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From TWO CISTS FROM BOATBRIDGE QUARRY, THANKERTON, LANARKSHIRE

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THE SKELETAL REMAINS

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with a report on the dentition by N W Kerr+ and Dorothy A Lunt'

The skeletons comprise a male adult and a child in Cist 1 and a male adolescent in Cist 2, and there is no indication of any other burial. The bones are fragile and many are slightly damaged, but the skeletons, other than that of the child, are complete except for some of the small bones of the limbs. Almost all the features of the pelvis are typically male in type; in the skull the eyebrow ridges and mastoid processes are prominent while, in general, the bone ridging, grooving and muscle attachments are all so strongly marked that the masculinity of the adults is as certain as can be. The age of the child and the state of its skeleton preclude the possibility of any reasonable attempt at sexing.

The adult, aged about 40, was some 1.75m tall and the adolescent slightly taller, about 1.8m. Measurements of long bones and estimates of height are given in Table 1.

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TABLE 1

MEASUREMENT OF ADULT AND ADOLESCENT LONG BONES

	Cist 1		Cist 2	
	Right	Left	Right	Left
Humerus, maximum length	-	334	350	352
Ulna, maximum length	288	282	293	292
Radius maximum length	-	259	272	266
Femur, maximum length	464	465	488*	505
Femur, bicondylar length	460	463	490	501
Femur, platymeric index	91.4	94.1	90.6	87.5
Tibia, maximum length	-	-	397	399
Tibia, platymeric index	75.0	75.8	69.4	73.5
Range of height estimated from bones of left side:				
Trotter & Gleser (1952, 498, Table 13)	1.70m to 1.78m		1.76m to 1.82m	
Manouvrier (in Martin 1928, Table p. 1069)	1.68m to 1.76m		1.75m to 1.82m	

*Bowed anteriopoteriorly

Dentition

Ciat 1 The adult skull is that of a mature individual. The loss in vivo of most of the second and third molars makes assessment of age more difficult, but the degree of attrition of the first molars indicates an individual of well over 40, perhaps between 44 and 48. There is no dental caries in the teeth that are present, but there has been severe periodontal disease with marked alveolar bone destruction and the formation of periodontal pockets. Massive calculus deposits on the teeth are probably associated with the periodontal condition, and the latter is also the most likely cause for the in vivo loss of second and third molars. One or more of the third molars may have been congenitally absent. The child accompanying the adult in Ciat 1 is aged between 3 and 4 years. This estimate is based on the degree of development of the dentition - the deciduous dentition is complete, but the first permanent molars are still lying deep in the crypts. There is only a slight trace of resorption at the apices of the maxillary first deciduous incisors, but these teeth are beginning to space as the jaw enlarges. There is neither disease nor abnormality in the jaws and dentition.

Ciat 2 The skull is of a young adult. There are 31 teeth present, the upper right third molar being absent. The periodontal condition is good with no marginal bone loss but there is a fair degree of supragingival calculus present in all areas, especially in areas adjacent to the parotid and submandibular salivary ducts. The teeth are free of caries to macroscopic and radiographic examination. Attrition is mostly confined to the incisor teeth and first molars: there being comparatively little wear affecting the second molars, premolars or

canines. The attrition on the molars is just sufficient to have worn through the enamel on the mesio-buccal cusps, but on the second molars one assesses the amount of wear is about one-third as much. This fact alone would suggest an age of 16 to 18 years. The three wisdom teeth present are impacted on the lower jaw and apparently only unerupted on the upper. Radiographs reveal that the apices of the wisdom teeth are not fully formed but, as expected the upper is in a further advanced state of closure of the apex. Assessing from known dates or eruption and root formation it would appear that the age can be assessed as between 16 and 19.

Age

For the burial in Cist 2 a skeletal age of between fifteen and seventeen years can be reasonably estimated from the epiphyseal condition of the long bones (Table 2). This compares well with a dental age of between sixteen and nineteen years. For the adult in

TABLE 2

STATE OF EPIPHYSES OF SKELETON IN CIST 2

Open	Humerus, proximal (left); radius, distal; ulna, distal (left); Iliac crest and ischial tuberosity; costal heads; vertebral plates.
Starting to Fuse	Humerus, proximal (right); ulna, distal (right); fibula, proximal (right); first, second and third pieces of sacrum; ischiopubic ramus (right).
Almost fused	Radius (proximal); femur (distal); fibula, proximal (left); distal (right); ischiopubic ramus (left).
Fused	Humerus, distal; ulna, proximal; femur, proximal; tibia; fibula, distal (left).

TABLE 3

MEASUREMENTS AND INDICES OF SKULLS

	Ciat 1 Adult	Ciat 2 Adolescent	Ciat 1 Child
Cranial length	180	172	144
Cranial breadth	154	149	127
Cranial index	85.6	86.6	88
Basibregmatic height	131	130	108
Height index	72.8	75.6	75
Breadth-height index	85.1	87.2	85
Basialveolar length	92	88	73
Longitudinal cranio-facial index	51.1	51.2	50
Auricular height	121	117	99
Auricular height index	67.2	68.0	68
Minimum frontal breadth	102	101	80(?)
Transverse fronto-parietal index	66.2	67.8	63
Circumference	528	513	427
Transverse arc	315	304	273
Frontal chord	110	113	89
Frontal arc	123	118	100
Frontal index	89.4	95.8	89
Parietal chord	108	104	86
Parietal arc	122	112	95
Parietal index	88.5	92.9	90
Occipital chord	91	91	80
Occipital arc	112	110	96
Occipital index	81.3	82.7	33
Foraminal length	32	39	36

TABLE 3 (contd)

	Cist 1 Adult	Cist 2 Adolescent	Cist 1 Child
Foraminal breadth	30	36	24
Basinasal length	104	102	78
Gnathic index	88.5	86.3	93
Facial angle	87°	88°	78°
Nasion-gnathion	109	110	88
Bizygomatic breadth	144	140(?)	104(?)
Total facial index	75.7	78.6(?)	84
Nasion-alveolare	64	68	54
Upper facial index	44.4	48.6(?)	51
Bimaxillary breadth	92	90	67(?)
Upper facial (virchow) index	69.6	75.6	80
Nasal height	50	51	42
Nasal breadth	26	25	20
Nasal index	52.0	49.0	47
Orbital height (left)	34	35	30
Orbital breadth (left)	39	38	25
Orbital index (left)	87.2	92.0	83
Orbital height (right)	36	35	-
Orbital breadth (right)	40	40	-
Orbital index (right)	90.0	87.5	-
Palatal length	40	41	31
Palatal breadth	33	38	34
Palatal index	82.5	92.7	109.7
Gonial angle	108°	112°	133°
Bigonial breadth	103	99	81
Coronoid height (left)	62	60	37
Minimum ramus breadth (left)	32	30	26
Maximum projective mandibular length	91	92	74

Cist 1 a dental age well over forty is suggested from the dental attrition but the skeletal age might be placed below that from consideration of the cranial sutures (Todd & Lyon, 1924; 1925). Stewart (1962) emphasises that dental attrition and skull suture closure are equally unreliable in discriminating ages over thirty years, but the earlier age is supported by estimates from the condition of the pubic symphysis (McKern & Stewart, 1957). On the other hand the advanced osteoarthritic condition of the vertebral column would usually suggest an age well over thirty-five. The dental age of the infant (three or four years) is supported by the relative sizes of such bones as are available and the stage of ossification of the axis.

Skulls The infant skull bones were separated and weathered but a partial reconstruction showed its brachycephalic character and allowed approximate measurement. The other skulls were well preserved, clearly brachycephalic and markedly similar. This can be appreciated by comparison of the measurements and indices of the skulls presented in Table 3.

Pathology of Adult in Cist 1 The vertebrae are extensively ankylosed and the column must have been virtually rigid, its mobility restricted to the highest cervical region and to some movement between the first and second and the second and third thoracic vertebrae.

The writers are indebted to Dr Julie Carter, Department of Pathology, University of Aberdeen, for reporting that it must be concluded 'that this is not a case of ankylosing spondylitis. It would seem rather to be osteoarthritis of a somewhat unusual distribution possibly with trauma as a factor in the aetiology.'
The changes are very similar to those described and illustrated by

Inglemark (1959) for a series of medieval skeletons, which he also terms osteoarthritis.

The lowest lumbar vertebrae are fused to the sacrum and hip bone by changes in the ligaments and the two first ribs are solidly fused to the manubrium sterni by a hollow osteophytic shell. The limbs show no signs of arthritis except for some lipping of the glenoid cavity of the scapula and the acetabulum of the hip joint so that the pathology is virtually confined to the trunk. On the anterior aspect of the vertebral bodies the lesions correspond to the position of the anterior longitudinal ligaments, through which the fifth cervical to first thoracic vertebrae were probably ankylosed. Below the fifth thoracic vertebrae the ankylosis becomes massive but is confined to the site of the right ligament from thoracic five to twelve and to that of the left from thoracic twelve to the sacrum, the opposite halves of the column showing only a variable degree of lipping. The interarticular joints of both sides are ankylosed as high as the third thoracic level but not in the lower thoracic and upper lumbar regions as might have been expected from Ingelmark's description. The beginning of lipping suggests however that ankylosis might have appeared with increasing age.

The costovertebral articulations show substantial lipping below the second thoracic vertebrae with apparent fusion between the sixth and ninth thoracic levels. According to Wells (1962) this is not common and its occurence here differs from the case he illustrates by its presence on the side opposite to the ankylosis of the vertebral bodies.

Chemical Changes in the Skeletons All the bones were discoloured

to the pale brown common in Scottish short cist burials, but certain parts were hard instead of friable and so dark as to be almost black. The presence of charcoal raised a question as to whether there had been some charring. Other areas showed destruction of the bone cortex and white incrustation of the cancellous bone.

Mr Brian Cookaley, Research Officer, Department of Chemistry, University of Aberdeen kindly examined the specimens and reports 'that X-ray crystallographic techniques demonstrated that the bones had not been subjected to a significant degree of heating (less than 500°C). This conclusion was reached by comparison of the powder diffraction lines of the bone apatite as demonstrated in comparison of the Guinier diffraction photographs for bone from a short cist and for cremated bone from a cinerary urn. The very small crystals of unheated bone become larger on heating, the lines are narrowed and hence better defined. The pattern for the hard dark bone is obviously similar to that of the unheated bone. Chemical testing showed that it was actually heavily impregnated with iron compounds. The Guinier diffraction photograph of the white incrustation suggests that this material is a calcium phosphate hydrate in the form of Brushite. Chemical analysis confirmed the presence of phosphate. Gypsum has a very similar pattern but chemical tests for sulphate were inconclusive. Quartz is also present in the soil in quantity. Chemical tests demonstrated a large amount of carbonate and of iron salts but only traces of phosphate. A test for sulphate was negative.'

The hard dark bone corresponds, at least for the skull and trunk, with areas of fallen soil. The white incrustations are also obvious

in a photograph of Cist 2, on the upper surfaces of the bone possibly where it has not been protected by fallen soil or iron impregnation. Mr Cooksley points out that one of the most common mechanisms of crystal formation is evaporation of a solution - in this case a solution of bone salts formed by the passage of water upwards through the bone, like a wick, and evaporating into the free air of the cist.

The bones, other than the left femur, both scapulae and the sacrum from cist 2, which were used for radiocarbon analysis, are preserved in the Royal Scottish Museum. Detailed photographs of the more important aspects of the pathology taken by the Department of Anatomy, University of Aberdeen, have been deposited in the National Monuments Record of Scotland.

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