as a refuge: contrastingly some sites appear to be badly overlooked, in the military sense; Dornadilla again provides an example. Childe included the brochs amongst his 'castles' (1935) and Cruden also describes them as the first Scottish castles (1963). Other writers also envisage broch landlords and their retainers. Alison Young regarded some brochs as bridgeheads for invaders from the sea (1962). Lindsay Scott believed that most brochs were fortified farmhouses (1947).

Amid such diversity of opinion, we would express as a personal view the suggestion that each of these hypotheses could be sustained by limiting attention to a carefully chosen group of examples.

The solution seems to be to accept most of the varied descriptions and to resolve the problem by realising that all brochs were not built for exactly the same purpose, using exactly the same materials. Nor would they be arranged internally on the same lines. For instance Dun Troddan in Glenelg would seem to have had a veranda-like structure or a roof supported by posts (Curle A O, 1921); in Gurness and Midhowe (RCAHMS, 1946, nos 263 and 553), there were slab partitions; Hamilton's timber ranges at Clickhimin may be another variant (1968); O' Neil's broch refuges might have yet another pattern (1954).

SUGGESTIONS AFTER CROSSKIRK

In submitting a personal view in this final section, one is acutely aware that the evidence from Crosskirk has dominated the issue. It is obvious that other sites in the Caithness-Orkney region would require total excavation to bear out these ideas: such extensive and costly investigations can hardly be expected in the ordinary course of events. Undoubtedly, however, much could still be learned from careful study of existing monuments, from a reappraisal of old excavation reports as in the case of Burrian (MacGregor, 1974), and from intensive field work. The following suggestions might act as a stimulus in this direction.

With its thick but relatively unconsolidated core of earth and rubble, and with the absence of any evidence of a gallery up to a height of at least 3 m, the Crosskirk broch seems to epitomise developments at an early stage, well before the tower-like structures such as Mousa, Dornadilla, Glenelg or Carloway, came into being. Lack of experience in building high walling is manifest in the extensive evidence of collapse on both the inner and outer faces. The Crosskirk radiocarbon determinations, appropriately corrected, seem to suggest an origin for the earliest brochs possibly before the end of the third century BC. That Crosskirk is a broch in the ordinary sense of the word, is obvious from the ground plan and indeed from the height of the wall as it still existed at the time of excavation.

The radiocarbon dates and the typology alike seem to focus attention on the Old Red Sandstone area of Caithness and Orkney as the region where the early brochs emerged. The case which has previously been made in terms of the large number of broch sites to be found there, and the availability of excellent building materials for early experiments, now seems to have been greatly strengthened. To prove such a case outright is perhaps verging on the impossible for a prehistoric monument of this type, but in our opinion the evidence is now strong. A considerable period of time, however, must surely be envisaged for the full development of such a complex structure as a high broch. During that time, the basic idea may already have spread widely, but as there is not a single broch monument in Caithness or Orkney which rises to tower height, it cannot be shown, as Hamilton has suggested, that the fully developed form emerged there.

In the light of contemporary knowledge of the archaeology of Northern Britain and of Western Europe generally in the Early Iron Age, it now seems impossible to think of the origins of the broch in terms of some invasion from far afield. In support of the idea of an autochthonous development, it is to be recalled that galleries in the form of lintelled passages and corbelled vaults were known in the Neolithic: Skara Brae includes a dwelling equipped with door checks and a bar-hole (Childe, 1931). If, as Hamilton believes (1968), the 'Forework' at Clickhimin precedes the broch, then such features as an intra-mural stair, corbelled cells, an entrance with checks and a bar-hole, and a scarcement, also pre-date the broch period.

Investigations in recent years have shown that fortified enclosures had come into being earlier than was formerly supposed, some dating to the late Bronze Age (Cunliffe, 1974), but we would suggest that the small duns and brochs are not to be regarded primarily as a minute form of hillfort, but are dwellings allied rather to the circular Iron Age homestead. We have been able to demonstrate at Kilphedir (Fairhurst and Taylor, 1971) in E Sutherland, that some of the hut-circles even resemble duns with their thick walls enclosing an area very similar in size to the interior of a broch. It is true that one of the Kilphedir radiocarbon dates seems to place these hut-circles in the broch period rather

than in an earlier period. It is to be admitted also that comparatively few hut-circles have been recorded in the Inventories for both Caithness and Orkney, in sharp contrast to Sutherland where they are abundant. Nevertheless, in our view, a broch is a homestead as well as a place of refuge: we return to Lindsay Scott's thesis that brochs were something in the nature of a fortified farmhouse (1947), though without accepting his view that the great majority were not encircled by walls higher than those found in the average Iron Age house.

We visualise a development beginning with attempts to strengthen and to raise the height of the enclosing wall of a circular house, by way of fortification. Thickening the walling within a well-built inner and outer face would result in a structure not unlike the small ring fort at Litigan in Perthshire, to which reference has already been made (Taylor, 1969); here the whole of the interior had been roofed within a thick stone wall faced with huge slabs. An earth and rubble core might be expected in Caithness within such a thickened wall, and into this a corbelled cell might easily be introduced; an underground corbelled cell occurs in an earth-house opening off a thick-walled hut-circle at Kilphedir (RCAHMS, 1911b, no 328). An intra-mural stair would become increasingly necessary as attempts to raise the wallhead continued. But even when excellent facing slabs were available, Crosskirk broch shows that when such a thick wall was extended upwards much above the level of the roof of the entrance passage, it became unstable.

This knowlege of structural instability would come only with bitter experience and a solution to this problem may well have been found indirectly. It was somehow necessary to lighten the higher part of the wall and stabilise it, and a single hollow gallery would serve, especially if slabs forming the floor and roof were tied into the inner and outer wall faces. Perhaps a wall-head with a breastwork was converted to this purpose. The roof of such a 'gallery' could then form a new wall-head and subsequently be utilised for further upward construction, without disastrous consequences if sufficient care were taken with the base. The value of the gallery would then become obvious when used in conjunction with the intra-mural stair.

How long it took to develop this technique to a point when tower-like brochs could be constructed is uncertain, although it may well have been a matter of a century or so after Crosskirk was built. A date about the first century BC, when writers in the past have claimed that the broch building period began, may be envisaged. The date at which a tower such as Mousa or Dun Carloway was erected would be a most interesting discovery.

Once the possibility of superimposing gallery upon gallery had been realised, highrise building seems to have become a prestige symbol, and the appearance of strength was all-important. The craze, as we see it, was to last for as much as two hundred years until finally it was felt no longer worthwhile to undertake the immense task of broch-building or the formidable problem of repair work. There is little or no evidence to indicate that broch construction continued after 100-150 AD (Taylor, 1971). Perhaps some wide-spread political change occurred, as Hamilton maintains (1962), thereby emphasising the importance of the destruction of the Caledonian confederacy in 84 AD.

In their heyday, brochs obviously proved a great success as is shown by the large numbers in Caithness, Orkney and the eastern coast of Sutherland. It is difficult to resist the conclusion that they were associated with agricultural communities as at Crosskirk, which in many cases supplemented barley production and stock rearing with beachcombing and fishing in sea and river. The utilisation of perennial supplies from the beach would as much as anything account for the numerous coastal sites, since trade and piracy can hardly have been of much significance in those remote parts.

It should be emphasized that it is in this region that so many settlements occur immediately outside the brochs, and in not a few cases, within an external rampart. This marked regional distribution of the settlements has not so far been sufficiently stressed, and when we find at Crosskirk that the broch and settlement were in occupation together, an association with small farming communities is again indicated. The marked clustering of the brochs in the same region, already discussed, may be the result of an expansion of the population within certain favoured areas and can surely not be explained in terms of the homes of hundreds of petty chieftains. We are inclined to think that the brochs in this region were refuges for small farming communities represented by the settlements: perhaps, but not necessarily, the broch was occupied continuously by the head-man's family, and each was constructed over a number of years by the community, and not by a peripatetic gang of professional builders. The clusters came slowly into being through an expansion of population.

Studied in detail, the siting of the individual brochs and the extent of the clusters would form a most interesting geographical survey.

From what we consider to have been the primary area in the Caithness-Orkney region, broch construction would appear to have spread at sometime northwards into Shetland, but more immediately into the straths of eastern Sutherland and Easter Ross. Away from the sea and in a rugged area of tough Highland rocks, the pattern of settlement appears to have changed in the more difficult environment. The external settlements are for the most part absent, while individual brochs stand in isolation along the straths of Kildonan, Brora, Fleet and northwards into Strath Naver. They often seem to dominate, from a strong position, the pockets of more attractive land, as for instance at Kilphedir. Often, too, these small areas of better land show evidence of a clustering of the population in the numerous hut-circles which have been recorded on them. Perhaps we should be thinking here in terms of some intruding broch lord establishing himself amongst the local Iron Age population, while the broch itself dominates the landscape like the castle of a Medieval baron.

Colonisation still further westwards to the Atlantic coastlands would again have led to somewhat different environmental conditions where, in the much fretted seaboard with its heavy rainfall, fishing and stock-rearing may well have become more important in the local economy. The brochs, where they occur, are widely scattered and are rarely far from the sea. A further expansion seems to have transplanted them to the Hebrides and, southwards, as far away as the Rhinns of Galloway, where there are three possible sites. We suspect that another change took place in these areas far from the plains of Orkney and Caithness, and that the traditional pattern of the broch lost its firm hold. The thin-walled brochs with a ground gallery became usual, with some saving in building material. Then there are the misshapen brochs, the galleried duns and the small forts with broch-like features. Many of these must surely be the equivalents of brochs, or else broch derivatives, constructed at a later date. Some, however, might well prove to pre-date the arrival of the fully developed tower-broch. The fine distinctions which have sometimes been made between what is a broch, a galleried dun and a simple thick-walled dun in this area may be useful for descriptive purposes, but may prove irrelevant in considering the main issue of broch origins.

In one other region, isolated brochs occur widely scattered, inland from the Firths of Tay and Forth, and southwards to the Tweed. Hamilton regards them as military units (1968), and excavations by Stuart Piggott at Torwoodlee (1951) and David Taylor at Hurley Hawkin (1971) seem to show that they belong to the period around 100 AD. Perhaps the early date from Crosskirk makes this southern colonisation seem less improbable in that it is no longer necessary to envisage the appearance in the far north of the first brochs, and the establishment of a fully developed example as at Tor Wood in Stirlingshire, as all taking place within little more than a century. Perhaps, too, the idea of adventurous broch lords building their characteristic 'castles' in the far S, strengthens our suggestion of a similar movement westwards from the homeland.

These tentative hypotheses have not been put forward in any sense as a full solution to the problem of the brochs, but we wish to make a final comment without reservations. Confined to Scotland, and located mainly on the northern mainland and in the Northern Isles, the brochs have too often seemed a local issue. It must be emphasised that what was achieved in the extreme north-west of the Old World, is relevant archaeologically to what was happening much further away in the less barbarous south. Isolation was never complete and any understanding of prehistoric culture generally in Britain and indeed in Western Europe, must be broad and deep enough to embrace the remarkable achievements, the crudities, and the crazes, of the people who lived on its remote Atlantic fringe.

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