

## I.

## A STONE CIST AND ITS CONTENTS FOUND AT PIEKIE FARM, NEAR BOARHILLS, FIFE. BY DAVID WATERSTON, M.D., F.R.S.E., BUTE PROFESSOR OF ANATOMY, ST ANDREWS UNIVERSITY.

Early in February 1926, it was reported to me that a stone cist (fig. 1) had been discovered at Piekie Farm, near Boarhills, in a field belonging to Mr Rodger, farmer, of Boarhills. To Mr Rodger I am greatly indebted for his permission to examine the cist as well as for his assistance in bringing the cist to the University.



Fig. 1. View of Stone Cist at Piekie from the west.

The history of the discovery was, as is so usual in these finds, that a ploughman, engaged in ploughing the field, noticed that the point of his plough struck a large buried stone. On examining the stone, he found that it proved to be a flat slab, forming the lid of a large, rough stone box embedded in the soil.

The plough had fractured the stone, knocking off one corner and leaving an aperture large enough to admit an arm. When I visited the site, a few days later, some soil had fallen into the cist through the opening, but the cist was undisturbed.

The situation was practically on the summit of a gently sloping knoll, rising from the north bank of the Kenley Burn, a short distance from Kenley Farm. The summit of the knoll was about 170 feet above sea-level, and 60 feet to 80 feet above the level of the stream.

The lid of the cist was a single stone slab, roughly rectangular, 51 inches in length, 31 inches wide, and 3 inches to 4 inches in thickness, of a close-grained heavy reddish-brown sandstone, and the surfaces had been roughly trimmed, the edges were flat and square cut. The stones forming the sides and ends were of the same material and character; the smallest one forming the east end had an undulating surface, and its upper edges were smooth, rounded, and water-worn, and this stone had evidently been taken from the bed of the adjacent Kenley Burn. The weight of one of

the side stones was worked out by calculation from its mass, and was found to be 6 cwt. The total weight of the stones could not have been less than 22 cwt. The upper edge of one of the side slabs was irregular, and some small flat stones had been used to give a level surface, so that the lid rested closely upon the sides and ends. These small stones and the interstices at the corners had been partly secured and filled in with lumps of a bluish clay, such as could be picked up in the field.

#### SIZE AND ORIENTATION.

The interior of the cist measured 48 inches in length, 24 inches in width at the west, and 27 inches at the east end, and 22 inches in depth. The floor consisted of gravelly soil. The long axis of the cist lay practically due east and west, with a deviation from this line of not more than two degrees north-west and south-east.

#### CONTENTS OF THE CIST.

Near the eastern end of the cist lay a skull, and at the north-western corner a pelvis, while between them lay vertebrae and portions of ribs, with several upper- and lower-limb bones irregularly arranged. Except for the femora there were no lower-limb bones except a small portion, much eroded, of the upper end of the right tibia. No pottery was found, nor anything which could be taken to be an implement, except a small triangular quartz stone, which is described later. All the portions of the skeleton were carefully removed and examined in my department in St Andrews University.

*The Skeleton.*—Examination of the skeleton afforded information of considerable value on the racial characteristics of the individual interred, and also (because many of the bones showed pathological and other changes) upon his life history and upon the manner of his death.

The skeleton was, on the whole, in a surprisingly good state of preservation, due no doubt to the site of the interment being a particularly dry one on the top of a knoll in gravelly soil.

The absence of all the skeleton of the lower limbs below the knees (with the exception of a short and much eroded part of the upper end of the right tibia) is surprising, but it is impossible to determine whether these parts had been damaged or cut off possibly in battle, or whether, through some accidental conditions, they had eroded much more rapidly than the rest and had been destroyed by decomposition. I cannot help thinking that the former view is the more probable one, for it is difficult to imagine what the conditions could be which would lead to so partial and

so complete destruction of two distinct parts of the skeleton which are ordinarily as resistant to decay as any other portions.

*The Skull.*—The left half of the skull (fig. 2) was nearly complete and a sufficient amount of the right side was present to enable the usual cranioscopic and craniometric observations to be made with accuracy.

On the left side the only deficiency was an opening on the side of the vault due to absence of the squamous portion of the temporal bone, and the zygomatic arch was absent. The remaining surface of the maxilla showed a surface which was almost clean cut, and had not the ragged character which is found where the bone has crumbled away. The broken temporal root was smooth and rounded. The thin bone forming the back of the left orbit was absent from erosion.



Fig. 2. Skull and Mandible from the left side.

On the right side, the greater part of the right half of the frontal bone, the anterior part of the right parietal, and the whole of the temporal bone, were absent, and the sphenoid and ethmoid bones as well as the tuberosity of the right maxilla were eroded away. The appearance suggested that this side of the skull had been severely injured.

The external surface of the skull was not smooth and polished but generally rough in texture, except over a small area of the forehead, where the surface was almost smooth. The parietal and posterior portions of the frontal bones were particularly affected. In parts the normal smooth surface of bone was replaced by a sponge-like surface, with innumerable small openings, suggesting that the diploe of the bone has been exposed. At some places small rounded areas showing this texture were surrounded by raised margins of dense, smooth, thickened bone. Above the parietal eminence the surface showed a multitude of fine raised lines of bone, radiating towards the middle line.

In places there were perforations of the whole thickness of the skull wall (fig. 3). Three of these were in the parietal bones, close to the sagittal suture, two on the left side and one on the right, about an inch behind the bregma, the largest the size of a threepenny, the others rather smaller, of irregular shape. The edges of the openings were sharp and the bone bevelled on the inner surface. The appearance suggested

that they were due to Pacchionian granulations which had eroded the skull from the interior. Another small opening at the floor of a small rough pit on the external surface opened into the groove for the middle meningeal artery. The internal surface of the cranial wall was smooth and polished, in great contrast to the outer surface.

The surface of the skull and of several long bones showed small patches, 2 mm. to 3 mm. in size, of a dark discolouration. Chemical examination of these areas by Dr Hynd, of the Physiological Department here, showed that the stain was not due to the presence of copper. From the behaviour of a fragment of this tissue to combustion, Dr Hynd's opinion was that the dark substance was a graphitic product of decomposition.

In form the skull was short and round, the face rather small, the orbits low and wide, the nasal orifice long and narrow. The supraciliary ridges were prominent, and in this and other well-known sex characters there was clear evidence that the skeleton was that of a male.

In regard to age, it can only be said that there was no obliteration of sutures, nor indication of senile changes in the jaws, and from a survey of its general characters one would consider it to be the skull of a man of from fifty to sixty years of age.

The maximum glabello-occipital length was 172 mm., the maximum (parietal) width of the left half 79 mm., giving a probable maximum width of 158 mm., and a cephalic index of 91.9.

The imperfection of the right half of the cranium prevents the determination to within one or two millimetres of the width, and of the index within a few points, but the evidence is clear that the index was very high, and certainly over 90. The basi-nasal length was 104 mm., and the basi-alveolar 100 mm., giving a gnathic index of 96.2. The orbital height was 33 mm. and the orbital width 38 mm., giving an orbital index of 86. The height of the nose (nasion to subnasal spine) was 50 mm. and the width of the nasal aperture was 27 mm. The palate was small and well formed, but too incomplete to admit of measurement. The basi-bregmatic height of the skull was 134 mm., giving a height index of 77.9.

Tape measurements of the skull gave the following figures:—

VOL. LXI.



Fig. 3. Norma verticalis of the Skull showing the three perforations.

Horizontal circumference (left side) 255 mm., giving the complete circumference as 510 mm., the vertical circumference, bregma to supra-auricular point, on the left side, 165 mm., giving the complete measurement for

the two sides as 330 mm., while the sagittal arc, from nasion to posterior margin of the foramen magnum, was 347 mm., of which the frontal segment measured 125 mm., the parietal 112 mm., and the occipital 110 mm. The foramen magnum, basion to opisthion, measured 37 mm.

*Mandible.*—The coronoid and condylar processes of the mandible were absent, and the body and rami showed no distinctive feature of special interest beyond those exhibited by the teeth, which must be specially described.



Fig. 4. Mandible and Teeth from above.

*Teeth.*—No right maxillary teeth were present, but the following teeth were present in the left maxilla: canine, second premolar, and the first and second molars (fig. 4). In the left half of the mandible were the two incisors, canine, and two molar teeth, while in the right half of the mandible there were present the two incisors, canine, two premolars, and the two last molars. The condition of all these teeth was good, and there were no signs of caries. As is so usually the case in such prehistoric specimens, the crowns of the teeth were very much worn. The masticating surfaces of the canines and first premolars were worn flat, while those of the second premolars and of the molars were worn obliquely, the mandibular teeth on the labial side and the maxillary on the lingual (fig. 5). So oblique was this wear that the opposing surfaces which articulated well with one another were at an angle of almost 45 degrees to the horizontal. The upper incisors and canines did not, as is usual, overlap the lower ones, but to judge from the flat wear of the opposing surfaces, these teeth met edge to edge. The grinding down of the molar teeth had gone so far as to reach the pulp cavity, and the

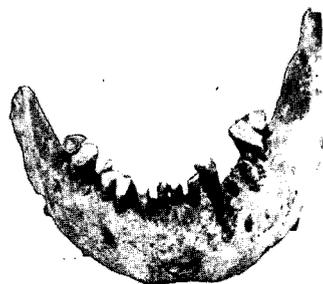


Fig. 5. Mandible and Teeth from the front, showing the oblique masticating surface of the molars.

apical part of that cavity was filled in by secondary dentine. The grinding movement which had worn the teeth down had been a movement of protrusion and retraction of the mandible, rendered easy by the "edge to edge" articulation of the cutting teeth. The obliquity of the surfaces of the molars showed that the movement had not been a "side to side" one, for had there been habitual side to side chewing movement, these surfaces must have been worn flat.

#### VERTEBRAL COLUMN.

The condition of the vertebral column was of special interest, showing as it does injuries which must have been inflicted just before death, and which, in all probability, were the cause of death.

*Cervical Vertebrae.*—These are in an extremely good state of preservation (fig. 6). The atlas vertebrae shows nothing of special significance, being in all respects a typical bone. The second and third vertebrae are united together by fusion of the articular surfaces. The spines of these vertebrae, usually stout and bifid, are absent; the broken surface remaining on the neural arch shows slight erosion. In the fourth vertebra the left horn of the bifid spine has been cut clean across at the root, leaving a sharply cut surface. In the fifth vertebra there had also been a partial injury to the spine, for while the "neural arch" is complete, the left horn of the bifid spinous process is missing, and there is a clean-cut surface with sharp edges, the surface slightly concave, extending from the tip of the right horn of the spine to the base of the spine on the left side of the median plane.

In the sixth and seventh vertebrae the spines, usually so large and prominent, are absent, and a slightly rough surface is present on the back of the neural arch at the root of the spines. In the upper three thoracic vertebrae the spines are absent, and the laminae and posterior wall of the neural canal are absent.

There was a deep reddish-brown discolouration of the transverse



Fig. 6. The Cervical and the upper two Thoracic Vertebrae from behind, to show the clean-cut surface on the fourth and successive vertebrae.

process (left) of the first thoracic vertebra and also, less distinct, of those of the seventh and sixth cervical vertebrae.

When the vertebrae are articulated together these fractured surfaces form a continuous level of injury, apparently due to a cut which had been inflicted, gradually deepening from above down, cutting into and dividing the spines and the neural arches until it reached the spinal cord. It extends, gradually deepening, from the spine of the second cervical vertebra to the third thoracic. The injury had been inflicted with a sharp-edged heavy cutting instrument—it may have been an axe. There is considerable erosion of the thoracic vertebrae 5, 6, 7, 8, whose neural arches and the transverse processes have gone, but the ninth and tenth are fairly complete. The bodies of the upper lumbar vertebrae are considerably eroded, and there is erosion of the lower ones anteriorly. The fifth one, however, is complete and is interesting, as on the right side an unusual "costal process," in the form of a slight elevation, articulates with an elevation on the ala of the sacrum, and on the left side there is a small similar area of contact of the corresponding parts.

#### UPPER-LIMB SKELETON.

The bones present are—both clavicles, very well preserved, with merely slight erosion of the acromial extremities; portions of both scapulae, including in each the glenoid fossa, neck of the scapula, the coracoid process and a portion of the spine and acromion process; the right and left humeri, slightly incomplete; right and left radius and ulna, slightly incomplete, and eroded especially at the distal ends; four metacarpal bones and three digital phalanges of the left hand.

*Clavicles.*—The clavicles are rather short but stout bones, the left 13·6 cm. and the right 13·1 cm. in length, or possibly some two to three millimetres longer, as in each there is some slight erosion of the acromial end of the bone.

*Humeri.*—The right humerus is complete but for some erosion of the greater tuberosity, and its length is 31·7 cm. It is a moderately stout bone, with an unusually pronounced curvature of the shaft forwards and to the side in its proximal half. The surface of the shaft below the insertion of the deltoid is rough and nodular from chronic periostitis, and the bone, as a whole, is light in weight and is not sclerosed.

The left humerus shows much less pathological change, but the distal articular surface and the greater tuberosity are eroded away. A very striking feature of this bone is a deep reddish-brown discolouration of the back of the shaft, from the lesser tubercle to the insertion

of the deltoid muscle over the whole of the posterior surface. The discolouration is similar to that of the transverse process of the seventh cervical and adjacent vertebræ, and is of such a character and colour as would lead one at once in a recent specimen to ascribe it to an effusion of blood from a bruise.

Dr Hynd kindly carried out a number of tests, with the view of determining the nature of the colouring substance, and especially to discover the presence of blood-pigment. Extraction of scrapings with water, with acetic and with hydrochloric acid, by themselves or after reduction with sodium hydrosulphite and other tests employed by physiological chemists, failed to show any spectroscopic absorption bands, and therefore no direct evidence was obtained of the presence of blood-pigment. The acid extracts gave marked reaction for the presence of iron, and this corroborates the view that the pigmentation was due to blood.

#### RADIUS AND ULNA.

*Radius.*—The right radius measures 25 cm. in length; the left, whose styloid process was eroded away, 24·8 cm. Both bones are rather slender and light in weight. The surface of the left is nodular and undulating from chronic periostitis, and the distal portion of the right is thickened and rough.

*Ulna.*—The right ulna (proximal end and two-thirds of the shaft) is stout and well formed. The left (distal and slightly eroded) measures 26·4 cm. without the styloid process, and the surface of the shaft is nodular.

*Metacarpus.*—The four left metacarpals, which were found, measure: the second 71, the third 66·5, the fourth 60, and the fifth, which remained attached to the fourth, 57 mm. in length. They are all rather short and slender bones. The phalanges showed no features of special importance.

#### RIBS AND STERNUM.

The manubrium sterni, nearly complete, is small but stout, measuring approximately 55 mm. from suprasternal notch to lower end, and 71 mm. transversely at the upper end. The left first rib, complete, is short, stout, and has well-marked muscular impressions. The other ribs were fragmentary.

#### PELVIS.

Very considerable interest is attached to the pelvis, from the light which it throws upon the physical condition of the individual during life and upon some illnesses from which it is clear he had suffered.

The alæ of the hip bones are somewhat eroded, the right in the anterior and the left in the posterior part, but otherwise the specimen is fairly complete (figs. 7, 8, and 9). There is a pathological formation of a large mass of bone beside the left acetabulum. The articular surface of the acetabulum is unaffected, and both that surface and the articular surface of the head of the femur are healthy, but the notch of the acetabulum is filled in by a rough mass of new bone, and the articular surface is prolonged on to it. From the outer surface of the ischium at the lower and back part of the acetabulum

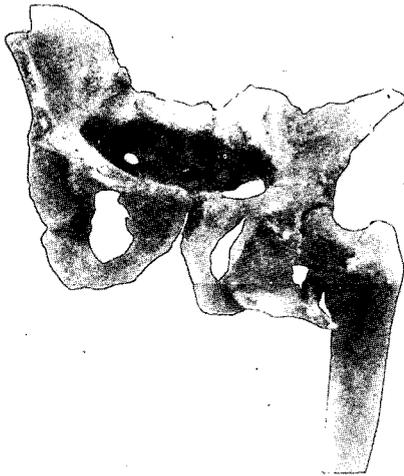


Fig. 7. Pelvis with the left Femur from the front.



Fig. 8. Pelvis with the left Femur from behind.

projects forwards an irregular and pointed new mass of bone, 2 inches across at its base, over 2 inches in height and almost three-quarters of an inch in thickness at its root. On a small part of its irregular upper and posterior border is a small smooth surface which articulates with a corresponding surface on a raised ridge on the back of the neck of the femur, and thus gives precisely the relative position of the two bones to one another during life. The limb must have been maintained habitually in the abducted position, and flexion was limited and extension impossible.

The new bone is rather soft in texture, porous and light. Of the nature of this pathological formation I cannot myself write with any assurance. Its effect had certainly been to produce impairment of the

movement of the left hip-joint, the left thigh being maintained somewhat abducted, flexion of the joint limited, and extension impossible. Hence walking would be possible, but not running.

There were other pathological manifestations in the pelvis. The sacro-iliac joints were completely ankylosed by bone at the upper surfaces, while curiously enough the lower parts of these joints were quite unaffected, and in addition there was the articulation on the side of the ala of the sacrum with the transverse process of the last lumbar vertebra already mentioned in connection with the description of the vertebral column.

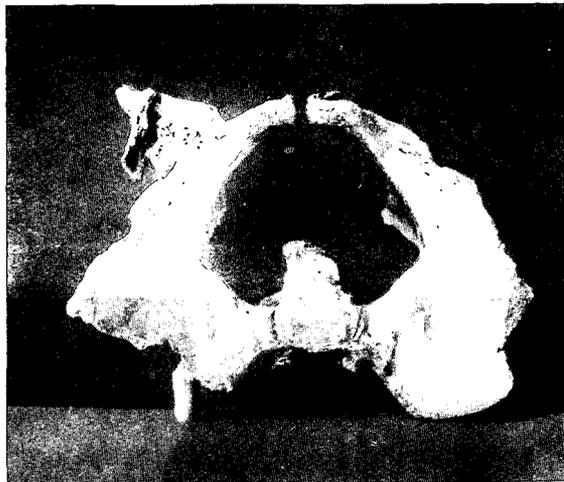


Fig. 9. Pelvis from above, to show the mass of new bone.

My friend, Mr D. M. Greig, F.R.C.S., conservator of the Museum of the Royal College of Surgeons, very kindly examined this bone, and his view, with which I am in accord, is that, in youth, there had been a severe injury of the pelvis on the left side, leading to an effusion of blood among the muscles and causing a tear of the periostium of the ischium. With the process of healing, bone-forming cells of the ischium had invaded the blood-clot, and given rise to the irregular mass of bone, in the same manner as occurs in other regions, and gives rise to a condition termed "myositis ossificans."

The left ischial spine is well developed and prominent, while the right was slightly eroded at its point, and in addition showed that its base was flattened, and obviously that spine had been very poorly developed. There is marked asymmetry of the pelvis, which showed

that for the greater part of the life of the individual the pelvis had been tilted, the right side higher than the left. Such a condition would follow upon an impairment of the left hip in youth, with abduction at the hip-joint. The abducted position of the thigh would lead to a tilting of the pelvis downwards on that side, in order to bring the sole of the foot to the ground.

#### FEMORA.

The condyles of the left femur are eroded away, but the bone otherwise is practically complete. Of the right femur the head had been eroded off through the neck, and lay separate from it, and the upper end of the shaft was eroded. At the distal end the surfaces of the condyles were eroded, but a considerable part of the articular surfaces remained. Taking the two bones (fig. 10), there was no difficulty in determining the maximum length with very considerable precision, and it proved to be not less than 45 cm., and possibly two to three millimetres more. Using the length of the femur as a guide to the stature (and it probably gives the most accurate results), Manouvrier's tables show that the femur length of 45.3 cm. corresponds to a stature of 167.7 cm. Further, this femoral length should correspond to a radius length of 24.6 cm., while that of the left radius in this skeleton was 24.8 cm., and to an ulnar length of 26.3 cm., while that in the specimen was 26.4 cm.—an extremely close approximation, which shows how identical the proportions of the limbs were in this individual with those of the modern subjects used by Manouvrier. Using the formula of Pearson for the estimation of the height from the length of the femur, the height comes out at 163 cm., and, using the combined length of the

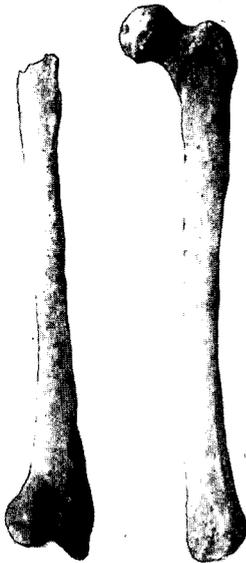


Fig. 10. Femora from the front, showing the obliquity of the condylar surface of the right femur, and the undulating or nodular surface of the shaft in both bones.

femur and humerus, as 164.1 cm., figures which confirm the other estimates of stature. The left femur is a stout, well-developed bone, showing antero-posterior flattening in the upper third, and prominent *linea aspera* in the middle third. There are indications of chronic periostitis as in other bones, the surface being nodular and undulating

on the anterior and outer aspects in the distal half. The measurements of the diameters are as follows:—

Upper sagittal diameter, 25 mm. (2.5 cm. below trochanter minor).	
„ transverse „ 31.6 „	Index 79.1.
Sagittal diameter at middle, 29 mm.	
Transverse „ „ „ 28.5 „	Index 101.7.

The right femur is lighter and more slender than the left. Its surface shows very distinctly the nodular or undulating character seen in other bones also, a pathological condition for which it is difficult to account. A curious feature is the obliquity of the articular surface of the condyles of this bone. This surface is intact, and when placed flat on the table the axis of the shaft is inclined at an angle of 72 degrees.

This condition implies that during life there was a marked degree of genu valgum (knock knee) affecting that limb, and harmonises with the condition of the left leg and of the pelvis. It was shown that early disease of the left hip-joint had brought about an abduction of that limb and a tilting of the pelvis so that the right side of the pelvis was raised. Such a condition would necessitate an adduction of the right thigh in order to bring the feet to the ground, and this would produce such an obliquity of the axis of the shaft as is actually found to be present.

The accompanying table of measurements shows a similarity in the size and proportions of the skeleton skull and limb bones of the present specimen and those from short cists of the Bronze Age in the Aberdeen University collection. There can be no question that the individuals represented were of the same type of physical structure, and though there was no pottery and no implements to help to date the present specimen, the anthropological evidence shows plainly that he belonged to the same "race" as the Aberdeen specimens, and had their distinctive and quite characteristic physical build.

Comparative measurements of the Piekie Farm skull, the average measurements of the Aberdeen University short-cist skulls,<sup>1</sup> and of one of the Aberdeenshire specimens (Leslie)<sup>2</sup>:—

<sup>1</sup> R. W. Reid, M.D., LL.D., *Illustrated Catalogue of Specimens from Prehistoric Interments found in the North-east of Scotland.*

<sup>2</sup> J. Graham Callander in *Proc. Soc. Antiq. Scot.*, vol. xli. pp. 116-29.

[TABLE

Average (Males):		Leslie.	Piekie Farm.
Stature . . . . .	5 ft. 4 ins.		5 ft. 6 ins.
Glab-occipital length . . . . .	179	177	172
Maximum width . . . . .	149	154	158
Cephalic index . . . . .	83·9	87	91·9
Basi-bregmatic height . . . . .	138	136	134
Height index . . . . .	78·1	76·8	77·9
Basi-nasal diameter . . . . .	99	97	104
Basi-alveolar diameter . . . . .	97	94	100
Aveolar index . . . . .	94·9	96·9	96·2
Orbital height . . . . .	32	30	33
Orbital width . . . . .	41	40	38
Orbital index . . . . .	78	75	86
Nasal height . . . . .	50	48	50
Nasal width . . . . .	24·7	26	27
Nasal index . . . . .	40·5	54·1	54
Horizontal circumference . . . . .	518	522	510
Naso-alveolar length . . . . .	67	62	64·5
Bi-gonial width . . . . .	106	...	103

## SUMMARY AND CONCLUSIONS.

The detailed examination of the cranium and skeleton afford sufficient information to enable one to reconstruct in considerable detail a picture and a history of the individual interred.

The interment was carried out with such labour and effort as would be expended only upon an individual of considerable social importance. He was an adult man, probably of about sixty years of age, of five feet six inches in height. He was of the usual "beaker folk" type, with a very round head, a slender and narrow nose, narrow and wide orbits, and he had an underhung jaw. He had shoulders of medium width, rather square, with shoulders well developed muscularly, arms of average length, and his hands were small and wide. He was somewhat lame, and had a stiffness of his left hip, and his left leg seemed to be longer than his right. He could walk comfortably, but could not run. In his youth he had sustained a severe injury to his left hip, to which his lameness was ascribed, for after it he had always been crippled. As he grew older, there was some stiffness in his back, possibly most noticeable in his neck. He suffered much from deep aching pains in his arms and legs (chronic periostitis). He may have received several scalp wounds, which healed slowly and gave much trouble. His food was gritty and coarse, needing much mastication, and he would grind his food in his mouth with a to-and-fro movement of his underhung jaw.

His death was sudden and violent. He was attacked by foes with weapons both blunt and sharp, such as axes and clubs, and he had no adequate weapon of defence against their blows. A blow with a club was aimed at his head, he threw up his left arm to defend his head, and received the blow on the back of his arm which was severely bruised, and on the lower part of the side (left) of his neck.

Finally he was struck down by a blow from a sharp-edged weapon from behind, which missed his head but cut into the back of his neck, cutting obliquely through his spine and into the spinal cord, and knocked him down. His legs may have been badly wounded, or cut away below the knee. While he lay on the ground, a blow from a club smashed in the right side of his head. He was buried in a stone coffin, and the only object interred beside him was a small white stone of triangular shape.

#### WHITE QUARTZ PEBBLE.

Lying in the gravel forming the floor of the cist I found a white stone of unusual shape. It was a white quartz pebble triangular in shape, one angle sharply pointed, the other two somewhat blunter. It formed an almost equilateral triangle, two of the sides 26 mm. and the third a millimetre or two longer. At one side it measured 10 mm. in thickness, and tapered from this to 2 mm. at the point opposite. The surface showed sharp crystalline facets, and the pebble was not water-worn. The finding of this object here acquires considerable interest in connection with a paper by Sir Arthur Mitchell "On white pebbles in connection with Pagan and Christian burials."<sup>1</sup>

He has collected a large number of instances of such pebbles being found in cairns as well as in association with later forms of burial, and shows how common was the practice of placing portions of flint or pebbles beside the dead, and discusses the significance of such rites in pre-Christian and in Christian times.

#### NOTE ON TESTS FOR BLOOD-STAINS IN PREHISTORIC BONES.

Considerable importance is attached to the determination of the cause of the localised pigmentation of portions of the skeleton here ascribed to blood-stains, and it is desirable to explain more fully the reasons for doing so.

The pigmented tissue failed to give the spectroscopic test which is characteristic of blood-pigment. A little consideration will show that

<sup>1</sup> *Proc. Soc. Antiq. Scot.*, vol. xviii, p. 286.

this is what might be expected, and forms no argument against the view that the stain is due to blood.

The spectroscopic test depends upon the presence of the organic compound hæmoglobin or its derivatives, and in specimens such as those described here the organic matter has been destroyed, and only the inorganic residue remains.

Iron forms a large proportion of the inorganic residue of blood, and in the present instance the pigmented tissue gave the Prussian blue reaction for iron in a much more intense degree than did the surrounding non-pigmented tissue, and hence weighty evidence is afforded that the stain was due to blood.

In order to determine approximately the amount of blood which would be necessary to give such pigmentation, the following experiment was carried out by Dr Hynd:—

A small piece of loose blood-clot from a vein of a dissecting-room subject was removed, and a portion of this, of about the size of a grain of barley, was calcined to destroy the organic matter. The residue was dissolved in hydrochloric acid, and it was found that the solution gave the Prussian blue reaction, a marked blue colouration being produced and no precipitate formed. The intensity of the reaction was similar to that obtained from a corresponding amount of the scraping from the bone.

This similarity afforded further evidence, and in the absence of any other tenable theory of the production of the pigmentation it would appear to be justifiable to ascribe it to blood-staining.

The presence of such staining has been described by Elliot Smith<sup>1</sup> in specimens which he examined from ancient burials in Nubia, and he states in this connection:—

“Professor W. A. Schmidt of Cairo examined the stain, and he failed to obtain any of the reactions which are characteristic of blood . . . because it was too ancient to give the typical reactions.”

“A period of about two hundred and fifty years is sufficient to alter the composition of the blood-stains sufficiently to make them unrecognisable by the ordinary blood tests.”

“In some cases we have come across the most extensive staining of the bones, without being able to find any bone that shows any certain sign of ante-mortem fracture. These cases are so exactly similar to those in which we find a certain cause of death, that it seems legitimate to conclude that, though no bone was broken, still the end was a violent one.”

<sup>1</sup> Elliot Smith, *Arch. Survey of Nubia*, Report for 1907-8, vol. ii. p. 330.