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Excavation of a cairn cemetery at Lundin Links, Fife, in 1965–6

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with contributions by M Campbell-Wilson, D Lorimer, I H M Smart & R Will

ABSTRACT

Skeletons and long cists were exposed on the beach at Lundin Links, Fife, after a severe storm in the winter of 1965. An excavation mounted the following Easter to record and excavate these features revealed part of a cemetery, with round and square cairns and long cists. Radiocarbon dates suggest that it was in use for upwards of a century at some time between about AD *450 and* AD *650. The cemetery may have been related to a long cist cemetery indicated by previous discoveries. Work in 1996 following discovery of a leg bone in the seaward sand-cliff did not add materially to understanding of either cemetery. A study of skeletal traits which can indicate family connections tentatively suggested that one burial group included people with closer connections to each other than to others buried in the cemetery. Burial customs from the late first millennium* BC *through the first millennium* AD *are discussed. Recent radiocarbon dates and publication are sponsored by Historic Scotland.*

THE SITE

A cairn cemetery (NGR: NO 412 023) is situated near the seashore west of the village of Lundin Links. The village lies on a south-facing slope on the edge of Largo Bay in Fife, on the north shore of the Forth estuary to the west of the East Neuk of Fife, between Leven and Kincraig Point (illus 1). The cemetery was excavated in 1965 and 1966. It lies at a height varying between 5 m OD and 10 m OD in an area of sand dunes which has suffered from severe degradation by both wind and marine erosion. The ground rises sharply inland. To its east the shelf on which the cemetery is sited narrows before widening out again after some 80 m. To the west the shelf disappears. The overall effect of these topographic variations is that the cemetery sits in a pocket of gently rising ground perched above the sea (illus 2).

ARCHAEOLOGICAL BACKGROUND TO THE 1965–6 EXCAVATIONS

Evidence of long cist burials on the beach here was first published after their discovery in 1856–8 by quarrymen, working a quarter of a mile to the west of Largo Station and just above the high

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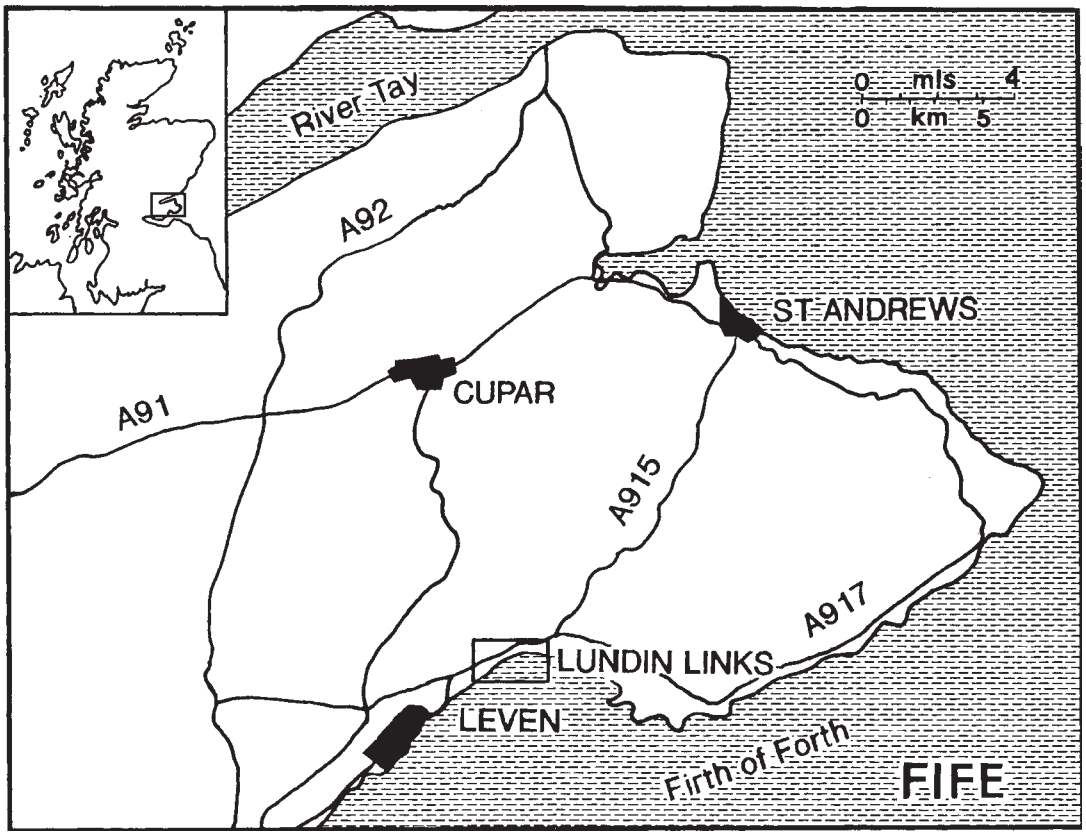
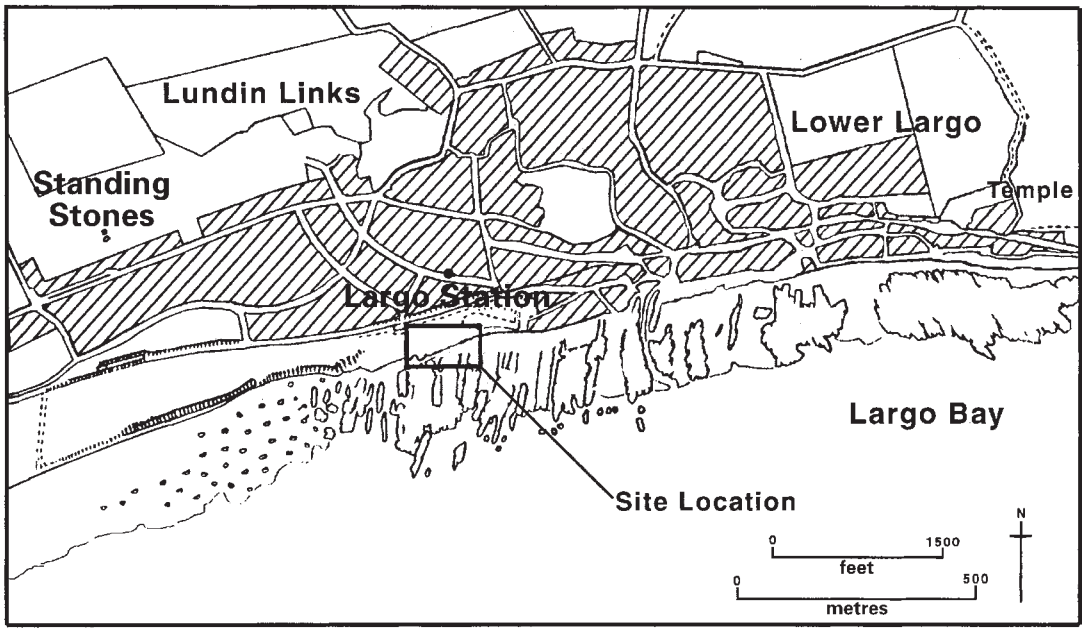


ILLUS 1 Location of Lundin Links (*Based on the ordnance Survey map © Crown copyright*)

water mark. Largo Station was at NO 4179 0265 (illus 2) and thus the discoveries will have been at approximately NO 414 024. Thirteen cists were found during the first three years of quarrying (Durham 1860, 76–7). Mention is also made of two others found while building the station itself. Four more were discovered shortly before 1862. The last two of these cists evidently lay 3 ft below an old ground surface, and they were each built of several slabs, two or three stones to a side. The cists and skeletons were perfectly preserved and one of the latter showed signs of a head injury. Subsequently parts of the skull and thigh bones from yet another cist were donated to the Society. They were described as coming from a cist about 2 ft 6 in below the surface of the links and nearer to the sea than those previously discovered, indeed, close to the sea beach (Donations 1860, 159). Subsequently more cists were found, and portions of human crania and other bones from cists were again donated to the Society (Donations 1860, 183). Three crania (Nat Mus Scot 1892 Catalogue, 194 ET. 1–3) donated by Mrs Dundas Durham in 1858 are in the Museum of Scotland. Miscellaneous remains of at least four other individuals, labelled I.B.212 are described on loose paper labels as 'from long stone cists, London Links, donor Prof. Chiene'. The name of the professor is difficult to decipher, leaving it in some doubt. Again in 1915 reference is made to cists being found, with 'the cists having been arranged in parallel rows, from east to west, at regular distances from each other' (Turner 1917, 228). Thus by that time many more than 18 cists had been discovered from the Links and two from Largo Station. No further publication appeared after 1915, although residents remember skeletal remains being uncovered in the 1920s.



ILLUS 2 Location of the site

In 1958 the National Museum of Antiquities of Scotland recorded a report by J A Bell and D Anderson of a small cairn covering a short cist containing a skeleton at NO 404 021, among the sand-dunes of the foreshore. Its grid reference suggests that it lay some 800 m west of the cairn cemetery. No details are available.

The bones from some of these discoveries were distributed amongst visitors. Some found their way to Dundee Museum Department of Anatomy. Others came into the possession of the Department of Anatomy at Edinburgh University, and have joined those inherited from the Society by the National Museum of Antiquities of Scotland in the Museum of Scotland.

The discovery of a skeleton was reported to the National Museum of Antiquities of Scotland in 1960. It was recorded as 'Skeleton found at Lundin Links — male age 40–45 years, height about 5 ft; sitting upright with arms extended side ways at shoulder level, legs straight out together at front; three stones over legs only; buried in coarse sand, shells scattered round bones'. Two rough location maps and a recent site inspection suggest that the skeleton was found to the south-east of the cairn cemetery in an area which has been eroded by the sea. A search in the Museum of Scotland stores for the bones referred to by the note was not successful. Good analogies for burials in this posture come from the Mesolithic period in southern Scandinavia (L Larsson pers comm); but although the position of the skeleton implied by the record makes it seem unlikely that it had merely slumped from a cist during erosion, it must remain possible, unless a more detailed account can be found, that the recorded posture reflects modern events.

Long cist cemeteries in Scotland had been reviewed eight years before the discovery of the cairn cemetery, by Henshall (1956, 267), who noted that the cists at many of the 54 examples then known were arranged in rows. Short cist burials occurred at seven sites and long cists were also used for medieval burials. The Yarrows and Catstane cemeteries may have been associated with early sixth-century inscribed stones. Long cists occurred close to two settlements with both putatively fourth-century souterrains and later, possibly sixth-century, houses in Angus (ibid,

270). At Cossins, Angus, and at Wester Delnies, Nairnshire, cists had been found close to a Pictish symbol stone, which suggested a date of the seventh or eighth centuries for the burials; and Henshall drew attention also to the Golspie cist with its cover made from a symbol stone. She noted however that there was very little overlap between the main distribution of long cist cemeteries — which her map showed to lie south of the Forth (ibid, fig 6) and that of Pictish symbol stones. Subsequent work has, however, increased the number of long cist cemeteries known in Fife and Angus (Proudfoot 1996, illus 28). The location of some long cist cemeteries in the Lothians suggested that they were created before the medieval parish system. Henshall (1956, 275) speculated that a small (3.5 x 3 m to 8 x 4.2 m), wooden chapel might have accompanied each of them, and estimated that they probably belonged to the sixth or seventh century AD.

Small cairns in similar topographical situations to those at Lundin in 1965, and like the Lundin cairns associated with long cists, had long been known at Ackergill (Edwards 1926 & 1927) and Keiss (Laing 1866, 15) in Caithness. The presence at Ackergill of a bronze chain, a Pictish symbol stone (which had been removed from the site some years before Edwards' excavation) and a fragment of another symbol stone incorporated in one of the cists suggested Pictish affinities. Thus two different lines of evidence combined to support the idea that the cemetery at Lundin Links might be of a broadly mid first millennium date even before excavation started.

EXCAVATIONS IN 1965–6

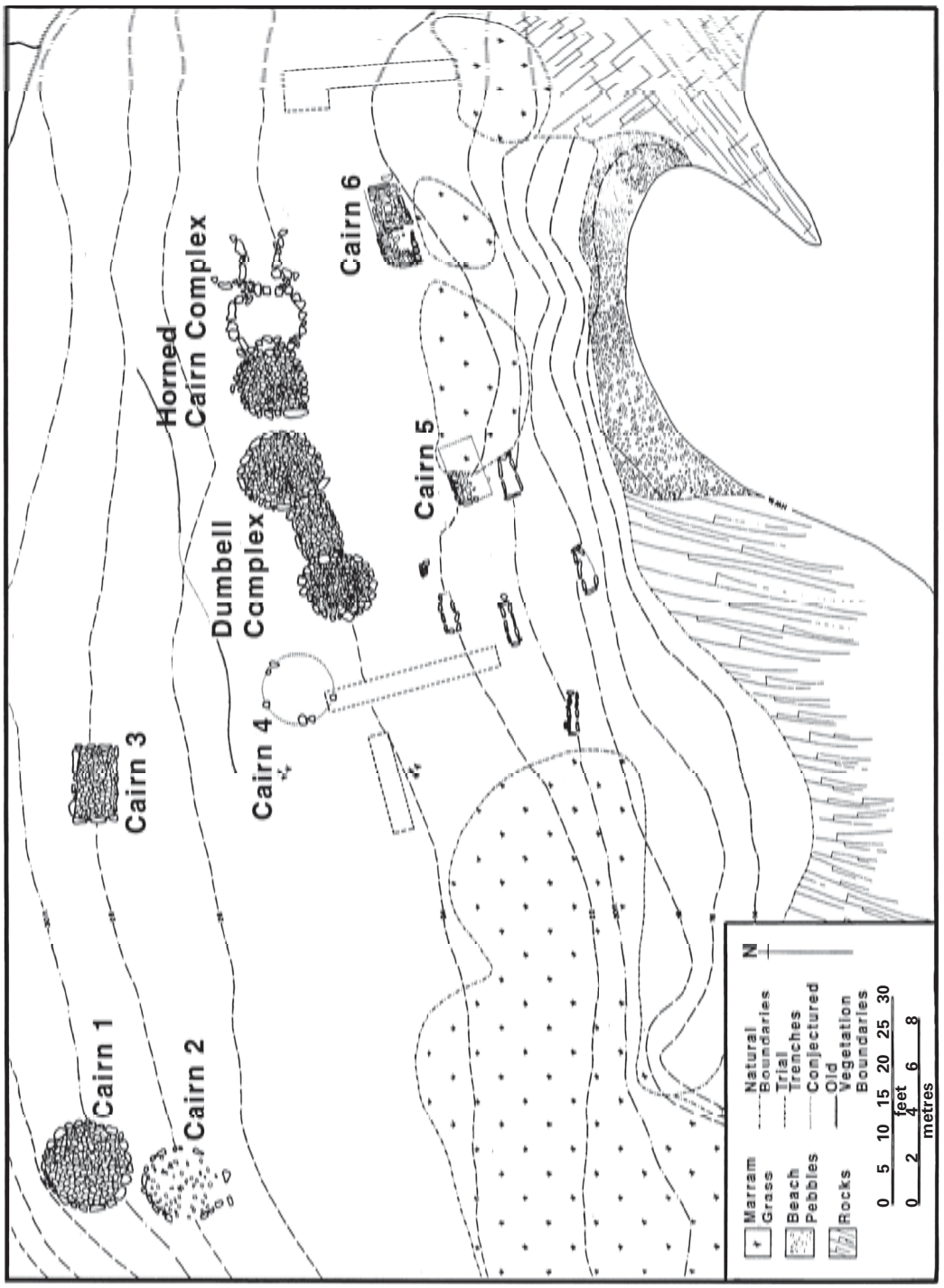
After a severe gale in the winter of early 1965, Mr John Greig and Mr Horne, of Lundin Links, reported the finding of exposed skeletons on the beach to the police. This renewed interest in the site, where tons of sand had been blown away, exposing what appeared to be two circular cairns. As the beach would become busier in the summer season it was decided that the then Aberdeen College of Education Archaeological Society, under the direction of one of the co-authors and Mr Robert Cairns, should carry out a two-week excavation during Easter 1965; two further weeks of excavation took place at Easter 1966.

On preliminary inspection of the site two cairns were observed, along with a few possible capstones of cists projecting through the sand. The site was surveyed and blown sand was cleared from the partly exposed features. This revealed a series of round cairns and other structures including long cists (illus 3). These scattered long cists lay south of the round cairns. There was evidence to suggest that their distribution had once stretched much further south but had suffered severely from coastal erosion, as fragments of cists lay just above the high water mark.

SCATTERED LONG CISTS (ILLUS 3 & 4)

A group of five long cists lay in the south-west area of the site, all roughly aligned east/west. Four were of poor construction and had relatively shallow interiors compared to the cists within cairns.

Cist T, 1.75 m by 0.75 m, lay c 50 mm below the beach surface with some capstones protruding through the sand. The east end of the cist was missing due to erosion. It contained the skeleton of a female (LL22), 23–35 years old, head at the west facing north, lying on a paved base. The right lower limb lay angled outwards, where the south side of the cist had been lost to erosion.



ILLUS 3 Site plan

Cist U, 2 m by 0.5 m, lay directly to the south. Again most of the capstones lay just under the surface, with a few appearing through it. It contained a probably female skeleton (LL4), around 25 years old, with the head at the west end facing south, on a paved base.

Cist V, 2 m by 0.5 m, lay to the south-west of this cist. It was aligned east/west, and lay 50 mm below the surface with some capstones showing through the sand. The south side of the cist lay against a natural outcrop of rock. Within was a possibly male skeleton (LL21), 20–25 years old, with the head at the west end facing south, lying on sand.

Cist W, to the east of Cist V, measured 2 m by 0.7 m, and had suffered from erosion; the south side of the cist was completely missing and only two capstones survived. The skeleton (LL7) was incomplete, with the lower limbs lying at the west end over the remains of the skull. They belonged to a probable male, 20–25 old.

Cist X, c 2 m by 0.75 m was found just south of the disturbed rectangular Cairn 5. Because it lay partly under a patch of marram grass it was not fully excavated. This grass had protected the cist from erosion so that it lay c 0.5 m below the surface. It contained the skeleton (LL 17) of a male in his 30s, lying on a paved base with the head at the west end.

SINGLE ROUND CAIRNS (ILLUS 3 & 4)

Two round cairns, 1 and 2, were uncovered towards the north-west area of the excavated site, lying close to each other but separated by a small gap. A third round cairn, Cairn 4, partly destroyed, lay c 20 m to the east of them.

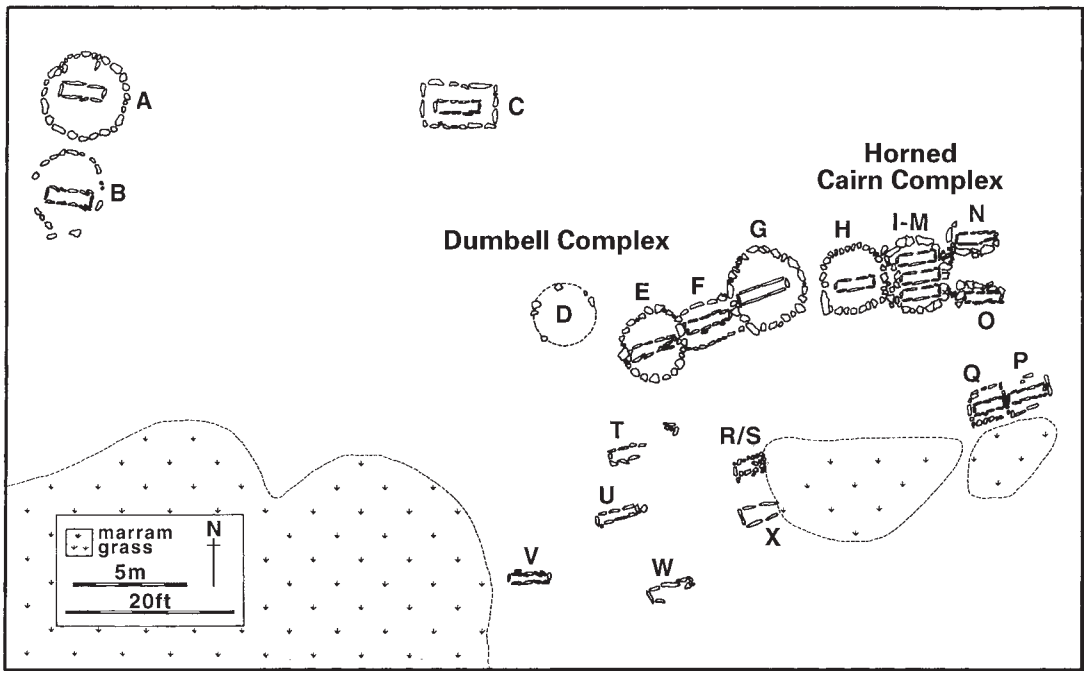
Cairn 1 (illus 5 & 6)

This cairn, 4.4 m in diameter, was the northernmost structure on the site. It was convex, 0.4 m high, and had been built on the level surface of the beach sand. Its exterior was defined by large kerb stones of water-rounded sandstone and lava boulders enclosing a 0.13 m thick layer of tightly packed beach pebbles. Beneath these pebbles was a lower layer of flattish sandstone and schistose slabs, averaging c 0.4 m by 0.4 m in size. Near the centre of this layer was a dressed sandstone disc, 0.6 m in diameter and 0.15 m thick. It was unmarked apart from faint dressing around the edge (illus 7).

Lying 0.58 m below the cairn were the capstones of a long cist, Cist A, which had been placed in a prepared pit which was backfilled before the construction of the cairn. The diameter of the cairn appeared to match the length of this pit exactly. The cist was 2.16 m long by 0.6 m wide and 0.3 m deep, containing the skeleton (LL6) of a male, probably about 25–30 years old who had been 1.78 m (5 ft 10 in) in height. No grave goods were recovered.

Cairn 2 (illus 5 & 8)

The second of this pair of cairns, Cairn 2, was found in a much disturbed condition. Its diameter, 3.8 m, was slightly less than that of Cairn 1. The remains of a kerb of water-rounded boulders enclosed an apparently random mixture of angular and rounded stones of varying sizes, coarse gravel and sand, rising to a height of 0.4 m in the centre. It showed none of the careful construction of the previous cairn. Beneath this material was a 0.1 m thick layer of light-coloured



ILLUS 4 Plan of cists

sand which overlay a 50 mm layer of dark sand. A long cist, Cist B, 1.96 m long by 0.62 m wide and containing the skeletal remains of a female (LL14), lay 0.44 m below the dark sand. This female was aged 20–23 years old (more broadly 18–25, Lorimer, this report) and had been 161.5 cm (5 ft 3½ in) in height.

Cairn 4 (illus 3)

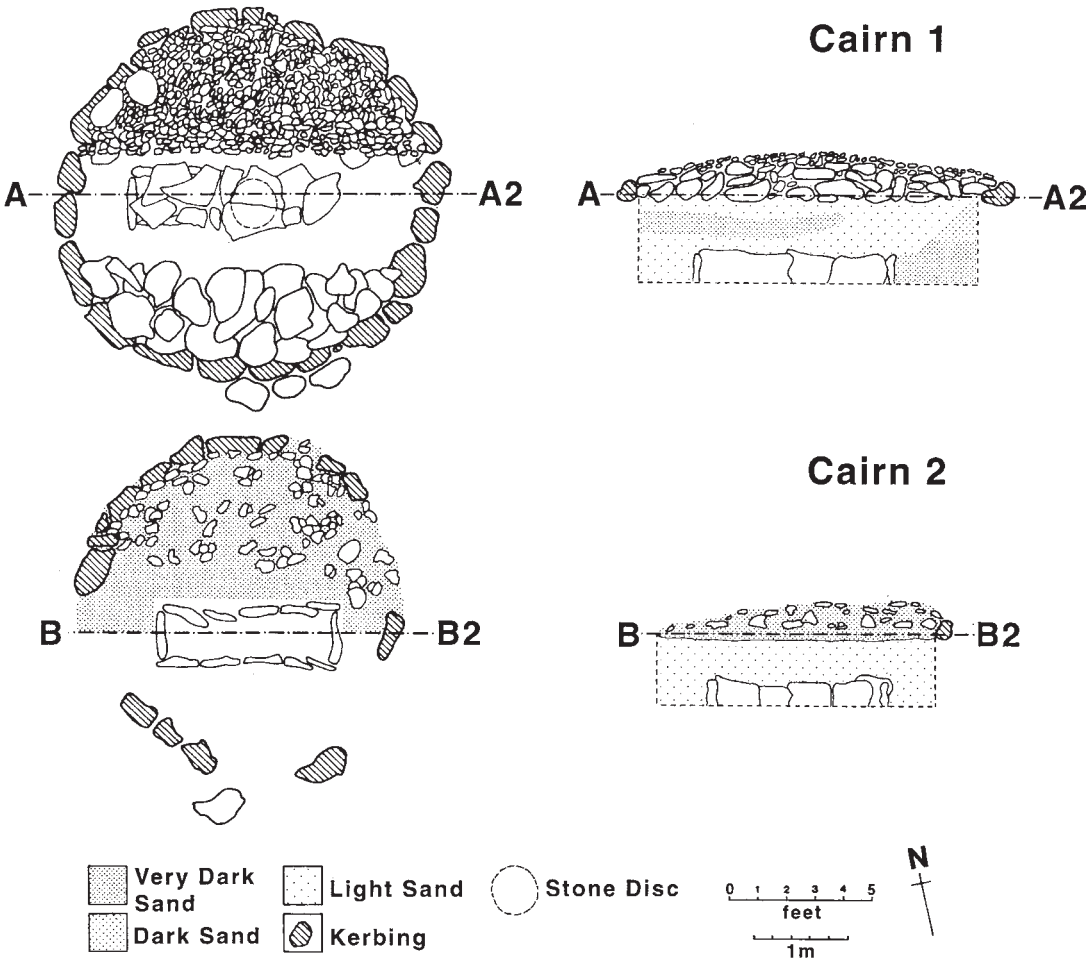
Cairn 4 lay to the south-east of Cairn 2, and had been c 3 m (9 ft 11 in) in diameter, but only fragments of kerb survived. The remains of a collapsed cist, Cist D, were uncovered. It had probably been disturbed recently, since a burnt wooden fish box had been placed in it. Only a few human teeth were recovered.

RECTANGULAR CAIRNS

There were two complete rectangular cairns, Cairns 3 and 6, and part of a third, Cairn 5, which had been disturbed by a secondary burial.

Cairn 3 (illus 5 & 9)

This well-constructed cairn lay 14.6 m east of Cairns 1 and 2, at the same level as Cairn 4. It was rectangular, 4 m long by 2.5 m wide, with a similar 0.3 m thick infill to Cairn 1. Its level upper surface of tightly packed pebbles was contained within large kerb stones. Beneath these pebbles was a lower layer of rounded stones of various sizes. A single long cist, Cist C, 1.82 m long by 0.62 m wide, lying east/west on the long axis of the cairn, contained the fragmented skeleton of a



ILLUS 5 Plans of elevations of Cairns 1 and 2

female (LL20), age about 25 years. (Smart & Campbell-Wilson and Lorimer, below, give estimates of 17–25 years and 20–30 years, respectively.)

Cairn 5 (illus 3)

To the south-east of Cairn 3 lay the remains of Cairn 5, another rectangular structure, roughly 2.7 m long by 1.5 m wide. Excavation revealed a primary burial, Cist S, whose fragmentary state was due to the insertion of a secondary burial. The primary burial skeleton (LL2) suggested a possible male, between 17 and 22 years old, and approximately 165 cm (5 ft 5 in) tall. The secondary long cist, Cist R, had been inserted without replacement of any of the original cairn material above it. This later cist, c 2.1 m by 0.75 m, was almost complete and the skeletal material (LL1) found scattered in the fill above it represented the extended inhumation of a male, 30–40 years old and 172 cm (5 ft 8 in) tall.

One of the secondary burial capstones consisted of a broken half of a dressed sandstone disc similar to the one found in Cairn 1.

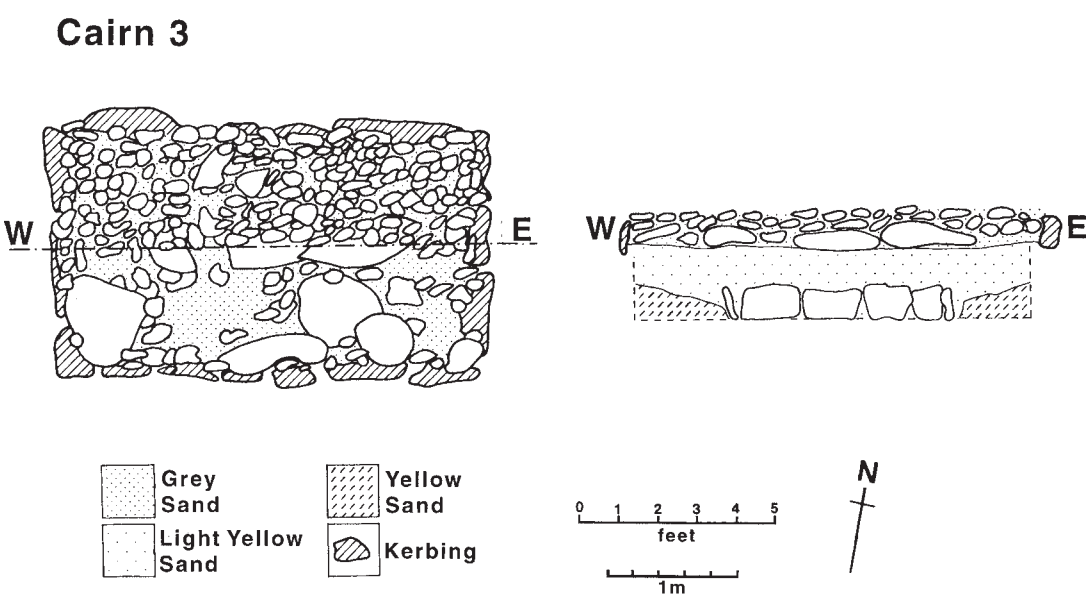
ILLUS 6 Round Cairn 1 (above left)

ILLUS 7 Sandstone disc in Round Cairn 1 (above right)

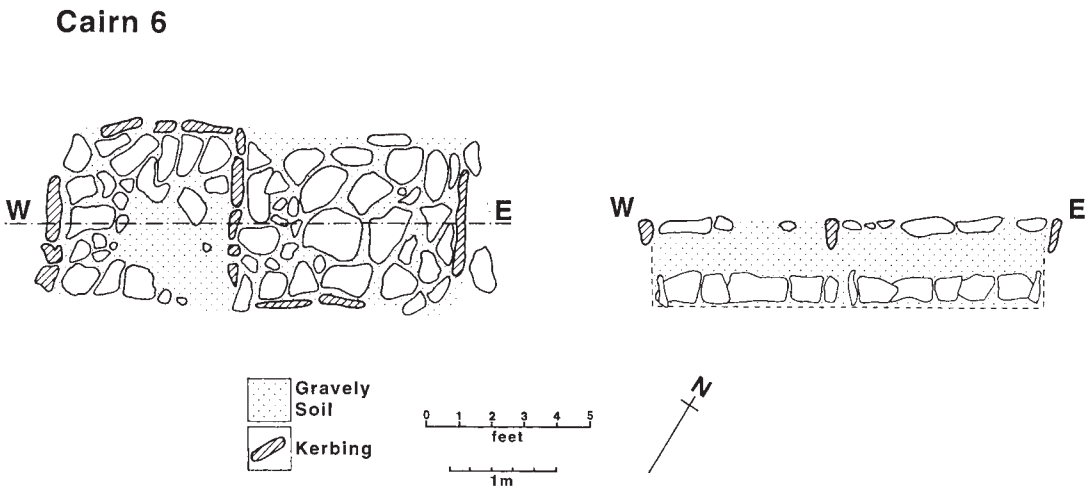
ILLUS 8 Cist B under Round Cairn 2

Cairn 6 (illus 3 & 10)

A third rectangular cairn, 4 m by 1.47 m, lay about 8 m to the east of Cairn 5 and on exactly the same centre-line. This cairn had a kerb of flat slabs, set on edge, with a reasonably level infill of various-sized round boulders. A line of vertical slabs ran north/south across the centre of the



ILLUS 9 Plan and elevation of Rectangular Cairn 3



ILLUS 10 Plan and elevation of Rectangular Cairn 6

cairn. Below each half of the structure, at a depth of 0.4 m, was a long cist, each containing the remains of a female skeleton. Cist P to the east, 1.82 m by 0.6 m, contained the remains (LL19) of a 20 year old, and Cist Q to the west, 1.74 m by 0.62 m, held fragments of bones (LL18) of a woman perhaps 30 year old and 147 cm (4 ft 10 in) in height.

CAIRN COMPLEXES

Lying east/west across the central area of the site were two distinctive cairn complexes. One, the Dumb-bell Complex, was composed of two round cairns linked by a subrectangular structure.

The more elaborate Horned Cairn Complex consisted of a round cairn abutting an oval stone setting with horns continuing their line beyond the eastern cairn.

The Dumb-bell Complex (illus 11 & 12)

This structure consisted of two round cairns, the eastern one being larger, linked by a flat, roughly rectangular kerbed area 2.4 m (7 ft 11 in) in length and 2 m (6 ft 7 in) wide. The complex was sectioned east/west.

The western cairn, 3.1 m in diameter, had a heavy kerb encompassing a variety of stones, with the gaps between the stones filled with small pebbles, rising to a height of 0.24 m at the centre. Below the base of the cairn, at a depth of 0.54 m, lay the capstones of Cist E (illus 13 & 14), a long cist aligned along the long axis of the complex. This cist, 2.4 m long by 0.6 m at its widest, tapered towards the eastern end. It contained the skeleton (LL3) of a male, possibly aged between 40–50 years old, and 178.5 cm (5 ft 10 in) tall. No grave goods were found.

The eastern cairn, 3.8 m in diameter and 0.4 m high at centre, was massively built, having not only an outside ring of heavy kerbing but also two inner concentric rings of similar sized boulders inside the kerb. The centre and top of the inner rings were covered with a variety of angular and rounded stones, again finished off with small pebbles. Lying 0.5 m below the base of the cairn were the capstones of a long cist, Cist G, 2.37 m by 0.62 m, aligned along the long axis of the complex. The cist was exceptionally well-built, each side having only two abutting large slabs, with one end slab at each end. It contained skeletal remains (LL5), of a probable male, aged 30–40 years (Smart & Campbell-Wilson, below) or 35–45 years (Lorimer, below) and 162 cm (5 ft 3 in) tall.

The link area between these two cairns was about 2.3 m long and up to 2 m wide. It was covered by a layer of lightly packed pebbles, 0.1 m thick, lying directly on the sand and contained within a slightly bowed-out kerb of flat slabs set on edge. At 0.6 m below the base of the pebbles, at a slightly greater depth than the cists under the cairns, was Cist F, a long cist, 2.24 m by 0.6 m. It contained the remains (LL15) of a female, age about 25 years, and 154 cm (5 ft 1 in) tall. The body had been laid on a bed of sea shells.

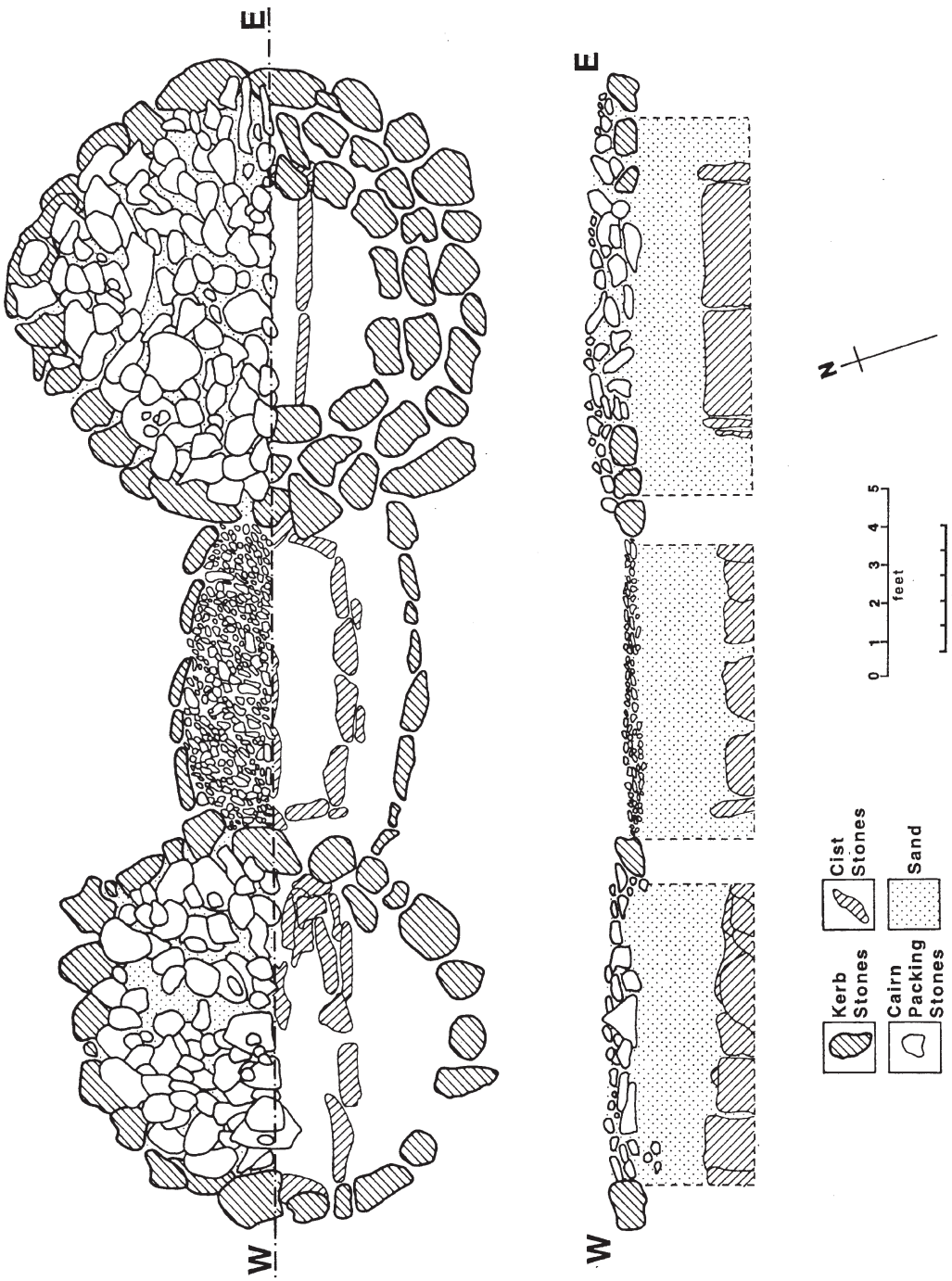
It was not possible from the section to observe the original excavation pit or pits for the three burials, as no related change in sand colour or texture could be discerned. It may have been that the edges of the pit or pits lay outside the area excavated.

Horned Cairn Complex (illus 15)

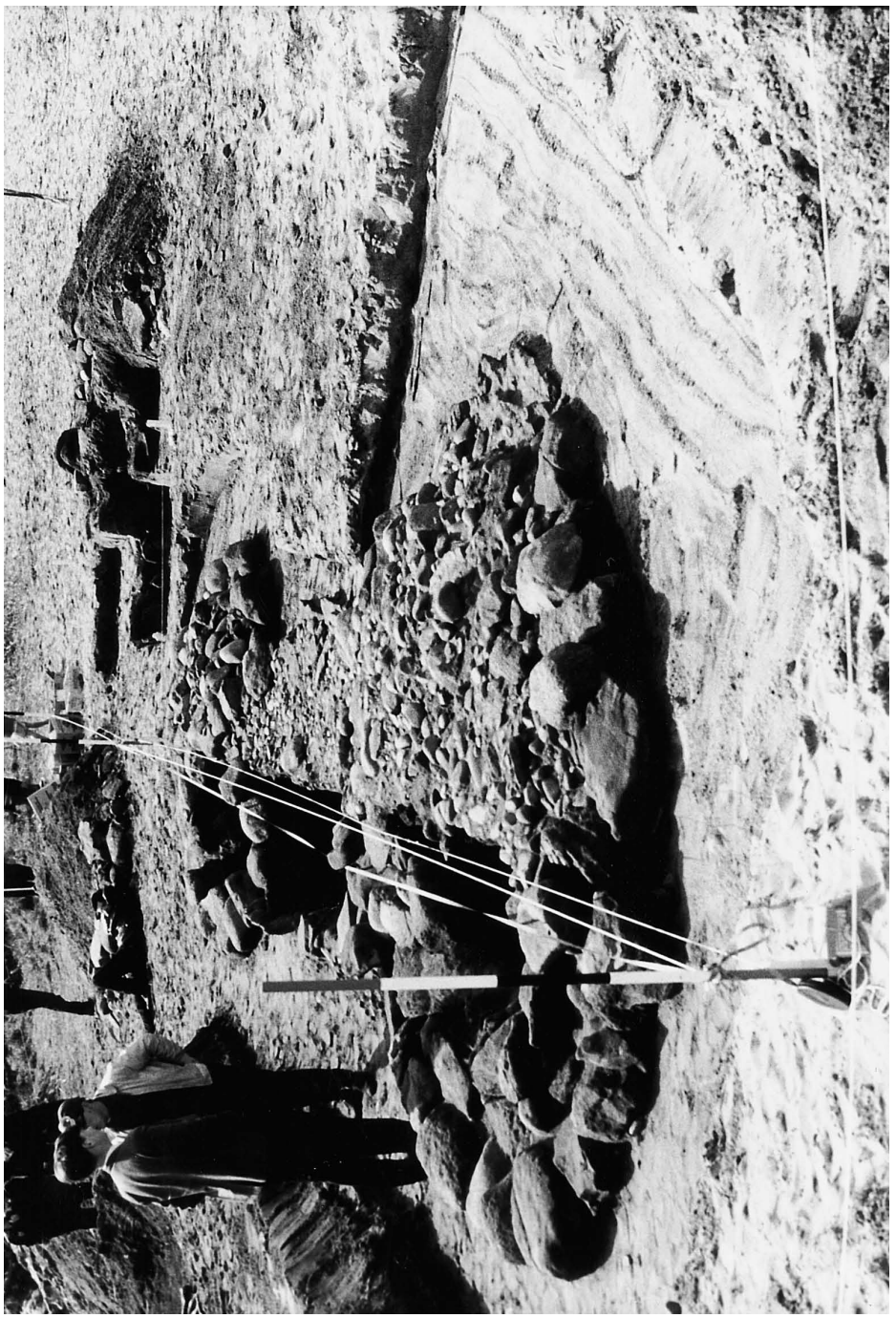
Lying immediately to the east of the Dumb-bell Complex was a complex burial structure comprising a round cairn linked to an oval setting of rounded boulders. This in turn had two curved, horn-like appendages to its eastern end. This complex was sectioned on its long axis.

The western cairn was convex in profile. It was 3.2 m in diameter and 0.4 m in height, and heavily kerbed, with a mass of stones of varying sizes bedded into the sand. There had been no attempt to finish off the surface with small pebbles as in the Dumb-bell Complex. On the western side of this cairn lay a large stone, 1.24 m in length, 0.34 m wide by 0.25 m thick, whose position suggested that it could once have stood upright at the western end of the cairn; it may have been a marker stone.

Below the base of the cairn, 0.42 m down, lay a long cist, Cist H, 1.74 m by 0.6 m, containing the remains of an extended inhumation (LL9) of a female, about 30 years old (25–30 according



ILLUS 11 Plan and elevation of the Dumb-bell Complex



ILLUS 12 The Dumb-bell Complex

ILLUS 13 Cist E before removal of capstones

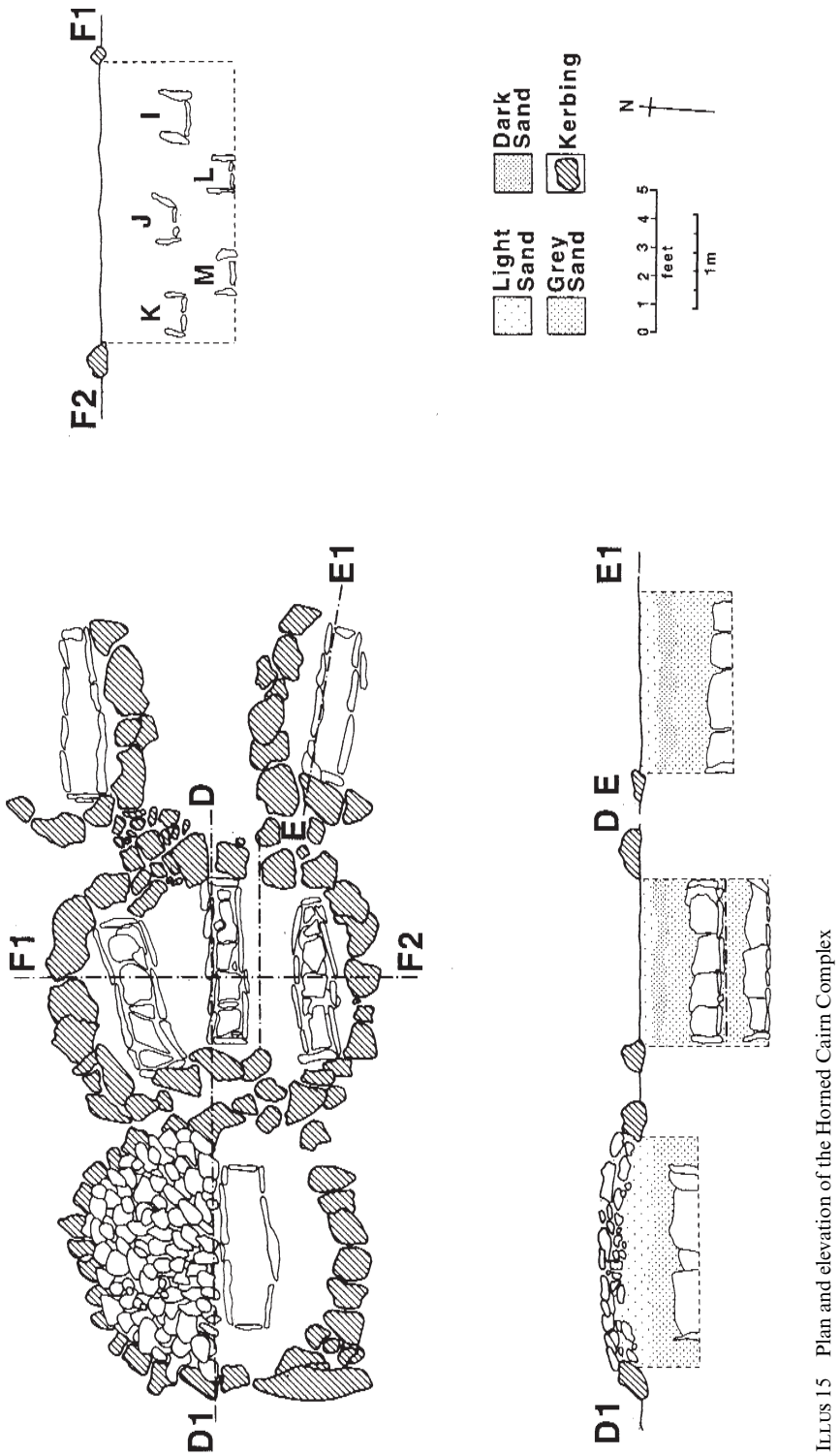
ILLUS 14 Cist E after removal of capstones

to Smart & Campbell-Wilson, this report; 30–35 according to Lorimer) and 159 cm in height (5 ft 3 in).

Attached to the eastern side of the cairn, with its long axis at right angles to the long axis of the complex as a whole, was an oval of rounded boulders, 2.8 m by 3.42 m. There was no infill of stones or pebbles within the edging stones. About 0.4 m below the surface were the capstones of three long cists, Cists I, J and K, average length 1.72 m by 0.44 m wide, each arranged roughly parallel to the long axis of the whole complex. All three contained single inhumations of females (LL13, LL8 & LL10), of average age 35–40 years old and between 152 and 166 cm tall (5 ft and 5 ft 5 in).

On continuing the section downwards two more long cists were uncovered. These were aligned in the same direction, c 0.2 m below the bases of the upper cists, and placed in the gaps between the three upper cists.

The northerly cist, Cist L, 1.75 m by 0.5 m, contained the skeleton (LL12) of a female, age 25–30 years and 159 cm (5 in 3 in) in height. She had suffered from a long-standing dislocation of the hip which must have meant a marked limp in life. A corroded, fragmentary iron pin was found under the right femur of the skeleton. One possible explanation for this may be that the pin was accidentally deposited at the time of the burial rather than being a grave good. Such was the



ILLUS 15 Plan and elevation of the Horned Cairn Complex

ILLUS 16 Cist O under the Horned Cairn Complex

fragmented state of the pin that no X-rays could be taken to determine its original shape or design.

The southerly cist, Cist M, 1.8 m by 0.4 m, contained the unaccompanied skeleton (LL16) of a female, 25–30 years old and 164 cm (5 ft 5 in) in height.

Attached to the eastern side of the oval were two crescentic stone settings, one to the north-east, the other to the south-east, their convex sides facing each other. The north crescent was joined to the oval by a tightly packed setting of flattish stones. The shape of the south crescent was less clear although it was similar to the north crescent. Both were sectioned independently and in both cases long cists were discovered some 0.66 m below the surface. The southerly one, Cist O (illus 16), 1.64 m by 0.48 m, contained the remains (LL11) of a female 30–40 years old and 156 cm (5 ft 1 in) in height. The left side of the body was substantially shorter than the right side and in life the woman must have suffered from one-sided paralysis (Smart & Campbell-Wilson, below). No skeleton survived in the northerly cist, Cist N, which measured 1.8 m by 0.46 m.

SURVEY AND EXCAVATIONS IN 1996

Bob Will

Skeletal remains eroding from the shoreline at Lundin Links were reported in March 1996 during a coastal assessment survey sponsored by Historic Scotland (Robertson 1996). The remains appeared to underlie a cobble pavement or cairn remnant. Historic Scotland commissioned an excavation and survey of the site. The main aims were to assess whether coastal protection should be improved in this area and to excavate any structures or skeletal remains immediately threatened by further erosion. Excavations in August 1996 showed that no skeletal remains survived *in situ*. No evidence was found for an associated cairn. The 'pavement' was typical of a

natural low-energy beach, the characteristic sign of which is an accumulation of sand between stones. Sand is generally absent between the stones of high-energy beach deposits. The large flat stones found in the sandy deposits under this layer were typical of a storm beach (Ritchie 1979).

Six sections were cleaned and recorded in other areas. A possible buried ground surface was identified in three of them. Other layers included gravel, comminuted marine shells and, in one cutting, modern building debris. Systematic auguring to a depth of 0.5 m in the area round the main 1996 cutting and around the cairn cemetery recorded stone-rich areas and traces of charcoal, but did not positively identify any new cairns or cists. It proved impossible to create a coherent model of the geomorphology of the area because of the depth of sand in many places, the highly variable soil depth, and outcrops of bedrock; but it is clear that there has been much modern disturbance in some places.

A more detailed report on the results of this work has been archived in the National Monuments Record of Scotland.

ANALYSIS OF THE HUMAN SKELETAL REMAINS

Two reports are included in this paper. The first, by I H M Smart and M Campbell-Wilson, was undertaken shortly after the skeletons were excavated from Lundin Links. During the period between their report and that completed by D Lorimer in 1999 some of the bones became mixed up with those from other cists; yet others (some, no doubt, consumed for obtaining radiocarbon dates in 1973 and 1982) were not found in 1999. Lorimer's report was designed primarily to assess possible family relationships, and to assess which bones could be reliably radiocarbon dated; and for the purposes for which it was designed it is not as a whole invalidated by these problems. However, it was impossible to resolve all the problems caused by mixing of bones, and the earlier skeletal report is important for basic information about the skeletons found in each cist, while the report on dentition contains some information unavailable to Lorimer.

The following are summaries of more detailed data given in the appendices below.

ANALYSIS OF HUMAN REMAINS IMMEDIATELY FOLLOWING EXCAVATIONS IN 1965–6

Iain H M Smart & Margaret Campbell-Wilson

Sex

Twelve skeletons were thought to be definitely female and two more probably female. Four were considered to be male and four more probably male. Six of the skeletons in the Horned Cairn Complex were female, and one probably female. In the Dumb-bell Complex the middle cist contained a female and the lateral cists males. The twin cairns contained a male and a female. The three cists under rectangular cairns contained females and the scattered cists contained three males (two probable) and one probable female.

Stature

The average height of the 12 definite females could be estimated as 156 cm (5 ft $1\frac{1}{2}$ in), ranging from 4 ft 10 in to 5 ft 5 in. Wells (1957) has commented on the presence of diminutive women in other long cist burials. Of the four definite males the average height was 173.5 cm (5 ft 8 in), ranging from 5 ft 5 in to 5 ft 10 in.

Age

The youngest skeleton was about 18 years old and the oldest between 35 and 45. The average age of the population was about 25–30 years. There was no apparent difference between male and female patterns. In four cases (LL4, LL6, LL11 & LL18) there was a discrepancy between the estimates arrived at by sutural and dental evidence.

Craniometry

The cephalic indices ranged widely from 69 to 82. Nine out of 18 were clustered between 74 and 77, that is the border between dolichocephaly and mesaticephaly. However, three skulls were frankly brachycephalic at 82, and one was markedly dolichocephalic at 69. Two of the brachycephalic skulls were reconstructed from fragments and the measurements are not reliable. The vertical indices ranged from 65 to 75, the majority lying in the middle of the range. Other features of the skulls were a characteristic narrow highly arched palate with a prominent chin showing flanging of the lower border of mandible on each side of the mental symphysis. The male skull of skeleton LL3 from the Dumb-bell Complex illustrates these characteristics in an extreme form.

Dentition

There was no evidence of congenitally missing teeth apart from the possibility of third molars. In two cases an upper lateral incisor was seen, but it is possible that some permanent molars which showed marked attrition had been carious and were now exhibiting 'arrested caries'. The upper left central incisor of LL4 was darker than adjacent teeth, suggesting that the pulp may have died during life, possibly as the result of trauma.

Estimations of the occlusion were possible in only 14 cases. One exhibited an ideal occlusion, three Angle's Class I malocclusion and ten Angle's Class II malocclusion. The deviations from an ideal occlusion were not great. The preponderance of Skeletal II and Class II malocclusions was unexpected.

Disease

The commonest diseases revealed by skeletal changes were osteoarthritic changes in the lower vertebrae which were present in nine skeletons, in three cases to a severe degree. One skeleton (LL3) had a unilateral fracture of the third lumber vertebrae associated with the osteoarthritis, and in another the arthritis involved the hip and sacroiliac joints. There was also one instance of an old, healed fracture of the clavicle. The most interesting pathologies were the dislocation of the hip in LL12 and the evidence of hemiplegia in LL11, which are interesting in that they had both been present for a long time before death. Periodontal disease was also widespread with six instances of probably dental abscesses often involving several teeth. No caries was found but advanced periodontal disease was common.

FAMILIAL TRAITS

Daphne Home Lorimer

The sample available for analysis of familial traits in the Lundin Links material was very small, especially as the fragmented nature of the base of the skull and facial bones precluded many

measurements. There was a preponderance of brachycephalic skulls (seven out of a total of the 13 which could be measured). Eight out of a total of ten were average in height. Five foreheads were average in width, two broad and two narrow. The nasal septum appeared, in general, to be narrow (five out of seven), the orbit equally distributed between narrow and wide. The palate was, in general narrow, but in three cases very broad. These indices were fairly evenly distributed over the complexes.

An analysis of the non-metrical traits of the cranium, given by Sjòvold as having heritability, showed that the absent parietal foramen, the mastoid foramen exsutural and, to a lesser extent, the supra-orbital foramen to be the most prevalent and present in all but one complex. The incidence number appears to reflect the size of the sample. These non-metrical traits appear to be peculiar to this population (five of Sjòvold's traits do not appear at all) and do not single out any one group. The minor varieties of the dental crowns were too sparse and the sample too small to be of any significance.

It is, however, of interest that, in the horned cairn, four individuals had one or more teeth which appeared to be congenitally missing and three of the mandibles had torus mandibularis, while, in the post-cranial skeleton, four of the individuals (three on one side only and one on both) had septal apertures at the lower end of the humeri. This could tentatively be interpreted as evidence of a familial connection among the women buried there.

RADIOCARBON DATING

The calibrations reported here were obtained using Oxcal 2.18 (Bronk Ramsey 1995) and the 1998 calibration curve (Stuiver *et al* 1998). Ten dates were obtained in 1999 from the femurs of ten skeletons by the Oxford University Research Accelerator Laboratory. Only ten skeletons could be dated reliably because the others may have been jumbled up between the time that they were studied by Smart, soon after excavation, and subsequent examination in 1999 by Lorimer.

Earlier attempts to date the cemetery had not been wholly successful. The dates gave rise to speculations about possible Iron Age origins and possible late first millennium AD survival of the cemetery (eg Ashmore 1981). Because even now those dates are not historically impossible and could be taken to support arguments for similar chronological spreads at other sites such as Hallow Hill (Proudfoot 1996, 443), it is worth exploring the reasons why three of them should be ignored, and the other two can be ignored, in some detail. Indeed they provide a case study relevant to many other sites for which radiocarbon ages were obtained two or three decades ago.

A bone sample from Cist F under the link of the Dumb-bell, dated in 1970 by Geochron Laboratories in Cambridge Mass, provided a date (GX-1988) which did not tie in with the excavator's ideas on the date of the site, so four other samples were submitted to two different laboratories. Two were dated in 1973 at the Institute of Physical and Chemical Research, Saitama, Japan: the female skeleton in the long cist from the south horn of the Horned Complex, Cist O (N-1590) and the secondary burial in the partly destroyed Cairn 5, which contained a skeleton with a skull which was remarkably different from the other skull types of the site (N-1591). Two were dated in 1982 at Glasgow University Chemistry Department Radiocarbon Dating Laboratory: the skeleton from Cairn 1 (GU-1593) and one of the male skeletons at the east end of the Dumb-bell complex in Cist G (GU-1594).

Since these dates were obtained in 1970 and 1982, the accuracy of radiocarbon dating has increased considerably (Ashmore *et al* 2000a). Before comparative studies of laboratory accuracy by the International Study Group (1982) and subsequent improvements, all the age measurements produced by some laboratories may have been too old, and those produced by other laboratories

TABLE 1

Radiocarbon dates obtained in 1999

Code	Description	Calibrated date	Yrs BP	*d*13C‰
OxA-8904	Left femur of an adult female inhumation LL18 from Cist P below the base of Rectangular Cairn 6	cal AD 340–560	1610 ± 40	–20.3
OxA-8898	Left femur of an adult female inhumation LL9 in Cist H under the western cairn of the Horned Cairn Complex.	cal AD 400–540	1600 ± 30	–21.1
OxA-8900	Right femur of an adult female inhumation LL11 in Cist O of the lower cist layer under the Horned Cairn Complex.	cal AD 420–600	1565 ± 35	–20.6
OxA-8895	Right femur of an adult male inhumation LL5 in Cist G below the base of the eastern element of the dumb-bell cairn complex	cal AD 420–600	1560 ± 40	–20.6
OxA-8901	Right femur of an adult female inhumation LL13 in Cist I of the upper cist layer under the Horned Cairn Complex.	cal AD 420–600	1555 ± 35	–20.8
OxA-8897	Right femur of an adult female inhumation LL8 in Cist J of the upper cist layer under the Horned Cairn Complex.	cal AD 420–600	1550 ± 35	–20.6
OxA-8899	Right femur of an adult female inhumation LL10 in Cist K of the upper cist layer under the Horned Cairn Complex.	cal AD 430–600	1540 ± 35	–20.8
OxA-8903	Right femur of an adult female inhumation LL19 from Cist Q below the base of Rectangular Cairn 6	cal AD 430–620	1535 ± 35	–20.8
OxA-8902	Right femur of an adult female inhumation LL14 from Cist B under Round Cairn 2	cal AD 540–660	1465 ± 35	–21.0
OxA-8896	Left femur of an adult male inhumation LL6 in Cist A below the base of Round Cairn 1	cal AD 540–660	1455 ± 35	–20.4

TABLE 2

Radiocarbon dates obtained in 1970 and 1982

Code	Description	Calibrated date	1970 and 1982 Yrs BP	1999 Yrs BP
GX-1988	Human bone from an inhumation in Cist F under the central linking cairn material of the dumb-bell cairn.	1300 cal BC–cal AD 400	2340 ± 110 (adjusted to 2340 ± 330)	
N-1590	Human bone from a female inhumation in Cist O under the south horn of the cairn.	cal AD 690–1160	1090 ± 100	(OxA8900) 1565 ± 35
N-1591	Human bone from the secondary inhumation in Cist R under the partially destroyed Cairn 5	cal AD 210–640	1630 ± 190	
GU-1593	Human bone from an inhumation in Cist A under Cairn 1	cal AD 400–950	1360 ± 60	(OxA-8896) 1455 ± 35
GU-1594	Human bone from a male inhumation from Cist G under the east end of a dumb-bell cairn (west end according to previous publication)	cal AD 250–800	1475 ± 110	(OxA-8895) 1560 ± 40

may all have been too young. Other errors may have been random, but larger than allowed for by the laboratory in quoting the error on the measurement. It seems very likely, therefore, that the errors attached to the radiocarbon ages produced by many laboratories up to the early to mid 1980s should be increased significantly if they are to be comparable with errors quoted today. After a comparative study of test results from several laboratories, the International Study Group (1982) advised that quoted errors, particularly those derived solely on the basis of counting statistics, should be multiplied by a factor of between 2 and 3. The two Glasgow dates were

obtained at a time when their quoted errors probably represented their true errors fairly accurately; but the same need not be true of the other three dates.

Three of these dates were from skeletons which were also dated in 1999. Dates N-1590 and OxA-8900 for the burial in Cist O are clearly significantly different from each other. The dates produced by Glasgow University are not significantly different from those produced by Oxford in 1999, but neither combining the two dates for LL5 nor those for LL6 produces a significant improvement in estimates of the true age of the bones, particularly after calibration. Nothing is lost by ignoring all of the dates obtained before 1999.

The 1999 dates fall into an awkward period in which it is impossible to obtain short calibrated date ranges through radiocarbon dating. The calibration curve has plateaux between AD 430 and 530 and between AD 550 and 600, during which the proportion of radiocarbon to ordinary carbon in the atmosphere diminished gradually at a rate such that radiocarbon measurements at the recent end of the period are the same as those at their beginning. That is why the dates from Lundin Links have such a broad span after calibration. Nevertheless, overall, the dates imply a significant period of use (a statistical attempt to combine those dates obtained in 1999 failed with Chi-squared with 9 degrees of freedom producing a T value of 18.494). It seems quite likely that the cemetery was in use for between 110 and 260 years (67% probability) and very likely that it was used for between 30 and 330 years (95% probability) (Bronk Ramsey 2000). Thus, in round terms, it was probably used for between about five and about ten generations, and was in use both before and after cal AD 540.

DISCUSSION

THE LUNDIN LINKS CEMETERY

Including those forming parts of the complexes, the round cairns varied in diameter between 4.4 m (Cairn 1) and 3.1 m (the west cairn of the Dumb-bell Complex). They were heavily kerbed with boulders and in general rounded in profile, reaching a maximum height of 0.4 m. The east cairn of the Dumb-bell Complex had a heavy treble kerb. The oval and crescentic settings of the Horned Cairn Complex did not enclose cairn material. The west cairn of the Horned Cairn Complex may have been marked by a small standing stone. The three rectangular cairns varied in size up to 2.7 m by 1.5 m and they seem to have been 0.2 m to 0.3 m high. Two had boulder kerbs and one had a kerb of small vertical slabs. The bowed link area of the Dumb-bell Complex, which could be thought of as a rectangular cairn, measured 2.3 by up to 2 m. About half of the round cairns and one of the rectangular cairns were finished off with a pebble layer. Apart from the lower layer of cists under the crescents of the horned cairn, the cists were 0.4 to 0.6 m below the bases of the cairns or kerbs.

All of the cists were orientated roughly east/west: eight were at about 65 degrees from north, one at about 70 degrees, seven at about 75 degrees, one at about 80 degrees and seven at about 90 degrees. Apart from a tendency for the cists in each complex to be aligned with one another, there is no significant correlation between these minor variations in orientation and any other characteristic of the burials. In particular, orientation was not correlated with date. The heads of the bodies were all at the west end of the cist (except possibly in the three cists where information about the position of the head did not survive). Eight of them faced north and eight south; three faced east. Again, there is no significant correlation for any other characteristic of the burials. All were extended and supine. Only one burial (Cist L in the Horned Cairn Complex) was accompanied by an artefact, an iron pin, revealed by X-ray but too corroded for positive

identification. The orientation of the burials, extended on their backs with their heads to the west, and the general lack of grave-goods may imply Christianity, but many non-Christian Romano-British burials (Philpott 1991, 240) share these characteristics and the religion of the people buried at Lundin is thus ambiguous.

Twelve of the 22 skeletons are thought to be definitely female and two more probably female; four are considered to be male and four probably male. Chi-squared tests with and without Yates' correction (Spiegel 1961, 203) suggest that the difference from equal numbers of burials of either sex is not significant. All of the eight skeletons in the Horned Cairn Complex were female or probably female. In the context of the cemetery as a whole there is a probability of less than 2.5% that this occurred by chance (Chi-squared, with two degrees of freedom, is 8.29), so although the lack of males is less statistically significant than it might appear at first glance it is still unlikely to have occurred without conscious selection. Lorimer (above) suggests that some of the eight females or probable females in the horned complex share enough unusual traits to allow a suggestion that they may have come from a particular family group. In the Dumb-bell Complex the bodies buried in the round cairns were male while that under the link between them was female. Taken in isolation the distribution of the sexes between different cairns in this complex may well be due to chance, but taken with the evidence from the Horned Cairn Complex it may be taken to suggest that males and females were purposefully buried in separate cairns and that this tradition was particularly strong in the family which buried its dead in the Horned Cairn Complex.

Thus, the picture from the excavated part of the Lundin cemetery is of a fairly small Christian community with a tradition of burying men and women under different cairns, possibly in family lairs, which flourished most probably for three or four generations at some time between the later fifth century and the early seventh century. Since the youngest person buried in the cemetery was at least 17 the community presumably buried its juvenile dead in a different way; and it may tentatively be suggested that, if the cemetery was Christian, baptism or confirmation did not take place until early adulthood.

POSSIBLE ANTECEDENTS TO THE LUNDIN CEMETERY

Current orthodoxy is that cremation was a more popular burial ritual in late Bronze Age Scotland than inhumation, and that human remains were probably disposed of in ways that leave no trace during the earlier part of the Iron Age. The truth is that many burials which may belong to this period have not been radiocarbon dated, possibly because of a preference, until recently, for dating burials with grave goods. Perhaps as a consequence little is known about burial customs in Scotland between 1000 BC and 500 BC. Three inhumations in short cists have dates which suggest that they belong to that period, two in Orkney (Neil 1981, 45) and one at Longniddry in East Lothian (Dalland 1991). One crouched or flexed burial at Dryburn Bridge in East Lothian may also pre-date 500 BC but the large error attached to it, and the other radiocarbon ages from burials in the same small cemetery, suggest that it could be later (Triscott 1982, 122; Ashmore *et al* 2000b). The cremations which have been dated to between 1000 BC and 500 BC are from a Clava cairn at Newton of Petty (Bradley 1997, 115), a ring cairn at Rullion Green (Watkins 1987; Ashmore *et al* 2000b) and a kerb cairn at Sands of Forvie (Sabine & Ralston 1984). This admittedly scanty evidence suggests that both inhumation and cremation were practised.

Including the loosely dated burial from Dryburn Bridge referred to above, 17 inhumations have radiocarbon dates suggesting that they belong to the period between 500 BC and the beginning of the Christian era. Two come from north of the Forth: a casually disposed of body at

Crosskirk in Caithness (Fairhurst 1984) and a crouched inhumation in a short cist burial (SK313) at Kirkhill, Fife, one of six possible burials in a prehistoric cemetery there (GU-1680, 2290 ± 65; Wordsworth & Clark 1997, 13). All the rest come from south of the Forth. Fourteen are from East Lothian and one, a burial in a stone-lined long cist (Grave 27) at Thorneybank near Dalkeith, from Midlothian (Rees 1999).

The date of 360 cal BC to 40 cal BC (OxA-8332 2120 ± 40 BP) from the Thorneybank inhumation, however, is aberrant. Re-examination by the laboratory confirmed that it had suffered from contamination by lower molecular weight components and it was replaced by OxA-10161 (1578 ± 34 BP) which calibrates to between cal AD 410 and 570. The next earliest dated burial from the cemetery, cal AD 20 to 240 (OxA-8758; 1900 ± 40) has also been replaced, by OxA-10160 (1581 ± 36) which calibrates to between cal AD 400 and 570. The earliest date from the cemetery is now thus cal AD 230 to 430 (OxA-8152; 1705 ± 45) and it may be suspected that it is more likely to be too old than too young.

The East Lothian burials come from small cemeteries, one of nine graves outside Broxmouth hillfort (Hill 1982, 179; Ashmore & Hill 1984, 94) and one of five inside the settlement at Dryburn Bridge (Triscott 1982, 122). Although the Broxmouth burials were generically similar to each other they differed considerably in detail. Some were in stone-lined pits while others were in shallow oval graves and two were in neatly rectangular cists. At both sites there were other burials elsewhere in the settlement. At least one of these at each site was later than those from the cemeteries.

A few cremations have dates suggesting that they belong to this period. One date comes from bones in an urn at Sanaigmhor Warren, Islay (Cook 1998, 126), and three from bone in various contexts, including a typically early Bronze Age collared urn at Fordhouse Barrow, Dun (Proudfoot 1999, 111). These radiocarbon ages seem most likely to reflect contamination with carbon from the environment, between the time that the cremations were deposited and the time their ages were measured. But a date of cal AD 20 to 400 (GU-2070 1825 ± 80 BP) from Acharn, Morvern, Cairn No 3 — provided by charred alder, hazel and oak in a cist with cremated bone, obtained subsequent to publication of the excavation (Ritchie *et al* 1975) — does possibly represent a cremation of this period. The scanty evidence available does, however, suggest that cremation was practised far less often than inhumation.

Around 23 burials have central dates within the period from the beginning of the Christian era to about AD 500, mostly from eastern and south-eastern Scotland. South of the Forth, a crouched burial in a pit from Winton House, Cockenzie, East Lothian (Dalland 1992, 178), reflects the predominant style of (or perhaps in truth belongs in) the previous half millennium. The other burials include an inhumation in a long shallow grave in the interior of the hillfort at Broxmouth, cut through natural gravel overlying a palisade trench (Ashmore & Hill 1984, 94; Hill 1982, 180), eight burials in long cists at Thorneybank (Rees 1999; but including the two re-dated burials discussed above which now belong around or slightly before AD 500), a curious double burial in a cist at North Belton in East Lothian (Crone 1992, 164), burials in cists from Lennelhill, Coldstream (Ritchie 1983) and Coldingham Loch (Smith 1981) in The Scottish Borders (in former Berwickshire), and an inhumation within Cist 2 at Avonmill Road, Linlithgow, in West Lothian (Dalland 1993, 343).

Further afield, radiocarbon-dated burials probably of the period include a long cist burial dated to between cal AD 130 to 530 from Galson in the Western Isles (Ponting 1989, 97; GU-2115, 1710 ± 70 BP); three further dates (Neighbour this volume; OxA-10164 1895 ± 36; OxA-10165 1848 ± 36 and OxA-10166 1858 ± 34) suggest a date between the first and third centuries AD for the cemetery. Other dates include those for three burials below two small cairns by the Brough

Road, Birsay, in Orkney (Morris 1989, 123), two burials at Hermisgarth, Sanday, Orkney (Downes & Morris 1997, 613) and a disturbed burial at a damaged cairn at Sands of Breckon Yell (Carter & Fraser 1996, 295). One of the burials at Hermisgarth is reminiscent of one type of burial found in the Broxmouth cemetery.

North of the Forth radiocarbon-dated burials probably of the first half of the first millennium AD include the two earliest dated burials at Lundin Links: the adult female inhumation LL19 from Cist P below the base of Rectangular Cairn 6 (OxA-8904; 1610 ± 40 BP) and the adult female inhumation LL9 in Cist H under the western cairn of the Horned Cairn Complex (OxA-8898; 1600 ± 30 BP). The earliest date from the cropmark square and round barrow cemetery at Red Castle (or Redcastle), Lunan Bay, Angus, from a skeleton under a round barrow, was dated to cal AD 80 to 340 (OxA-8412; 1815 ± 40 BP) (Alexander 1999). The second oldest, cal AD 240 to 470 (OxA-8413; 1675 ± 40 BP), from a tooth, may provide a better indication of the likely start date for the cemetery. A sample from a femur from the same body had given a later age (Alexander 1999; OxA-8143, 1305 ± 35 BP), but it was re-measured (OxA-10163 1661 ± 36), providing a date range of cal AD 250 to 540. The sample prepared for this second measurement has a C/N ratio like that expected from an uncontaminated sample. OxA-8413 and OxA-10163 represent the true date of the burial fairly well. These two ages can be combined and calibrated to give a date range of cal AD 260 and 430. This is younger than both of the Lundin Links dates quoted above but indistinguishable from the second oldest date of cal AD 230 to 430 from the long cist cemetery at Thorneybank (OxA-8152 1705 ± 45 BP).

After about AD 500, as discussed below, inhumation in long cists and graves dominated burial practices. However, cremation still seems to have been used occasionally during the second half of the first millennium AD. Two single-entity radiocarbon ages, AA-21258 of 1445 ± 130 BP and AA-21259 of 1290 ± 95 BP, were obtained for hazel charcoal in a patch of charcoal, cremated human bone and lithic artefacts found outside the main structure of the ring cairn at Balnuaran of Clava (Bradley 1996, 139). They are not significantly different from each other and suggest a date between cal AD 560 and 890.

What little evidence there is, then, suggests that the burial traditions of the pre-Roman period in south-eastern Scotland included the idea of inhumation of flexed bodies in cists, and the concept of grouping graves together in small family or peer-group cemeteries, but did not include the idea of extended burials in large cemeteries. The available dates suggest a distinct possibility that burial in long graves and cists was prevalent throughout much of Scotland from some time between the second and fourth centuries AD. The practice of inhuming the dead under low mounds may have started in the fourth or fifth century AD. Throughout the first millennium inhumation was the normal rite, but cremation remained in occasional use at least into the second half of the millennium.

LUNDIN AND LOW BARROW OR CAIRN CEMETERIES

The low cairns found at Lundin Links are at the bottom end of the size range (c 11 m to 3.5 m) of first millennium AD mounds in Scotland, if no account is taken of the occasional much larger square cropmark enclosure, such as the 30 m square example with interrupted ditch corners at Wester Denhead (NMRS: NO24SW 46), near Coupar Angus, in Perth & Kinross. The cemetery at Lundin Links' other characteristics suggest it is intermediate in style between Ackergill in Caithness and Garbeg near Drumnadrochit, in Inverness-shire (Ashmore 1981, 351). At both of those sites fragmentary Pictish symbol stones were incorporated in cairns, but while the burial pits at Garbeg were orientated approximately east/west (Wedderburn & Grime 1975), those at

Ackergill displayed orientations varying by more than a right-angle, between WNW and NNE (Edwards 1926, 162 fig 2; 1927, 197 fig 2).

More broadly, the Lundin cairns reflect a tradition which may have flourished throughout Scotland, except perhaps south-east of the Forth. Even in the latter area, the recent excavation of rectilinear enclosures round two burials at Thorneybank near Dalkeith (the larger measuring 4.6 m by 3.3 m internally), and a four-post timber setting round one burial there (Rees 1997, 53–4, fig 12), suggest there may have been at least weak links with Lundin and other more northerly cemeteries. Indeed, the four-post setting at Thorneybank may be conceptually similar to the four-boulder setting at the rectangular cairn at Garbeg (Wedderburn & Grime 1975, 1–2). A loose connection need not conflict with the excavator's preferred parallel for the Thorneybank four-post setting with a similar setting, interpreted as a shrine or mortuary house, at München-Aubing in Germany (Rees 1997, 53–4, fig 12). While it might seem possible that the rectangular enclosures at Thorneybank represent small chapels of the kind predicted by Henshall (1956) the lack of any evidence for structural components makes it seem unlikely (Rees pers comm, 2000).

Since the last extensive synthesis of evidence for burials in long cists and graves under low cairns was published (Close-Brooks 1984), many more examples of cropmark square barrows have been discovered with the gaps at the corners of their ditches which distinguish them from possible Iron Age examples (Ashmore 1980, 353). Most have been found in the same general area as concentrations of Pictish symbol stones and in the context of this discussion their main importance lies in narrowing the gap in distribution between Lundin and more northerly examples of square barrows and cairns. However, four undated small square cairns from the Western Isles, one excavated near Cille Pheadair (Parker-Pearson 1998, 103) and the others surveyed at Berneray causeway (Downes & Badcock 1998, 101) and on Sandray (Branigan and Foster 2000, 74), taken with the cropmark square and trapezoidal barrows with gaps at one or more corners of their ditches near Gatehouse of Fleet, Thornhill, Johnstonebridge and Dumfries (Cowley 1996, 107–11), demonstrate the presence of such cairns or barrows in areas without a known strong Pictish tradition. The Thorneybank enclosures referred to above and a pentagonal cairn at Alnham in Northumberland (Cowley 1996, 112; Jobey 1966) are also important in the context of this discussion in suggesting that Lundin is not at the southern extreme of the distribution.

The Lundin dates overlap with those from the recently excavated cropmark barrow and long cist cemetery at Red Castle, Lunan Bay, Angus, but this cemetery probably had earlier origins and continued later in use than can be demonstrated for Lundin Links (Alexander 1999). The four dates from square barrow burials ranged between cal AD 400 to 570 (OxA-8140; 1580 ± 35 BP) and cal AD 600 to 710 (OxA-8383; 1385 ± 35 BP). Two round barrow burials provided dates of cal AD 80 to 340 (OxA-8412; 1815 ± 40 BP) and cal AD 440 to 660 (OxA-8144; 1470 ± 40 BP). The burials in the two isolated cist burials had ages of cal AD 240 to 470 (OxA-8413; 1675 ± 40 BP) and, apparently erroneously, cal AD 660 to 780 (OxA-8143; 1305 ± 35 BP) (ibid), the second re-dated as discussed above to between cal AD 240 and 540. There is a hint here that the round barrows tended to be earlier than the square barrows. Most of the burials were oriented approximately SW/NE with their heads to the south-west (Alexander 1997, 13 and pers comm).

One possibly related site, Boysack Mills in the Lunan Valley, Angus, has provided an earlier date. The date comes from birch, hazel and willow brushwood taken from a shallow pit in square enclosure II, possibly the bottom few centimetres of a grave. However, the pit was amorphous and did not contain a burial (Murray & Ralston 1997, 374). The error attached to the age quoted by the laboratory (GU-1256; 2085 ± 115 BP) must be multiplied by 1.4 to allow for errors greater

than those recognised by the laboratory at the time. That suggests the brushwood belongs to the period 550 cal BC to cal AD 350. Since there is no obvious reason for brushwood charcoal in a grave it may have been incorporated accidentally. The pit may not be a grave, it may not be of the same date as the enclosure, and the date is best treated as providing a *terminus post quem* for the pit rather than the enclosure (Ashmore 1997, 376–7). However, it provides a tantalising hint that cropmark square burial enclosures without gaps at their corners may belong to the first few centuries BC or AD.

LUNDIN AND LONG CIST CEMETERIES

Proudfoot & Aliaga Kelly have recently discussed long cist cemeteries in Fife (Proudfoot 1996, 436–49). They concluded that they originated in pre-Christian times with the bulk of burials taking place in the sixth to ninth centuries and changes in site use and burial developing in the eighth (ibid, 447).

The Lundin Links cemetery was probably well established before the long cist cemeteries at Hallow Hill and Kirkhill. The two most recent radiocarbon ages of ten obtained from Lundin Links (1455 $\pm$ 35 and 1465 $\pm$ 35 BP) are older than all but three of the 19 human bone ages from Hallow Hill (1490 $\pm$ 55, 1480 $\pm$ 50 and 1460 $\pm$ 50; Proudfoot 1996, 423). One context at Hallow Hill did produce an earlier age, from charcoal from dark soil of a disturbed burial pit (GU-1855 2000 $\pm$ 60 BP; ibid, 423–4), but its taphonomy is ambiguous. As Proudfoot pointed out, the Roman artefacts found in some of the cists at Hallow Hill may well have been heirlooms of considerable antiquity at the time they were buried, so do not provide additional evidence for an early phase (Proudfoot 1996, 417–20; 439). The Lundin ages are also older than all those from the long cist burials at Kirkhill, St Andrews, although considerably younger than that for the underlying prehistoric cemetery there (Wordsworth & Clark 1997, 13).

The cemetery at Lundin may, however, be contemporary with or later than long cist cemeteries south of the Forth. The Lundin ages overlap considerably with those from the long cist cemetery at the Catstane, near Edinburgh, which vary between 1335 $\pm$ 120 BP (GU-1159) and 1365 $\pm$ 80 BP (GU-1157) to 1585 $\pm$ 85 BP (GU-1156), although the large errors attached to the Catstane ages make detailed comparison impossible. The conclusion that 'the available evidence suggests that ordered deposition of oriented burials in long cists had commenced on the site by the early fifth century AD' (Cowie 1980, 199) has been vitiated by improvements in calibration; we would now see the radiocarbon ages from the Catstane burials as indicating at earliest a late fifth-century date and more likely one in the sixth century. The 30 dated burials from Thorneybank cemetery near Dalkeith in Midlothian have provided ages ranging from 2120 $\pm$ 40 BP (OxA-8332) to 1395 $\pm$ 35 BP (OxA-8191), and 1255 $\pm$ 40 BP (OxA-8155) (Rees 1999). Taken at face value they imply that burials in long cists had started at a date between 360 and 40 BC. However, as argued above, it seems more likely that the origins of the cemetery lay in, at earliest, the third century AD. Its use probably continued to some time between AD 560 and 690 or perhaps, taking the somewhat chronologically isolated date (OxA-8155) into account, even as late as between AD 670 and 890.

It is tempting to ascribe the practice of burying people in long cist cemeteries, at least in part, to contacts with the Roman Empire. The reuse of Roman arch slabs at Thorneybank (Rees 1997, 53), the Roman artefacts at Hallow Hill, and the Latin inscription on the Catstane certainly reflect Roman and post-Roman influences. However, the imprecision of radiocarbon dating and the paucity of excavated Roman burials in Scotland (Breeze 1996, 87) leave many ambiguities, and small pre-Roman cemeteries with loosely flexed inhumations in pits, some reminiscent of long cists in that they were stone-lined and capped, demonstrate a pre-Roman native inhumation

tradition. It could, nevertheless, be argued that these were small family cemeteries, and that, although the traditions which they expressed eased acceptance of the large long cist cemeteries, the latter are an expression of more centralised social arrangements extending over larger areas and strongly influenced by Christianity.

CONCLUSIONS

It appears that none of the possible connections between the first-millennium AD cairn cemeteries of Scotland and other broadly coeval burial traditions can yet be excluded (Ashmore 1980, 352–4). Parallels with rectangular burial and commemorative structures in the Baltic lands and Ireland are at best loose.

In 1981 it was suggested that the most stimulating hypothesis to test is that a La Tène burial tradition continued sufficiently long in Scotland to be incorporated in Pictish culture (Ashmore 1980, 354). The southern connections, most recently discussed by Cowley (1996, 112), leave open the possibility of a relationship to the burial practices of Iron Age Yorkshire. But burials under low square cairns are currently attested in Scotland by at earliest the early fifth century AD (if the radiocarbon date from Boysack Mills is treated as too ambiguous to be relevant). The chronological gap between the latest attested expression of the La Tène square barrow tradition and the earliest Scottish square barrows is still very large, so the evidence which has appeared since 1981 has no direct bearing on the hypothesis.

Thomas (1981, 275–94) speculated that long cist cemeteries in Scotland were a product of the Ninianic conversion of the 'southern Picts' in the first half of the fifth century. The new evidence discussed above suggests that the origins of at least some Scottish long cist cemeteries lay in south-east Scotland, in an area not traditionally associated with Picts, perhaps as early as the second century AD and very probably by the fourth century AD.

In Fife, judging by the prehistoric cemetery at Kirkhill, St Andrews, there may have been a pre-Roman tradition of small family cemeteries like those found south of the Forth. The later fifth- to early seventh-century cairn cemetery at Lundin Links may reflect burial traditions emanating from Angus, because one of the round barrows from Red Castle pre-dated the fifth century. Looking at each mound cemetery as a whole, Lundin and Red Castle are similar, and the latter is earlier in origin. But it is still possible that the rectangular Cairn 6 at Lundin is the earliest known in Scotland, because the two dates from burials below it are statistically indistinguishable from that from the earliest square barrow in Angus. The cist burials to the east of the cairn cemetery at Lundin, attested from 19th- and early 20th-century accounts, seem to have formed a long cist cemetery similar to those in Lothian, which have origins perhaps as early as the second to fourth centuries AD. It seems likely on the present limited evidence that the two traditions met around the late fifth century at Lundin Links, and that by the late seventh century AD the practice of burying people under cairns became unpopular there, although it may have remained in favour in northern Scotland until about the end of the millennium.

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APPENDIX 1
ANALYSIS OF HUMAN REMAINS FOLLOWING EXCAVATIONS IN 1965–6

I H M Smart & M Campbell-Wilson

A somewhat longer version of the data and analysis presented here is archived in the National Monuments Record of Scotland. Although a fairly complete series of osteometric measurements were made, only summaries are presented here. The detailed osteometric measurements and dental report are filed in the Dundee University Library.

A total of 22 skeletons was received for examination. The majority of the bones, including the crania, were in good condition, and were still embedded in the sand from which they had been recovered. In some cases the skull had fragmented but it was usually possible to reconstruct sufficient of the cranium to make at least some of the standard measurements. Craniometric measurements were made with standard craniometric callipers, and long bones were measured with an osteometric board. Estimates of stature were obtained using the equations of Trotter & Gleser (1952) for the white races which, although the best available, are still liable to give an error of $\pm$ 5 cm (2 in). The sex of the skeleton was determined using the specific skull and pelvic characteristics as outlined in standard anatomy texts. Age was determined from the extent of fusion of the epiphyses and skull sutures, and the amount of wear on the teeth.

The small post-mortem loss of teeth in the material meant that a fair assessment of the dental conditions was possible. Each dentition was examined for teeth present, post- and ante-mortem loss, caries, attrition and bone loss. The age estimations were made using Brothwell's (1981) table for attrition in pre-medieval skulls and his criteria were also used for bone loss assessments which are an indication of periodontal disease. Where possible an estimate of the occlusion was made using Angle's classification.

DESCRIPTION OF INDIVIDUAL SKELETONS

I H M Smart

The skeletons are described in groups according to the burial groups from which they came. Age, height and the cephalic or cranial and vertical indices are listed in Table 1.

Horned Cairn Complex

Cist H contained Skeleton LL9 of a female aged 25–30.

Cist I contained Skeleton LL13 of a muscular probable female aged 35 years. The dimensions of the long bones correspond to those of a male but the skull and pelvic characteristics are predominantly female. There was fusion of the L5 vertebra with the sacrum, with severe osteoarthritic lipping of all the lumbar vertebral bodies and the invertebral joints.

Cist J contained Skeleton LL8 of a female aged 40 years. There were alveolar abscesses in the right upper molars. The upper and lower third molars were missing on each side, possibly congenitally absent. There was some osteoarthritic lipping of vertebrae, particularly on the adjacent surfaces of bodies of the seventh and eighth thoracic and fourth and fifth lumbar vertebrae.

Cist K contained Skeleton LL10 of a female aged 40 years. The upper teeth were missing on the right side, with resorption of the alveolar process and obliteration of tooth sockets. The situation on the left side appears similar but more bone was missing due to damage in excavation. The mandible bore seven well-worn teeth and four empty sockets with the alveolar margin much resorbed. The left ramus and condyle were smaller than the right ones, suggesting long term muscular predominance of the right side. Some osteoarthritic lipping of vertebral bodies was present, particularly in the lumbar region.

Cist L contained Skeleton LL12 of a female, aged 25–30 years, with good muscular markings on the bones. The head of the left femur is missing and the mushroomed neck of the bone articulates with a facet on the ilium above the atrophied acetabular fossa. The appearance is consistent with a long standing dislocation of the hip, perhaps congenital or following an epiphysitis. In life a marked limp must have been present.

Cist M contained Skeleton LL16 of a female, aged 25–30 years, with good muscular markings on the bones. The upper teeth were noticeably protuberant. The mandibular angle was about 115 degrees although all the teeth were present. There were slight osteoarthritic changes between the fifth lumbar vertebra and the sacrum.

Cist O contained Skeleton LL11 of a female, aged 30–40 years judging by the sutures, but 17–25 years (lower end of range) judging from tooth wear, a great difference. The lack of epiphyses even at the medial end of the clavicle suggests that the age was at least around 25 years and the discrepancy here may be due to the presence of widespread severe peridontal disease. All the bones on the left side of the body were substantially shorter and lighter than those on the right. The angle of torsion of the shaft of the left femur was about 75 degrees, suggesting that the limb was held in internal rotation during life. These skeletal changes are consistent with a long standing hemiplegia (one-sided muscular paralysis). There was also erosion of the mandibular condyle on the right side with shortening of the condylar neck and greater wear on the molars of the left side compared to the right. There was marked resorption of the alveolar margin related to lower left molar teeth, with heavy deposits of calculum on the surfaces.

Dumb-bell Cairn Complex

Cist E contained Skeleton LL3, a male aged 40–50 years, with big bones with good muscular markings suggesting a tall muscular man. The skull had the most pronounced features of the type 2 found in this cemetery — a high, narrow arched palate, a longish face with narrow nasal aperture and prominent nasal

bones, a slight keeling of the cranial vault, a prominent bifid chin produced by flanging of the mandible outwards on each side of the symphysis menti. There was a dental abscess in the upper left molars. Pronounced osteoarthritic changes were present in the lumbar and thoracic segments of the spine with ossification of the anterior longitudinal ligament, particularly in the region of lumbar vertebrae 3 to 5 where there was also evidence of protrusion of inter-articulate disc. A unilateral fracture through the lamina of the 3rd lumbar vertebra was also present.

Cist F contained Skeleton LL15, a female aged probably about 25 years, as the epiphyses line at the upper end of the tibia is still visible. No skull was provided for examination. The bones were stout with good muscular markings. There was no evidence of disease.

Cist G contained Skeleton LL5, probably a male, although the sex characteristics are ambiguous, aged 30–40 years. This skeleton had a bilateral fracture through the laminae of the fifth lumbar vertebra with some osteoarthritic lipping of the vertebral bodies.

Round Cairns

Cist A, in Cairn 1, contained Skeleton LL6, a male aged 35–40 years from the sutures but 17–25 years (middle of range) from dental evidence. This is another instance of disagreement between the two methods of ageing (Lorimer, below, suggests an age of 25–31). As the epiphyses were fused, including that at the medial end of clavicle, the age was probably at least 25 years.

Cist B, in Cairn 2, contained Skeleton LL14, a female aged 20–23 years.

Rectangular Cairns

Cist C, in Cairn 3, contained Skeleton LL20, a female aged 25 years. Only the skull was available for examination and it was much fragmented and required reconstruction.

Cist P, in Cairn 6, contained Skeleton LL19, a female aged about 20 years. Only the much fragmented bones of the skull and mandible, with 30 loose teeth, were available for examination. The condition of the skull sutures and slight tooth wear suggested youth.

Cist Q, also in Cairn 6, contained Skeleton LL18, a female aged 30 years. The cranial vault was reconstructed from fragments. Most of the other bones were also badly fragmented.

Cist R, in Cairn 5, contained Skeleton LL1, a male aged 30–40 years. There was slight osteoarthritis of the lumbar spine. There was an abscess in one tooth. The most striking feature of this individual was the marked difference in the form of the skull particularly the broad flat palate which contrasts with the narrow arched palate of the other skulls.

Cist S, also in Cairn 5, contained Skeleton LL2, probably male and aged 18 years (more broadly, 17–22; Lorimer, below). Only the left half of the mandible and some fragmented long bones were present.

Scattered cists

Cist T contained Skeleton LL22, a female aged 23–35 years.

Cist U contained Skeleton LL4, probably a female and aged 30–40 years from the sutures, but 17–25 years (top end) from tooth wear (analysis by Lorimer, below, concurs with the age suggested by the tooth wear). The clavicular epiphysis was fused so the minimum age was about 25 years.

Cist V contained Skeleton LL21 probably a male, and aged 20–25 years.

Cist W contained Skeleton LL7, again probably a male, and aged 20–25 years. The skull was fragmented but the vault could be restored.

Cist X contained Skeleton LL17, a male. No skull or teeth were available; the probable minimum age was in 30–35 years judging by the amount of arthritis. There was extensive osteoarthritis of the hip and sacroiliac joints, and also ossification of the insertion of the hamstrings, or ischial tuberosity and inter-muscular septae of the humerus. An old healed fracture of the right clavicle was also present.

Summary of skeletons

The cranial, or cephalic, index is the ratio of maximum skull breadth over maximum length x 100: the higher the figure the proportionately shorter the skull: the normal range is divided into dolichocephalic 65–70, mesalicephalic 70–75 and brachycephalic 75–80.

The vertical index is the ratio of maximum skull height to maximum length; the higher the figure the 'taller' the skull; the normal range is divided into chaemocephalic 65–69, and orthocephalic 70–75.

TABLE 3

Summary of skeletons.

Skeleton	Sex	Age	Cephalic index	Vertical index	Height
Dumb-bell Cist E LL3	M	35–45	79	74	179 cm (5 ft 10 in)
Dumb-bell Cist F LL15	F	25			154 cm (5 ft 1 in)
Dumb-bell Cist G LL5	M?	30–40	82	75	162 cm (5 ft 3½ in)
Horned Complex Cist H LL9	F	25–30	75	72	159 cm (5 ft 3 in)
Horned Complex Cist I LL13	F?	25–35	–	–	166 cm (5 ft 5½ in)
Horned Complex Cist J LL8	F	35–45	76	70	152 cm (5 ft 0 in)
Horned Complex Cist K LL10	F	35–45	77	66	153 cm (5 ft 0½ in)
Horned Complex Cist L LL12	F	25–30	74	70	159 cm (5 ft 3 in)
Horned Complex Cist M LL16	F	25–30	72	71	165 cm (5 ft 5 in)
Horned Complex Cist O LL11	F	25–30	69	65	156 cm (5 ft 1½ in)
Isolated Cist T LL22	F	25–35	75	71	156 cm (5 ft 1½ in)
Isolated Cist U LL4	?F	25–30	74	69	162 cm (5 ft 4 in)
Isolated Cist V LL21	?M	20–23	77	70	166 cm (5 ft 5½ in)
Isolated Cist W LL7	?M	23–25	80		167 cm (5 ft 6 in)
Isolated Cist X LL17	M	30–40?			164 cm (5 ft 5 in)
Rectangular Cairn 5 Cist R LL1	M	25–35	74	68	172 cm (5 ft 8 in)*
Rectangular Cairn 6 Cist LL20	F	17–25	82	65	
Rectangular Cairn 6 Cist P LL19	F	20			
Rectangular Cairn 6 Cist Q LL18	F	25–30	82	72	145 cm (4 ft 10 in)
Rectangular Cairn 5 Cist S LL2	M?	18			165 cm (5 ft 5 in)
Round Cairn 1 Cist A LL6	M	25–30	75	66	179 cm (5 ft 10 in)
Round Cairn 2 Cist B LL14	F	20–23	74	74	162 cm (5 ft 4 in)

* very approximately estimated from a reconstructed femur and its epiphysis

DENTAL REPORT

M Campbell-Wilson

The skulls were examined for dental base relationship, inter-arch and intra-arch relationships, caries and attrition, and alveolar bone loss. A photographic technique was devised which was based on orientations comparable with those used for cephalometric radiography. Because the skulls were so frail it was impossible to mount them accurately, and it was decided that the photos should only be used to complement the clinical findings.

Criteria for various assessments

Dental base relationships An ANB angle of zero to four degrees was considered within average limits for the angle between nasion and Down's points A and B. For skeletal pattern, antero-posterior relationships of the incisal apical bases were assessed using the method of incisor angle correction. The Frankfurt mandibular angle was ranked in five categories, as high, moderately high, average, moderately low, and low, using Walther's criteria.

Inter-arch relationships A modified angles classification was used for the relationship of the first permanent molars. The amount of attrition made assessments difficult.

Class I	Normal relationship or less than half a unit pre- or post-normal
Class II	Half a unit or more post-normal
Class III	Half a unit or more post-normal

No account was taken of forward movement of lower buccal segments following antemortem loss of lower incisors. An incisor overjet of 2–4 mm was considered average.

Class I	Average overjet
Class II, division I	Overjet increased
Class II intermediate	Overjet increased but upper incisors appeared retroclined
Class II, division 2	Central incisors with average overjet and lateral incisors with increased overjet
Class III	Decreased overjet

Results

Dental base relationships Eight of the skulls were mild skeletal II and in eight the ANB angle was increased; these characteristics were not invariably concomitant. The Frankfurt mandibular angle showed a wide range of values, the majority having lower than average values.

Inter-arch relationships In eight cases the relationship of the first permanent molars was Class II, although in six of these the relationship was only half a unit post normal. No pre-normal relationships were found. One upper first molar was in lingual cross-bite and in two other cases there was a tendency for the upper first premolars to be in a similar relationship. The preponderance of Class II labial segment relationships was striking, and also the differing skull morphologies with which the malocclusions were associated.

Caries No caries was found by the method of examination used.

Alveolar bone loss Of all the teeth present in all the skulls 8% had no bone loss. It was slight for 42%, moderate in 21% and severe for 29% of the teeth. The estimates may be on the high side due to post mortem loss of bone. The loss was most marked in the upper and lower anterior regions and in relationship to the

first permanent molars. Most of the individuals were aged 20–30 years at the time of death and periodontal disease seems to have been quite severe. All indications were that it was responsible for antemortem loss of teeth.

Although the group of skulls is small it does show that the dental base relationships as well as the arch relationships, were incompatible with a so-called ideal occlusion.

It is difficult to estimate how much of the periodontal disease and antemortem loss of the lower incisors has contributed to the malocclusions. The bimaxillary proclination shown in fig 4 may have been produced by the severe periodontal condition and as the whole right side of the skeleton was smaller than the left, other factors may have been present. Nevertheless it is not impossible that the variations in skeletal pattern were due to racial intermingling.

Small separated groups of skulls are unlikely to be representative of their period. If the group examined had become an isolated community, once a malocclusion has been established it would perpetuate. This could explain the preponderance of Class II malocclusions.

TABLE 4

Summary of main findings from dental assessments

Skull No	Skel No	ANB	FMA	Skel Pattern	Rel of FPMs	Incisal Rel	Degree LLS	Degree ULS	crowding	Age
1	LL6	inc		mod low	mild II	II	I	mild	mild	17–25
2	LL11		inc low	mod II	mild	II	II/I	mild	spaced	17–25
3	LL1	ave	low	mild II	I	II indef	N/O	none		25–35
4	LL16		inc	high II	mild	I	II/I	mod	spaced	25–35
5	LL21		inc high	mod II	mild	II	II/I	severe	severe	17–25
6	LL7	N/O	low	mild II	II	II indef	mod	mild		17–25
7	LL9	inc	ave	I	I	I	none	spaced		17–25
8	LL18	ave	mod low	I	I	I	none	spaced		17–25
9	LL13		N/O low	mod	mild	II indef	II	severe	N/O	35–45
10	LL12		ave low	mod	I	II	II/I	severe	none	17–25
11	LL4	inc	low	I	II	II/2	mild	mod		17–25
12	LL3	inc	ave	mild	I II	II/I	severe	mod		35–45
13	LL20	N/O	low	I	II	I	mild	mod		17–25
14	LLPUH	inc	ave	I	I	II/I	mod	N/O		17–25

TABLE 5

Frankfurt mandibular angles

FMA	Number of skulls
High	1
Moderately high	1
Average	3
Moderately low	5
Low	4

TABLE 6

Labial Segment Relationships

Class I	4	–	
Class II	10	Division 1	6
		Division indet.	3
		Division 2	1
Class III	0	–	

APPENDIX 2
ANALYSIS OF POSSIBLE FAMILIAL RELATIONSHIPS AMONGST THE SKELETONS FROM LUNDIN LINKS

Daphne Home Lorimer

The cist burials were arranged in a number of distinct complexes, the largest containing seven, the smallest two cists. There were, in addition, several single cists scattered in the area. It was hoped, by non-invasive techniques, to ascertain indications of possible familial relationships between the skeletons buried in each complex. Twenty-two skeletons were excavated from the site but only 20 were available for this investigation, numbers LL17 and LL22 (Smart & Campbell-Wilson, above) being missing.

METHOD

The bones were inventoried and allocated, where possible, to the appropriate cist and complex. Those bones not too fragmented and friable were measured and both cranial and post-cranial non-metrical variations, pathological conditions and enthesopathies indicative of possible occupation, were noted. The identification of the skeletons to cist was not always secure: in some cases there was no key to coding, and previous measurements and descriptions were used as possible clues to identity. Intrusive bones from second individuals were found in some boxes. A description of the reasoning behind the allocation of the bones is given, where necessary, with the report on the individual skeleton.

The sex of the skeletons was determined using the criteria given by Bass (1987) and Krogman & Iscan (1986); the age was ascertained using the degree of dental attrition given by Brothwell (1956; 1981 edn) and the degree of wear on the symphisis pubis using the Suchey-Brooks method (Brooks & Suchey 1990). Other criteria are mentioned in the text. Height was determined from the formula of Trotter & Gleser given by Brothwell (1981). Ortner & Putscher (1985) and Resnick & Niwayama (1988) were used for pathological conditions. A revised American edition of Gray's *Anatomy* (1977) was used for general anatomy. The skeletons were then studied according to their burial groups to determine familial relationship, if any, within the complex.

Since the friable and fragmented nature of many of the bones reduced the size of the sample available for metric comparison, it was decided to use the presence of some of the non-metrical or epigenetic variations in the skeleton also. These differences in ossification, formation of ossification centres, or the formation of foraminae for the passage of nerves or vessels through or between the bones are available on fragmentary material, and it is only required to note their presence or absence (Sjòvold 1984). The choice of the non-metrical variants used has to be made with care. The heritability of variants is not high, as the genetic component is only one of a number of factors affecting their formation. The cranial non-metrical variations initially scored were the 30 selected by Berry & Berry (1967) and the 30 post-cranial ones of Finnegan (1978). Of these it was decided to use the 14 cranial variations given by Sjòvold (1984) as having a heritability (H^2) between 0.15 and 0.95 with standard deviations significantly greater than zero on the zero to 75% level.

Other features such as the presence of a mylo-hyoid bridge were examined. This only occurred on one mandible and the fragmented nature of many of the cranial bases precluded examination of features such as the pterygo-spinous and pterygo-alar bridge. Where the degree of attrition made it possible, dental crown variants were studied.

TABLE 7
Heritability of 14 non-metrical traits (after Sjòvold 1984)

Non-metric trait	Heritability (H^2)
Ossicles at the lambda	0.238 ± 0.242
Lambdoid ossicles	0.563 ± 0.439
Parietal foramen absent	0.313 ± 0.125
Metopism	0.344 ± 0.376
Fronto-temporal articulation	0.954 ± 0.513
Ossicle at asterion	0.555 ± 0.196
Mastoid foramen exsutural	0.171 ± 0.215
Accessory palatine foramen present	0.196 ± 0.205
Maxillary torus present	0.679 ± 0.524
Zygo-facial foramen absent	0.269 ± 0.231
Supra-orbital foramen complete	0.378 ± 0.183
Anterior ethmoid foramen exsutural	0.182 ± 0.176

Tooth size is under genetic control which enabled scoring of hypodontia or the congenital absence of teeth to be used. Hypodontia is strongly influenced by environment (ie mother's health during gestation), but if the tooth germ is below a certain size, the tooth will not develop (Brothwell *et al* 1963). The incidence of hypodontia was unusually high in the skeletons from Lundin Links.

Similarly, but with rather more caution, torus mandibularis, a bony growth on the inner surface of the mandible, has also been scored. There is an inherited predisposition to the condition (Mollison 1993), although Ossenberg (1981) considers it to be strongly influenced by environment. It is more prevalent in the northern latitudes, being found more often among the Aleuts and Norse Icelandic settlers than in mainland Europe. Significant percentages have been found in medieval sites in Orkney (D Brothwell pers comm) and in Shetland (Lorimer 1998).

In the post-cranial skeleton, a large number of non-metrical variations are the result of stress and use, but hereditary traits such as the septal foramen in the olecranon fossa of the humerus are genetically controlled and have been included. The traits have been scored for both sides of the body separately and traits thought to be sex and age dependent are noted.

RESULTS

Skeletons in the Horned Cairn Complex

The Horned Cairn Complex contained eight cists. One in the West Cairn, Cist H contained Skeleton LL9 (marked LCA 11/66). Of five in an oval setting, three lay at an upper level: Cist I containing Skeleton LL13 (marked Com^1), Cist J with Skeleton LL8 (marked Com^3), and Cist K with Skeleton LL10 (marked Com^4). In the lower layer Cist L held the bones of Skeleton LL12 (marked Com^2) and Cist M held Skeleton LL16 (marked Com^5). To the east of the oval setting lay two horns. The north horn contained Cist N which was empty, but in Cist O in the south horn was the skeleton of LL11 (post-cranial bones marked L/C ComV1/66, but the skull possibly L/C^a V/66).

A discrepancy was found between the statures ascertained in this investigation and those formerly calculated, ie the measurements of the long bones in the box labelled *5*. L/C Com /66 (?LL16) gave a height of 153.88 cm, but the height given in the earlier report was 165 cm. The post-cranial bones in boxes labelled LC Com^4/66 (ie the same as Skull LL10) were found to produce a height of 165 cm, but the height given by the previous report was 153 cm. There was no skull found with LL16, but articulation attempted between the atlas (first cervical vertebra) from each skeleton and the occipital condyles of LL10 indicated that the post-cranial bones labelled LC Com^5 belong to Skull 10. It is presumed (but not necessarily certain) that

the post-cranial skeleton labelled LC Com[4]/66 belonged to the missing skull LL16 since the height and the pathological conditions conform to the previous report on LL16.

Of the seven skeletons examined from the Horned Cairn Complex six were female and one probably female. The age at death lay within the range 25–35 years for five skeletons. Two individuals probably died between 35 and 45 years (see Table 8).

TABLE 8

Horned Cairn Complex: age at death

Skel No	LLl2	LLl3	LL9	LL10	LL8	LL11	LL16
Age	25–30	25–40	30–35	40–45	30–35	25–35	25–29

The bones were gracile and the average height of the six skeletons with post-cranial bones was 159 cm (5 ft 2½ in) (see Table 9).

TABLE 9

Horned Cairn Complex: stature

Skel No	LLl2	LLl3	LL9	LL10	LL8	LL11	LL16
Stature	–	166 cm 5 ft 5½ in	160 cm 5 ft 3 in	154 cm 5 ft 0½ in	153 cm 5 ft 0 in	156 cm 5 ft 1½ in	165 cm 5 ft 5 in

Three of the six skulls were dolichocranic and three mesocranic. Cranial height could only be measured on five skulls due to basal damage and of these, four were of average height and one (LL10) was low. The forehead was broad in two of the four available and in two it was medium. The facial bones were mostly incomplete, but of the three nasal septa measured, one was broad, one narrow and one average, while three orbits were wide and one narrow. All five palates available were narrow.

TABLE 10

Horned Cairn Complex: indices

Skel No	LLl2	LL13	LL9	LL10	LL8	LL11	LL16
Cranial	74.6	74.7	75.7	76.5	77	72	–
Length-height	73.9	73	73	67.4	72	–	–
Mean height index	84	83	83	76.3	81	–	–
Fronto-parietal index	69	–	73.13	64.7	70	–	–
Total face index	93	–	–	76	75	–	–
Upper face index	54	–	–	–	48	–	–
Nasal index	56	–	47	–	52	–	–
Orbital index	89	–	78	82	77.2	–	–
Palatal index	91	90	91.6	99.7	84.9	–	–

All the femora available were platymeric, ie the shafts were flattened antero-posteriorly. This is a common condition among earlier populations and is thought to be due to lack of calcium, the bone taking up a shape which provided the maximum area for the attachment of muscles. Platycnemia or side-to-side flattening of the tibia was not, however, present (Oetteking 1930).

Horned Cairn Complex: non-metrical variations

Non-metric traits were available for study in six of the crania and, of the 14 traits given by Sjòvold, an ossicle was found in the lambda of one skull, lambdoid ossicles found on three sides, the parietal foramen was absent on five sides, an ossicle at the asterion on one side only, but the mastoid foramen was exsutural in seven sides (out of five skulls); the accessory lesser palatine foramen was present on two sides; the zygomatic facial foramen present on three sides as was the supra-orbital foramen. Metopism, the fronto-temporal articulation, the maxillary torus and the ex-sutural anterior ethmoid foramen were not present at all (see Table 12).

TABLE 11
Horned Cairn Complex: number of variants found either in midline or on each side in each skull

Skel No	LLl2	LLl3	LL9	LL10	LL8	LL11	LL16
No variants	6	2	4	6	2	5	–

Berry (1978) concluded that even minor variations in the dental crowns have a strong element of genetic control although they are influenced by environmental factors. Unfortunately, caries and tooth wear make scoring difficult and limit their usefulness. This (and edentulous jaws) was particularly true of the Lundin Links material. Of interest was perhaps the presence of slight shovelling of the maxillary incisors in LLl3 and LL9 and the mandibular incisors in LLl2 and LL13, while cingulum nodules were found on the upper second incisors of LL12, LL13 and LL9 and on the upper canines of LLl2 and LL9. There were one or more teeth congenitally missing out of four of the six dentitions available for examination (ie 66%). This high proportion must indicate the influence of a strong genetic factor.

Most of the non-metrical variants of the post-cranial skeleton were probably the result of use (see Table 13), but of possible genetic interest was the surprising number of humeri with an aperture between the olecranon and coronoid fossae (the septal aperture). The variant was found on seven sides of five skeletons and was of Type 2 (a small aperture less than the full size of the fossa) This part of the humerus is very thin and the phenomenon can be the result of post-mortem damage, but, in these cases the edges of the apertures were smooth and did not have the appearance of breakage.

Skeleton LL12 (from cist C^2/ Acc. No. 1973 — 860 from AB-1972–59). The post-cranial bones of LL12 and LL13 have, at some period, been mixed and, using compatible articulation and all available information, an attempted separation has been made. Some bones, however, appear to be missing. Skeleton LL12 was that of a female of about 25–30 years at the time of death. She had a long head of average height, average width of face with broad nasal apertures and a narrow palate. Among the few non-metrical variations present, torus mandibularis was significant. A dislocated left hip, a dental abscess and periodontal disease were present. There was hypodontia of the left second premolar.

Skeleton LL13 (from L/C^1/66 Acc. No. 1973 861 from CM/51B/4). Skeleton LL13 was that of a female of about 25–40 years at the time of death. She was about 155 cm (5 ft 0½ in) in height, with a long head (average in height). There was flattening of the upper part of the femoral shaft. The non-metrical variations both in the cranial and post-cranial bones, from those available, seemed few, although the absence of the lower third molars suggested the presence of hypodontia and torus mandibularis was present, both possible familial traits. Cribra orbitalia indicated anaemia in childhood. Periodontal disease and a root abscess were noted, as well as osteoarthritis of the diarthrodial joints of the upper cervical spine. There were extensive osteoarthritic changes in the vertebrae and in the fingers of the left hand. There was evidence of intervertebral disc lesions in the lower thoracic and lumbar spine.

Skeleton LL9 (L/CA 11/66 Acc. No. 1980 721). Skeleton LL9 was that of a female 30–35 years old at the time of death and about 161.5 cm (5 ft 3 in) in height. Her skull shape was average, but the nasal aperture was narrow, while the palate was broad. There was antero-posterior flattening of the femora. Degenerative changes were seen on the upper three thoracic vertebrae and a possible Schmorl's node on T2 suggested an intervertebral disc lesion. There appeared to be scoliosis of the spine in the region of L1 and L2.

Skeleton LL10 (L/C Com^4/66). The skull was probably that of a female of about 40–45 years. The cranial index was average, but the skull was low with a narrow forehead, although the face and palate were broad. Non-metrical variations were few.Of interest was possible hypodontia of the left lower first or second premolar: the X-ray shows the socket of the canine (lost post-mortem) adjacent to only one premolar.

TABLE 12

Horned Cairn Complex: non-metrical variations of the cranium

Skel No	LL12	LLI3	LL9	LL10	LL8	LL11	LLl6
Highest nuchal line present							
Ossicle at lambda						+	
Lambdoid ossicle present	L	+					
Parietal foramen absent	+		L	R		L	
Bregmatic bone present						–	
Metopism							
Coronal ossicle present						–	
Epiteric bone present		–				– –	
Fronto-temporal articulation		–				– –	
Parietal notch present							
Ossicle at asterion	R						
Auditory torus present							
Foramen of Huschke present				+			
Mastoid foramen exsutural	R	R	–	R	+		+
Mastoid foramen absent	L	–					
Posterior condylar canal patent		+			–	–	
Condylar facet double		R			–		
Precondylar tubercle present						+	
Anterior condylar canal double		+		R			
Foramen ovale incomplete			–				
Foramen spinosum open		L		R			
Accessory lesser palatine foramen present				+		– –	
Palatine torus present							
Maxillary torus present							
Zygomatico facial foramen present		–	–	+		R	–
Supraorbital foramen complete			R		+		
Frontal notch or foramen present	L		R	+		–	–
Anterior ethmoid foramen exsutural	– –				– –		
Posterior ethmoid fora. absent	– –	– –				– –	
Acc. infraorbital foramen present		–	–				– –

+ = both sides, R = right side, L = left side, – = part missing.

As previously stated, it is assumed that the post-cranial bones labelled Com[5] do, in fact, belong to this skull and are those of a female of at least 40 years (and probably more) of age at the time of death and 153.8 cm (5 ft $0\frac{1}{2}$ in) in height. There was antero-posterior flattening of both femora and possible evidence of right handedness. There were marked degenerative changes in the spine and articular surfaces of the long bones, and evidence of disc lesions. The non-metrical variations were few and use-related.

Possibly LL16 Post-cranial bones found with L/C Com[4]/66 (LL10). The post-cranial bones labelled L/C Com[4]/66 were those of a female of probably 25–29 years at the time of death and about 165 cm (5 ft 5 in) in height. There was antero-posterior flattening of both femora and there was a possible lesion of the intervertebral disc between the seventh and eighth thoracic vertebrae and osteophytic lipping of the lower lumbar vertebrae. Of possible familial interest was the presence of a septal aperture in the humerus.

Skeleton LL8 (C[3]/66 1980 718 AR 1978 129). Skeleton LL8 was that of a gracile female of over 30 years old. She was about 153 cm (5 ft) in height with a mesocranic cranial index. Non-metrical variations were few, but of interest was the atlas facet form, a septal aperture on the right humerus and hypodontia of all the third molar teeth. Possible evidence of anaemia in childhood was found and there was evidence of intervertebral disc lesions, a degenerative condition in the spine and ribs and periodontal disease of the alveolar margin of the maxilla. Lytic lesions on the skull could be metastatic or, more possibly, a pseudo-pathology.

TABLE 13

Horned Cairn Complex: non-metrical variations of the post-cranial skeleton

Skel No	LL12	LL13	LL9	LL10	LL8	LLl6	LL11
Allen's Fossa	R	–	–	–	–	–	–
Poirier's facet	–	– –	– –	– L	R –	R –	R –
Plaque	–	– –	– –	–	– –	R –	R –
Hypertrochanteric fossa		– –					
Exostosis in trochanteric fossa	R	– –		+	+		L
Third trochanter		– –					
Medial tibial squatting facet	–	– –	–	+	+		L R
Lateral tibial squatting facet	+	– –	–	+	+	–	L
Supracondyloid process		– –					
Septal aperture	– L	– –		+	R –	R	– –
Acetabular crease		– –			R		
Pre-auricular sulcus	+	– –	+	+	+	R	
Accessory sacral facet		– –					
Acromial articular facet	– –	– –					
Suprascapular foramen	– –	– –					
Circumflex sulcus		– –	L	+	+		
Vastus notch	– –	– –					
Vastus fossa	– –	– –					
Emarginate patella	– –	– –					
Os trigonum		– –	– –				
Medial talar facet		– –	– –	– –		–	– R
Lateral talar extension		– –	– –	– –		–	– R
Inferior talar articular surface		– –	– –	R –		+	
Anterior calcaneal facet double		– –	– –	L		+	
Anterior calcaneal facet absent		– –	– –				
Peroneal tubercle		– –	– –	– –		+	
Atlas facet form		– –			L		
Posterior bridge on atlas	+	– –					
Lateral bridge on atlas		– –				L	
Transverse foramen bipartite	R	– –		L	R		

+ = both sides, R = right side, L = left side, — = part missing.

Skeleton LL11 (post-cranial bones labelled L/C Com VI/66. Skull L/CV^{A} /66). The boxes containing the five skeletons from the round cairn of the 'horned complex' all appeared to be marked 'Com' with a superscript number 1–5. The skeleton in the west end cairn was given the Roman numeral II, while the post-cranial bones of skeleton in the southern crescent to the east appears to have been given the numeral VI. Its skull, LL11, was reconstructed from bones selected from fragments of two skulls found in a box labelled L/CV^{A}/66, one parietal fragment of which was marked LL11. The very marked curvature of the occipital condyles of this skull matched the condylar facets of the atlas of L/C ComVI/66, but the atlas and articulation could not be completely reconstructed. The cephalic index matched that from the previous report (Smart & Campbell-Wilson, above), as did the periodontal disease of the mandible and the presence of gross calculus. The wear on the maxillary and mandibular teeth matched. The right condylar process was missing, however, and comparison with the left side impossible. The neck of the left side was very short and, contrary to the previous report, it was the teeth on the right side which showed the greater wear, which poses a query about identification but is ascribable, more probably, to a typing error. The probability is that these were the skull and long bones of the skeleton from the southern crescent of the horned complex.

The skeleton was of a female, probably over 30 years at the time of death and 156 cm (5 ft 1 $\frac{1}{2}$ in) in height. She was gracile in build with a small dolichocranic head and not only antero-posterior flattening of the femoral shafts, but side to side flattening of the tibiae. Among the non-metrical variations were some due to activity (notably an os acromiale of the right scapula), but of possible familial significance was a torus mandibularis. There was marked shortening of the bones on the left side of the body suggesting long standing hemiplegia and possible evidence of a healed fracture of the fifth cervical vertebra. Osteophytosis

was present in the spine and articular joints and there was evidence of possible lesions of the intervertebral discs.

Skeletons in the Dumb-bell Cairn Complex

The Dumb-bell Cairn Complex consisted of two round cairns containing, to the west, Cist E (Skeleton LL3) and to the east Cist G (Skeleton LL5), joined by a rectangular long cist, Cist F (LL15). It is possible that the second skull and long bones from boxes labelled L/L^{A}/V/66, which contained the skull of LL11, are those of LL15.

The three skeletons found in the Dumb-bell cists were those of two males (LL3 & LL5) and a female, LL15 (possibly LL/V/66). The two males lay in the age range 33–45 years and the female was 24–29 years at the time of death.

TABLE 14

Dumb-bell cairn complex: age at death

Skel No	LL3	LL5	LL15
Age at death	35–45	35–45	24–29

The post-cranial bones of one male, LL3, were missing, although the skeleton was originally recorded as having a height of 179.5 cm (5 ft 10 in). The second male, LL5, was about 160 cm (5 ft 3$\frac{1}{2}$ in) in height and the female about 154 cm (5 ft $\frac{3}{4}$ in) tall.

TABLE 15

Dumb-bell cairn complex: height

Skel No	LL3	LL5	LL15
Height	179.5 cm 5 ft l0 in	161 cm 5 ft 3 $\frac{1}{2}$ in	154 cm 5 ft 0 $\frac{3}{4}$ in

The cranial bones of LL15 were too fragmented for measurement but of the two males, the skull of LL3 was average in shape, of an average height with a narrow forehead, average shaped face and nasal aperture, but the orbits and the palate were narrow. The skull of LL5 was hyperbrachycranic, but no facial measurements were possible. The chest was probably very wide. The femora of both LLS and LL15 were platymeric. No platycnemial was found on the tibia.

TABLE 16

Dumb-bell cairn complex: cranial indices

Skel No	LL3	LL5	LL15
Cranial index	76	–	–
Mean height index	81	–	–
Fronto-parietal index	64.9	68	–
Total facial index	89	–	–
Upper facial index	54.9	–	–
Nasal index	34.9	–	–
Orbital index	89.2	–	–
Palatal index	–	–	–

Of the non-metric cranial variations given by Sjòvold, only the mastoid foramen was found exsutural on both sides in both LL3 and LL5. In addition, LL3 had an ossicle at the lambda and the supra-orbital foramen complete. LL5 also had lambdoid ossicles and absent parietal foraminae on both sides The total number of non-metrical variations found either on the midline or on both sides of the cranium of each skeleton was as follows: LL3 — 5; LL5 — 6; LLl5 — 0.

The teeth were either too worn or absent for dental crown variants to be scored, but on LL5 a grooved cingulum was noted on the second upper incisor and shovelling of one mandibular incisor. The post-cranial non-metrical traits were all indicative of use.

Skeleton LL3 (from Cist E; HH/RA Acc. No. 1990–32). A complete skeleton was reported from the excavation, but only the skull has been received. The skull criteria were those of a male. The wear pattern of the teeth indicated an age of about 35–45 years at the time of death. The cranial index was average with narrow nasal aperture and high arched palate. The gonial region of the mandible was very flaring and the jaw was square with a deep indentation at the gnathion. Among the non-metrical variations a torus mandibularis was noted.

Skeleton LL5 (from Cist G; Acc. No. 1980–728 AR 1978–122). Skeleton LL5 was possibly that of a male (although the characteristics of the bones were ambiguous) of between 33 and 45 years at the time of death and about 162 cm (5 ft 3½ in) in height and very brachicephalic. There was a possible congenital malformation of the base of the skull and possible evidence of a systemic disturbance during childhood which might have been tubercular. Skeletal changes also indicated excessive load-bearing. The wide ovate sternum suggested a broad chest. Torus mandibularis was present.

L/C^{A} V/66 (Acc. No. 1973 869: possibly LL15 from Dumb-bell Cairn Complex). Fragments of a second skull (part of base - since reconstructed) were found with a skull, fragments of which were marked 'LL1 1'. A second box of post-cranial bones, bearing the same code, was found. The age and the height suggest that this could be the missing skeleton, LL15 from the Dumb-bell Cairn Complex, although '?LL2' is written on the lid. The details do not, however, fit LL2.

TABLE 17

Dumb-bell cairn complex: non-metrical variations of the cranium

Skel No	LL5	LL15	LL3
Highest nuchal line present			
Ossicle at lambda			+
Lambdoid ossicle present	+		
Parietal foramen absent	+		– –
Bregmatic bone present			
Metopism			
Coronal ossicle present			
Epiteric bone present			
Fronto-temporal articulation			
Parietal notch present			
Ossicle at asterion	L		
Auditory torus present			
Foramen of Huschke present			
Mastoid foramen exsutural	+		+
Mastoid foramen absent			
Posterior condylar canal patent			+
Condylar facet double	– –		
Precondylar tubercle present			
Anterior condylar canal double			R
Foramen ovale incomplete	–		
Foramen spinosum open	–		
Accessory lesser palatine foramen present	– –		
Palatine torus present	– –		+
Maxillary torus present	– –		
Zygomatic facial foramen absent	– –		+
Supra-orbital foramen complete			R
Frontal notch or foramen present	R		L
Anterior ethmoid foramen exsutural	– –		
Posterior ethmoid foramen absent	– –		
Accessory infra-orbital foramen present	– –		+

+ = both sides, R = right side, L = left side, — = part missing

TABLE 18

Dumb-bell cairn complex: non-metrical variations of the post-cranial skeleton

Dumb-bell cists	LL5	LL15	LL3
Allen's fossa	–		
Poirier's facet	R –	+	
Plaque	–		
Hypertrochanteric fossa	–		
Exostosis in trochanteric fossa	R –		
Third trochanter	–		
Medial tibial squatting facet	–		
Lateral tibial squatting facet	R –	+	
Supracondylar process	–		
Septal aperture			
Acetabular crease			
Pre-auricular sulcus			
Accessory sacral facet			
Acromial articular facet			
Suprascapular foramen			
Circumflex sulcus	L		
Vastus notch	+		
Vastus fossa			
Emarginate patella			
Os trigonum			
Medial talar facet			
Lateral talar extension			
Inferior talar articular surface double	+		
Anterior calcaneal facet double	+		
Anterior calcaneal facet absent			
Peroneal tubercle	L		
Atlas facet form			
Posterior bridge on atlas			
Lateral bridge on atlas			
Transverse foramen bipartite			

+ = both sides, R = right side, L = left side, – = part missing

This skeleton was that of a female 24–29 years old at the time of death and 154 cm (5 ft $\frac{3}{4}$ in) in height. The non-metrical variations were few, but the right first metatarsal was very small and an unusual articular facet was found on the medial margin of the proximal end.

Skeletons in single round cairns

The two round cairns (Cairns 1 & 2) lying to the north-west area of the excavated site were separated by a small gap and contained, in Cairn 1/Cist A, Skeleton LL6 and, in Cairn 2/Cist B, Skeleton LL14. From the details reported above and comparison of the available bone measurements, it is assumed that these cairns are in Site A and that the skeleton labelled Site A LI ?l/66 Acc. No. 1973 - 871 is, in fact, LL14 from Cairn B.

The skeletons in the twin cairns were of a male (LL6) 25–31 years and a female (LL14) of about 18–25 years. The male was about 180 cm (5 ft 11 in) in height and the female about 160 cm (5 ft 3 in) tall. Both skulls were dolichocranic. The female skull was high, but the height of the male not obtained. The forehead was average in width, the nose and orbits narrow in both cases. The palate, however, was broad in the male, but average in the female.

Platymeria was present in the femora, but no platycnemia in the tibiae

Of the cranial non-metrical variations used by Sjòvold, both skulls had exsutural mastoid foraminae on both sides. In addition, LL6 had a lambdoid ossicle on the left side, absent parietal foraminae and

TABLE 19

Single round cairns: cranial indices

Skel No	LL6	LL14
Cranial index	70.67	74.3
Mean height index	–	84.6
Fronto-parietal index	67.8	68.3
Total facial index	–	–
Upper facial index	–	–
Nasal index	50.9	43.9
Orbital index	90.2	93.9
Palatal index	92.6	82.3

accessory lesser palatine foraminae on both sides. Skull LL14 also had complete supra-orbital foraminae on both sides. The total varieties either in midline or by each side were LL6–7 and LL14–4.

Two dental crown variants only were seen on LL6: a grooved cingulum on the first and second upper incisors. On the teeth of LL14, however, a grooved cingulum was seen on the upper first incisor, a cingulum nodule on the upper canine, five cusps on the first upper molar and Caribelli's phenomenon was present. In the mandible, there was an extra cusp on the second premolar. There was no hypodontia or torus mandibularis.

TABLE 20

Single round cairns: non-metrical variations of the cranium

Skel No	LL6	LL14
Highest nuchal line		
Ossicle at lambda		
Lambdoid ossicle present	L	
Parietal foramen absent	+	
Bregmatic bone present		
Metospism		
Coronal ossicle present		
Epiteric bone present		
Fronto-temporal articulation		
Parietal notch present		
Ossicle at asterion		
Auditory torus present		
Foramen of Huschke present		
Mastoid foramen exsutural	+	+
Mastoid foramen absent		
Posterior condylar canal patent	+	+
Condylar facet double	+	
Precondylar tubercle present		+
Anterior condylar canal double		
Foramen ovale incomplete		
Foramen spinosum open		
Accessory lesser palatine foramen present	+	
Palatine torus present		
Maxillary torus present		
Zygomatico facial foramen absent	L	
Supra-orbital foramen complete		+
Frontal notch or foramen present		
Anterior ethmoid foramen exsutural	–	
Posterior ethmoid foramen absent	– –	
Accessory infra-orbital foramen present		

+ = both sides, R = right side only, L = left side only, – = part missing

Skeleton LL6 (Cist A skull LL6 L/L^{A} IV/66). LL6 is the skeleton of a male aged 25–31 years old at death and about 180 cm (5 ft 11 in) in height. There is evidence of disc lesions and possible evidence that he may have been carrying heavy objects cradled in the arms (King 1969, 116–23).

Skeleton LL14 (Site A L/L ?1/66 Acc. No. 1980 726). In the boxes with the post-cranial bones were found fragments of right and left fibulae from a second skeleton and the bones of a complete right foot strung together in articulation, oily to touch and yellow in colour. This was probably intrusive and part of an anatomical teaching specimen.

Skeleton LLl4 was that of a female of about 18–25 years and about 160 cm (5 ft 3 in) in height. The skull was dolichocranic and had a small shallow osteoma on the squamous portion of the right temporal bone. There was marked periodontal disease on both alveolar margins. There was evidence of lesions of the intervertebral discs and there was a discrepancy in measurements between the bones of the right and left sides.

TABLE 21

Twin cairns: non-metrical variations of the post-cranial skeleton

Skel No	LL6	LL14
Allen's fossa	–	
Poirier's facet	– L	
Plaque	– L	
Hypertrochanteric fossa		
Exostosis in trochanteric fossa		
Third trochanter		
Medial tibial squatting facet	+	+
Lateral tibial squatting facet	+	+
Supracondylar process		
Septal aperture		
Acetabular crease		
Pre-auricular sulcus		R
Accessory sacral facet		
Acromial articular facet		+
Suprascapular foramen		
Circumflex sulcus		
Vastus notch	L	
Vastus fossa		
Emarginate patella		
Os trigonum		
Medial talar facet		
Lateral talar extension	L	
Inferior talar articular surface double	+	
Anterior calcaneal facet double	+	
Peroneal tubercle	+	
Atlas facet form	+	+
Posterior bridge to atlas		
Lateral bridge to atlas		
Transverse foramen bipartite	+	

+ = both sides, R = right side only, L = left side only, – = part missing

Skeletons under rectangular cairns

Three skeletons were found beneath rectangular cairns. Skeleton LL20 came from Cist C in Cairn 3 while LL18 and LL19 were from Cists Q and P in Cairn 6.

The skeletons were those of three females, LL20 aged between 20 and 30 years, LL19 aged about 20 and LL18 aged 30–40 years at death. There were no post-cranial bones for LL20, and those of LLl9 were

few and very friable. The skulls of both were very fragmented. There was hypodontia of both lower third molars in LL18, while LL18 and LL19 exhibited dental crown variants. LL20 was edentulous.

TABLE 22

Rectangular cairns: dental crown variants

Skel No	LL19	LL18
Maxilla		
Shovelling of I		+
Grooving of cingulum on I^1		
Grooving on cingulum on I^2		
Cingulum nodule present on I^1		+
Cingulum nodule present on I^2		+
Cingulum nodule present on C	+	+
Extra labial cusp on PM^1		
Extra labial cusp on PM^2		
Extra lingual cusp on PM^1		
Extra labial cusp on PM^2		
Cusp number other than 4 on M^1		
Cusp number other than 4 on M^2		
Caribelli's pit present – Caribelli's phenomenon present		
Mandible		
Shovelling of I		
Extra labial cusp on PM^1		
Extra labial cusp onPM^2		
Extra lingual cusp on PM^1		
Lingula groove on PM^1		+
Extra lingual cusp onPM^2		+
Lingual groove on PM^2		+
Furrow instead of pits on PM^1		
Pits instead of furrows on PM^2		
Cusp number other than 5		
Cusp number other than 4		

Skeleton LL20 (Cist C from Cairn 3 Acc. No. 1980 719). No post-cranial bones were available and the skull was very fragmented, the cranium only being available for partial reconstruction. The skull was that of a female of 20–30 years. The age was calculated from union of the cranial sutures which can vary considerably and is considered unreliable. Those sutures available were still open (Stage 0) which, according to the table adapted from Acsádi & Nemeskéri by Krogman & Iscan (1986, 121) gives a mean age of 28.6 years with a standard deviation of 13.08. There were no depressions for Pacchionian bodies present and the grooves for the middle meningeal artery were not particularly marked which indicated an age of under 40 years. Of the eight possible non-metrical variations, only a possible lambdoid ossicle was present; the ossicle was missing, but was indicated by the surrounding sutures.

Skeleton LL19 (L/C^A III ^{1}/66 Acc. No. 1973–870). Skeleton LL19 consisted of very fragmented bones of the skull and some fragmented and friable bone-fragments of the post-cranial skeleton. They were those of a female of twenty, height and cranial index unknown. Non-metrical variations were few. There was evidence of a systemic disturbance between the ages of three and four years.

Skeleton LL18 (L/L^A III^2 /66 Acc. No. 1980–727 Cist Q in Cairn 6). The skeleton was that of a female between 30–40 years. Her skull was brachicephalic in shape and of average height. Both her femora were platymeric. There was hypodontia of the third mandibular molars and some periodontal disease of the lower jaw.

TABLE 23

Rectangular cairns: non-metrical variations of the cranium

Skel No	LL20	LL19	LL18
Highest nuchal line present			
Ossicle at lambda	+	+	
Lambdoid ossicle present	+	+	+
Parietal foramen absent			
Bregmatic bone present	– –	– –	– –
Metopism			
Coronal ossicle present		– –	– –
Epiteric bone present	– –	– –	– –
Fronto-temporal articulation		– –	– –
Parietal notch present	– –	– –	– –
Ossicle at asterion	– –		
Auditory torus present	– –		
Foramen of Huschke present	– –	–	
Mastoid foramen exsutural	– –		
Mastoid foramen absent	– –		
Posterior condylar canal patent	– –	R L	R L
Condylar facet double	– –		
Precondylar tubercle present	– –		
Anterior condylar canal double	– –		
Foramen ovale incomplete	– –		
Foramen spinosum open	– –		
Accessory lesser palatine foramen present	– –	– –	– –
Palatine torus present	– –		
Maxillary torus present	– –		
Zygomatico facial foramen absent	– –	R	–
Supra-orbital foramen complete			
Frontal notch or foramen present			R
Anterior ethmoid foramen exsutural	– –	– –	– –
Posterior ethmoid foramen absent	– –	– –	– –
Accessory infra-orbital foramen present	– –	– –	– –

+ = both sides, R = right side, L = left side, – = part missing

Skeletons in scattered cists

Five scattered cists were excavated, numbers LL4, LL7 and LL21 being available for examination. Two, numbers LL17 and LL22, were not found with the present assemblage.

The three skeletons were two males, LL7 and LL21 aged 20 to 25 years and 17 to 25 years, respectively, at the time of death; and a female, LL4, aged between 17 and 25 years.

There were no post-cranial bones for LL2l, but LL4 was 155cm (5ft 1 in) and LL7 168 cm (5 ft 6 in) in height, respectively. Two skulls were brachycranic and one average in shape with average height for LL4 and LL21. The forehead of LL4 was narrow but that of LL2l average. Where measured, the nasal apertures were narrow, but the orbit of LL4 was narrow, while that of LL21 was average. The palates of LL4 and LL7 were broad, but that of LL21 was narrow.

Of the non-metrical variations given by Sjòvold, LL7 and LL21 both had an ossicle at the lambda and the parietal foraminae were absent on both sides in LL4, and on the right side of LL7 and LL21. In addition, LL4 had the foramen spinosum open, LL21 had the mastoid foramen exsutural and the supra-orbital foramen complete, while LL7 had an ossicle in the right lambdoid suture.

Only LL21 had any dental crown varieties: a grooved cingulum on the upper I^1 and I^2 and four cusps on the lower M^1. There was no hypodontia nor torus mandibularis. There were no relevant post-cranial non-metrical variations.

Skeleton LL4 (Cist U Acc. No. 1980 — 729). The boxes containing this skeleton are marked LL4, but a discrepancy was found between the estimated stature and the cranial indices produced for this report and

TABLE 24

Rectangular cairns: non-metrical variations of the post-cranial skeleton

Skel No	LL20	LL19	LL18
Allen's fossa	– –	–	–
Poirier's facet	– –	–	–
Plaque	– –	–	–
Hypertrochanteric fossa	– –	–	–
Exostosis in trochanteric fossa	– –	–	–
Third trochanter	– –	–	–
Medial tibial squatting facet	– –	–	– –
Lateral tibial squatting facet	– –	–	– –
Supercondylar process	– –	–	–
Septal aperture	– –	–	–
Acetabular crease	– –	–	–
Pre-auricular sulcus	– –	–	–
Accessory sacral facet	– –	–	–
Acromial articular facet	– –	–	– –
Suprascapular foramen	– –	–	– –
Circumflex sulcus	– –		–
Vastus notch	– –	–	–
Vastus fossa	– –	–	–
Emarginate patella	– –	–	–
Os trigonum	– –	–	– –
Medial talar facet	– –	–	– –
Lateral talar extension	– –	–	– –
Inferior talar articular surface	– –	–	– –
Anterior calcaneal facet double	– –	–	– –
Anterior calcaneal facet absent	– –	–	– –
Peroneal tubercle	– –	–	– –
Atlas facet form	– –		
Posterior bridge on atlas	– –		
Lateral bridge on atlas	– –		
Transverse foramen bipartite	– –		

+ = both sides, R = right side, L = left side, – = part missing.

TABLE 25

Scattered cists: cranial indices

Skel No	LL4	LL7	LL2l
Cranial index	83	80	75
Mean height index	81	–	75
Fronto-parietal index	61	–	65.9
Total facial index	–	–	–
Upper facial index	–	–	–
Nasal index	40	–	43.5
Orbital index	98	–	87
Palatal index	98	–	79.8

those of the earlier one. The sexual criteria of these bones were unequivocal whereas the previous report suggests they were indeterminate.

The skeleton was that of a female about 25 years old at death and about 155 cm (5 ft 1 in) height. There is evidence of a systemic disturbance with possible anaemia during early childhood. The non-metrical variations are few, but those in the post-cranium indicate flexion of the joints, possibly due to sitting cross-legged.

Skeleton LL21 (Acc, No. 1980 723 AR 1978 105). There is some confusion in the box labelling between LL7 and LL21. However, the cranial bones match those of LL21 in the previous report (Smart & Campbell-Wilson, above); the post-cranial bones indicated in that report have not been located.

The skull of LL21 was probably that of a man of about 17–25 years at the time of death. Since the post-cranial bones were missing, it was not possible to estimate his height, but the cranial indices were average, although the nasal aperture and the palate were narrow. The non-metrical variations were few, but of interest was an ossicle at the lambda, a parietal foramen present, and mastoid foramina exsutural, and marked bilateral winging of the upper central incisors. There was evidence of systemic disturbance at about two to three years of age.

Skeleton LL7 (Acc. No. 1980 - 724 AR 1978 107). There is some confusion in the box labelling between LL7 and LL17. However, the bones match those of LL7 in the previous report (Smart & Campbell-Wilson, above).

Skeleton LL7 was that of a male of 20–25 years and about 168 cm (5 ft 6 in) in height . Non-metrical variations were few, but there was evidence of squatting. A small exostosis was seen on the superior surface of the palatal process of the right maxilla.

Second skeleton One epiphysis and two carpal bones (one capitate and one pisiform) from a second larger skeleton were found together with four skull fragments which did not fit LL7.

TABLE 26

Scattered cists: non-metrical variations of the crania

Skel No	LL4	LL21	LL7
Highest nuchal line	+	+	
Ossicle at lambda		+	+
Lambdoid ossicle present		R	
Parietal foramen present		L	L
Bregmatic bone present			
Metopism			
Coronal ossicle present			
Epiteric bone present			
Fronto-temporal articulation			
Parietal notch present			– –
Ossicle at asterion			– –
Auditory torus present			– –
Foramen of Huschke present			– –
Mastoid foramen exsutural		R	– –
Mastoid foramen absent		L	– –
Posterior condylar canal patent	L	R	– –
Condylar facet double			– –
Precondylar tubercle present	+		– –
Anterior condylar facet double			– –
Foramen ovale incomplete			–
Foramen spinosum open	R		– –
Accessory lesser palatine foramen present			– –
Palatine torus present			– –
Maxillary torus present			– –
Zygomatic facial foramen absent	–	L	L –
Frontal notch or foramen present		L	–
Anterior ethmoid foramen exsutural			– –
Posterior ethmoid foramen absent		– –	– –
Accessory infra-orbital foramen present	– –		– –

+ = both sides or centre-line, R = right side, L = left side, – = part missing

Disturbed burial The bones of a primary burial, LL2, were said to be disturbed by a secondary burial LL1, but the bones found in the four sections possibly attributed to this code (AB-1970–104, 108, 109 & 110)

TABLE 27

Scattered cists: non-metrical variations of post-cranial bones

Skel No	LL4	LL21	LL7
Allen's fossa	R	– –	–
Poirier's facet		– –	R –
Plaque		– –	–
Hypertrochanteric fossa		– –	–
Exostosis in trochanteric fossa	R	– –	–
Third trochanter		– –	–
Medial tibial squatting facet	R L	– –	– L
Lateral tibial squatting facet	R L	– –	– L
Supercondylar process	– –	– –	
Septal aperture	– –	– –	
Acetabular crease		– –	
Pre-auricular sulcus	R	– –	L
Accessory sacral facet		– –	
Acromial articular facet	– –	– –	
Suprascapular foramen		– –	
Circumflex sulcus		– –	
Vastus notch		– –	
Vastus fossa		– –	
Emarginate patella		– –	
Os trigonum		– –	
Medial talar facet		– –	
Lateral talar extension		– –	
Inferior talar articular surface		– –	
Anterior calcaneal facet double		– –	
Anterior calcaneal facet absent		– –	
Peroneal tubercle		– –	– –
Atlas facet form		– –	
Posterior bridge to atlas		– –	
Lateral bridge to atlas		– –	
Transverse foramen bipartite		– –	

+ = both sides or midline, R = right side, L = left side, – = part missing

appeared to come from three, not two individuals. There were in fact three right petrous-temporal bones present: one on the skull labelled LL1 (Acc. No. 1990–33), one in the bag of fragments with AB-1970–110 and one with the bone fragments of AB-1970–109. Further examination revealed discrepancies among the other post-cranial bones.

The skull labelled 'LL1' matched the description given, but among the available fully adult post-cranial bones, no lumbar vertebrae with osteoarthritis were found and an estimation of stature from the incomplete fragments of adult humeri in AB-1970–109 (Krogman & Iscan 1986) did not match that previously given for LL1. Neither did these bone fragments match those described for LL2, since the half mandible included was that of the right side of an adult of about 25–35 years and not that of a sub-adult of about 17–20 years.

Among the post-cranial bones found with AB-104, 108 & 110 there appeared to be those of a sub-adult, epiphyseal union indicating an age of about 18 years. One part of an os innominatum was found in AB-1970–104 which fitted part of one in AB-1970–110 suggesting that they were bones from the same skeleton.

Skeletons LL1 and LL2 revealed very little information except that LL2 was probably a sub-adult 17–22 years old, while LL1 was probably a mature adult of 33–45 years with a dolichocranic skull, narrow nasal aperture and orbits, but a very broad palate and square chin. Of Sjòvold's traits, a lambdoid ossicle and an exsutural mastoid foramen were present.

Skeleton LL2 (Acc. Nos.1980–730 and 732 AR 1978–104 and probably 108 & 110). The bones found in sections labelled AB 1978–104, 108 & 110 were probably all from the same skeleton and were those of a sub-adult who, according to the degree of epiphysial union, was 17–22 years old. Very few non-metrical traits were available.

Skeleton LL1 (Acc. No.1990 33). The post-cranial bones were missing but the skull was that of a mature male adult of about 33–45 years according to dental attrition (Brothwell 1956; 1981). The skull was dolichocranic, the nasal aperture and orbits narrow, but the palate was very broad. The chin was very square. There were ten non-metrical traits present out of a possible total of 54. Of these the lambdoid ossicle, the ex -sutural mastoid foraminae and the incomplete foramen ovale were of possible familial interest. There was a slight degree of torus mandibularis in the region of the molar teeth on both sides, and abscesses at the roots of the two left first and the right upper second molars.

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