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Spatial Relationships, Dating and Taphonomy of the Human Bone from the Mesolithic site of Cnoc Coig, Oronsay, Argyll, Scotland

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This paper is dedicated to the memory of Richard W. Nolan who died on April 17, 2004 of complications from multiple myeloma. His direct input was critical to the successful completion of this paper which he was still working on at the time of his death.

This paper examines the spatial distribution of the human bone sample excavated from the Mesolithic shell midden site of Cnoc Coig on Oronsay in the Inner Hebrides, Scotland. Although no burials were recovered the information from the apparently isolated bone finds has been significant. Two types of bone group are distinguished, one that resembles the widely reported 'loose bone' phenomenon that is widely recognised from European Mesolithic sites. The other, represented by two bone groups at Cnoc Coig, is, at this time, restricted to western Scotland. It is dominated by hand and foot bones and appears to represent purposive behaviour. We concentrate our discussion on the latter phenomenon and place it within discussion of the nature of the later Mesolithic in western Scotland.

INTRODUCTION

This paper extends the discussion of human skeletal material excavated from Cnoc Coig, a late Mesolithic shell midden on Oronsay. It examines the spatial distribution of the bones, based on the overall analysis of the site (Nolan 1986) and adds additional information regarding interpretation of recently published radiocarbon dates (Richards & Sheridan 2000). Forty-nine bones were recovered from the site in 1975 and 1977, previously inventoried and interpreted within the then known distribution of isolated bone finds from European Mesolithic sites (Meiklejohn & Denston 1987). Bones from two nearby sites described at that time, Caisteal nan Gillean II and Priory Midden, are not further discussed here in any detail. None of the bones recovered were in a context indicating primary inhumation. Stable isotope analysis confirms the ecological unity of the materials recovered (Richards & Mellars 1998).

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THE SITE OF CNOC COIG IN ARCHAEOLOGICAL CONTEXT

Cnoc Coig forms one of a group of five late Mesolithic shell midden sites located on the small island of Oronsay in the Scottish Inner Hebrides, immediately to the south of the larger island of Colonsay (Fig. 1). At the time of occupation in the 5th to earliest 4th millennium BC the island would have had a total land area of less than 5 km², owing to the relatively lower land/sea levels at that time resulting from the delayed isostatic recovery of western Scotland from the effects of ice loading during the last

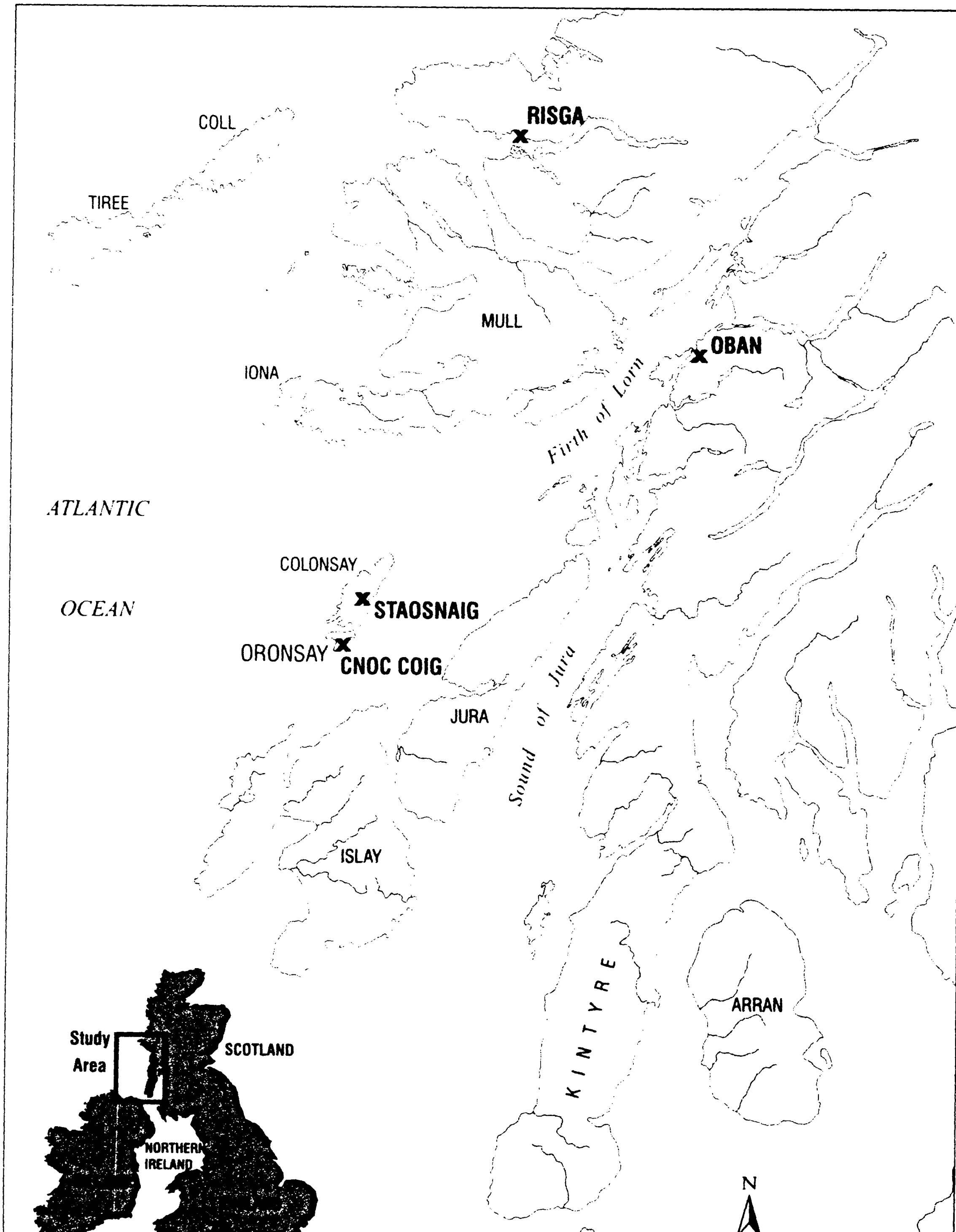

Fig. 1.
Location of Oronsay and Cnoc Coig in the southern Hebrides and other main sites and localities discussed in the article.

glaciation. Oronsay lies approximately 9–13 km to the west of the two much larger islands of Jura and Islay, and some 90 km from the north-west tip of northern Ireland.

Excavations on the Oronsay middens were first carried out by Symington Grieve and William Galloway in the 1880s, with later excavations at the site of Cnoc Sligeach by A.H. Bishop in 1913 (see Lacaille 1954; Bishop 1914). No further work occurred until a major new campaign of excavations and associated palaeoenvironmental work was undertaken by one of the present authors (P.M.) between 1970 and 1979. This was subsequently published in monograph form (Mellars 1987a; see also Mellars 1978 & 2004). In addition to smaller-scale sampling excavations at the sites of Cnoc Sligeach, Caisteal nan Gillean I and II, and the newly discovered Priory Midden, a major campaign of area excavations was carried out at the Cnoc Coig midden over four seasons between 1973 and 1979. During these excavations a total of 196 m^2 of the site was totally excavated, which is estimated to represent at least 70% of the original extent of the midden deposits at the site (see Fig. 2).

The methods employed in the Cnoc Coig excavations are described fully by Mellars (1987a). All finds of artefacts and faunal material found *in situ* were recorded in terms of three-dimensional coordinates. Subsequently, all of the excavated material was water-sieved on site through a 3 mm mesh, and then sorted off-site to recover smaller specimens of artefacts (including thousands of perforated cowrie-shell beads) and faunal remains not recovered *in situ*.

The dating of the Cnoc Coig midden is based on two sets of radiocarbon determinations (see Table 12 and Fig. 6). The earlier set, from the Cambridge laboratory, are on charcoal and were obtained as part of the excavation program of the site (Mellars 1987b; Switsur & Mellars 1987). These results have been calibrated using intcal98 and are expressed at 2 σ rounded out to 10 years following recommendations by Mook (1986). This provides a range from *c.* 4700 to 4000 cal BC. The later set, from the Oxford AMS laboratory, are on human bone and were part of a program looking at both the chronology and diet of the site (Richards & Mellars 1998; Richards & Sheridan 2000). For these results the $\delta^{13}C$ levels (*c.* −12) from Table 12 indicate an almost 100% marine diet. The results are expressed at 2 σ, rounded to (not out to) the nearest century. Marine data are from Stuiver and Brazunias (1993) and atmospheric calibration data are from Stuiver *et al.* (1998). Calibration is performed using OxCal 3.3 (Bronk Ramsey 1995). These results provide a range from *c.* 4400 to 3800 cal BC. The minor divergence between the two date sets is discussed further below. It is the feeling of the excavator that the total period of occupation is not much more than around 200 years.

The stratigraphy of the midden deposits at Cnoc Coig was complex, clearly reflecting a long succession of repeated, closely-spaced occupations on the site. The central core of the midden deposits was formed during two major phases of human activity (Phases 1 and 2) each centred on a large and repeatedly-used hearth and associated hut-like structure, with surrounding accumulations of shell-midden deposits

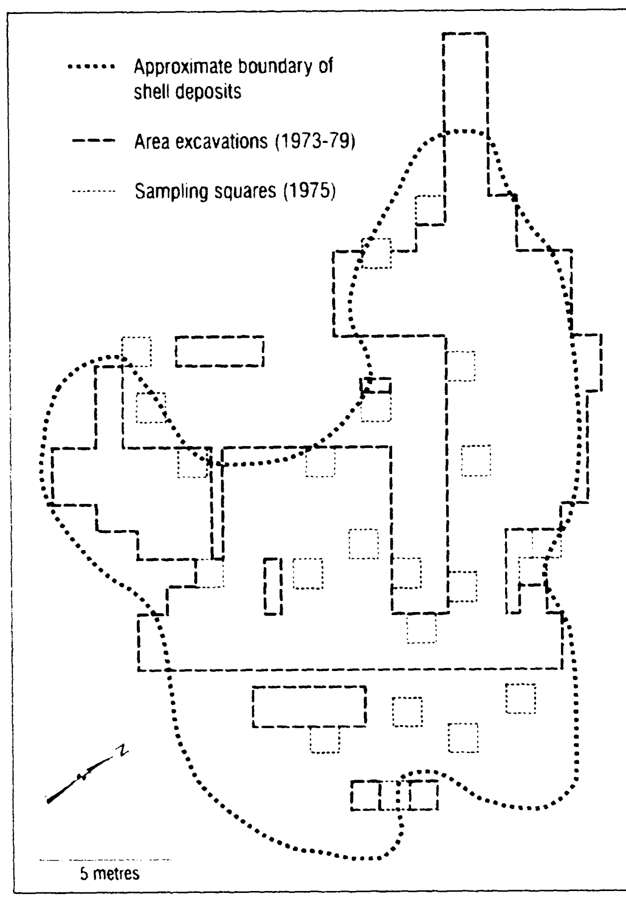

Fig. 2.
Simplified diagram of the Cnoc Coig midden and areas excavated, simplified after Mellars (1987b, fig. 14.2).

reaching to a maximum thickness of *c.* 0.7 m. (see Mellars 1987a). The third major phase of midden accumulation (Phase 3) has a less clearly structured form and may conceivably involve some redistribution of the earlier midden deposits on the southern part of the site. Economically the occupations were clearly focused very heavily on the collection of intertidal molluscs (especially limpets) and crustaceans, and the exploitation of very young (one- to two-year-old) saithe (*Pollachius virens*), with much smaller components of seals and marine birds (including Great Auk). Analysis of the size distribution of otoliths of saithe point to a strong emphasis of fishing activities during all phases of occupation centred primarily on the autumn months (September–November) (Mellars & Wilkinson 1980). Similar analyses of otoliths from the adjacent sites of Cnoc Sligeach, Caisteal nan Gillean, and the Priory Midden point strongly to occupation on Oronsay during most, if not all, seasons of the year, with regular seasonal movements between the different sites – though with demonstrable sporadic social and economic contacts with either the Scottish mainland or with some of the larger adjacent islands to secure red deer antlers and other materials for tool manufacture.

The character of the bone, antler, shell, and stone artefacts recovered from all of the Oronsay sites demonstrates clearly that they belong to the grouping of so-called 'Obanian' sites in western Scotland (including the sites of MacArthur's Cave and Druimvargie near Oban, and Risga in Loch Sunart). These demonstrably have a chronological distribution extending back (at the Druimvargie rock shelter) to the 8th millennium BP. Most recently they apparently overlap with the earliest evidence for fully Neolithic communities on the Scottish mainland. Nevertheless the material recovered from the Oronsay sites shows no trace whatever of traditional 'Neolithic' elements, either in terms of artefacts or clearly domesticated animal or plant remains. Isotopic analyses of human bones from three of the Oronsay sites (including Cnoc Coig) (Richards & Mellars 1998 and see further below) indicate a diet heavily dependent on marine resources, with only one specimen showing any substantial component of terrestrial resources – perhaps representing an individual recruited by marriage into the Oronsay groups. It is also noteworthy that the Oronsay sites have yielded no trace whatever of typical 'microlithic' technology, of the kind represented abundantly at many later Mesolithic sites on the adjacent islands of Islay, Jura and Colonsay (Mithen 2000) and which is assumed on these sites to reflect mainly land-based hunting strategies. Mithen (2000; 2001a; 2001b) has pointed out that the occupation of the Oronsay sites appears to coincide with a conspicuous gap in the available radiocarbon dates for the microlith-dominated sites on Colonsay, Jura, and Islay, between *c.* 6500 and 5400 cal BP. How far this may relate to changing patterns of economy in this area during the closing stages of the Mesolithic is currently a major point of debate, as discussed more fully in Mellars (2004), Mithen (2000; 2001a; 2001b), and Saville (2004b). Within this framework the human remains we report below have provided what appears to be the latest evidence for a marine focused population, just prior to evidence for a massive shift to a terrestrial diet in the Neolithic (Bonsall *et al.* 2002a; Schulting 1998; Schulting & Richards 2002; see further discussion below).

THE BONE GROUPS

The human bones from Cnoc Coig are plotted in Figure 3, derived from Nolan (1986) with minor revisions. The plot shows that the distribution is not random. Rather, Nolan identified seven bone groups, two of which (2B and 3B) appear to be spatially related to other, larger groups (2A and 3A). In addition, seven bones occur as isolated finds. Though compressed onto one horizontal surface in Figure 3, it should be noted that the total bone sample is scattered at various depths throughout the midden deposits (50 mm arbitrary levels 7 through 28 from Nolan (1986)).

The isolated pieces

Of the seven isolated pieces only three are plotted on Figure 3. The other four were recovered in sieving or, in one case, lies stratigraphically removed above group 3A. All are listed in Table 1. Full anatomical descriptions of these and all further finds are provided by Meiklejohn and Denston (1987). None of the isolated pieces had apparent anatomical partners in the matching tests described below. Thus these pieces can neither be demonstrated to have direct relationship with each other, nor with any other groups. Though the full set of distributions is discussed below, it should be noted that three of the

TABLE 1. ISOLATED BONE PIECES

Inventory no.	*Bone*	*Location*
8135	Tooth - maxillary M3L	central area of lane 5
10638	Tooth - mandibular M2R	Peacock's pits
12100	Tooth - molar crown fragment	Peacock's pits
12140	2nd right proximal foot halanx	Peacock's pits
15057	proximal hand phalanx [?human]	isolated in lanes H & I between groups 2A and 3
15112	unfused dens of axis [juvenile]	isolated in lanes H & I between groups 2A and 3
17047	? Fragment of patella [? human]	isolated in lane I above group 3A

four teeth in the total sample occur here (43% of this group), while only two represent hand or foot bones (29%). This contrasts sharply with the total bone set in which 8% of the sample are teeth, while 61% derive from the hands and feet. A *prima facie* case is thus made that the isolated bones represent a different phenomenon than those in the grouped portion of the sample, assuming the group portion is itself homogeneous (see further below). If true then this group has a distribution similar to tooth dominant loose bone assemblages such as seen in the roughly contemporary Dutch early Neolithic Swifterbant sites (Constandse-Westermann & Meiklejohn 1979; Meiklejohn & Constandse-Westermann 1978). Tooth loss is a normal process, with European Mesolithic and Neolithic skeletal series showing considerable premortem tooth loss subsequent to periodontal disease, abscessing etc.

The identified bone groups

The remaining 42 bones fall into seven circumscribed groups varying in degree of compactness and size[1]. Two (2B and 3B) appear to be outliers of spatially associated larger groups (2A and 3A). The remaining three (1, 4, and 5) are small with only eight bones in total, 16% of the total sample (Table 2).

Group 2 is a rather diffuse scatter of 16 bones, 12 in 2A and four in 2B (Table 3), 33% of the sample. The spatial relationship between the subgroups is somewhat ambiguous with 2B lying deeper within the deposits than 2A. Despite this, 2B occurs in a slight depression near the base of the midden, at the foot of a fairly steep slope on the western margin of 2A. As a result, it could be a western down-slope extension of 2A, in which case the two subgroups may well belong to a single depositional episode, as assumed in further discussion.

Group 3 consists of 16 bones in 3A plus two outliers in 3B, accounting for 37% of the total sample (Table 4). Subgroup 3A is the largest and most compact of the groups (Fig. 3), and spatial association of all these bones indicates that they clearly represent a single depositional episode. Even though it lies two to three metres to the south-east, subgroup 3B is situated so that its spatial association, and hence depositional contemporaneity, with 3A is much less problematic than is the case with the pairing of 2A and 2B.

Both groups 1 and 5 consist of a pair of bones separated horizontally by more than a metre and are located in areas of the site where no other human bones were found (Table 2). They therefore appear to be closer in affinity to the loose finds since neither has demonstrated stratigraphic contemporaneity. Group 4 (Table 2) is an isolated scatter of four bones in the south-western area of the site. With its small size and the fact that one of the bones (18189) is less clearly associated with the other three, it appears closest to groups 1 and 5 and the isolated finds in terms of overall patterning. In summary, groups 2 and 3 appear to represent a different kind of depositional episode than the rest of the human bone assemblage from Cnoc Coig.

TABLE 2. MINOR BONE GROUPS

Inventory no.	*Bone*	*Location*
Group 1		
4094	Cranial vault fragment	1
7032	Left clavicle	1
Group 4		
18089	Cranial vault fragment	4
18104	Left clavicle	4
18143	Right temporal [3 fragments]	4
18147	Right 1st proximal foot phalanx	4
Group 5		
16091	Left innominate	5
16103	6 rib fragments	5

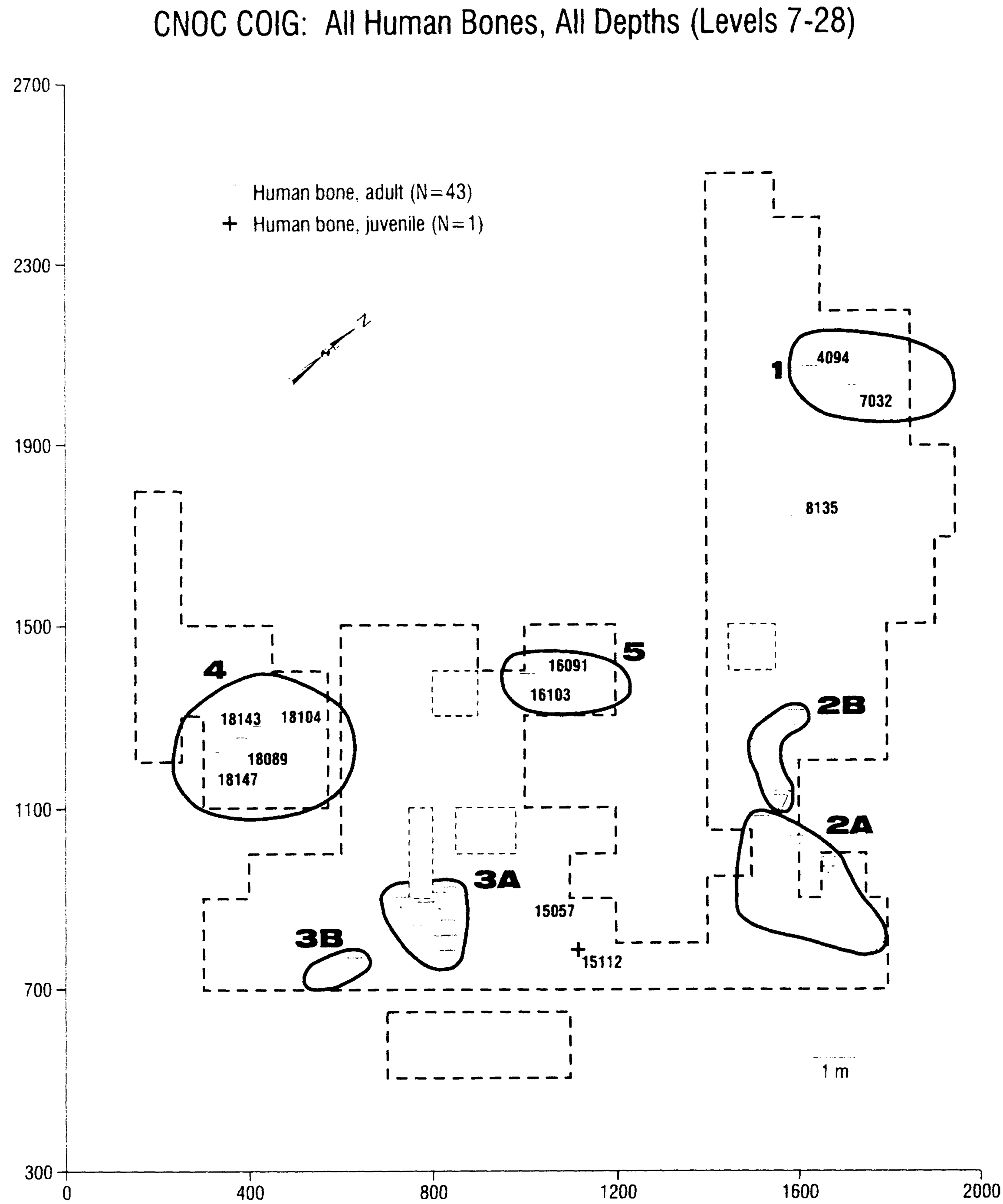

Fig. 3.
Distribution of all human bones at Cnoc Coig

TABLE 3. GROUP 2

Inventory no.	*Bone*	*Location*
15294	Right 5th distal hand phalanx	2A
15382	Left 5th middle hand phalanx	2A
15647	1st proximal hand phalanx	2B
15742	Left 5th distal hand phalanx	2B
18238	Right 5th middle hand phalanx	2A
18279	Left 5th middle hand phalanx	2A
18282	Cervical vertebra body	2A
18283	Left 2nd proximal hand phalanx	Sieved from area of 2A
18284	Right 1st metacarpal	2A
18287	Fragments of 2nd Cervical Vertebra	2A
21024	Right 2nd distal hand phalanx	2A
21039	Right medial Cuneiform	2A
21089	Right 3rd metacarpal	2B
21091	Right 5th metatarsal	2B
21142	Right 5th proximal hand phalanx	2A
25574	Right 4th or 5th proximal hand phalanx	2A

TABLE 4. GROUP 3

Inventory no.	*Bone*	*Location*
17109	Vertebral fragment	3A
17119	Left lateral cuneiform	3B
17124	Maxillary M3L	3A
17137	Right 2nd or 3rd proximal foot phalanx	3A
17142	Left 2nd metacarpal	3A
17145	Right 2nd proximal foot phalanx	3A
17157	Left clavicle	3A
17168	Right tibia fragments	3A
17173	Middle foot phalanx	3B
17187	Right 2nd metacarpal	3A
17193	Right 2nd middle hand phalanx	3A
17194	Left 2nd middle hand phalanx	3A
17201	Right 2nd middle hand phalanx	3A
17203	Left 3rd metacarpal	3A
17204	Left cuboid	3A
17234	Right talus and fragments of calcaneus	3A
20243	4th distal foot phalanx	Sieved from area of 3A
22560	Right clavicle	3A

Analysis of groups

In this section we examine the bone distribution within and between identified groups, for several reasons. The groups clearly differ in size and density. In fact, group 3A appears to be the only real 'group' as opposed to associated bone scatter. An immediate concern is whether the groups represent similar depositional and/or taphonomic phenomena. A related issue is whether anatomical links occur within and/or between groups. In other words can it be demonstrated that various bones represent single individuals? If this is the case the distribution differs from a pattern of random loss and subsequent scatter, and is most likely to reflect the taphonomy and disposal of the dead. If, furthermore, links are restricted *within* groups there is evidence that these represent depositional 'events'. However, *between* group linkage would suggest larger 'events', including depositional contemporaneity in various parts of the site, and the nature of scatter from individual behavioural episodes.

The most explicit manner of demonstrating anatomical linkage is analogous to lithic or ceramic fitting. This can be accomplished in three ways, only two of which apply to this case. We have no adjoining broken bone fragments. We do, however, have bones that are anatomically adjacent and appear to articulate. We also have side/side antimers that appear identical. In both cases we have demonstration, or strong suggestion, that the bones in question represent a single individual. Their relative position in the site is then of interest.

After demonstrating links or fits within or between groups, it is possible to examine the distribution of bones within the groups for overlap (or its absence), thus testing for the possible presence of multiple individuals. This is of special interest and value if the bones represent only limited areas of the skeleton, as in groups 2 and 3. When only limited areas are represented, the chances for bone duplication increase. Absence of duplication increases in significance, carrying with it possible interpretation of all bones as representing a single individual. Such a pattern would be suggestive of the disposition of a single dead person either as an inhumation or in some other fashion.

Anatomical fitting experiment

In the spring of 1985 one of us (CM) spent time in Cambridge examining the Oronsay bones for possible fits, as described above (the bones had been previously identified in 1984 (Meiklejohn & Denston 1987)). All possible side/side pairs and anatomical articulations were examined. It should be noted that bone preservation was generally excellent. Matching or fitting of pieces involved complete or near complete key surfaces (eg, distal and proximal surfaces of adjacent bones of the same digit) and clearly matching articular surfaces in bone pairings such as adjacent tarsals or metacarpals. Opposite side pairing was dependent on high levels of symmetry. Given the generally excellent preservation the pairings were relatively straightforward. Exclusion is more clearly certain than is inclusion. False exclusion is most clearly possible in side/side matches in an individual showing considerable asymmetry. False inclusion requires similarity of joint surfaces not only of size but of detailed morphology and is thus highly unlikely. While neither errors of exclusion or inclusion can be totally avoided, we consider them highly unlikely. We would stress that while we are unaware of any other study that specifically uses the kind of matching we report here as central to its interpretation, the practice of matching reported here is a routine task in any osteology laboratory, especially when dealing with multiple mixed burials or otherwise commingled remains.

At the time of the matching experiment the spatial position of the bones in the site was *not* known[2]. As a result no attempt was made to specifically look for fits either within or between groups. Only *after* the fits were identified was the spatial distribution examined. No changes to the diagnoses were made as a result. This work identified six high certainty match pairs, involving 16 bones (33%) of the total sample. Several possible pairings were excluded. The match pairs and group assignments are shown in Table 5. It should be noted that no bone matches were specifically made in the original field situation.

All fits involve groups 2 and 3. There is one high certainty fit within 2A, three within 3A, one linking 2A and 2B, and one linking 3A and 3B. *All* are therefore *within* group. Two lower certainty fits occurred, one linking 2A with 3A, the other 2B with 3A. There is thus immediate confirmation of the suspected relationship within the 2A/2B and 3A/3B

TABLE 5. ANATOMICAL BONE MATCHES

Inventory nos.	*Bone and group location*
a) high certainty	
15294 - 18238	5th right medial and distal hand phalanges [2A/2A]
15382 - 15742	5th left medial and distal hand phalanges [2A/2B]
17119 - 17204	Left lateral cuneiform/cuboid [3A/3B]
17142 - 17187	Left and right 2nd metacarpals [3A/3A]
17142 - 17203	Left 2nd and 3rd metacarpals [3A/3A]
17157 - 22560	Left and right clavicles [3A/3A]
b) low certainty	
17193 - 21024	Right 2nd medial and distal hand phalanges [3A/2A]
17203 - 21089	Left and right 3rd metacarpals [3A/2B]

group pairs, and a lower reliability link of groups 2 and 3. The latter should be treated with considerable circumspection (see further below, under major groups). There is also increased resolution to identification of two pieces described by Meiklejohn and Denston (1987). 15294 is now clearly identified to the left side, and 21024 now identified as a 2nd (as opposed to 5th) distal hand phalanx. Finally, exclusion of possible pairings within some groups establishes the presence of more than one individual in those groups.

THE MINOR GROUPS

No anatomical fits or exclusions occurred within groups 1, 4, and 5. This fits the pattern of isolated bone pieces identified on many Mesolithic sites (Newell *et al.* 1979). In addition, none of these groups shows anatomical unity. Group 1 contains one cranial and one shoulder girdle fragment; group 4 two cranial, one shoulder girdle and one foot fragment; and group 5 one pelvic girdle and several related rib fragments (Table 2).

As with the isolated bone finds, the bone distribution in groups 1, 4, and 5 appears to contrast with the total sample. Only one of eight pieces (12.5%) represents hands or feet compared to 61% of the total sample (30 of 49), while three of eight (37.5%) are cranial fragments compared to 6% of the total sample (3 of 49, comprising all cranial fragments at Cnoc Coig). No anatomical pairings were present in the bones recovered, preventing the demonstration of bone fits. The presence of left clavicles in Groups 1 and 4 excludes relationship of the total bone set in all minor groups to a disturbed single inhumation.

In order to test the significance of the difference we ran a chi-square analysis[3], testing the distribution of the combined loose bone and minor groups against the major groups. We divided the inventory into four categories, hand/foot bones, cranial material, teeth, and other. The basic matrix is seen in Table 6. The difference between the two samples was highly significant (χ^2=18.634, df=3, p=0.0003). Any assumption that the total sample is homogeneous is shown to be false.

THE MAJOR GROUPS

Given the evidence above linking groups 2A/2B and 3A/3B we drop the distinction in the remaining discussion. Group 2 is dominated by hand and foot bones, 88% of the sample (14 of 16 bones) (Table 3; Fig. 4). Of these, 12 (75%) belong to the hand, with one clear duplication, of the 5th left middle phalanx. There are thus at least two individuals in the group. However, looking at bones attributable to the 5th digit increases the complexity. From Table 5 15294/18238 and 15382/15742 are anatomical fits involving right and left 5th digits, respectively. However, the fitting experiment indicated that these pairs are not paired to each other. They are not left and right sides from a single individual. Furthermore, specimen 18279, a 5th left middle phalanx, is not a pair to 18238 and thus represents a third individual. While none of the other bones shows such obvious patterning, they also cannot be linked specifically to the three individuals identified above. Thus, even though no further overlaps occur it is difficult to know whether all belong to one individual or whether they need to be partitioned among all three (or more) individuals. Certain demonstrated non-fits suggest the latter type of case is more likely, however.

Group 3 is similar to group 2, with 13 of 18 (72%) bones from the hands and/or feet (Table 4; Fig. 5). The hypothesis that the two groups were similar was clearly supported by chi-square (χ^2=1.592, df=2, p=0.451[4]) (see Table 7).

Group 3 contains four high certainty fits, linking left lateral cuneiform and cuboid (17119/17204), left and right 2nd metacarpals (17142/17187), left 2nd and 3rd metacarpals (17142/17203), and left and right clavicles (17157/22560). Note the commonality of left 2nd metacarpal 17142 to two of the fits. In addition, there is overlap of two 2nd right middle hand phalanges (17193/17201), neither of which apparently fit to the 2nd left middle phalanx (17194), again suggesting the presence of at least three individuals in the group. As bones from all three lie within 0.10 to 0.20 m of each other, they do not appear to be separated within the group.

The above commentary argues that groups 2 and 3 each represent at least three individuals. There are also two lower certainty fits linking the groups, both involving hand bones. The first pairs a 2nd right medial phalanx (17193) from group 3 with a 2nd right distal phalanx (21024) from group 2. Note that the first of these two bones is involved in the identification of three individuals in its group. The second pairs the two 3rd left and right metacarpals, 17203 in group 3 and 21089 in group 2. Again, the first of these is also involved in a separate pairing in group 3. Thus there may, again, be a *prima facie* case for linking the sets of individuals in the two primary groups. It should, however, be stressed that these two inter-group links are not nearly so strongly based as are those within the groups. In addition, and see further below, the vertical (stratigraphic) distribution of these two groups argues strongly against any inter-group linkage.

TABLE 6. DATA MATRIX FOR COMPARISON OF MAJOR AND MINOR GROUPS WITHIN CNOC COIG SAMPLE

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Minor & Loose	3	3	3	6	15
Major	27	0	1	6	34
Total	30	3	4	12	49

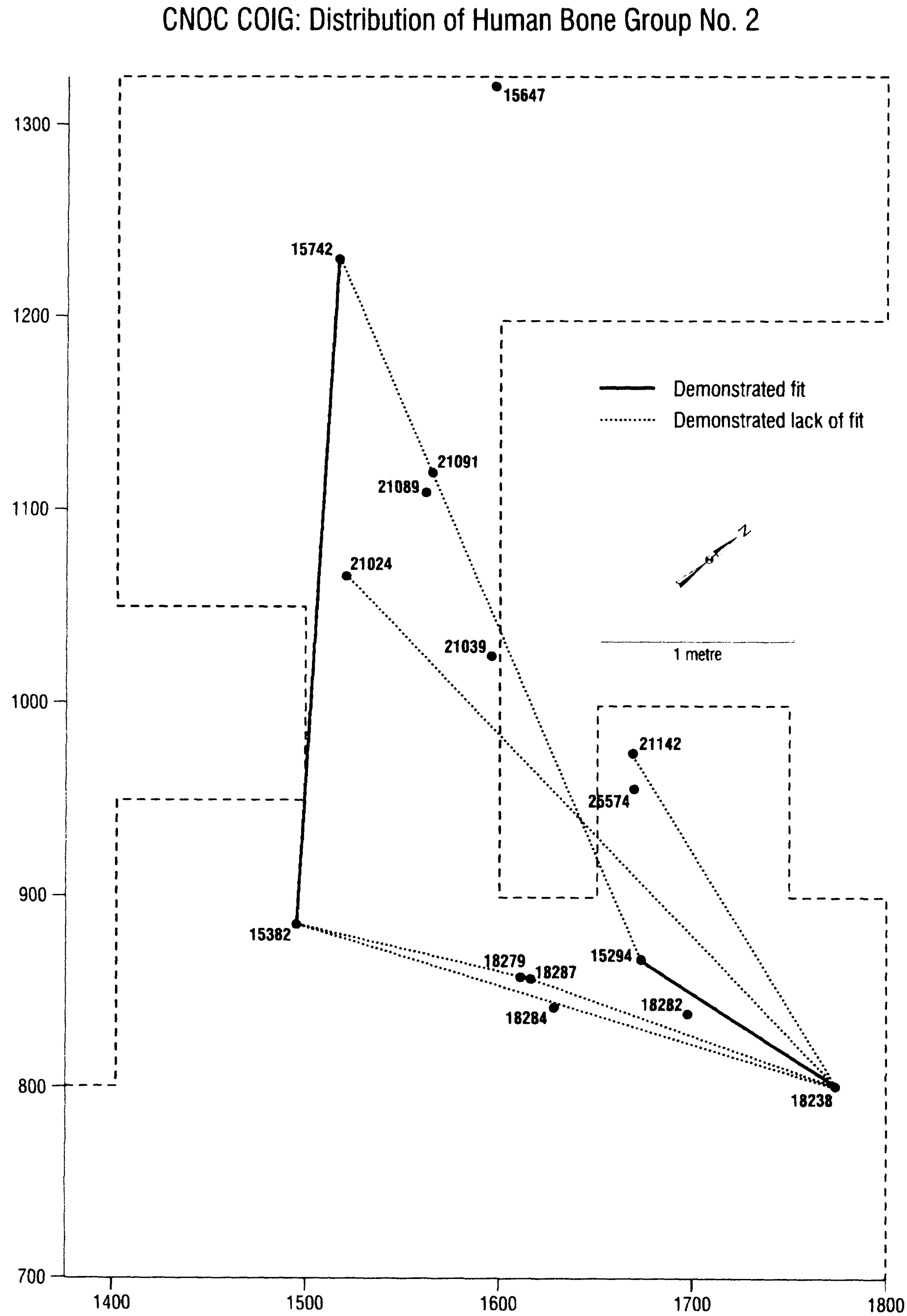

Fig. 4.
Distribution of human bones in Cnoc Coig Group 2.

Results of the spatial analysis

The spatial analysis discussed above clarifies some aspects of the human bone distribution at Cnoc Coig. In summarising the preliminary analysis of the material (Meiklejohn & Denston 1987, 297) it was suggested that 'a number of different processes may be involved.' At that time the overall Oronsay collection (including Caisteal nan Gillean and Priory Midden) was shown to differ from other European Mesolithic loose bone samples in its anatomical makeup, most specifically in dominance of bones from hands and feet. Furthermore, while the materials from other European sites were shown to have two patterns, neither fit the overall Oronsay pattern. These conclusions were reached prior to examination of the spatial data discussed here and did not therefore consider that more than one pattern was present at Cnoc Coig.

The work reported here extends these conclusions. While the Oronsay sample, as a whole, differs from other European samples, it also appears to represent two different phenomena. The anatomical makeup of the isolated pieces (Table 1) and three minor groups (1, 4, & 5; Table 2) is as follows: 3 cranial fragments, 3 teeth, 3 hand and foot bones, 2 vertebral and rib fragments, and 2 other postcranial bones. This distribution appears to be similar in makeup to loose bone finds seen elsewhere in Europe. The taphonomic origin of such finds is not clear and may be multifactorial. The fact remains, however, that the majority of Mesolithic sites with good faunal preservation also possess loose human bones, not clearly related to nearby burials. These have generally been viewed as homogeneous within sites, but the number of bones per site tends to be small. As already

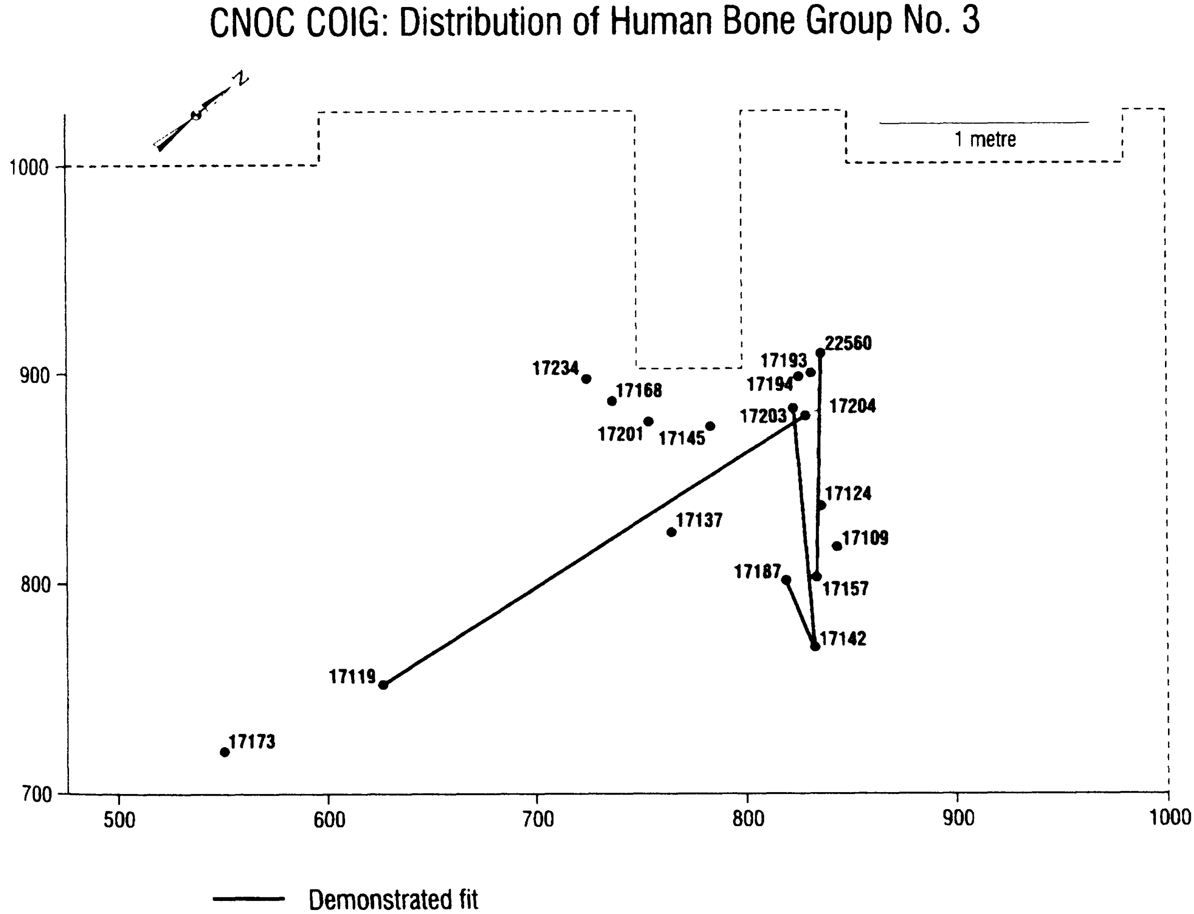

Fig. 5.
Distribution of human bones in Cnoc Coig Group 3.

TABLE 7. DATA MATRIX FOR COMPARISON OF CNOC COIG GROUPS 2 AND 3

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Group 2	14	0	0	2	16
Group 3	13	0	1	4	18
Total	27	0	1	6	34

indicated, no reported patterns appear to mirror the bone group distribution seen in groups 2 and 3 at Cnoc Coig.

In order to test the apparent resemblance of the isolated pieces and three minor groups at Cnoc Coig to patterns seen elsewhere in Europe we used the distribution found in Scandinavia for a comparison. Our reason for doing so is that this is the largest known sample and the one that has been most systematically recorded (for summaries of finds and discussion see Larsson *et al.* 1981; Meiklejohn & Constandse-Westermann 1978; Meiklejohn & Denston 1987; Newell *et al.* 1979). The final sample used involves 80 loose bone finds from 21 sites, three in Sweden, one in Norway and 17 in Denmark (see Appendix 1)[5]. The makeup of the basic matrix is seen in Table 8. The result of this comparison supports the position that the distribution of bones in the minor groups plus loose bones at Cnoc Coig is similar to the Scandinavian pattern (χ^2=2.970, df=3, p=0.396).

We do *not* have an unequivocal explanation for the 'loose bone' finds in Mesolithic sites but their ubiquitous presence where there is good faunal preservation suggests, to us, a pervasive taphonomic basis rather than a specific human behaviour, though we note that a ritual symbolic explanation, though considerably generalised, has been made for bone scatter on Danish Neolithic sites (Kaul 1992). Moreover, we also note that Kaul's study is largely directed at finds from clear inhumation contexts such as megaliths, and involves phenomena such as missing bones, disarticulation, and cremation. None of these is particularly germane to the Mesolithic pattern. For example, where cremation occurs in a Danish Mesolithic context there is a clear case for intentional burial (Brinch Petersen & Meiklejohn 2003).

In contrast, the anatomical distribution of pieces in groups 2 and 3 at Cnoc Coig (Tables 3 & 4) is strikingly different: no cranial fragments, 1 tooth, 27 hand and foot bones, 3 vertebral and rib fragments, and 3 other postcranial bones. We have already shown that the two patterns are significantly different (see Table 6). When Cnoc Coig groups 2 and 3 were compared to the Scandinavian sample discussed above the resultant matrix is seen in Table 9. The difference between the two groups is, as expected, highly significant (χ^2=39.813, df=3, p=10^{-8}).

Two final points need to be made here. The first relates to the Cnoc Coig distribution. The basic fitting experiment is largely restricted to the hand and foot bones, and these play a major role in both the comparisons above and the further interpretation below. We must indicate that, at this time, we are not certain that the isolated bone pieces and minor groups at Cnoc Coig are, themselves, homogeneous in origin. Though they fit the generalised Mesolithic pattern, as shown above, they do include hand and foot bones. Insufficient evidence existed to link any of these to the hand and foot bones of groups 2 and 3. Whether any of these bones should be linked to the interpretation made for groups 2 and 3 remains moot. It is possible but cannot be proven at this time.

The second, and final, point that needs noting is that the bones recovered from Caisteal nan Gillean II and Priory Midden (Meiklejohn & Denston 1987) are congruent in element distribution with major groups 2 and 3 at Cnoc Coig. Five of six identified bones are from hands or feet. It can therefore be tentatively suggested that the pattern seen in groups 2 and 3 at Cnoc Coig is also seen in the other Oronsay midden

TABLE 8. DATA MATRIX FOR COMPARISON OF CNOC COIG GROUPS 1, 4, AND 5 PLUS LOOSE BONES TO SCANDINAVIAN LOOSE BONES

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Cnog Coig	3	3	3	6	15
Scandinavia	15	28	6	31	80
Total	18	31	9	37	95

sites. The resultant matrix for testing this is seen in Table 10. Again, as expected, the results are congruent (χ^2=0.189, df=2, p=0.910). Finally, the statistical comparisons and their results are summarised in Table 11.

Interpretation of the major groups

At this point we have shown that there is clear grouping in the pattern of human bones at Cnoc Coig, and that the pattern appears to be the end result of at least two processes. We suggest a generalised but nonspecific taphonomic base for the loose finds and minor groups. In the discussion that follows we concentrate on the interpretation of major groups 2 and 3, which we feel may result from explicit human behaviours. In so doing we revisit some earlier publications on the human bones and scrutinize some of the ideas raised.

INTERPRETATIONS FROM RADIOCARBON DATING

Traditional radiocarbon dates on charcoal from Cnoc Coig placed the occupation of the site as most likely between 4700 and 4000 cal BC (see also above, Table 12 & Fig. 6). The more recent collagen based AMS dates from the human bone provide the slightly later range of 4400 to 3800 cal BC. The two data sets show considerable overlap, though the marine corrected collagen dates suggest a final occupation of the site about 200 years later than do the charcoal dates.

As noted above the calibration methods discussed by Richards and Sheridan (2000) correct for the strong marine shift noted in the $\delta^{13}C$ values. The initial interpretation of these dates, compared to the earlier charcoal-based figures, is that the human bones date to the youngest occupation of the midden. A similar interpretation is given to the single dated bone at Caisteal nan Gillean, a damaged metatarsal. The figures appear to extend into the range of early Neolithic dates elsewhere in Britain, thereby raising the following question: '[d]id the deposition of human bones in the midden signify the end of the use of the midden?' (*ibid.*, 314).

Since all three of the recently dated bones are from bone groups 2 and 3, they represent the more obvious and potentially explainable of the two suggested patterns. The pattern of groups 2 and 3 at Cnoc Coig might be a culturally specific and overt act of placing bone on a site prior to leaving or deserting it.

However, this interpretation is not congruent with Nolan's (1986) spatial analysis examined in the light

TABLE 9. DATA MATRIX FOR COMPARISON OF CNOC COIG GROUPS 2 AND 3 WITH SCANDINAVIAN LOOSE BONES

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Cnog Coig	27	0	1	6	34
Scandinavia	15	28	6	31	80
Total	42	28	7	37	114

TABLE 10. DATA MATRIX FOR COMPARISON OF CNOC COIG GROUPS 2 AND 3 WITH BONES FROM CAISTEAL NAN GILLEAN AND PRIORY MIDDEN

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Cnog Coig	27	0	1	6	34
CnG/PM	5	0	0	1	6
Total	32	0	1	7	40

TABLE 11. SUMMARY OF CHI-SQUARE COMPARISONS

Comparison	*Chi-square*	*df*	*Probability*
Cnog Coig - Major vs Minor groups	18.634	3	0.0003
Cnog Coig - group 2 vs group 3	1.592	2	0.451
Cnoc Coig Minor groups vs Scandinavia	2.97	3	0.396
Cnoc Coig groups 2 & 3 vs Scandinavia	39.813	3	10^{-8}
Cnoc Coig groups 2 & 3 vs other Oronsay	0.189	2	0.91

TABLE 12. RADIOCARBON DATES FOR CNOC COIG

Result	*Lab no.*	*cal* BC *intcal98*	*cal* BC *marine curve*	*Marine curve rounded to nearest century*	*Material*	$\delta^{13}C$	$\delta^{13}N$
5430 ± 130	Q-1352	4550-3950	na	na	charcoal	na	na
5495 ± 75	Q-1351	4500-4050	na	na	charcoal	na	na
5534 ± 140	Q-1354	4700-4080	na	na	charcoal	na	na
5645 ± 80	Q-1353	4690-4340	na	na	charcoal	na	na
5659 ± 60	Q-3005	4670-4350	na	na	charcoal	na	na
5675 ± 60	Q-3006	4690-4360	na	na	charcoal	na	na
5465 ± 55	OxA-8014	4460-4220	4030-3780	4000-3800	Human metacarpal, group 3	-12	14.7
5615 ± 45	OxA-8019	4540-4350	4210-3950	4200-4000	Human clavicle, group 3	-12.3	16
5740 ± 45	OxA-8004	4780-4450	4330-4030	4400-400	Human metacapal, group 2	-12	17

of the stratigraphy of the site (Mellars 1987b, 222–32). Group 2B lies deep within the midden in the north-central area of the site and is definitely part of the Phase 1 deposits. Group 2A is stratigraphically more ambiguous but probably also associated with phase 1. Thus group 2 represents an early event in the depositional sequence. Group 3 is located in the basal deposits of the 'Southern Areas' and is therefore part of the phase 3 occupations. Therefore, even though group 3 is relatively late in the sequence, its stratigraphic location is such that it does not represent a *final* depositional episode in this area of the site. In short, the spatial/stratigraphic position of human bone groups 2 and 3 within the midden indicates that neither represents an event associated with final abandonment of the site. A further result is that the three new radiocarbon dates from the site (Richards & Sheridan 2000) appear to be incongruous with the earlier series of dates derived from charcoal samples (Switsur & Mellars 1987), an incongruity that still needs explanation.

Methods of accurately correcting radiocarbon dates for marine reservoir effects are still being refined, so it is possible that with better models in the future then the human bone dates may fall into line with the charcoal dates. Also, radiocarbon dating methods continually improve. Therefore, it is also possible that redating the charcoal would provide more accurate and precise dates, which again could be better related to the newer bone AMS dates. We should also note the possibility of the 'old wood' problem, which could result in the charcoal being older than the occupation levels of the site, as was considered briefly by Switsur and Mellars (1987) in their original article. For the purposes of this paper, however, we are giving primacy to the spatial patterning and stratigraphic positioning of the bone, and putting aside the discrepancies between the radiocarbon dates.

As a final point here, it is useful to ask where the Cnoc Coig dates fit relative to current understanding of the date of the Mesolithic to Neolithic transition in Western Scotland. If we take the position above, that the new AMS dates and their correction for $\delta^{13}C$ values is correct and that it may be valuable to revisit the charcoal dates, then we have a date for the midden that falls within the range of 3800–4300 cal BC. This falls later than the transition elsewhere in Britain but is congruent with the sequence in the area (Bonsall *et al.* 2002a; see also Bonsall *et al.* 2002b and papers in Saville 2004a).

DISCUSSION

We have demonstrated above that human bone groups 2 and 3 represent a phenomenon differing from any other reported deposition of human bones in European Mesolithic context. Though the full ritual/symbolic significance is unclear at this point, the stratigraphic and anatomic uniformity of these bone

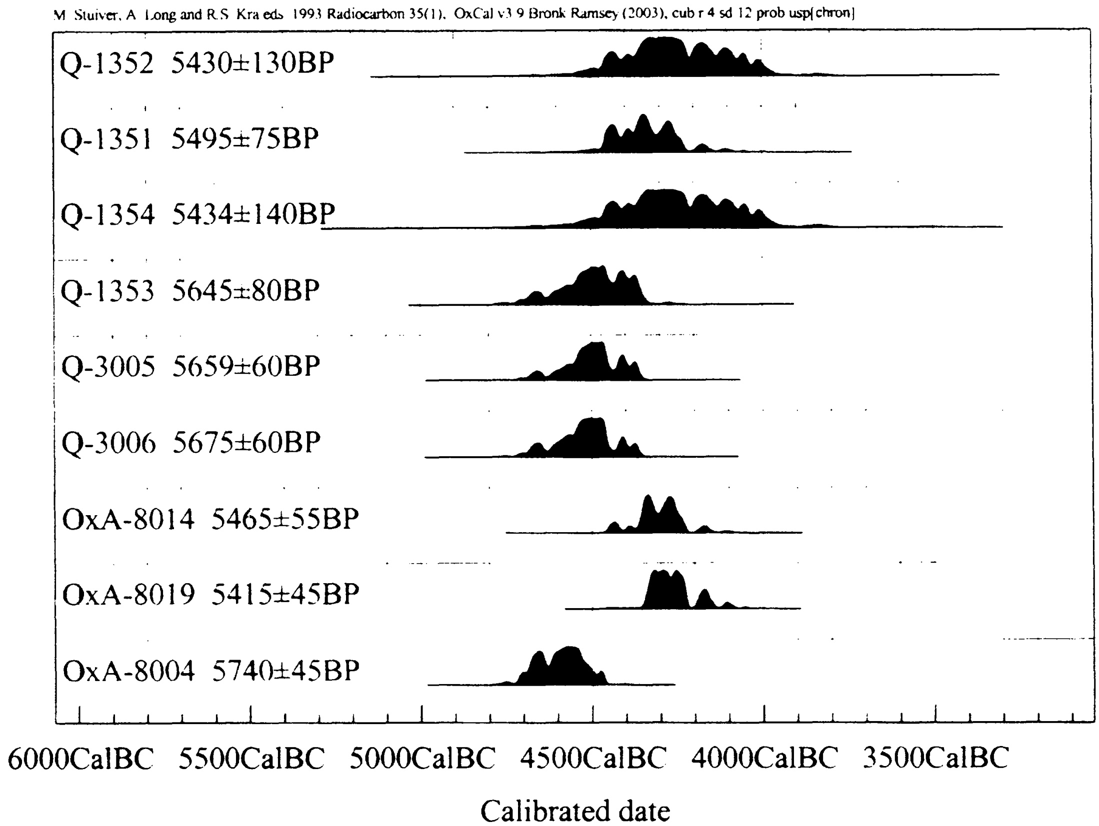

Fig. 6.
Probability distributions for the Cnoc Coig radiocathon dates.

groups argues against either an isolated or random event. The actual source of the bone is unclear since no inhumations have been recovered on Oronsay.

The nature of these finds makes them hard to deal with as a classic archaeological feature. As a result, some of the potential insights that might be expected from excavating inhumation burials are lacking. A core current approach to burials and burial taphonomy is *Anthropologie de Terrain*, a technique developed by Henri Duday in France in the 1970s (see Duday & Masset 1987) and recently applied with considerable success to the south Scandinavian Mesolithic by Liv Nilsson Stutz (2003). The core thesis of the method is that combined application of anthropological and archaeological techniques as 'field anthropology' can permit reconstruction of the original burial process. It is thus an extension of taphonomic methods and of the applied discipline of forensic archaeology (Nilsson Stutz 2003, 139 *ff.*). However, it is a method whose application is most obvious in undisturbed inhumation burials. In this case we are dealing with neither inhumations nor obvious delimited features. Nolan's original analysis (1986, 251 *ff.*) shows that the bone groups are interspersed with hearths. Overall body part distributions are most similar on the site to those seen in red deer and pig, least similar to seal and otter. Deposition of group 2, along with seal bones of similar anatomical area, is discussed in more detail below, and represents an exception to the generalisation about seal bone representation. The 3A portion of group 3 underlies a hearth but cannot be linked to it as a feature since the human bones are not charred. Moreover, nothing in the obvious deposition separates groups 2 and 3 from the patterns seen in those groups that we believe are random scatters (1, 4, and 5). The conclusion at this time must be that the patterns we are examining fall outside the potential explanatory powers of the Duday/Nilsson Stutz approach. It should also be noted that this is not unexpected, as incomplete and disturbed burials are sometimes uninterpretable by this approach. For example Nilsson Stutz's analysis of the well known sample of classic inhumation burials from the Danish Mesolithic site of Vedbæk-Bøgebakken considered 18 features (2003). Three could not be analysed using the method and a further five allowed only limited analysis.

One possibility is that we are looking at the consequences of placing bodies on scaffolds. Scaffolding as a practice has been suggested for English Neolithic sites, most specifically Hambledon Hill (Roger Mercer pers. comm. 1992; see also Mercer 1980). Such a model was tentatively suggested in the original discussion of the Oronsay bones, though without reference to specific examples (Meiklejohn & Denston 1987). However, we suggest extreme caution at this point. To our knowledge, and excluding Carding Mill Bay, discussed below, no British Neolithic site shows a site distribution that resembles that reported here for Cnoc Coig. At Hambledon Hill articulated skeletons were recovered, some apparently showing considerable evidence of decomposition and suggesting a pattern of 'exposure centres' (Mercer 1985; 1988), a practice that is most practical if based on true scaffolding. The final report on the human remains (McKinley n.d.) supports the suggestion of exposure and also indicates the presence of disturbance by canids (Jacqueline McKinley pers. comm.). The pattern of small bones we describe was not present. The overall pattern is therefore very divergent from the situation we report at Cnoc Coig. Although, *per se*, this does not exclude a scaffolding scenario, it appears to remove the obvious Neolithic equivalent. In addition, though details differ, other English Neolithic sites fail to yield similar patterns. As an obvious example, Neolithic burial cairns appear to show the burial of all body parts. Although few have been published in full, one example is that of Hazleton North in Gloucestershire (Saville 1990). In this case all body parts are represented and MNI estimates from foot bones are roughly equivalent to those derived from other bone groups (Rogers 1990). Again there is no obvious equivalence.

Of further interest here is, of course, the suggestion of ritual continuity from Mesolithic to Neolithic within Britain. If we assume conscious behaviour in the deposition of the bones in groups 2 and 3, then where would the bones come from? Presaging further discussion below, scaffolding would provide access to bones either directly from the scaffolds, or from bones lost in the decay process and recovered afterwards from the ground. Especially subject to the latter process would be the hand and foot bones that dominate the Cnoc Coig assemblage, given their small size. Clavicles might also fit this model, given the tenuous nature of their articulations with scapula and sternum. While this model would fit a random scatter of smaller bones it is harder to reconcile with the grouping or clustering seen in groups 2 and 3 at Cnoc Coig, especially if the failure to collect the bones for burial elsewhere were accidental. What else has been suggested or can be inferred?

Extension of the point just made can be found in the recent review of monumentality, including burial, in the Scottish Neolithic and its Mesolithic roots (Telford 2002). Telford considers burial within the context of 'formalised ritual practice', with the clear suggestion that the Oronsay human bone represents an aspect of this. Telford refers to Pollard's (1996) idea that the shell middens themselves are liminal markers identifying the relationship of sites to their location. Pollard then also builds on the idea that the bones on the site result from the exposure of the body that permits decay and results in 'clean' bones (excarnation), perhaps both literally and figuratively. This would be part of a process leading to the removal of bodies for burial elsewhere. This would clearly fit with evidence suggesting the absence or rarity of hand and foot bones in English chambered tombs (eg, Hambledon Hill) and might seem to mirror, or perhaps foreshadow, the later Neolithic pattern. Here again is a suggestion of symbolic continuity across the Mesolithic–Neolithic transition. Pollard's idea does, however, suggest a somewhat random pattern, only likely if the bone groups actually identify the location where the bodies were initially placed.

This idea can be extended somewhat further following Mithen and Lake (1996) who make reference to a stone cist, identified as a feature at the site of Staosnaig on the island of Colonsay, the near neighbour of Oronsay. They comment on the superficial resemblance of the cist to the burial structures of the Breton Mesolithic sites of Téviec and Hoëdic, while noting the effective lack of bone preservation at Staosnaig. Telford (2002) speculates that Staosnaig or an as yet undiscovered equivalent structure on Colonsay could be the source of the Oronsay bone. It should perhaps be noted that Pollard's model and the original scaffolding idea of

Meiklejohn and Denston see the origin of the bone as integral to the Cnoc Coig site, while Telford's reference to Staosnaig sees the bones as having an external origin. An external origin might fit the pattern of groups 2 and 3 but is less consistent with the other bone groups. It should, however, be noted that dating of the Staosnaig cist to the Mesolithic has been seriously questioned by Saville (2002) who suggests that the feature belongs to the Early Bronze Age, contemporary with a radiocarbon dating of 3395±60 BP (AA-21630; 1880–1520 cal BC) (see also Mithen & Finlay 2001; 391).

A further suggestion made by Telford appears to be implicitly derived from Nolan's thesis (1986), the close association of hand and foot bones with seal bones derived almost entirely from the flippers. This idea was originally put forward in a context lacking detailed data by Finlayson (1998; pers. comm.). We can speak more clearly to this here. Finlayson's suggestion implies a generalised association of the human and seal bones, with the implicit understanding that it refers to the whole human bone assemblage. In addition, and as noted above, the overall anatomical representation of human and seal bones is quite divergent. The association to which Finlayson alludes is far more specific, between human bone group 2, Nolan's seal group 3, and a hearth:

> '... [T]he main concentration of human group 2 is virtually horizontally coterminous with that of seal group 3, although the human group lies just above the seal group. However, this vertical separation is so slight that they must represent successive depositional events which were very closely spaced temporally. Indeed, *if the bones of the two groups were assigned to one species, they would almost certainly be judged to be depositionally contemporaneous.*' (Nolan 1986, 255: italics added)

There is thus a prima facie case that human bone group 2 and seal bone group 3 represent a single, purposive event, though in a currently unclear social context. Unfortunately there is no apparent equivalency in human bone group 3, so the point cannot be generalised. We do, however, suggest that the two human bone groups (2 and 3) are part of a common social pattern, differing in origin from the human bones represented by the isolated bones and groups 1, 4, and 5.

Unfortunately, Mesolithic sites in western Scotland have tended to lack good bone preservation (Cnoc Coig and other key sites discussed below are shown in Fig. 1). Prior to 1980 the only obvious reported cases of human bone in apparent Mesolithic contexts were the classic 'Obanian' cave middens of Distillery, Gas Works, MacArthur and MacKay Caves at Oban, originally described at the end of the 19th century (eg, Turner 1895). However, and *contra* Telford (2002), none of these finds is demonstrably Mesolithic (Newell *et al.* 1979). Indeed, the very presence of 'Obanian' levels has been questioned for all but MacArthur Cave. Moreover, human bone from MacArthur Cave has been recently dated to the Iron Age, querying whether any of the recovered skeletal remains are germane to a discussion of Mesolithic burial practice (Saville & Hallén 1994). The only other material from Scotland mentioned by Newell *et al.* (1979) was from Inchnadamph in Sutherland where skeletons were recovered in 1926, apparently with late Pleistocene and Holocene fauna. The site, under its alternate name, Reindeer Cave at Creag nan Uamh, has been shown to have possible evidence for occupation in the terminal Palaeolithic (Lawson & Bonsall 1986). However, further work has directly dated the associated human remains to the Neolithic (Hedges *et al.* 1998; see also Lawson 1981).

Based on the comments made above, we feel that reference to the possible burial cist at Staosnaig on Colonsay (Mithen & Lake 1996) should be treated with extreme caution. A post-Mesolithic feature is most likely. This would obviate stylistic comparison of the feature with Téviec and Hoëdic in Brittany, and Telfords' idea of an external source for the human bones (2002). It also would neither provide a specific cultural interpretation of what we see at Cnoc Coig nor provide any basis for a symbolic linkage between the Oronsay burial practice and the interpretation of Staosnaig as a source for the Cnoc Coig bones.

Most recently, possible late Mesolithic human bone has been reported from Carding Mill Bay, a shell midden site near Oban with an Obanian industry and apparently wild fauna (Connock *et al.* 1992). Unfortunately, further work shows that the material is almost certainly in Neolithic context with direct AMS dates of 4330 to 4830 BP (Schulting & Richards 2002; see also Schulting 1998). However, the makeup of the collection is still of considerable interest. With six of ten bones from the hands and feet, it appears to mirror the Oronsay pattern, though the data

TABLE 13. DATA MATRIX FOR COMPARISON OF CNOC COIG GROUPS 2 AND 3 WITH BONES FROM CARDING MILL BAY

Groups/Bones	*Hands/Feet*	*Cranial*	*Teeth*	*Other*	*Total*
Cnog Coig	27	0	1	6	34
Carding Mill Bay	6	1	0	3	10
Total	33	1	1	9	44

presented so far (*ibid.*) does not suggest the clustering that marks the Cnoc Coig material. However, the site is apparently a remnant, so that the full context may be unclear. Any possibility of a continued social/symbolic practice involving human bone would be a strong argument for local population continuity from Mesolithic to Neolithic. With this in mind we compared the two sites, providing the matrix of Table 13. There is no significant difference (χ^2=4.659, df=3, p=0.199).

Finally, the results presented here suggest social/symbolic linkage of human and seal in possible common burial of their remains. This can be tied to some recent ideas about the use of shell midden sites in western Scotland (Finlayson 1995; Mithen 2000; Mithen & Finlayson 1991). The argument is that the middens are linked to exploitation of marine resources, something that is almost implicit in the stable isotope values at Cnoc Coig (Schulting & Richards 2002; Richards & Mellars 1998). Beyond extracting fish and sea mammal oils, processing of seal skins for waterproof clothing could be central to what Finlayson (1995) calls 'dirty processing activities' (see also Schulting & Richards 2002). If this economic pattern was a key to life in this part of the Southern Hebrides then it might explain the evidence that occupation of the Oronsay middens overlapped with early agricultural activity elsewhere in Britain and the resultant major dietary shift (*ibid.*). That remnant patterns of the associated social activities might survive at later sites with fully terrestrial diets such as Carding Mill Bay simply points to the symbolic significance of the earlier association, especially if the shift is economic but the population shows continuity over this transition.

CONCLUSION

In expanding discussion of the human bone found at Cnoc Coig on Oronsay, this paper has firstly provided spatial data for the bones previously inventoried by Meiklejohn and Denston (1987). In doing so we provide the context for any further discussion of their place in the interpretation of the latest Mesolithic in western Scotland.

As a second objective extending beyond the simple configuration of the bones in the site we have shown that they are divided into five spatially proximate groups, the nature of which appears to represent two processes. The first of these, represented by minor bone groups 1, 4, and 5, and the isolated loose bones on the site, resembles similar bone scatter recorded widely in the European Mesolithic. This reasonably random dispersion of human bones, usually in small numbers per site, derives from all parts of the body. Presence of preserved faunal remains on a site is usually predictive of such finds. We conclude that this represents a random taphonomic phenomenon that may be produced by several means. The most obvious source of the bone is from inhumation burials elsewhere, on or off the site. Teeth may represent a separate phenomenon, with two obvious sources, shed deciduous teeth or teeth lost by various pathological processes. The overall conclusion is that these patterns are not the product of purposive cultural behaviour.

In contrast, human bone groups 2 and 3 present a far from random pattern. Both are dominated by hand and foot bones, a pattern not previously reported in a European Mesolithic context. The spatial analysis and fitting experiment shows that the bones represent a limited number of original individuals or skeletons, and are recovered from circumscribed locations within the site. In the case of bone group 2 the depositional pattern also appears to involve seal flipper bones. The limited anatomical origin of the bones is the antithesis of a random taphonomic process. Rather it suggests the signature of a purposive cultural act. The question that remains is, of course, why? The absence of other archaeological cases and ethnographic equivalents makes the answer elusive. A stumbling block to more explicit conclusions is a lack of other clear examples of the pattern seen in bone groups 2 and 3. Though possibly present at the other two Oronsay middens with human bones, Caisteal nan Gillean and Priory Midden, the bone numbers in the latter sites are insufficient to prove the point. Similarly there is insufficient evidence to fully defend the equivalence of the two Cnoc Coig clusters to the bone distribution present at Carding Mill Bay in the Neolithic.

We have also shown that one previous idea about these bones appears to be incorrect. One of us [MR] had asked whether intentional placement of these bones might represent the last activity on the site prior to abandonment. The spatial analysis shows, however, that neither clusters 2 nor 3 are from the uppermost portion of the midden deposit. Whether they represent the end behaviours at the end of a specific occupation season is harder to judge, given the complexity of the stratigraphic sequence.

This paper has centred upon the distribution of the human bones from the Cnoc Coig site. We would be negligent if we failed to point out that there are other potential lines of enquiry. These include the relationship of the human bone scatter to other evidence from the site, including faunal and artefactual materials. Such an exercise is, however, obviously beyond the scope of this paper, and would require comparison of these distributions to those found on other Mesolithic and Neolithic sites from the west of Scotland.

Finally, we suggest that there may be justification for some of the social models that have been developed around the evidence of the human bones at Cnoc Coig. Beyond their use in demonstrating a strikingly marine-focused diet in western Scotland at the end of the Mesolithic, they may show, in the case of bone group 2, a close association with the exploitation of seals. Such a social focus on the sea may have been central to these populations, making the evidence of the profound dietary change in the subsequent Neolithic all the more striking, whatever its cause. We hope that the data presented here assist in interpretation of what Mithen has recently expressed as the 'Mesolithic experience' (2004).

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Endnotes

1. The group numbers are derived from Nolan's preliminary numbering of February 1985. In his thesis (Nolan 1986) he renumbered the groups listed here as 1, 2A, and 2B. 2A and 2B are referred to as 2 and 1 respectively and 1 is removed. Nolan now feels that the original numbering, used here, is the most appropriate.

2. All three Oronsay sites were examined in this way. No inclusions or exclusions could be made for Priory Midden, as a simple function of number (1 bone), or Caisteal nan Gillean, probably a function of the small sample size (5). Between site matches were examined and all excluded, as a simple procedural check.

3. All statistical analyses were performed using the Crosstabs option in SPSS, edition 10.1. These results were confirmed by the use of the statcalc option in Epiinfo.

4. The absence of cranial bones in both samples meant that the chi-square analysis automatically removed this category, producing a resultant 3 x 2 table with 2 df.

5. The series used is a modified version of that summarised by Larsson *et al.* (1981). One sample mentioned in that source has no associated inventory (Holmegaard-Jutland). Some minor corrections have been made in the inventories, primarily referring to Newell *et al.* (1979). Most obvious is that the Larsson list omits tooth remains. In a commentary on an earlier draft of this paper it has been noted that the series used here is far from complete especially as regards Denmark (Erik Brinch Petersen pers. comm.). However the

full series has never been fully inventoried and is likely to include samples that may not be Mesolithic. Work on such inventory is in progress (EBP). It is confirmed, however, that all of material in the full inventory fits the pattern described here for the abbreviated data set (EBP).

6. The nature of the Obanian industry is outside the scope of this paper, other than to indicate that its original nature as defined by Lacaille and Movius a half century ago is now seriously questioned. For recent perspectives of the Obanian and its context and the place of the Orosay middens see Mellars (2004) and Saville (2004b; 2004c)

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APPENDIX 1

Site	*Hands/Feet*	*Cranial*	*Teeth*	*Other*
Arlöv I, Sw	1	1	-	-
Rotekärrslid, Sw	-	2	-	-
Segebro, Sw	2	-	-	-
Skipshelleren, No	2	-	-	-
Bergmansdal, Dk	-	2	-	6
Bloksbjerg, Dk	-	2	-	-
Brabrand, Dk	-	1	-	2
Brovst, Dk	-	2	4	-
Flynderhage, Dk	1	1	-	3
Henriksholm, Dk	-	1	-	2
Kolind, Dk	-	-	-	2
Lund by I, Dk	1	-	-	-
Meilgaard, Dk	1	1	-	2
Mullerup I Syd, Dk	1	1	-	1
Nivaagaard, Dk	3	5	2	3
Norsminde, Dk	-	3	-	-
Sølager, Dk	-	1	-	-
Sværdborg I 1917, Dk	-	1	-	-
Sværdborg II 1921, Dk	2	2	-	7
Tybrind Vig, Dk	-	2	-	-
Vinde Helsinge, Dk	1	-	-	1
Totals	15	28	6	31

Data derived from Larson *et al.* 1981 and Newell *et al.* 1979