Excavation of this short-horned cairn presented few problems, either of technique or of interpretation. Before excavation the general characteristics of its type, including both pairs of horns, were visible, but there was doubt as to the position of what was then thought to be a single chamber and passage. Published plans of the short-horned cairns of Ormigill (Cat 42) and Garrywhin (Cat 26) showed that entrance to a single passage and chamber was from either SSE. or SSW. Surface indications at Tulloch of Assyery A suggested that a passage opened from the northern forecourt, the cairn being orientated almost exactly N.-S. At an early stage of excavation, however, it was realised that the cairn contained a passage and a chamber entered from each forecourt. Excavation was planned to uncover as much as possible of the body of the cairn. Considerably more than half of the total area of the cairn was uncovered, and the major structural details were located. A reconstruction of the original plan of the cairn may therefore be offered (fig. 8).

Northern Chamber and Passage (figs. 8, 9, and Pl. VI)

The northern chamber comprised the chamber proper and an ante-chamber. The latter was subrectangular in plan, 7 ft. 6 in. wide and 5 ft. long. Its E. and W. walls were built of dry-stone walling. Its N. and S. limits were each marked by two orthostats which separated it respectively from the passage and chamber, with gaps between each pair of orthostats to allow access. The chamber proper was polygonal in plan, measured 10 ft. at its greatest width, and was 8 ft. 9 in. long. Its N. limits were formed by two orthostats, common to both chamber and ante-chamber. A large orthostat, set leaning backwards at a slight angle, formed the end wall. The E. and W. walls were each built of a single orthostat, each leaning backwards, and linked to the other three orthostats by very well-built dry-stone walling.

There was no evidence that the sockets of the orthostats were packed with stones to aid stability. In this, Tulloch of Assyery A and Tulach an t-Sinnach differ from Tulloch of Assyery B. The sockets of Tulloch of Assyery A were set in sockets whose shallow depth was limited by outcrops of flagstone beneath the cairn. Stability was achieved by the selection of orthostats having flat bases, their incorporation into a composite structure of orthostats and dry-stone walling, backing walls and, where appropriate, the setting of orthostats at a small angle from the vertical.

The side-walls of the passage were constructed of dry-stone walling which had a slight backward batter, that of the eastern wall being more pronounced than the western. Slabs of greater than average length were used in the foundation course. A pair of jamb-stones, aligned with the line of the façade, marked the entrance. The western orthostat had been slightly displaced and leaned outwards into the forecourt. Between the jams, and extending for a distance of 3 ft. into the passage, there was a blocking of carefully laid horizontal slabs. The passage measured 14 ft. 6 in. from the entrance to the pair of orthostats which separated it from the ante-chamber. Its width varied slightly at ground level from 2 ft. 3 in. to 3 ft. and from 3 ft. 6 in. to 4 ft. 9 in. at its uppermost surviving courses. The S. end of the passage was blocked by loosely, but carefully, laid slabs.

Roofing did not survive in situ in any part of the cairn. A considerable number of large flat slabs, having an average width of 3 ft., lay at different angles in the northern chamber, and were of a size suitable for roofing material. Several slabs lay close together in vertical stacks as they had fallen. One very large slab, measuring approximately 5 ft. by 3 ft., which had fallen near the junction of ante-chamber and chamber, would have been of a size and of proportions appropriate to the top of a central stone. This evidence suggests the former existence of a fairly massive corbelled roof.

Recent interference in the N. part of the cairn was considerably less than that in the S. and, apart from roofing, the only direct evidence for disturbance came from each side of the W. orthostat, set between ante-chamber and chamber, and from the N. side of the opposed orthostat. While this interference may have been sufficient to disturb and destroy the delicate stability of the roofing, there is no evidence to suggest further human depredation in either passage or chamber. Beneath the infill of stone in the chamber burials were found, apparently undisturbed since prehistoric times.

The highest point of the W. orthostat in the chamber was 5 ft. above floor level, but the underside of the roofing at its highest point must have exceeded this. It is most improbable that the chamber could have been spanned by roofing stones resting directly on the side-walls and, as has been suggested, the quantity of fallen stone found in the chamber suggests that some form of corbelling was employed. The upper course of dry-stone walling, in those areas where it survived undisturbed, was formed of a single large slab, similar to that in the passage at Tulach an t-Sinnach (cf. p. 9). These appear to have been chosen, both for their stabilising effect, and as seating for corbels. Behind the orthostats cairn material was built up in horizontal layers in the form of a rough, but substantial, backing wall. The uppermost undisturbed material forming the body of the cairn in the immediate vicinity of the chamber was composed of flagstones, set with a slight upward inclination towards the centre. Each of these details would have contributed to the stability of a corbelled structure. It is not known to what height such a corbelled structure would have been built, although it would undoubtedly have afforded clearance sufficient to allow a man to stand upright, at least in the centre of the chamber. Evidence for corbelling was noted by Anderson in both long- and short-horned cairns in Caithness, although roofing did not remain intact in any of the cairns examined by him.1 The floor of the chamber was not paved. Two platforms of dry-stone construction were

1 Anderson, J., P.S.A.E., vi (1867-8) 495.

1 N.G.R. ND 0881689.
subsequently revised an earlier interpretation of deliberately set extra- revetment to one caused by slip. Although similar evidence from chambered cairns elsewhere in the Hiberno-British province may not necessarily be relevant to the interpretation of such features in cairns of northern Scotland, it is perhaps germane to refer to this lack of unanimity. It is also possible that there has been a tendency to oversimplify the problem and regard all extra-revetment material as being either entirely the result of deliberate construction or entirely the result of slip.

The present writer was able to visit this cairn on three occasions subsequent to excavation. The first visit took place just under one year after the excavation of 1961, the second nine months later, and the third three years after the original excavation. During this time the site had been left uncovered and had been undisturbed. Walling remained relatively stable, but there had been progressive flaking of dry-stone walling, some of the individual stones of which had entirely disintegrated into small flakes (Pl. VII, 3). Perhaps more than other evidence, this supports the conclusion that Tulloch of Astrey A could not have been left without some sort of extra-revetment for any length of time. Such evidence cannot be applied indiscriminately to cairns of similar construction elsewhere, as it is not known to what extent factors such as climate, physical properties of the stone used in construction and the length of time incorporated in a cairn, may be relevant. The present writer found that similar weathering of a similar type of revetment wall occurred within a similar period of time at Luckington in Wiltshire.

Burials

Apart from collapsed roofing material, the N. chamber did not appear to have been disturbed, and burial deposits were here recovered intact. Two low platforms of dry-stone construction were built and burial were placed on them. One platform was built of seven courses of dry-stone walling and was set in the SW. corner, in an angle formed by the W. and S. orthostats and their intercalary walling. It formed a segment of a circle in plan, having a curved frontal edge. The other platform was of similar construction. It was approximately rectangular in plan, and lay along the W. side of the chamber between the SW. platform and the NW. orthostat of the chamber.

Five burial deposits were found in the N. chamber, two lying on each platform. Each of these four latter deposits comprised disarticulated assemblages of human bone. The surviving portion of the fifth burial was articulated and lay on large slabs immediately to the E. of the N. platform. Bone was not found in the E. part of the chamber, but a small deposit was found in the E. part of the N. ante-chamber. Full details of bones identified are given in Appendix A, and it is convenient here to summarise that evidence (Pls. VIII-X, fig. 6).

Burial deposit A. The main part of this deposit lay on the S. part of the SW. platform and was concentrated in an area of approximately 1 ft. square. At the time of excavation, it could be seen that parts of a crushed cranium overlay vertebrae and other bones. Parts of bones of the forearm and a scapula had fallen from the platform. The greater part of an ulna and three ribs lay against the S. orthostat of the chamber. A femur had been jammed into a cranium, and part of a pelvic margin was in contact with a mandible. Traces of burning could be identified on the surface of two bones of the foot. It was apparent that this deposit represented the careful collection of bones from decayed bodies.

Remains of two individuals were identified. One was a mature adult, some of
The effects of short-term exposure of the eye to intense light are well documented. However, the long-term effects of such exposure are less well understood. In an effort to better understand these effects, a series of experiments were conducted in a controlled environment. The experiments involved exposing subjects to intense light for prolonged periods of time. The results of these experiments were then compared to those of a control group that was not exposed to the intense light.

The study was conducted over a period of six months, with subjects being exposed to intense light for a total of three hours per day. The results showed that the subjects exposed to the intense light exhibited significant changes in their visual acuity and contrast sensitivity. These changes were not observed in the control group.

The implications of these findings are significant, as they suggest that short-term exposure to intense light can have long-lasting effects on visual function. This information could be useful in developing strategies to protect individuals from the potential harm caused by intense light exposure.
for almost a century as a short-horned cairn, the distribution of which is apparently limited to Caithness, Sutherland and Orkney. Its size, relative proportions and method of construction compare with those of other excavated cairns of its class, although Tulloch of Assery is the only known cairn of the type to have been built with a separate chamber and passage entered from each forecourt. The ground plan of the cairn is similar to those of Ormiegill (CAT 42) and Garrywhin (CAT 26), although its horns splay outwards in plan more than do those of the two cairns cited and those of the unexcavated cairn at Skelpick South (NOT 55). The plan of the horns of unexcavated short-horned cairns at Eday Church (ORK 15) and Fara (ORK 17) and those of the long-horned cairn at Head of Work (ORK 18) resemble those of Tulloch of Assery A. It is not suggested that conclusions concerning typological sequences should be drawn from these observations. The plan of both chambers in Tulloch of Assery A resembled the bipartite arrangement of chamber and antechamber at Garrywhin (CAT 26). Both differ in this from Ormiegill (CAT 42), where the chamber was of tripartite construction, and from Eday Church (ORK 15) and Fara (ORK 17), at both of which the chambers appear to have at least three sub-divisions.

The back-to-back arrangement of independent chambers with their passages under a single cairn is paralleled in Caithness at Langwell (CAT 34), but here the cairn has been much disturbed. At present it is oval in plan and apparently without horns. It has chambers of Camster type. A more widespread use of this back-to-back arrangement may be seen in the double-horned (or dual-court) cairns of the Carlingford Culture in the north of Ireland.
Fig. 16. Tullach of Amary A: sections
Evidence derived from the excavation of each of the three cairns described in this paper has been discussed individually. In this final section reference is made to matters of more general interest concerning the three. Any discussion of possible relationship between them is inhibited by lack of detailed evidence of absolute chronology. Although the slant of each cairn appears to lie within the Neolithic in Caithness, the wheel certainly extended over several centuries, and on present evidence there is no certainty that any two of the cairns were in simultaneous use. There is similarly no evidence to suggest that the builders of any one cairn adopted either the building techniques or the ritual usage of the others.

Each of the three cairns provided evidence that their builders possessed a high degree of competence in handling local building materials. Structural details of the individual cairns have been discussed separately, and it is here only necessary to refer again to the use of 'cores', inner walls and buttress stones in the achievement of internal stability. The type and scale of the cores vary, but in each instance the need to support and contain thrust from the chamber area was achieved. Having accomplished this, the outermost wall of each cairn was not required to fulfill any structural function beyond that of containing the capping of the cairn, and of acting as a revetment wall. The small amount of slip from Tulloch of Assynt B demonstrates the effectiveness of this method of construction. It has been suggested that at Tulloch of Assynt A the extra-revetment was deliberately built, and was not the result of slip. If this were so, the extra-revetment had a function which was not simply structural, as the system of cores, inner walls and buttress stones ensured that little pressure was exerted on the revetment wall from the interior of the cairn. Disturbance, due at least partially to the building of the later enclosing wall, had destroyed some evidence from the heel-shaped cairn at Tulloch an t-Siannach, but here again the outer most walls appear to have experienced a minimum of thrust from the interior. There is no evidence of a deliberately built extra-revetment in this cairn. Stone alone appears to have been used in the construction of each of the cairns, without any admixture of earth or turf, apart from the northern structure of Tulloch an t-Siannach.

The original external appearance of the cairns is unknown in detail, but it might be assumed that the distinctive ground plan of both the heel-shaped and the horned cairn was to some extent reinforced in the elevation of each. It has been suggested that the central midden in each cairn rose above a lower, flatter platform. In its original condition Tulloch of Assynt A may have had a stepped appearance, and the heel-shaped cairn at Tulloch an t-Siannach may similarly have been stepped. Tulloch of Assynt B appears to have been a hemispherical cairn rising from its straight-sided revetment.

Each of the three cairns yielded evidence of multiple burial, but again there appears to have been little uniformity in the method of depositing the dead in the different cairns. Evidence from the N. chamber of Tulloch of Assynt A appears to be the most ambiguous. There were the remains of at least nine, and possibly eleven, individuals. Of these, all but one, burial deposit E, were fragmentary and disarticulated. It is uncertain whether this implies a sequence of successive interments which, after the decay of the non-skeletal parts, may have subsequently been collected together and retained within the chamber, or whether there had been a simultaneous deposit of remains which previously and temporarily may have been housed in a new burial within a new structure in some sort of ossuary. The condition of burial deposit E which, although incomplete when excavated, was almost certainly interred while flesh still remained on the body, might argue that successive burial was practised. On the other hand, the condition of the other deposits, and their fragmentary condition, might support the hypothesis that these deposits represent a token burial of remains brought from an ossuary. Burial deposit B, in its casing of clay, might similarly be thought to add weight to such a hypothesis. Had this been so, the position of burial deposit E, which is illustrated that space on the platforms was not cleared for it. It seems probable, on account of its position, that burial deposit E represents the remains of a body deposited in the chamber subsequent to the interment of the remaining deposits on the platforms, whenever these latter deposits may have been placed there.

The small number of individuals buried in both Tulloch an t-Siannach and Tulloch of Assynt B – apparently no more than three or four in each cairn – and the condition of the burial deposit suggest that the human remains found in these two cairns had previously lain elsewhere. In each cairn, and more particularly in Tulloch of Assynt B, there would have been adequate room in which to lay the newly dead. The incomplete skeletal remains and complete lack of articulation of all human remains from the two cairns were clearly not the result of subsequent disturbance. Furthermore, the occurrence of animal bones mixed with human bone, and in the case of Tulloch an t-Siannach of layers of stone, in the same deposit suggests that the contents of each chamber had been deposited simultaneously. Although the remains of four individuals were identified in these two cairns, in each case the third and fourth individuals were represented by very fragmentary remains, and the possibility must be allowed that the chamber had been used previously and cleared to make room for the final deposit. The remains of the third and fourth individuals might therefore be regarded as skeletal debris from an earlier use of the chamber.

The process as common practice in the N. of Scotland must await evidence from future excavation. Should it eventually be proved to have been normal, only then will it be possible to begin to speculate on the implications inherent in the hypothesis of an ossuary. The occurrence of a small quantity of burnt bone in the chamber of Tulloch an t-Siannach must similarly pass without comment until comparable data are available. The final use of each chamber was marked by the construction of a carefully built blocking to seal the low and narrow entrance to the passage. At Tulloch of Assynt A this was followed by the positioning of the forecourt blocking and, perhaps, of extra-revetment along the sides of the cairn.
Any attempt to compare evidence of burial in these three cairns with that from those cairns in Caithness excavated during the nineteenth century is hampered by lack of detailed data from the latter. In general, it may be seen that most of the individual features observed in Tulloch of Assyery B were paralleled in one or more of the other Caithness cairns in which unburnt bone overlay a deposit of burnt bone. Tulloch of Assyery A appears to be unique in the evidence derived from its N. chamber, and Tulloch an t’-Sìonaich should properly be compared only with Shetland cairns. The layer of charcoal and burnt bone from Tulloch of Assyery B was much thinner than that, for example, from Camster Round (Cat. 13), both being round cairns with Camster-type chambers. The thin layer of the former, and possibly the ‘paving’ overlaying it, are more closely paralleled by those in the Camster-type chambers of the two long-horned cairns at South Yarroors (Cat. 54, 55). The little evidence available suggests that the burnt deposit in each of the Camster-type chambers of the four cairns on Warehouse Hill (Cat. 62-65) was relatively thin. At Garrywhin (Cat. 26) and Ormigill (Cat. 42), both short-horned cairns, there was a thick burnt layer in each chamber. There was no evidence whatever of a burnt layer in the N. chamber of Tulloch of Assyery A, and disturbance in the S. chamber had destroyed all relevant evidence. Where the burnt deposit reached a thickness of some 12 in., as at Kenny’s Cairn (Cat. 31) or Ormigill, it clearly differed from the thin scatter identified at Tulloch of Assyery B.

It is not known to what extent the practice, observed at the latter cairn, of scattering the burnt deposit on the former ground surface prior to the building of the chamber, was followed. It would appear that a distinction should be made between a scatter and a deposit. The former, as at Tulloch of Assyery B, might be covered and protected to a certain extent by a ‘paving’. A layer, however, measuring 12 in. or more in thickness, had it been deposited prior to the building of the chamber, could hardly have survived the activity attendant on such an operation. It may be inferred that burnt material of this quantity was deposited in an already existing chamber. A further distinction may be observed. Burnt bone in the thicker deposits appears to have been derived from the common type of prehistoric cremation, in that some of the bone was only partly burnt and that recognizable fragments were included. Burnt bone from Tulloch of Assyery B and South Yarroors South (Cat. 55) was, to use Anderson’s expression in referring to the latter, ‘extremely comminuted’. In the former cairn no individual fragment of burnt bone measured more than 1 in. across, the majority of them measuring less than ½ in., and were unidentifiable. If the distinction is accepted between a pre-cairn scatter and a deposit made subsequent to the building of the chamber, it may be assumed to reflect some variation in cult practice. On present evidence it is not possible to correlate such distinctions with the plan of cairn or chamber. Although imperfect in detail, accounts of early excavation in Caithness suggest that the condition of unburnt bone in most cairns resembled that of Tulloch of Assyery B. Evidence of articulated remains is ambiguous, but in any case appears to have been a rare occurrence. Human and animal bone appear to have been deposited together. This fact, and the broken, scattered and fragmentary condition of the human skeletal material suggests, as in the case of Tulloch of Assyery B, that the majority of deposits were placed in position after the decay of flesh.

There is no known parallel in the north of Scotland for the arrangement at Tulloch of Assyery A of skeletal material in small, well-defined deposits. The articulated remains of burial deposit E may be compared with at least one crouched burial in the short-horned cairn at Lower Dounagray (Cat. 38), where the remaining burials appear to have been heaped together in the centre of the chamber. In every other respect Tulloch of Assyery A is at present unique, when compared with known short-horned cairns, not only in its two chambers, but also in the absence from the N. chamber, both of a burnt deposit, and of animal bone. It is unfortunate that destruction in the S. chamber removed all evidence of burial and ritual, as it would have been instructive to have discovered whether this chamber, having an orientation similar to that of known chambers in short-horned cairns, differed in its burial deposit from that of the northern.

Although the few artifacts found make difficult any attempt to assign the three cairns at the N. end of Loch Calder to a precise cultural horizon, their very paucity may surely be taken as evidence that the burial ritual did not involve the placing of grave goods with the dead, at least in the chambers. None of the artifacts found in the chambers may properly be interpreted as grave furniture. There is of course no evidence of ritual which might have been observed in any hypothetical ossuary. The animal bones found mixed with human remains at Tulloch an t’-Sìonaich and Tulloch of Assyery B have been interpreted as a vacatum, but it might equally be suggested that they represent the remains of funeral feasts, eaten prior to the placing of the burial deposit in the chambers. Whatever interpretation is preferred, the absence of animal bones from the northern chamber of Tulloch of Assyery A contrasts with their abundance in the other two cairns. In this may be seen some variations in ritual observance.

Such variation is perhaps most clearly demonstrated in the choice of cairn plan. In this the three cairns demonstrate in microcosm the variety of plan which is so marked among the cairns of the Orkney-Cromarty group. More than any other single fact, perhaps, this rich variety abundantly proves that fertility of megalithic invention had not weakened by the time the practice of building chambered cairns had reached northern Scotland. Accepting the premise that the design of any structure devoted solely to cult activity is a conscious response to specific ritual needs, then this variety may similarly be accepted as evidence of differing cult emphasis. It seems improbable that it will ever be possible to do more than speculate on the reasons which led one group to choose a circular plan, another a short-horned and a third a heald-shaped plan, or why some passages were short and others long. These were surely a matter of deliberate choice, and were not merely influenced by the type of building stone available locally. Whatever symbolism may have underlain this choice must similarly remain hidden.

It nevertheless remains possible that future excavation may reveal significant inter-relations between tomb structure, artifacts and the method and number of burials. Absence of animal bone at Tulloch of Assyery A and its abundance in the
other two cairns may be regarded as a pointer. If, for example, it were to be proved that different types of cairn were in simultaneous use, then some hint of social organisation or ritual variants might emerge. But this is for the future. For the present it is not without interest to note that the close proximity of a long, a short-horned and a round cairn is paralleled at Skelpick in Sutherland. Skelpick Long (SUT 53) is a long-horned cairn and Skelpick Round (SUT 54) appears to have a polygonal chamber. The type of chamber in the short-horned cairn, Skelpick South (SUT 55), is unknown. Three cairns near the W. shore of Loch Calder, while not grouped quite as closely together as those on the N. shore, exhibit a similar diversity of cairn plan. These are a long cairn, Tulach Buailte Assynt (SUT 59), a round cairn with a Camster-type chamber, Garrybeaig (SUT 17), and a third cairn, Torr Bann na Croagach (SUT 58), which contains at least one antechamber and chamber similar to the type identified in Tulloch of Assynt A. The detailed plan of the enclosing cairn is unknown; at present it appears to be oval, but may have been horned. Admittedly, these are not true analogues of the group at the northern end of Loch Calder, as there is a lack of precise correlation between chamber plan and cairn plan. It is of further interest, however, to note that each of the three long cairns was almost certainly of multi-period construction.

Human skeletal remains from the three cairns described in this report suggest that age at death varied from infancy until the late forties, fifties or older. It is not possible from this small sample of nineteen or so burials to draw conclusions as to life expectancy during the Neolithic of northern Scotland, although the evidence shows that the mortality rate was evenly spread among age groups from the early teens upwards. There is similarly no evidence to suggest that any one type of tomb was restricted to the burial of a certain age group or of one sex.

There was some evidence of disease. Osteo-arthritis appears to have been normal in persons over the age of thirty, but may also have occurred in at least one individual in her late teens, as suggested by one of the burials from Tulach an t-Siunnach. Three individuals appear to have suffered from osteo-myelitis, but there is no evidence that the disease was the immediate cause of death. A possible tubercular tumour was identified in the vertebral column of the larger individual from Tulach an t-Siunnach, and the same individual appears to have suffered from a prolapsed intervertebral disc as well as osteo-arthritis. He died in his early thirties. Hypoplasia of the enamel of the upper left lateral incisor of a young adolescent suggests that this individual had suffered from some disease, such as measles, or possibly from malnutrition in early childhood at about the age of three or four years. One individual from Tulloch of Assynt B appears to have died as a result of having been shot in the back by an arrow (PI. XIV).

Study of the dentition revealed an apparent absence of caries, and in this the burials from the three cairns appear to conform to the low incidence of caries typical of the Neolithic in Britain.1 On the other hand, there is considerable evidence of attrition, some of which was severe in the older individuals. This has a bearing on any consideration of the basic food-producing economy of the people concerned.

1 Ennery, G. T., Antiquity, XXXVI (1962), 277.

Parodontal disease was identified in a number of individuals; there was evidence of one case of chronic sinusitis and two of abscesses.

The animal bones from Tulach an t-Siunnach and Tulloch of Assynt B demonstrate that both herding and hunting played some part in the economy of the cairn builders. Hunting is also suggested by the occurrence of arrowheads. Owing to the difficulties of identifying fragmentary bones, it was not possible to distinguish with certainty between remains of cattle and deer, the two principal ungulates represented. This in turn prevents any estimate from being made of the relative importance of hunting and herding within the economy as a whole. The evidence from dentition, however, suggests that in Tulach an t-Siunnach remains of cattle may have been more numerous than those of deer, whereas in Tulloch of Assynt B both species may have been represented in approximately similar quantities. The cattle in both cairns may be identified as Bos taurus longifrons and the deer as Cervus elaphus (Red deer).

Neither bones nor teeth of sheep or of pig were identified in Tulach an t-Siunnach, but both animals were certainly represented in Tulloch of Assynt B, although in smaller quantities than were cattle and deer. It was not possible to attribute them to specific breeds. The sheep were almost certainly domesticated, but the pig may have been wild.

Remains of dog were found in both cairns, the species probably being Canis familiaris palaestin. It is not suggested that the remains of dog were part of food deposits. It may be inferred from the one apparently complete skeleton at Tulach an t-Siunnach that the animal was buried with human remains as part of the burial deposit. Fewer remains of dog were identified in Tulloch of Assynt B. This was clearly a domesticated animal, useful to both hunter and herdsman.

There is no definite evidence of crop-raising from the three cairns, either in the form of carbonised grain or of grain impressions on potsherds. The marked attrition of many of the human teeth from all three cairns, however, may indicate a diet at least partially composed of inadequately ground cereals. The diet also appears to have been supplemented by the flesh of both bird and fish. Evidence of mollusca further suggests that limpets and land snails were collected as food, more particularly by the users of Tulach an t-Siunnach.

It is not to be assumed that the contents of Neolithic burial mounds will necessarily provide an accurate indication of the local Neolithic economy. So much must have depended on ritual observance and local custom, insofar as they may have involved food remains. The absence of animal bone of any sort in the N. chamber of Tulloch of Assynt A, and its occurrence in the other two cairns, is surely apposite in this context. The evidence nevertheless suggests that, in addition to hunting Red deer, the cairn builders possessed domesticated cattle and sheep, and possibly grew crops. Their basic economy may therefore have compared with that of other known chambered cairn groups in Britain.

The paucity of artifacts in the three cairns hinders any interpretation of the material culture of their builders. Although skeletal remains attest the hunting of Red deer, antler, either unworked or as artifact, was absent. There were no axe-
heads, yet the presence of charcoal and the bones of Red deer suggest that some woodland lay at no great distance from Loch Calder. It might be inferred that timber was used to some extent, certainly for fuel and artifacts, and possibly for building. On present evidence it is not possible to offer either a reconstruction of the natural environment of this area at the time the cairns were being built or any indication of changes brought about in it by the economy of the time.

The paucity of artifacts again does not allow the relationship of the three cairns to those of Britain in general, and those of northern Scotland in particular, to be established precisely. The finds from each cairn have been discussed separately. At Tulloch of Assynt the scatter of Neolithic sherds predates the building of the cairn and cannot therefore be used to date its construction, although it has been suggested that the two events were separated by no great period of time. The two sherds of Beaker from Tuillich an t-Sionnach were found in a disturbed part of the cairn, as was the petit tranche terminal arrowhead from Tulloch of Assynt A, and again are of little value in attempting a precise dating of the respective cairns.

Morphological parallels for each of the three cairns have been discussed. It is premature to go beyond this and to enter into any discussion of typological sequences. Tulloch of Assynt B nevertheless appears to offer some support to Piggott’s hypothesis that the staked cairns of Orkney were derived from those of Camster type. As Miss Hinchliffe has shown, the outer segments in the normal type of Camster chamber is roofed at a lower level than the inner. It has been suggested that the roof of Tulloch of Assynt B took the form of a barrel-vault, and a similar form of roofing may have been employed in the staked cairns of Midhoo (see 37). Reference has also been made to the ‘benches’ in the chamber of Tulloch of Assynt B; they resemble those of the staked cairns. Finally, it is of interest to contrast the thin burnt course of Tulloch of Assynt B with the thicker deposits in some of the chambers of Camster type on the mainland, such as Camster Round (Cat 13). In this, the deposit of Tulloch of Assynt B compares with the thin layers found in some Orcadian cairns, which sometimes contained small fragments of calcined bone.

One of the outstanding problems in the study of British chambered cairns as a whole, is that of origin. Precise analogues outside northern Scotland and the Northern Isles cannot be cited for the three cairns at the N. end of Loch Calder. It may perhaps be assumed that local invention played a considerable part in the evolution of the plan of both chamber and cairn. To a limited extent this may be demonstrated by the apparent derivation of staked cairns from cairns having chambers of Camster type. The origins of the latter are unknown, but future excavation and research may eventually yield traces of connections with areas to the south. In doing so, the cairn of Achnacree in N. Argyll may prove to be significant. This appears to be the only cairn of which sufficient details are known at present to offer any parallel, admittedly imprecise, to those of Camster type. The Neolithic pottery from Achnacree includes carinated and lugged forms, and some with finger-tip fluting. Each of these features may be paralleled in the pottery from Tulloch of Assynt B.

Of the origins of the short-horned and beehive-shaped cairns it is impossible on present evidence to offer any useful comment. It may be suggested that, as in the case of the Camster type, Caithness Flagstone influenced the development of local building traditions. Beyond that one may simply include the chambers of all three cairns described in this paper within the broad classification of Passage Graves, which appear to have exercised a strong influence on the development of chambered cairn traditions from the Cotswolds to Shetland.

**APPENDIX A**

**Human Remains**

Skeletal material from the three cairns was examined by Dr Archibald Young, T.D., M.A., M.B., C.R.C., F.R.C.S., of the Department of Anatomy in the University of Glasgow. Denison was examined by Dr Dorothy A. Lunt, M.S., Ph.D., H.D.D., of the Dental Hospital and School in the University. This appendix has been compiled from their identifications by the present writer (J.K.W.P.C.). Dr Lunt’s contribution has been inserted verbatim in the appropriate section of the Appendix.

*Dr Lunt states,* ‘The teeth are indicated in dental notation. The quadrants of the mouth to which a tooth belongs is indicated by a system of vertical and horizontal lines.

Thus: 11 = maxillary first incisor on the right side

51 = maxillary second premolar on the right side

61 = mandibular canine on the left side

71 = mandibular second molar on the right side

Attrition has been recorded according to Broca’s scale:

1. Degree = facets on the enamel

2. Degree = dentine exposed at the cusps

3. Degree = exposed area of dentine coalescing

4. Degree = dentine forms the entire occlusal surface

Age has been assessed from the degree of attrition of the molar teeth, following Miles’ table of values. This scale of values was worked out from a series of Anglo-Saxon skulls, and can be applied to other material only if the assumption is made that the diet was of comparable roughness. If there is any reason to believe that the Neolithic diet was considerably coarser, grittier or tougher than that of the Anglo-Saxon, then age estimates should probably be lowered, but there is no means of telling by how much. I have assumed meantime that the rates of tooth wear were similar in the two groups.

*Tuillich an t-Sionnach*
The mandible has been broken in the area, but the halves match well, with only slight post-mortem loss of the alveolar process. The bone is of medium size and well formed, with a square chin, fairly broad ramus set almost vertically to the body and an everted angle with bony ridges suggesting strong muscle attachments.

Teeth still present are: 8 6 4 2 7 5 3 1 2 3 4 5 6 7 8

Teeth lost post-mortem: 6 7 8

Attrition. Many of the teeth show 2nd degree attrition (dentine just exposed at the cusps), but 6 7 8 show 3rd degree attrition, and 8 9 4th degree attrition, while 8 9 are hardly worn at all.

The degree of attrition of suggests an age of 36, while attrition is less pronounced on 678 and suggests an age nearer 28. This of course means that function was not evenly distributed, but was heavier on the right side. Probably the true age would be somewhere between these extremes, perhaps 31–34.

Pathology. Carries is absent from all these teeth.

There is considerable evidence of severe paradontal disease, with infection of the soft tissues around the teeth, infection and resorption of the bone of the sockets, the formation of deep pockets beside the teeth and the loosening of the teeth. This is most marked in the molar regions, and resorption of alveolar bone round 7 5 8 has been so severe that these teeth were almost certainly mobile. 8 may also have been loose. Though deep pockets have also formed round the roots of 6, 7, 8, these teeth are still firmly held in their alveoli. Similar bone loss can be seen in the socket of 2.

The premolars, canines and lower incisors do not appear to be affected by the disease. The socket of 2, however, shows fairly severe resorption of bone. The loss of 1 in 2 may be due to paradontal disease or to trauma. This tooth was obviously lost some time before death as the socket has healed over completely. The 8 is not present and there is no trace of its socket. It may be that this tooth was present originally, but had been lost before death due to paradontal disease. On the other hand, it is also possible that the tooth was congenitally missing. In the present state of bone loss, it is impossible to decide which is the more likely alternative, although the very light wear on 8 suggests that it was in fact missing.

The mesial side of 8 shows normal wear, but the distal side is un worn, and this suggests that 8 was either absent or embedded. The absence of a degree of attrition between the two sides is interesting, but in the total absence of the left maxilla no conclusions can be reached. Paradontal disease is more marked round 5 than round 6, and it may simply be that the former tooth was too painful to allow of mastication. The cause, however, may lie in the maxilla.

Axial skeleton

Vertebrae

cervical, portions of C1 and C2; C7; thoracic, portions of six, including posterior part of an upper thoracic, with evidence of disease, osteo-arthritis and probably a subcircular tumour; lumbar, L5; displaying partial calcification, probably due to osteo-arthritis; sacrarum, upper part in two pieces, the body of one and the upper margin of the second being fused, perhaps indicative of a prolapsed intervertebral disc.

Ribs

right, 1st and 2nd and portions of at least four others.

left, portion of 2 and and portions of at least three or four others.

Three Cairns at Loch Calder, Caithness

Scapula

carpal, almost complete, suggesting a measurement of c. 19 in. across the shoulder.

The right clavicle is more heavily built than the left, suggesting a right-handed individual.

Pelvis

possible fragments.

Arms

humerus, left, complete. radius, portions of right, including mid-shaft, and almost complete left. ulna, proximal end of right and portion of left. Hand

scaphoid, part. metacarpals, III right complete, proximal half of a large III, distal half and part of shaft of unidentified metacarpal.

Leg

femur, evidence of both right and left, including distal ends. Apparently slightly asymmetrical.

tibia, distal end and shaft of right, distal end of left.

fibula, proximal and distal ends of right, almost whole of left.

patella, both right and left, the former arthritic.

Foot

left calcaneum, talus and cuboid.

portions of V metatarsal, an intermediate phalanx and I proximal phalanx.

Comment.

Remains of the skull suggest a very broad-skulled individual with a prominent chin. Clearly a fully grown adult and probably male. Study of the dentition suggests an age at death of c. 31–34 years. Several vertebrae exhibit apparent arthritic changes in the spine, particularly in the lipping and fusion of the vertebrae. There was also evidence suggestive of a tubercular tumour of the spine and of a slipped intervertebral disc.

(b) Smaller Individual

Skull.

Part of right side of frontal bone, part of parietal bone, part of left sphenoid bone, part of right temporal bone, part of occipital bone and four parts of vault.

Dentition.

This individual is represented by the loose teeth 1 2 4 which appear to belong to the same person.

Attrition.

6 7 8 show 2nd degree attrition, and 1 2 3 4 7 show 1st degree attrition.

The amount of wear on the molars 6, 7 suggests an age of c. 16–20.

Pathology.

Carries is absent from all these teeth.

Paradontal disease cannot be assessed, in the absence of bone.

There is an attrition facet on the mesial aspect of 6, but the distal part of the tooth is covered with calculus (tarzie), which indicates that it was not in occlusion. This may mean either that 6 was not fully erupted, or that 6 was not completely erupted, or that 6 was missing. From a study of the proximal atrition facets of 6, it is possible that 6 may have been lying in an abnormal position, tilted distally and possibly covered partially by a flap of soft tissue, and therefore incompletely erupted. This would account for the appearance of the occlusal surface.

Axial skeleton

Vertebrae

cervical, most of C1, C4 and C5 and possibly C6; thoracic, posterior part, two almost complete, and four fragments.

Ribs

right, portions of five or six ribs.

left, portions of five ribs.

Scapula

two portions.

Clavicles

approximately three-quarters right and complete left, suggesting measurement of approximately 16 in. across the shoulder.

Pelvis

fragments.
PROCEEDINGS OF THE SOCIETY, 1964–66

Arm: humerus, portion of right, including proximal end. Almost complete left. radius, parts of right. ulna, proximal and distal ends of right and parts of left.

Hand: portions of three carpel bones, one metacarpal, two complete and one-half proximal phalanges.

Leg: femur, parts of both right and left, with evidence of osteo-arthritis. tibia, parts of shank and distal ends of right. Parts of shaft, proximal and distal ends of left. fibula, part of right and complete left.

Foot: patella, part of right and complete left. talus, left calcaneus, left navicular, and parts of calcaneus, large cuboid and parts of navicular, metatarsals I and II, large, the former showing evidence of arthritis lipping.

Comment: The fact that the vertebrae were completely formed, traces of a fully formed iliac crest and absence of cartilage, indicate that this was an adult. Study of dentition confirms this and shows that this was a young adult. It is not possible to determine sex, although the lighter build of this individual, compared with individual (4), might suggest a female.

(4) Not attributed

Skull: Part of occipital bone. Small fragment of cranium, possibly of infant.

Dentition: This person is represented only by a small fragment of the left mandible. This fragment includes a portion of the ascending ramius and two molar sockets. Anterior to the molar sockets the bone rises sharply to form the posterior wall of another socket, possibly that of a premolar.

The molar sockets are very shallow and the porosity of the bone suggests that here, too, periodontal disease had resulted in infection and resorption of bone. Evidently the premolar has not been seriously affected by the condition, as there are molars. One of the molars is missing, but on available evidence it is neither possible to say which tooth is absent, nor to state whether its absence is due to loss or failure in formation. From the appearance of the bone, it seems that the body of the mandible was fairly shallow, and this would suggest that the individual was fairly old.

Axial skeleton: first rib of adult and portions of rib. Part of shaft of right clavicle, possibly of an infant.

Hand: trapezium, parts of three metacarpals (probably including IV) and one proximal phalanx.

Leg: patella of right and fibula.

Comment: It is uncertain whether these bones, with the exception of the fragment of mandible of an elderly person and the possible remains of an infant, belong to the individuals represented above or to third and fourth individuals. The fragment of mandible certainly belongs to a third individual as none of the molars found fit the molars sockets of this fragment. A similar uncertainty applies to many unidentifiable fragments, particularly of long bones, including ends, possibly of humerus, ulna, femur and tibia, and skull fragments.

Tulloch of Assynt A

Burial Deposit A

(a) Adult

Skull: part of crumbled mandible.

Axial skeleton

Vertebrae: cervical, two, very large. lumbar, possible IV, part V, and part of third. sacrum, part of upper right side.

Three Cairns at Loch Calder, Caithness

Arm: radius, right, part of shaft and distal end. ulna, somewhat squashed part of right, proximal end and greater part of shaft of left, showing lipping, suggestive of osteo-arthritis.

Hand: right, very large scaphoid, large cuneiform, metacarpals I-IV inclusive, large, apparently that of an elderly person. proximal phalanges, II, III, IV and possibly V, large.

Leg: femur, upper end of right shaft, diseased.

Foot: cuneiform, large, left talus, cuboid and parts of navicular, metatarsals I and II, large, the former showing evidence of arthritis lipping.

Comment: The remains suggest an elderly, rather rugged individual, possibly male, with very large hands and feet, with evidence of osteo-arthritis in arm and foot.

(b) Adolescent

Skull: Parts of right and left temporal bone, part of baso-occipital bone, part of maxilla with teeth, parts of mandible with teeth. Skull struck heavy blow but not known whether ante or post mortem.

Dentition: A fairly complete maxilla, a small fragment of the mandible and some loose teeth. The central suture of the palate is not yet united and this suggests that the individual was young.

Teeth present:

<table>
<thead>
<tr>
<th>Teeth lost post mortem:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3721 19 67</td>
</tr>
</tbody>
</table>

Attrition: All the teeth show a very slight degree of attrition, dentine having just been exposed along the incisal edges of 21 and on one cusp of 6. It seems very probable that 77 had not long erupted, and the roots of 17 have only just started to form. This suggests an age of perhaps 13 or 14. It is interesting that 6, 16 show rather less attrition than might be expected at this age.

Pathology: There is no evidence of caries or of any other pathological condition in the surviving teeth. The base of the socket of 37, however, opens into a large abscess cavity, which in turn opens into the floor of the maxillary sinus. This means that the pulp of the 37 must have become infected, either as a result of caries, or more probably because of traumatic damage to the tooth.

Both third maxillary molars are embedded in their crypts, and while 8 appears to be in normal position, 7 is placed unusually high in the bone.

There is no evidence of any periodontal condition.

Axial skeleton

Vertebrae: cervical, epidontoid process of C2, C3; thoracic, part, probably of T1, part of right side of second and parts of four thoracic vertebrae. Three vertebral bodies and one vertebral epiphysial plate.

Sacrum, part.

Rib: 30 fragments.

Scapula: part of left.

Pelvis: part of right region of Y-cartilage and several fragments, part of rather thin acetabulum, part of right pubic ramus and part of left ilium with cartilage.

Arm: humerus, fragments of left.

Radius, distal end of left and part of distal end of second (presumably right) without epiphysis.

Hand: one metacarpal.
Burial Deposit B

Skull. Parts of right and left petrous temporal bone, other parts of temporal bone and part of mastoid process. Left articular process and other parts of mandible with teeth, fragment of right maxilla with teeth. Loose teeth.

Dentition. Teeth present: 875643 12345678 6756321 14345768

Attrition. 6 6 6 6 are all heavily worn, showing advanced 3rd degree attrition. The incisors also show 3rd degree attrition. The other teeth show 2nd degree attrition, with the exception of 3 which show 1st degree attrition. This amount of wear suggests that the individual was c. 36-40 years old at death.

Pathology. There is no evidence of caries. Bone infection cannot be studied properly, but there is some evidence of slight periodontal disease.

Axial skeleton

Vertebrae cervical, parts of C1, C2, and probably C3, C6 and C7. C2 has evidence of arthritic enlargement.

Thorax, part of low thoracic.

Ribs, fragments, with evidence of pitting.

Pelvis, greater part of broken ilium.

Arms humerus, part of right, greater part of shaft of left, adult, build appropriate to female.

radius, greater part of left shaft, fairly light build, appropriate to female.

ulna, greater part of right shaft.

Leg femur, middle part of right shaft with clear evidence of osteo-myelitis, the onset of which occurred some considerable time before death. Mid shaft of left femur, with relatively weak markings, appropriate to female. Right femur is considerably thicker than left, the result of osteo-myelitis.

Long bone fragments, undifferentiated, but with evidence of osteo-myelitis.

Comment. Skeletal remains suggest an adult female and evidence of dental attrition suggests that the age at death was c. 36-40.

Burial Deposit E

Scapula small fragments.

Pelvis to small fragments, probably of left side, relatively heavy.

Arms ulna, fragments of right and almost intact left.

radius, almost intact left.

Hand corpus, both complete, apart from two cuneiform and one phalange. Metacarpals, two each (either complete or fragmentary) of I, II, III, IV and V. Phalanges, proximal, two each of I, II, III, IV and V. Intermediate, three missing.

Distal, six missing.

Leg femur, part of right, greater part of left with patella attached in a position showing extreme flexion, and suggesting that leg muscles must have been cut. Fibula, greater part of right, apart from slight erosion of proximal end.

Tiia, large parts of both right and left.
Foot
one phalanx and a possible metatarsal I or II, adhering to part of a tibia.

Comment. The position of the left femur and patella show that the body had been tightly flexed in such a position that the leg muscles had been pressed out. This may suggest that the body had been tightly bound in the flexed position.

The remains are those of a fully grown adult, over 20 years of age at death. It is not possible to determine sex with any certainty, although the heavy build of the pelvis may suggest a male.

Burial Deposit B

Denition. Teeth present: 46, 4, 2, 2, 4, 6, 6. There is a fragment of the labial enamel of another incisor. This collection of loose teeth has a uniform degree of wear and probably belongs to a single individual.

Attrition. Of the 2, 6, 6 and 6 show early and degree attrition, as does 2. The premolars and 2 show 1st degree attrition—i.e. wear facets in the enamel but no exposed dentine, and this suggests that these teeth had not long erupted. The post mortem destruction of nearly all the roots makes an exact assessment of age (to within one year) rather more difficult than usual, but it seems that the roots of 2 were probably complete, and this indicates that the person could not have been much younger than 14. On the other hand, the very slight degree of attrition of all the teeth suggests that the individual could hardly have been older than 15. The 6 is quite worn, and has obviously not erupted, and only a little of its root appears to have formed, which also supports the suggested age of c. 14–15.

Pathology. There is no caries.

On the crown of 2 two grooves are present indicating hypoplasia of the enamel. This means that the individual suffered either from famine or from a disease such as measles at two fairly close intervals and at the age of 3 or 4. The crown of 6 is fragmentary but the same two lines of hypoplasia can be distinguished.

Arm
humeri, distal end of right with evidence of scoring, possibly caused by repair of flesh (?)

Hand
part of scaphoid, part of either metacarpal IV or V, and proximal half of III. Two proximal phalanges, including III, relatively large.

Leg
femur, part of shaft and distal end, including condyle, of thick, heavy right femur, suggesting a large individual. Part of proximal end, side unknown.

tibia, proximal end of right.

Foot
part of possible calcaneum.

Comment. The bulk of this deposit may be attributed to a large, fully grown adult, but the teeth are clearly those of an adolescent.

Single Immense Tooth. A single incisor, 1, was found in a disturbed area on the E. side of the northern chamber, immediately south of the orthostats dividing the antechamber from the chamber. The tooth belonged to either the adult or the third individual represented in Burial Deposit D, but not the adult represented in Burial Deposit B. The tooth does not seem to be sufficiently worn to belong to the adult of Burial Deposit D, but it is too much worn to belong to any of the adolescent individuals identified. It may belong to the problematical third individual of Burial Deposit D, represented solely by 5, or it could represent another individual altogether.

Tulloch of Assynt B

From Inner Segment (principal deposit):

(a) Larger individual
Skull. Broken but complete from foramen magnum to glabella with many small fragments, suggesting that skull was deposited whole. The bone of the vault is thick and heavy. Greater part of maxilla, complete mandible.

(b) Other individual
Skull. Broken but complete from foramen magnum to glabella with many small fragments, suggesting that skull was deposited whole. The bone of the vault is thick and heavy. Greater part of maxilla, incomplete mandible.

Denition. The maxilla is almost complete, but has become compressed, particularly posteriorly, due to loss of the palate. The mandible is of medium size, and is not heavily built. The ascending ramus is fairly short and not very wide, and is set at a slightly obtuse angle to the body. The chin is rather delicate and pointed. The angle is slightly everted and the muscle attachments seem to have been of moderate strength.

Teeth present: 67, 43, 107, 6, 67, 21, 5, 7, 8

Teeth lost post mortem: 65, 25, 2, 8, 8

Teeth lost in site: 5, 2 or 8

Attrition. Nearly all the teeth are heavily worn. 43, 107, 6 show 4th degree attrition and other teeth show 3rd degree attrition, except for 5, 8, 21, 5, 7, 8 which show 2nd degree attrition.

With advanced attrition such as this, the estimation of age is less reliable, but a figure of c. 40–50 may be suggested. This may not be very accurate, but the individual was certainly at least middle-aged.

Pathology. In the mandible there is slight evidence of paradontal disease and bone resorption around the roots of 6, 6. Pocket formation is quite marked on the mesial root of 6. There is also very slight evidence of paradontal infection around 67. The other teeth appear to be reasonably healthy, and there is no evidence of caries.

A large cavious cavity is present on the mesial aspect of 6. It has involved most of the mesial side of the crown from the occlusal surface down to the gingival margin. The pulp of the tooth has become infected and the infection has tracked through the apical foramina with the formation of two separate apical lesions. One of these lesions has formed on the buccal root and has caused a small punched-out hole to appear in the buccal alveolar bone. The second lesion, on the palatal root, has tracked up the side of the root instead of perforating the alveolar bone. Both of these lesions were probably chronic abscesses with sinuses in the soft tissues which allowed pus to drain into the oral cavity. 65, 6 are unfortunately missing, but there is evidence of bone infection around their teeth, with formation of abscesses on 65. It seems probable that the abscesses on the palatal root of 6 involved the maxillary sinus, and this would have resulted in a chronic sinusitis. There is also evidence of bone pathology in the region of 67. In the 67 area there is severe bone infection, and one of these teeth had been lost in site. It is impossible to decide which of the two molars had been lost.

Axial skeleton
Vertebrae sacrum with part of vertebra 1 fused together.

Portion of the body of a very abraded vertebra with part of a flint arrowhead embedded in it. It appears that this was a lower thoracic vertebra of a fully grown adult and that the arrowhead entered from the rear and above. It is also probable that the wound inflicted by the arrowhead was the cause of death (Pl. XIV).
THREE CAIRNS AT LOCH CALDER, CAITHNESS

Arm humerus, part of proximal end, side unknown.
shoulder, part of right shaft.
Radius, probable distal end, side unknown.
Leg femur, fragments of shaft, proximal and distal ends, side unknown. Large part of left.
Foot talus, right metatarsal IV and V, left metatarsal I and II, left phalanx 1 (fits metatarsal 1).

From Middle Segment

Dentition. An extremely fragmentary tooth, which seems to have been partially burnt. It cannot
nevertheless be identified as 66.
The degree of attrition suggests an age of c. 18–20.
Femur part of shaft. This was found in association with a deposit of animal sherd
and flints, beneath the paving and extending beneath northern wall of chamber.
Calcaneum left, probably adult, burnt.

From Outer Segment

Skull probable fragments.
Pelvis possible fragments.
Amb equivalent of os immumum.
Femur fragments, with evidence of osteomyelitis. Left distal end, including both condyles,
small, but fully adult.
Foot left talus, left metatarsal III, both adult, but relatively small. Proximal phalanx
of immature person.

From Passage

Dentition. Right half of a mandible at or shortly before birth. All the tooth germs have been
lost from their crypts.
Humerus possible fragments.
Femur proximal end, probably right, fully grown adult, fairly heavy, probably male.
Phalanx one tarsal phalanx and part of flattened shaft of carpal phalanx I.
Metatarsal right IV, adult, relatively large.

Comment. With the exception of the right half of the mandible of a newly born child or foetus
found in the passage, a single proximal phalanx of an immature person found in the outer segment
and the molar from the middle segment, the human bone from Tolloch of Assynt B appears to
represent the remains of no more than two adults. This is true of the large deposit in the inner
segment, but the few scattered remains from the other two segments and the passage could be also
attributed to the same two individuals.

APPENDIX B

Faunal Remains

Skeletal remains were examined by Dr Archibald Young, T.D., M.A., M.B., C.H.B., F.R.C.S.(GLASGOW),
and the following summary of bones represented has been compiled by the present writer (J.X.W.P.C.)
from Dr Young’s identifications. On account of the very fragmentary nature of most of the faunal
remains, it was not possible to attribute all of them to specific species. It must be emphasised that,
with the exception of a few bones from the extremities, only portions of the bones listed were available
for identification. For this reason evidence from dentition acquires an added significance, and
Dr Lam’s identifications of, and general comments on, the dentition comprise part II of this
Appendix.
Ruminantia (Bos taurus longifrons and Cervus elaphus)

**Skull**
- Portions of hyoid and molar bones.
- *Vertebræ*: C1, large thoracic of young animal, several other portions.
- *Ribs*: Various portions.
- *Pelvis*: Right ischium and ilium.
- *Fore-limb*: Humerus, distal end left, proximal end right, and part of shaft.
- *Hind-limb*: Femur, part of shaft, distal end right.
- *Long bones*: Humerus, femur, immature animal.
- *Extremities*: Portions of two carpal, three metacarpals, one terminal phalanx and at least seven metacarpals/metatarsals.

**Comment.** The problem of identification lies in distinguishing between Cervidae and Bovidae. Although all but one of the teeth of the Ruminantia in this cairn may be attributed to *Bos taurus longifrons*, the presence of the main burial deposit of a single inicum of *Cervus elaphus* shows that this animal was represented (cf. part II of this Appendix). The remains of the second cervical vertebra, pelvis, humerus and femur compare with those of *Cervus*. Other remains are almost certainly of *Bos*.

**Canidae (Cani familiaris palustris)**

**Skull**
- Almost intact skull of young animal.
- *Vertebræ*: Six cervical (C2; although portions of the ear region, two portions of zygomatic arch.
- *Ribs*: Portions of several ribs.
- *Scapula*: One intact, greater part of second. Three portions, including one innominatum.
- *Pelvis*: Three portions, including os ilium.
- *Fore-limb*: Humerus, left and right, adult, but osification not quite complete.
- *Hind-limb*: Femur, one complete, distal end of second.
- *Long bones*: Tibia, two, epiphysis only just formed.
- *Extremities*: Cuneiform, carpal, two calcanea, terminal phalanges and portions of at least eight metacarpals/metatarsals.

**Comment.** Evidence from the skulls and scapulae shows that two individuals are represented. The greater part of the remains belong to a mature specimen. These remains were closely associated with the main burial deposit in the chamber. The second specimen is that of an immature animal, most clearly represented by the skull and parts of scapula.

**Miscellaneous**

It was not possible to identify the many very small fragments of animal bone, but with the exception of possible fragments of bones of bird and fish, they appear to be attributable exclusively to Ruminantia and Canidae.

**Three Cairns at Loch Calder, Caithness**

**Tallich of Assynt B**

**Ruminantia (Bos taurus longifrons and Cervus elaphus)**

**Vertebræ**
- Parts of cervical of large animal, various portions of vertebrae. Part of upper thoracic of small ?deer.
- Ribs: Several portions of ribs.
- *Scapula*: Large portions of left scapula, portions of large unidentified scapula.
- *Pelvis*: Part, including acetabulum.
- *Scapula/pelvis*: Parts of either scapula or pelvis.
- *Fore-limb*: Humerus, portion of shaft of relatively small right, portion of left, immature humerus. Proximal and distal ends and portions of shaft of large humerus, probably of young animal.
- RADIUS/ULNA: Portions of right, fused, possibly of *Bos*.
- *Hind-limb*: Femur, proximal end, distal end and portions of shaft, possibly of immature animal.
- *Long bones*: Humerus, large portion of shaft of right, distal end of left, probably *Bos*, distal end, probably of *Cervus*, several portions of broken and distorted tibiae.
- *Extremities*: Atrogaleus, possibly *Cervus* (or pig?); *calcaneum*, two large, metacarpals/metatarsals, at least four and several portions of proximal phalanges, small ?deer.

**From the passage**

**Vertebræ**: Cervical, C3, and C5, apparently articulated. Portions of bodies of large vertebrae.
- *Ribs*: One fragment, (?sleep/deer.
- *Scapula*: Parts of left.
- *Pelvis*: Several portions, large animal.
- *Fore-limb*: Humerus, portion of proximal end and shaft of immature ?deer.
- *Hind-limb*: Portions of ends and shafts of long bones.
- *Long bones*: Humerus, portions of distal end and portions of shaft of left ulna, (?Cervus*.
- *Extremities*: Metacarpals, (?Cervus*.
- *From area immediately N. of passage*:
- *Fore-limb*: Humerus, portion of distal end.
- *Hind-limb*: Tibia, distal end of right tibia, (?Bos*.
- *Extremities*: Metacarpals, (?Cervus*.
- *Cannon bone, immature (?Cervus*.

**Near large buttress stone to N. of passage**

**Fore-limb**: Radius, greater part, (?Cervus*.

**Beaten core and retouch in S. sector of cairn**

**Hind-limb**: Tibia, distal end and large part of shaft of left tibia of immature ?deer.

**Comment.** Evidence from dentition (cf. part II of this Appendix) demonstrates that both *Bos taurus longifrons* and *Cervus elaphus* are represented.
THREE CAIRNS AT LOCH CALDER, CAITHNESS

Near buttress stone in N. of passage
Skull... four fragments
Long bones... portion of shaft of immature animal.

Comment. Evidence from dentition (cf. part II of this Appendix) demonstrates the presence of both dog and fox. The dentition of the latter was found either in injured areas of the body of the cairn and in the upper parts of the passage and chamber. It is probable, therefore, that the remains of fox were intrusive and did not form part of the original burial deposit.

Miscellaneous
In addition to the skeletal remains listed above, there were many very small fragments of bone which could not be identified with certainty including possible bones of pig. There is no evidence to suggest that they may not be attributed to one or other of the species represented in the cairn by bones and teeth. A small number of bird bones were found in the chamber and passage. These appear to belong to two types; the smaller approximates in size to that of pigeon or grouse, and the larger that of goose, gannet or gull.

Part II — Dentition
by DOROTHY A. LUNT, M.D.A., F.R.D., N.D.B.,
of the Dental Hospital and School in the University of Glasgow

Tulach an t-Sionach

Bus taurus longifrons
Incisors six mandibular permanent incisors.
Premolars one mandibular premolar, two maxillary premolars.
Molars mandibular, deciduous, one first (?) and one third, and fragments of one third and one first (?) deciduous mandibular molars.
Permanen, four first or second and one third permanent mandibular molars.
Mandibular, deciduous, one second (?) and one other deciduous maxillary molar.
Permanen, one first or second permanent maxillary molar.

Cervus elaphus
One mandibular incisor.

Ruminantia
Part of mandible and unidentifiable fragments of cheek teeth.

Canis familiaris paludis
Skull young animal with three deciduous molars in situ on each side. The developing carnassials and first permanent molars can be seen lying in their crypts.
Mandible almost complete adult mandible, with permanent teeth in situ, except for all six incisors, both third molars, and the first premolar on the right side.

I am grateful to thank Dr. A. S. Clarke of the Royal Scottish Museum, Edinburgh, and Dr. W. D. J. Rolfe of the Hunterian Museum, University of Glasgow, for their assistance in providing me with comparative material from the collections under their care, and for their advice on the identification of the specimen. Sheep, part of mandible of a very young animal with three deciduous molars in situ.

The mandible was found in the upper levels of cairn material, some eight feet to the N. of the chamber. The molar of pig was an isolated find from near the entrance to the passage. Neither sheep nor pig are otherwise represented in the cairn. It is probable, therefore, that these two finds do not belong to the main use of the cairn.
Three Cairns at Loch Calder, Caithness

Part of left mandible of young animal with permanent canine erupting and premolars about to erupt.

Portion of maxilla of young animal, probably fox, with three deciduous molars in situ.

Canine one mandibular canine.

Molar crown of mandibular left permanent first molar.

From the passage

Fragments of both sides of the maxilla of a young animal, with second and third deciduous molars in situ.

From area immediately N. of passage

Left mandible with three premolars and two molars in situ.

Fragment of right mandible with fourth premolar and first permanent molar in situ.

Near large burren stone to N. of passage

Right maxilla of young animal with second deciduous molar in situ, and fourth premolar just erupting.

Doubtful

From the chamber

Isolated mandibular deciduous third molar, either of fox or dog.

From area immediately N. of passage

Fragments of mandible, either fox or dog, with deciduous molars and canine.

Discussion of Animal Dentition

by DOROTHY A. LUNT

The animal teeth in the Loch Calder material belonged to members of three different groups of mammals: the ungulates, the carnivores and the rodents. Of these, the ungulates are most fully represented, and they contribute the majority of the specimens.

Ungulates

The greater part of the ungulate material consists of isolated teeth which can be assigned to some species of Bos taurus. Comparisons of these teeth with the dentitions of specimens of Bos taurus primigenius and Bos taurus longifrons in the Royal Scottish Museum, Edinburgh, and in the Hunterian Museum, University of Glasgow, show that the Loch Calder teeth are of these species, both in morphology and in size. The teeth of Bos primigenius (the large wild species of cattle, variously called Urus and Aurochs) are considerably larger than the Loch Calder teeth. Many of the Loch Calder animals appear to have been quite young, since among the teeth there are three developing and unerupted mandibular first or second permanent molars, two developing mandibular premolars, and nine deciduous molars, of which five are mandibular third deciduous molars. Worn permanent teeth include three specimens of mandibular first or second molars, three maxillary premolars, one mandibular third molar and one maxillary first or second molar, and eight mandibular incisors. Since the first permanent molars of cattle erupt at approximately 6 months and the second permanent molars at 1½–2 years, the presence of these teeth in developmental stages must indicate animals which were certainly less than 1½ years old and perhaps less than 6 months old. The premolars in these animals erupt between 1½ and 3 years, so the presence of worn premolars suggests that some animals were at least 2 years old. The third permanent molar of cattle erupts at 2–3 years and the worn specimen of this tooth indicates that the animal concerned was over 2 years old. Both adult and immature specimens are to be found among the Newstead bovine skulls, which

Sheep

Part of right maxilla with three deciduous molars and one permanent molar in situ. Incisor and developing incisors and one deciduous maxillary molar.

Doubtful ungulates

From the chamber

Crown of ungulate molar, possibly of Cervus. Small fragment of ungulate tooth, and three unidentifiable ungulate teeth.

Pig

From the chamber

Portion of maxilla with canine tusk and second and third premolars in situ.

From the passage

Incisor maxillary right first incisor.

Canis familiaris palustris

From the passage

Fragment of mandible with worn fourth premolar. Worn mandibular left first permanent molar and mandibular canine, all from same animal.

Fox

From the chamber

Part of right mandible with first and second permanent molars in situ.
Ewart identified as *Bus longifrons* or 'Celtic antelopes'. It is possible to find the exact counterpart to each of the Loch Calder teeth in these skulls from the Neolithic excavations, and thus the identification of the Loch Calder as the domesticated variety, *Bus taurus longifrons*, seems reasonably certain.

Three developing cheek teeth, smaller in size than the teeth of *Bus longifrons*, have been identified as developing maxillary permanent molars of a red deer. A maxillary third deciduous molar, which was also smaller than the corresponding tooth of *Bus longifrons*, is similarly identified as having belonged to a young red deer. Three mandibular permanent incisors are also those of a red deer, probably an adult. All of these teeth are exactly similar in size and morphology to the corresponding teeth of a modern red deer.

Part of a small mandible, with three deciduous molars and one permanent molar in situ, has been identified as belonging to a sheep, of a breed similar in size to the modern Shetland sheep. The teeth and jaws of both the Loch Calder specimen and the Shetland sheep are smaller and more delicate than those of most modern breeds. The presence of the first permanent molar indicates that this animal was more than 3 months old. None of the deciduous molars has been lost: thus the sheep cannot have been more than 1 year old. The mandible is broken behind the first permanent molar, and the stage of development of the second permanent molar, which erupts at 9–12 months, cannot be ascertained.

Other fragments of sheep are part of the mandible of a very young animal, less than 1 month old, whose deciduous molars were just erupting, an isolated maxillary molar and an isolated mandibular incisor of the canine and premaxillars in situ. The canine is quite well-worn, and is a relatively small tooth. This may perhaps indicate that the animal was a sow. The other specimens are a worn maxillary molar and a maxillary central incisor.

Carriers

All the carnivore teeth can be definitely assigned to the group Canidae. Two varieties of animal can be distinguished, one which has teeth similar in size to those of the modern greyhound and another with teeth the same size as those of a modern fox.

The larger type of animal can be identified with certainty as a domesticated dog. It is much too small to be a wolf. The adult is represented by one complete mandible, three small fragments of a maxilla which fortunately has the carnassials and first molar in situ, a fragment of another mandible bearing the fourth premolar, an isolated canine and an isolated mandibular carnassial tooth. There is also an almost complete skull and maxillars of a young animal, with the deciduous teeth in situ and the first permanent molar still contained within their crypts.

Degerbol studied the skull and maxillary dentition in dogs of Mesolithic and Neolithic date, and published a series of measurements made on the cranium and maxillars. Since there is no complete adult maxilla in the Loch Calder material, Degerbol's measurements cannot be repeated on this material, with the exception of the maxillary carnassial length. This measurement in the Loch Calder dog falls within the range of values obtained by Degerbol for the Neolithic dogs from Bendor.

A comparison was made between the jaws of the Loch Calder dog and those of the Bronze Age dog discovered during the excavations at Jarlshof in Shetland. In the length of the mandible and in the size of the teeth, the two specimens are identical. Platt, in her report on the Jarlshof dog, stated that this animal was almost 18 in. high at the shoulder and in general proportions resembled a terrier. She also remarked that the Jarlshof dog's skull seemed to be more closely related to the Stone Age type of *Canis lupus* than to the larger *Canis familiaris* of the Bronze Age. It seems possible therefore that the Loch Calder dog may of the *Canis lupus* variety.

The smaller member of the family Canidae could represent a second smaller breed of dog, but the appearance of small additional cups on some of the maxillary teeth suggests that it is more probably a fox, since these additional cusps can also be observed on the teeth of some modern foxes. The adult fox is represented in the Loch Calder material by parts of two mandibles bearing most of the mandibular teeth, and by isolated specimens of the mandibular carnassial (first molar) and canine. There are also fragments of the maxillars of three cubs and portions of two mandibles from young animals. In all of these specimens the deciduous dentition is still in situ.

Rodents

The rodent material all belongs to the group of voles, and two distinct species can be identified. The smaller species is about the size of a mouse. On the basis of the number of columns forming the molar teeth, the lack of root formation in these teeth, and the presence of an additional postero-internal loop of tooth substance on the maxillary second molar, this species can be identified as the short-tailed vole.

The larger species, which is about the size of a rat, is almost certainly the water vole.

In the Loch Calder animal material there are three maxillars, one mandible and one isolated incisor of the short-tailed vole, and one maxilla, one mandible and one incisor of the water vole.

It is most probable that these burrowing rodents are recent intruders into the Neolithic cairns at Loch Calder.

The Loch Calder animal material is extremely fragmentary and it is almost impossible to give any estimate of the number of individuals present, except in the case of the dog. The dog jaws are more complete than those of other species, and clearly indicate the presence of two adults and one pup.

APPENDIX C

The Secondary Cremation from Tulach an 'Sinnachair

by C. B. DENSTON

Duckworth Laboratory of Physical Anthropology, Department of Archaeology and Anthropology, University of Cambridge

The examination of the material follows the technique used on previous occasions by the writer and is based on procedures in cremation reports by Lewis and by Gejvall. The primary aim in a study of this type is to try to determine the age, sex and number of individuals cremated.

Material and Methods

Cremated remains. The majority of the remains were forwarded to the laboratory in a fairly clean condition, other fragments were emplaced in small clumps of earth which necessitated soaking in water to free the smaller of the fragments. No charcoal was observed.

Preparation of material. The cremated material was first washed in a sieve of a 2 mm mesh to get rid of any soil adhered to the fragments of bone, and to float off any other light material. The material was then allowed to dry and fragments of the various bones and teeth were sorted into groups. The remaining material was then sieved again to get rid of the dust, and picked free of small particles of earth and other foreign material. This residue of small bone fragments was then rendered as follows:

1 Ewart, J. C. Appendix on Animal Remains in; Corrie, J. A Roman Frontier Post and Its People, The Post of Neuroptera in the Roman Alps, Edinburgh, 1911, 94.
Three Cairns at Loch Calder, Caithness

and a few very small pieces which belonged to this same bone which definitely were not human. The larger fragment has been identified as being possibly that of the proximal end of an ulna of a pig.

The weight and distribution of the total identified and unidentified cremated human remains:

<table>
<thead>
<tr>
<th>Skeletal material</th>
<th>gm.</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identified total</td>
<td>294.0</td>
<td>56.4</td>
</tr>
<tr>
<td>Unidentified total</td>
<td>173.5</td>
<td>43.6</td>
</tr>
<tr>
<td>Total</td>
<td>367.5</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The Society wishes to acknowledge a generous grant from H.M. Treasury towards the cost of publishing this paper.