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# Anthropological Observations on the Skeletal Remains from Giv'at ha-Mivtar

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FIFTEEN limestone ossuaries were found in 1968 in three burial caves at Giv'at ha-Mivtar, Jerusalem (see above, pp. 18-32). Thirteen were filled to the brim with human skeletal remains, and two only partly so. It was ascertained that these remains had been arranged within the ossuaries in a particular and set order. The anthropological study attests the presence of 35 individuals. Almost all the skeletal remains found were well preserved; a few insignificant animal skeletal elements were intrusive (Pl. 18: A).

Evidence of death by violence was found in five cases: tomb I, ossuary No. 4, skeleton A — by crucifixion; I/6C and IV/1A — by conflagration; IV/3E — by an arrow wound; and I/7A — by a blow from a mace. One case (IV/4A-B) was found of a woman who had died in childbirth; there were three cases (I/8B and III/1A-B) of children who had died of starvation.

In the 13 completely filled ossuaries, considerable moisture was found, bringing about a peculiar kind of preservation of the packed bones. Some skulls, bones and teeth were found in an exceptional, but ephemeral, state of freshness. This allowed for an intensive study, and the observations gathered were accurately recorded at the time. These were later classified and corroborated with the information acquired during and after the preparation of the skeletal material.

In some cases, complete skulls or long bones mingled with skull fragments were found at the top of ossuaries; in the case of I/1A-B, the long bones were found atop, fastened together by plaited plant stems. In I/1 and III/2, well-preserved plants such as bunches of withered flowers or plaited cereal spikes were found. In these cases, well-preserved bones and organic material were found at the bottom of the ossuaries.

A syrupy fluid was found filling the lower third of 13 ossuaries. The bones and other material immersed in this fluid were coated with a limy sediment. On the surface of some bones dark-brown blotches were occasionally observed, or even a thick, adherent black-brown crust.

The anatomical and anthropological observations confirmed that the skeletal remains were deposited in a certain intentional order, a sort of grouping to be explained by the customary reburial. This was to place the corpse in the cave and then to gather the bones for reburial in ossuaries after decomposition of the flesh. The fact that hand or foot bones were found occasionally in their anatomical relation

in the ossuaries, and at other times the small bones were spread amidst the long bones, indicates that decomposition was not necessarily complete in all cases at the time of reburial.

The two cases of intrusive animal bones, I/1 — humeral bone of a dog; IV/1 — two bones of a lamb (cannon and tibia), and the case of an intrusive human atlas bone (I/2 — three individuals, four atlas bones), must be due to carelessness during exhumation and reburial, without any ritualistic meaning.

Our anthropological work was hampered by circumstances beyond our control which allowed only four weeks for the examination of the remains before their modern reburial. This necessitated emergency manipulations and precluded proper preservation leading up to complete measurements, study and proper photographic recording. Each bone found in this sort of ossuary requires a month of intensive work for initial preservation. After this period the bones are suitable for comparative study. Another two or three months are needed for adequate impregnation, without which even photography is impossible.

#### THE MATERIAL

In tomb I there were eight ossuaries; in tomb III, two; in tomb IV, five. Thus, 13 ossuaries of various sizes were found filled with skeletal remains. The two large ossuaries (I/8 and III/1) contained two infantile skeletons each, and were only partly filled and dry.

Five ossuaries contained each a single skeleton: I/3, a female; I/5, a male; I/7, a female; IV/1, a male; IV/2, a male. In IV/4, there was a female with a foetus between the pelvic bones.

Five ossuaries contained two individuals each: I/1, a male and a female; I/4, a male and a child; I/8, two children; III/1, two children; III/2, a male and child. Ossuary I/3 contained three individuals, a male, a female and a child.

Three ossuaries contained five individuals each: I/6, two males, two females and a child; IV/4, a male, three females and a child; IV/5, a male, two females and two children.

The total from the 15 ossuaries was thus 35 individuals: 11 males, 12 females and 12 children.

The special nature of the skeletal remains in eight ossuaries — people who had died from illness or violence — was recognized during reburial, as is indicated by external evidence which singled them out from those who had died from natural causes. This feature was the presence of dark-brown blotches, probably from oil, on those bones which had been damaged by violence or disease, which injuries were the most likely cause of death.

In two cases — I/1 and III/2 — the presence of a salty liquid at the top of the ossuary had preserved bunches of withered flowers (in the first case) or plaited bundles of cereal spikes (in the second case). In I/1, two skulls (male and female) and the long bones were found at the top of the ossuary, with the flowers. The long bones be-

longing to the two individuals were fastened together with a plaited bundle of plant stems. This ossuary was labelled: 'Simon, builder of the Temple'. In the second case (III/2), a crippled male (51–60 years old) was buried with the skull atop, together with a very young child (0–12 months old) at the bottom. A number of partially carbonized seeds (barley = *hordeum perlatum*) were found among the bones.

The peculiar conditions referred to above preserved the nailed calcanean bones in I/4A in a relatively good condition. On the right tibial bone, broken in the shin region, was a large, almost circular dark reddish spot. Similar spots, blotches or crusts of various nuances (from black to reddish-brown) were observed on skeletal remains in seven other ossuaries. In every instance, the spotted bones belonged to individuals who had died from illness or violence. The age distribution involved was between 16 and 60 years. No infantile skeleton was found spotted, even in an obvious case of violent death (IV/3E, a child of 3–4 years, with one occipital perforated by an arrow). No uncrippled individual (age-group 16–60 years) was found with spotted bones. It is clear that the damaged bones were thus marked prior to reburial in the ossuaries.

It was observed that priority of position within an ossuary was given to particular individuals, as far as the skulls and long bones are concerned in the collective ossuaries. In the six ossuaries containing the bones of children and adults together, the skulls of the children were placed at the bottom. In the single collective ossuary containing only two adults, male and female (I/1), both skulls were found at the top. The other four collective ossuaries containing males, females and children show a priority of the male (if there was only one) or for the senior male (if there were two). This latter arrangement was observed in three cases: I/2; I/6; and IV/5. In the case of IV/3, priority was given to a young female (25–35 years old), her skull being found on top, whereas those of a senior male (45–50 years old) and a female (45–50 years old) had been placed below, with the skull of a girl (16–17 years old), among the other bones of all four individuals.

#### ANTHROPOLOGICAL RÉSUMÉ

##### I/1. Two adults.

A. *Male* (45–48 years old). Broad-headed (cranial index 82). Rough featured facial skeleton (see Pl. 18: B). All teeth present; no caries; attrition second degree. A very strong and robust individual; upper limbs and vertebral column; very strongly built hand bones.

*Stature*: 170–178 cm.

*Diseases and malformations*: Slight marks of arthritis on the right knee bones. Marks of friction on the condylar surfaces of right femur and tibia. Presence of the 'third condyle' on the base of the occipital, in articulation with the anterior arch of the atlas bone.

TABLE I  
Skeletal Remains from Giv'at ha-Mivtar: Age-Sex Distribution of the Individuals

Tomb/ Ossuary	Individuals in		Sex determination		Total for tomb	Age — group distribution									
	ossuary		M	F		0-1	2-6	7-15	16-20	21-25	26-35	36-50	51-60	Over 60	
I/1	2		1	1							B	A			
I/2	3		1	1	1	C					B	A			
I/3	1		1						A						
I/4	2		1	1		B				A					
I/5	1		1						A						
I/6	5		2	2	1	E		B	D	C				A	
I/7	1			1								A			
I/8	2			2	17	B	A								
III/1	2			2											
III/2	2		1		4	B		A						A	
IV/1	1			1					A						
IV/2	1		1									A			
IV/3	5		1	3	1	E		D		A	B	C			
IV/4	2			1	1		B			A					
IV/5	5		1	2	2	E		D	C	B				A	
Total	35	11	12	12	35	3	7	2	4	3	7	4	3	2	

A (bold) — Male. A (roman) — Female. A (italic) — Undetermined.

B. *Female* (30–35 years old). Long-headed (cranial index 73). Fair but robust facial skeleton. All teeth present; no caries; no attrition (see Pl. 18: C).

*Stature*: 162–170 cm.

I/2. Two adults and a child.

A. *Male* (45–50 years old). Long-headed (cranial index 74). Fair but robust facial skeleton. All teeth present; no caries; attrition second degree. Strongly shaped forearms and hands.

*Stature*: 165–170 cm.

*Diseases and malformations*: Osteophytes on the last thoracal vertebrae (XI–XII).

B. *Female* (25–30 years old). Broad-headed (cranial index 85). Fine, tapering shape of the lower facial skeleton. All teeth present; no caries; no attrition.

*Stature*: 150–154 cm. Fine, slenderly-built long bones.

*Diseases or malformations*: Slight deformation of the left knee bones: genu varus.

C. *Child* (4–5 years old). Almost complete skull. Eighteen teeth; no caries. All the vertebrae and long bones present, at the same stage of growth as the deciduous teeth and the permanent tooth buds.

I/3. One adult.

A. *Female* (23–25 years old). Long-headed (cranial index 73). Occipital bone with prominent iniac region; gracile but asymmetrical facial skeleton; fine, angular chin. Sixteen teeth present; 12 lost post mortem; four lost during life; many marks of peridontitis on walls of sockets; two caries (on first left lower molar and on third right lower molar, both quite advanced); overattrition in the right side; the right side of the jaws more muscular than the left.

*Stature*: 153 cm. Very light, smooth long bones.

*Diseases and malformations*: Obvious marks of osteoporosis in the upper and lower limbs. The right lower limb shorter than the left by 3 cm. Presumably caused by chronic endocrine disorders. Spotted lower limb bones (brownish stains).

I/4. One adult and one child.

A. *Male* (24–28 years old). Moderately long-headed (cranial index 77). Plagiocephalic; mild featured facial skeleton; triangular-shaped lower face; robust chin; large, curved nose; the cheek bones stronger on the right than on the left. Cleft palate on the right side. Most of the teeth present; no caries; no marks of diseased alveolar processes.

*Stature*: 167 cm. The limb bones are smooth and slender. No mark of acute or chronic diseases on the bones.

Both the heel bones were found transfixed by a large iron nail. The shins were found intentionally broken. Death caused by crucifixion (see below, pp. 49–59).

Right tibia spotted (dark-brown stain).

TABLE II  
*Skeletal Remains from Giv'at ha-Mivtar; Severely Diseased Bones  
 and Traumatic Evidence*

<i>Tomb/ Ossuary</i>	<i>Presumptive evidence of violent death</i>	<i>Severely diseased bones</i>	<i>Presence of dark blotches</i>	<i>Presumptive cause of death</i>
I/1				A? B?
I/2				A? B? C?
I/3		A	A	A §
I/4	A		A	A † B?
I/5				A?
I/6	C	C		A? B? C? D ∩ E?
I/7	A	A	A	A ∅
I/8		B		A? B ∅
III/1		A B		A ∅ B ∅
III/2		A	A	A § B?
IV/1	A		A	A ∩
IV/2		A	A	A §
IV/3	E			A? B? C? D? E ←
IV/4		A	A B	A § B §
IV/5				A? B? C? D? E?
TOTAL	5	9	8	35

? = Cause of death unknown    § = Death from lack of proper medical care  
 † = Crucifixion    ∩ = Death by conflagration    ∅ = Death from mace blow  
 ← = Death from arrow wound    ∅ = Death from starvation.

B. *Child* (3–4 years old). Fragments of skull, vertebrae, long bones. Fourteen teeth; no caries. No marks of disease.

I/5. One adult.

A. *Male* (24–26 years old). Long-headed (cranial index 74). Medium gracile facial skeleton. All teeth present; no caries.

*Stature*: 157 cm. The limbs robust; no marks of diseased bones.

*Functional note*: The presence of the 'oriental facet' on the distal end of both tibiae is characteristic of habitual squatting.

I/6. Four adults and one child.

A. *Male* (over 60 years old). The skull was found at the top of the ossuary, but very crumbled and not sufficiently preserved for study or observation. The lid of the overfilled ossuary had crushed this skull. The jaws well preserved; a strong, pointed chin. On the lower jaw, all teeth were present; no caries. On the upper jaw, only four teeth had been lost during life; no caries; very advanced attrition.

*Stature*: 167 cm. Extensive osteophytes on the thoracic vertebrae.

B. *Male* (18–19 years old). The skull was found intact but soon disintegrated under treatment; by visual observation: Long-headed; dolichocranic: 65–74. Only seven teeth were found in sockets; no caries.

*Stature*: 159–161 cm.

C. *Female* (24–30 years old). Long-headed (cranial index 73). Facial skeleton incomplete. Eight teeth present in the upper jaw; eight teeth in the lower jaw; no caries; no attrition. The missing teeth were lost post mortem; no marks of diseased alveolar walls.

*Stature*: 160–164 cm.

D. *Female* (24–26 years old). The skull partly calcined; unharmed shoulder bones; large portions of both hip bones burnt; lateral sides of left femur scorched to depth of medullar canal. No teeth were found. The skull and the long bones were not sufficiently preserved for anthropological measurements.

*Presumed cause of death*: Conflagration.

Spotted skull and left femur (brownish stains).

E. *Child* (3–4 years old). Skull fragments, vertebrae, hip and long bones. Six teeth present: five permanent, non-erupted teeth in alveolar cavities of the upper and lower jaws; a deciduous canine in the right upper jaw.

I/7. One adult.

A. *Female* (50–60 years old). Broad-headed (cranial index 84). Robust, quadrangular, large facial skeleton; very thick skull cap bones; thickness in the parietal eminence region 8 mm. Most of teeth lost during life; only six teeth present in sockets, without occlusal contact between the teeth in the upper and lower jaws; marks of pyorrhea alveolaris.

*Stature*: 151 cm. Left forearm bones slightly bent; marks of well-developed muscularity on the left humerus and left hand bones. Significant evidence of a hard-working individual.

*Diseases and malformations*: Extensive osteophytes on last three lumbar and on first sacral vertebrae; marks of osteoporosis on the femoral bones.

*Evidence of violent death*: The atlas, the axis vertebrae and the slope of the occipital bone broken into sharp slivers. This damage might conjecturally have been produced by a heavy blow of a blunt weapon, such as a mace.

Spots on the skull and shoulder bones (brownish stains).

I/8. Two children.

A. *Child* (5–6 years old). Almost complete skeleton. Eleven teeth; no caries.

B. *Child* (6–8 months old). Well-preserved skeleton. Five buds of non-erupted teeth. Cribrosis on temporal bones and on the left orbital roof. Many authors accept that this sort of cribrosis might be a significant indication of external distress of the



TABLE III

*Skeletal Remains from Giv'at ha-Mivtar: Typological Distribution*

Tomb/ Ossuary	Cranial index			Stature					Typological attribution				
	65-74	75-79	80-95	150-159	160-163	164-166	167-169	170-180	Ancient Mediterr.	Classic Mediterr.	Mixedtype	Asiatic Alpine	Dinaro Armenian
I/1	B		A				B	A	B				A
I/2	A		B	B			A		A			B	
I/3	A			A						A			
I/4		A					A				A		
I/5	A			A						A			
I/6	B C	A			B	C	A		A C	B			
I/7			A	A									A
I/8													
III/1													
III/2	A						A		A				
IV/1				A									
IV/2	A				A					A			
IV/3		A	B				C	B	A C		B		
IV/4	A			A						A			
IV/5	A C		B	B			C		A C			B	
Total	11	3	5	7	2	1	7	2	9	5	2	2	2

newborn or young child, resulting indirectly from undernutrition or starvation.

III/1. Two children.

A. *Child* (3-4 years old). Well-preserved skeleton. Five deciduous teeth. Cribrosis on the roof of both orbits.

*Presumed cause of death*: Starvation.

B. *Child* (7-8 years old). Well-preserved skeleton. Five teeth; three permanent, two deciduous. Cribrosis on left orbital roof, on the frontal bone (above the glabella and the supraorbital brims), on temporal bones (above the mastoid region).

*Presumed cause of death*: Starvation.

III/2. One adult and one child.

A. *Male* (50-60 years old). Long-headed (cranial index 73). Robust, quadrangular facial skeleton; lower jaw with everted angles; strong tritubercular chin. One tooth present in the left upper jaw; another lost post mortem and missing; marks of pyorrhea alveolaris in right upper jaw; nine teeth present in the lower jaw; two teeth lost during life; five lost post mortem; marks of suppurative destruction of alveolar

walls in the place of lower right premolars; attrition third degree.

*Stature*: 168 cm. The left femur bent laterally and shorter by 54 mm than the right one. Linea aspera and the gluteal impressions of right femur stronger than in left. A true ankylosis between the ankle bones; certain bony excrescences on the cuboid, sustentaculum talii, on the three first left toes; all suggesting a 'club foot' in the left lower limb.

Spotted left limb bones (reddish-brown stains). Plaited bundle of spikes over the skull.

B. *Child* (0–4 months old). Skull fragments; well-preserved lower jaw.

IV/1. One youth.

A. *Male* (16–17 years old). Skull almost complete but badly calcined on the left side. All 28 teeth present; third molars still not erupted; no caries.

*Stature*: 149–153 cm. The postcranial skeleton well represented. On the right clavicle a trace of burning (1.5 cm). Slight marks of burning on ischial tuberosities of both hip bones. The left fibula shows five alternate grey and white parallel marks of varying calcination (Fig. 1). Sinusoidal trace of black-brown matter on all lower limbs.

*Presumed cause of death*: Conflagration. The alternate grey and white parallel lines on the left fibula and the slight burning marks on the ischial tuberosities imply that this individual had been put on a burning rack, and left on the fire long after death.



Fig. 1. IV/1: Left fibula showing marks of calcination.

IV/2. One adult.

A. *Male* (40–45 years old). Long-headed (cranial index 72). Forehead nearly feminine; finely built upper facial skeleton; tapering lower face. In contrast with this feminine appearance are the everted, coarse angles of the lower jaw, the sharply cut profile, the large, curved nose and the pointed chin. Twenty-nine teeth present in lower and upper jaws; no caries; attrition of third degree; three teeth lost during life; first lower right molar extracted in brutal manner, partially breaking right horizontal branch of the lower jaw. An extensive lopping osteomyelitis might be inferred as a sequel of this extraction, which may have been the cause of death. *Stature*: 162 cm. Strong upper limbs, but not a really robust type. The finger bones of the thumb and the last row of phalanges of the index and medius of the right hand slightly deformed. This latter may have resulted from this individual being a cutter of letters on stone. The phalanges of the right and left first toes and those

of the fourth and fifth are bent towards the second toe. The phalanges of the fifth toe were fused and bent downwards. Deformations such as these ordinarily are found among persons wearing too narrow shoes.

Although the osteomyelitis of the lower jaw may not have been the direct cause of death, the large spots of black-brown matter observed on the right horizontal ramus of the mandible and on the right side of the forehead would support such a presumption.

IV/3. Four adults and one child. This is the case of a female skull being found at the top of an ossuary though it contained an adult male as well.

A. *Female* (26–35 year old). The skull cap had been damaged by pressure of the ossuary lid. The facial skeleton and the base of the skull were well preserved. Five teeth in the sockets; the others lost post mortem; no caries; no marks of peridontitis on the alveolar walls. The facial skeleton belongs to a fine, gracile type; the pointed chin is a little rebarbative. The fragmentary state of the long bones does not allow for an estimation of stature. The hip bones and the lower limb fragments make the sex diagnosis certain.

B. *Male* (45–50 years old). Broad-headed (cranial index 82). Facial skeleton rather robust; the lower facial skeleton tapering. Thirty-one teeth in sockets; one molar lost during life; no caries; attrition third-fourth degree.

*Stature*: 181 cm. Strong upper limb muscularity, well represented in the hand bones; stronger on the left side; marks of well-developed muscularity on the lower limb bones.

C. *Female* (55–60 years old). Skull cap bones damaged; facial skeleton well preserved; strongly-built lower face; pointed, rebarbative chin (as in A, above; this may indicate a familial tie between the two). The presence of the temporal bones connected with the facial skeleton attests a female. Three teeth lost during life; eleven teeth found in sockets; no caries; eighteen teeth lost post mortem. No marks of peridontitis; attrition fourth degree.

*Stature*: 167 cm. On the upper limbs flat marks of muscularity; on the lower limbs more developed marks; a well-relieved gluteal tuberosity on both femoral bones, and bulging solar line on both tibiae. These marks of muscularity are generally accepted as an indication of habitual climbing of hills. Large lumbar vertebrae, without osteophytes, in spite of advanced age.

D. *Female* (16–17 years old). Skull bones poorly preserved: two fragments of the frontal bone, a large fragment of the upper left jaw with an articulated zygomatic bone and an upper border of the left orbit; a large piece of the occipital bone in junction with the right temporal bone; small fragments of the lower jaw. Seven teeth found in sockets; no caries. All the diaphyses of the long bones and hip bones present. Seven cervical, one thoracic, four lumbar vertebrae; complete sacral bone.

E. *Child* (3–4 years old). Almost complete skull. Eighteen deciduous teeth in the sockets. All the vertebral column; some ribs. Diaphyses of both femoral bones, left fibula and tibia. The occipital bone, on the left side above the inion, shows a small round hole with radiating fissures. On the external surface, obvious marks of decay and reorganization. We assume that this wound was produced by the penetration of an arrow-head; the signs of decay and reorganization indicate that death did not immediately follow the injury.

IV/4. One adult with a foetus.

A. *Female* (30–35 years old), with foetus (at term) within pelvis. Long-headed (cranial index 73). Fine, narrow facial skeleton, but pointed, strong chin; triangular lower face. Eighteen teeth present in the sockets; two teeth lost during life; ten lost post mortem. Abnormalities in dentation: the upper and lower left second premolars missing, with no room for their alveolar processes; probably a congenital lack of the germinal buds. Overcrowding incisors. Undercalcification of all the teeth; perikymata; three caries; paradentosis on all alveolar processes of the right side. Palatine torus strongly developed; third degree.

*Stature*: 153 cm. The postcranial skeleton well preserved. Two thoracal vertebrae (v and vi) deformed and chisel-shaped. Slightly hunchbacked, but with a straight sternal bone. Asymmetrical pelvis: the left side normal, the right side bent inwards (4–5 cm). A congenital luxation of the head of the femur, located in the foramen obturatum of the right hip bone. This right hip bone shows a polished surface on the ischial tuberosity as a result of permanent friction with the top of the greater trochanter of the femur.

B. The *foetus* found in the pelvis was already engaged by his head through the outlet, in an anterior-posterior presentation, using the conjugate diameter (from the lower margin of the pubic symphysis to the tip of the coccyx). The dimensions of the skull cap of the foetus were found suitable for passing through the pelvic straits by an oblique left-right axis (from the junction of the ischial and pubic ramus of the left side to the point of crossing of the sacrotuberous and sacrospinous ligaments of the right side). The presentation as found was incompatible with the life of both the mother and the child. We are sure that this parturient woman died because of the lack of a simple intervention by a midwife. Inside the false pelvis were several ribs, the scapulae, the cervical and lumbar vertebrae and the diaphyses of three long bones. The facial skeleton and hip bones of the woman were spotted by brown-reddish matter.

IV/5. Three adults and two children.

A. *Male* (over 60 years old). Long-headed (cranial index 71). Robust type in facial skeleton; strong glabella; large, curved nasal bones; broad cheek bones; coarse, everted angles of the mandible. Seventeen teeth present; one lost during life; thirteen

lost post mortem; no caries; advanced attrition (third-fourth degree); marks of peridontitis on two sockets. Palatine torus, second degree.

*Stature*: 167 cm. Well-developed muscularity in the occipital subnial region. Atlanto-occipital ankylosis. The axis vertebra with biphoid spinal apophysis. Extensive osteophytes on the bodies of the third and fourth cervical vertebrae; on the last three lumbar vertebrae large osteophytes. Strong muscularity on the upper limb bones. Marks of arthritis on the head of the left humerus. It may be presumed that this was a workman. Very similar to the case of I/1A.

B. *Female* (34–40 years old). Broad-headed (cranial index 84). Tapering lower facial skeleton; pointed chin; straight nose. All teeth present; no caries; attrition of second degree.

*Stature*: 153 cm. Slenderly-built post-cranial skeleton.

C. *Female* (17–18 years old). Long-headed (cranial index 74). Oblong facial skeleton (leptoprosopy 91.4; lepteny 58.2); large, curved nasal bones; pointed, robust chin; rounded occipital. Seventeen teeth present in sockets; the four third molars still not erupted; no teeth lost during life; eleven teeth lost post mortem; no caries; the seventh and sixth upper teeth show Carabelli's tubercle. Almost all the post-cranial skeleton present.

D. *Child* (5–6 years old). Almost complete skull. Seven deciduous teeth in sockets; nine permanent germinal buds still not erupted. All the vertebral column; the diaphyses of the long bones; most of the hand and feet bones.

E. *Child* (8–9 years old). Complete skull found at the bottom of the ossuary. Three deciduous teeth present in sockets; nine permanent teeth already erupted; nine still not erupted. The vertebral column, the diaphyses of the long bones, the proximal epiphysis of the left humerus, the distal epiphysis of the left femur.

#### THE CASE OF CRUCIFIXION

The skeletal finds from I/4 (see above, pp. 42–43) are of unusual interest in that they include two calcanean bones pierced by a large iron nail. This, we submit, is evidence of crucifixion. The contents of this ossuary were identified as the skeletal remains of two individuals; an adult male (24–28 years old) and a child (3–4 years old) of undetermined sex.

Although the remains were found to be in a very poor state of preservation, they were easily diagnosed when the ossuary was opened. Concomitantly with the operation of classification, each fragment of bone was carefully dehydrated and gradually impregnated in order to consolidate it. All the bony elements were gathered in two assemblages, representing the adult male and the child respectively. There was no evidence of intrusion of a third individual.

In the first stage of consolidation, the state of the bones permitted only precarious

TABLE IV

*Cranial dimensions and indices of I/4A. Stature 167 cm; and some dimensions of the limb bones*

1. Glabella-opisthocranion length	171 mm	24. Biorbital breadth (dakrya)	31 mm
2. Basion-bregma height	141	25. Dakryon-dakryon-nasion salient	13
3. Nasion-bregma chord	116	26. Upper nasalia breadth	11
4. Bregma-lambda chord	121	27. Lower nasalia breadth	20
5. Lambda-opisthion chord	91	28. Nose breadth (apertura piriformis)	28
6. Lambda-inion chord	58	29. Nose height (nasion-nasospinale)	51
7. Inion-opisthion chord	50	30. Nasion-prosthion height	72
8. Maximum vault breadth (eurya)	131	31. Nasion-menton height	107.5
9. Maximum frontal breadth (coronalia)	142	32. Gonion-symphyrion length	91
10. Minimum frontal breadth (fronto-temporalia)	99	33. Direct ramus height	56
11. Bizygomatic breadth (zygia)	127	34. Minimum ramus height	33
12. Right metopion-left asterion diameter	152	35. Chin height (gnation-infradeukle)	21
13. Left metopion-right asterion diameter	175	36. Bicondylar breadth (condylia)	112
14. Zygomaxillar breadth (Virchow)	85	37. Bigonial breadth (gonia)	92
15. Zygomaxillar-subspinal height (Jarcho)	32	38. Mandibular angle (angulus mandibularia)	110°
16. External palate length	56	1. Cranial index	77.2
17. External palate breadth	58	2. Facial index	84.6
18. Orbital height, left	29	3. Upper facial index	56.6
19. Orbital height, right	25	4. Nasal index	40.7
20. Orbital breadth, left	35	1. Right radius	243 mm
21. Orbital breadth, right	35	2. Left femur	453
22. Biorbital breadth (ectococonchia)	99	3. Right femur	450
23. Interorbital breadth (maxillo-frontalia)	30		

manipulation; they preserved for two to three weeks their original form without deformation or decay; a further preparation allowing for permanent preservation required supplementary work of 3–4 months.

The short time at our disposal prior to reburial of the remains, four weeks in all, imposed a severe selection of priorities. Extensive preparations for treating the skeletal material being impossible, we placed priority on the bones directly related to the crucifixion. The fragile condition of the bones in the first stage of preparation delayed measurement and photography for some time. Even in the final stages, only measurements were successfully taken. Solely the bones showing the marks of crucifixion could adequately be photographed after the considerable preparation. This was carried out at the Department of Anatomy of the Hebrew University–Hadassah Medical School by Mrs. C. Salomon. These latter remains are presently in the custody of the Israel Museum (Rockefeller Section), and are the only extant remains from antiquity known to be evidence of a crucifixion.

#### *Description of the Material*

The best preserved parts of the adult male skeleton were the facial bones, the upper right limb and the left leg bones. The cerebral cranium, the vertebral column (vertebrae and sacrum), the pelvic bones, the femora and the right tibia, both calcanei and some tarsalia were found in a soft condition, although readily suitable for initial preparation and study. The other bones, the left upper limb, the scapulae, all the ribs and some metatarsalia, could not be studied because of their poor preservation.

The marks of violence ascertained on the skeleton were limited to the nailed calcanei, the comminuted tibiae and left fibula and a scratched right radius. All these marks are related to the act of crucifixion, directly or indirectly. There were no other marks of violence or other deformations observed, whether of healed or healing fractures, either on the head bones, cervical vertebrae or wrist bones (carpalia and metacarpalia). The skull was found apparently undamaged, with the bones joined. After initial treatment, it was studied closely in spite of its fragile condition. After two days of dehydration and impregnation, the facial skeleton was still well preserved, but the cerebral cranial bones were already untied into separate entities. At this stage of preparation, it was impossible to attempt restoration with the view of photography. Prior to this, it was possible to obtain 38 anthropological dimensions, four cranial indices and 28 other measurements, sufficient for a portrait reconstruction and a complete drawn contour of the facial skeleton (see Table IV and Figs. 2–5).

The cranial index value shows mesocrany (77.2) in spite of a dolichocranic appearance. The maximum vault breadth (eurya) is 11 mm less than the maximum frontal breadth (coronalia). An obvious asymmetry of the cerebral cranium may explain this discrepancy. The braincase was asymmetrical in its oblique dimensions (right metopian-left asterion 152 mm; left metopian-right asterion 175 mm) with a difference of 23 mm. The forehead was more flattened on the right side than on the left.

The facial skeleton was mesoprosopic (the total facial skeleton index, including

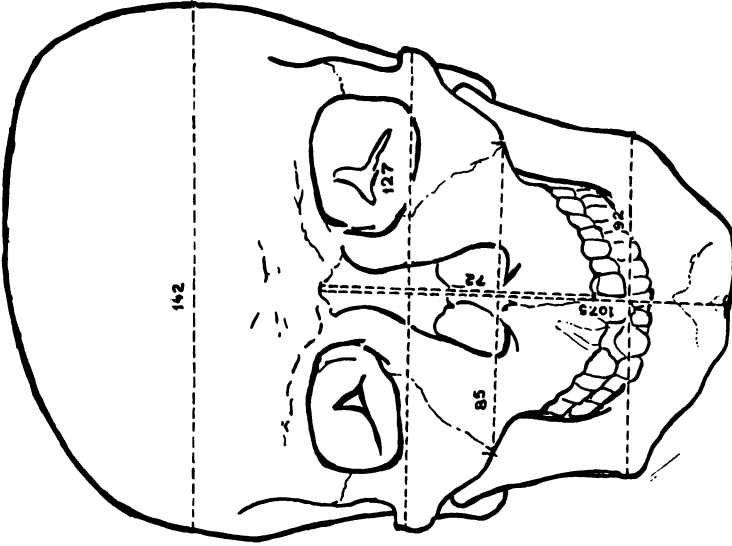


Fig. 3. 1/4A: Basic measurements of the skull.

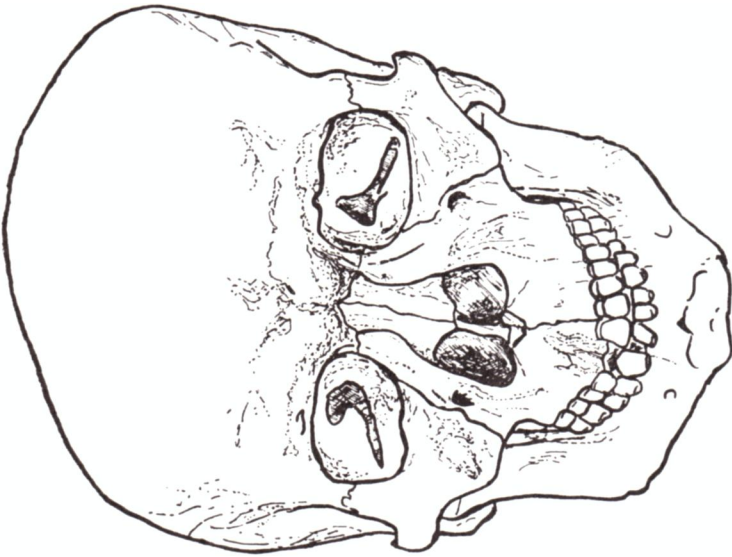


Fig. 2. 1/4A: The skull.





Fig. 5. I/4A : The restored portrait.

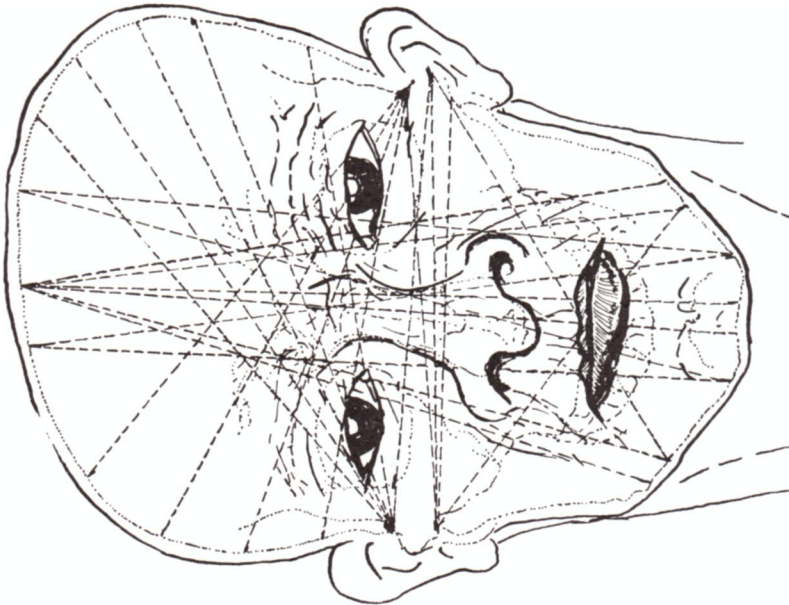


Fig. 4. I/4A : Basis of restored portrait.

the lower jaw — 84.6), but leptenic (considering the upper facial skeleton index only — 56.6). The general shape of the facial skeleton, including the forehead, was pentagonoidal; excluding the forehead, it was triangular, tapering below the zygomatic arches. The nasal bones were large, curved, tight in the upper region and coarse in their lower part (see Fig. 3).

Twenty-eight teeth were found, part *in situ* and part scattered amongst the bones. All the teeth, including the third molars, were already erupted. All the alveolar cavities and tooth sockets were unaffected by alveolar pyorrhoea or abscesses. The tooth quality was excellent, with no caries and only a very slight wear. The region of the upper right canine was totally underdeveloped, the canine missing congenitally — this region being the beginning of a true right palatal cleft (length 3.5 cm). The second right upper incisor was mesially drifted and the first incisor overthrown and included in the palatal roof of the upper maxillar bone.

The asymmetry of the cerebral cranium is a case of plagiocephaly. We are quite sure that this asymmetry was not a post mortem deformation, being correlated to the asymmetrical feature of the facial skeleton. The asymmetry of the facial skeleton has a direct association with the presence of the right palatal cleft. The palatal cleft is an indubitable congenital anomaly.

The right palatal cleft formation associated with a congenital absence of the right upper canine, the overthrown first right incisor and the mesial drift of the second incisor was studied also by means of two radiographical pictures: with the overthrown incisor in place, and after its removal. In the second picture, the gap produced in the maxillar bone by the palatal cleft is clearly visible (Pl. 19:B). In the first picture this gap was radiophotographically obstructed by the presence of the compact body of the tooth (Pl. 19:A).

The asymmetrical feature of the facial skeleton is displayed by: the differences between the height dimensions of the left and right orbits; the differences between the left and right branches of the lower jaw bone; and the differences between the left and right halves of the nasal aperture.

Concerning the plagiocephaly, it is generally agreed that this asymmetry appears subsequently to disturbances in the final period of pregnancy or as a result of difficulties in the act of parturation.

The palatal cleft and the associated asymmetries of the face are a result of more complex causative factors. The majority of modern authors have not incriminated a genetic factor, but rather an environmental one, viz. a critical change in the manner of life of the pregnant woman in the first two or three weeks of pregnancy. This critical change has frequently been ascertained as an unexpected deterioration in the woman's diet, in association with psychical stress. Statistically, this malformation occurs more frequently in chronically undernourished and underprivileged families than in the well-situated. It is understandable that unexpected stress occurs more frequently in the lowest social classes, but this does not exclude an unexpected social deterioration produced by some catastrophe in the life of a well-to-do woman.

We can conjecture for the portrayal of the personal life of this crucified person that he was twice branded by destiny before birth: by a crisis in the first few weeks of his mother's pregnancy; and by a most difficult parturition.

In spite of these taints, the portrait sketch of his visage is pleasing, but rather wild: mild features of the muscular impression stemming from the muscles of mastication; coarse features from the insertions of the mimicry muscles. The chin contributes to an energetic physiognomy; the cheek bones to a feminine appearance (see Fig. 2).

The calculated stature of this person was 167 cm, i.e. no taller than the classical mean for Mediterranean peoples.

The general aspect of the limb bones was fine, slender, gracile and harmonious, dissimilar to the contradictory features of the cranial skeleton. It is undoubtedly the skeleton of a male, but the study of the post-cranial skeleton has strikingly confirmed that this person never engaged in heavy corporeal labour. He was never seriously injured, as is evidenced by the absence of any pathological deformations, or of any traumatic bony lesions — until the crucifixion itself. The lack of any marks of disease or nutritional deficiency indicates that, after birth, the conditions of his life had improved.

The leanness of the muscles in both the upper and the lower limb bones, and the thinness of the entire post-cranial skeleton, point to moderate muscular activity, in both childhood and after maturity. This man was, nevertheless, of a healthy constitution. The absence of dental caries, the normal growth of all the permanent teeth unaffected by the infirmity of a palatal cleft, the well-developed vertebrae lacking any marks of deformation, as well as the straight, firmly-built long bones, are all testimony in favour of this assertion.

An attempt to portray this young man beyond the purely anthropological aspect might be stated as follows: The face was quite remarkable, but pleasant in spite of the almost imperceptible defects which were hidden by the hair, beard and moustache (see Fig. 5). The body, being very proportionate, was agreeable to sight, particularly in motion, because of the gracious, almost feminine allure; it reminds us of the Hellenistic ideal *ephebe*.

### *Proofs of Crucifixion*

The calcanean bones pierced by an iron nail were discovered amidst the well and poorly preserved bones, below the cranial skeleton in the syrupy fluid at the bottom of the ossuary. At first look, they seemed to be a single bone — the right calcaneum. Further observation revealed the presence of the sustentaculum tali of the left bone. At the moment of discovery, however, the two calcanean bones appeared to be two formless, unequal bony bulges surrounding an iron nail, being coated by a thick calcareous crust (see Pl. 19:C).

One could see very clearly that a relatively large (1.5–2 cm) wooden plaque, in a well-preserved state, was situated below the head of the nail, between it and the bony

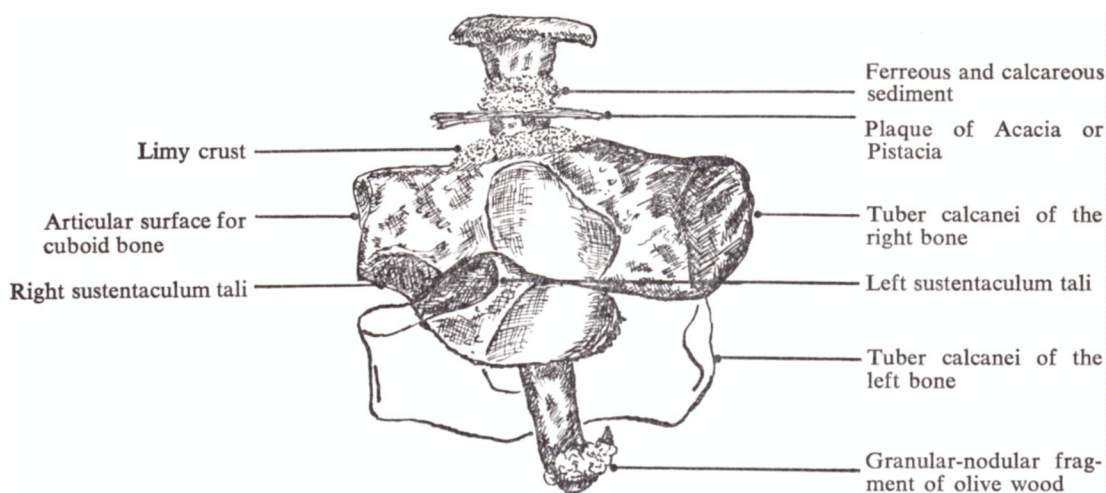


Fig. 6. I/4: The calcanei with the nail.

bulges (Pl. 21:B). From the first, we were sure that this represented proof of a crucifixion. Our dilemma was whether we should preserve the piece of wood, even at the expense of the bones, or whether it would be more important to preserve the latter, in order to identify them, but at the expense of the wood. Eventually, we decided that identification of the bones would be of more significance.

Fragments of the wood underwent a microscopic, palaeo-botanical analysis and were determined as belonging to general *Pistacia* or *Acacia*. In the same way, we studied some small granular fragments of wood, heavily impregnated by iron oxides, which were found near the tip of the iron nail. They were identified as olive wood (Fig. 6; Pls. 20:A and 21:B).

After dehydration, cleaning and impregnation, the two bony bulges were identified. The larger one, belonging to the right bone, was situated near the head of the nail and partially glued to the wooden plaque. Some fragments of the pistacia or acacia wood were found embedded in other large fragments of the right calcaneum, which were discovered among the long bones. The fragment of the left calcaneum adherent to the iron nail and to the larger fragment of the right bone was the calcaneum sustentaculum tali apophysis. Immediately after the first stage of impregnation, we identified only one such apophysis: the sustentaculum tali of the left calcaneum. Several months later, we were convinced that, in reality, there were two sustentacula tali in collision; the complete one, belonging to the left calcaneum, and another one, a crumbled sustentaculum tali, belonging to the right calcaneum (Fig. 6; Pl. 20:B).

In the first stage, ignoring the presence of the second sustentaculum tali apophysis, but aware that all the bones found would be reinterred almost immediately, we made a provisional sketch showing the position of the feet during the crucifixion. We inferred that the lower limbs were in an 'open position', the two calcanei (the right

before the left) being crossed and fixed in their middle region by the iron nail (Pl. 24:A).

Not knowing at that time of any osteological proof concerning the position of the upper limbs on the cross, we conjectured that iron nails had been fixed in the distal region of the forearms. After succeeding in obtaining a considerable delay for study of only those bones definitely suspected of or proved as being directly affected by the crucifixion, we were able to improve our interpretation. This stay was utilized for a permanent impregnation and restoration of the bones of the feet, tibiae, left fibula and right radius.

The bones bearing marks ascribed to the crucifixion had been situated above the level of the fluid within the ossuary. They were quite friable at the time of discovery and were recognized as having a bearing upon an understanding of the mechanics of crucifixion only after their complete consolidation.

The restoration of the talus, navicular and cuboid bones in their anatomical relation to the right calcaneum refutes the 'open position' hypothesis (Pl. 24:A). The two calcanei were attached by their medial surfaces laid adjacent. The right foot was the first to be transfixed by the nail, exceeding the left anterior-posteriorly by 2.5 cm. This fact indicates that the legs were also adjacent on the cross (Pl. 24:B).

The right tibia and the left calf bones (tibia and fibula) were all broken in their last third at the same level, but in a different manner: the right tibia had brutally been fractured, by comminution, into sharp, large slivers; the left tibia and fibula were broken by a simple, oblique, dentate-serrate line. Both types of fracture are characteristic in fresh bone (Pl. 23:B-C). The fracture of the right tibial bone (the fibula being unavailable for study) was produced by a single, strong blow. This direct, deliberate blow may be attributed to the final 'coup de grâce'. The same blow had had indirect repercussions on the left ankle bones. The percussion, passing the already crushed right calf bones, was a harsh and severing blow for the left ones, attached as they were to the sharp-edged wooden cross. The simple, oblique but serrate fracture resulted from this bilateral sharp pression. The obliquity of the line of fracture in both left calf bones is valuable evidence for determining the position of the legs on the cross. It presumes that the long axis of the left shin bones was, at the moment of the blow, at an angle of 60-65°, crossing the axis formed by the sharp edge of the upright of the cross (Pl. 23:A; and cf. Pl. 24:B). This ascertained fact compels the interpretation that the knees were semi-flexed. The study of the nail shows that the penetration was directed anterior-posteriorly, superior-inferiorly, oblique to the plane of the vertical shaft, leading to the conclusion that it was a compulsive position, a difficult and unnatural posture.

While the hypothesis of the 'open position' was refuted by the osteological evidence, our first conjecture concerning the attachment of the upper limbs to the cross was corroborated by the study of the right radius (Pl. 22:A-C). This bone shows a small scratch on the distal third of the interosseous border. The scratch looks like an incisure, more abruptly shaped at its proximal edge than on the very smooth distal

end, where it almost disappears. The scratch is an artefact produced on fresh bone by compression, friction and gliding. This artifact, in our interpretation, is the osteological evidence of the penetration of the nail in the interosseous space between the radius and the ulna. The abrupted proximal edge of this scratch is evidence of the first direct contact of the nail with the radial bone. The smoothly-shaped, vanishing slope is a secondary testimony, explained as the further result of the slight and gradual increasing movement of friction, rotation and gliding between the radial bone and the nail, towards the end of the crucifixion. It should be remembered in this context that the wrist bones (either the carpalia or the metacarpalia of both arms) were found undamaged.

The whole of our interpretation concerning the position of the body on the cross may be described briefly as follows: the feet were joined almost parallel, both transfixed by the same nail at the heels, with the legs adjacent; the knees were doubled, the right one overlapping the left; the trunk was contorted; the upper limbs were stretched out, each stabbed by a nail in the forearm (see Pl. 24:B).

A study of the nail itself, and of the situation of the calcanean bones between the head and the tip of this nail, shows that the feet had not been securely fastened to the cross. This assumption requires the addition of the traditional 'sedecula' in our sketch (Pl. 24:B). The 'sedecula' — previously fastened to the upright of the cross — was intended to provide a secure seating for the buttocks of the victim, to prevent collapse and to prolong agony (cf. Pl. 24:A–B). In our case, of a very precarious stability of the feet, the use of a 'sedecula' was technically essential to provide support for the body on the cross. We suppose that the improvised 'sedecula' was just large enough to bear the left buttock.

The forced position of the body, the oblique penetration of the principal nail, the fact of an encounter between the tip of the nail and a knot in the olive wood, all together resulted in the iron nail having become bent and forcing out a bit (1–2 cm) of the olive wood. The study of the nail shows that its initial length was 17–18 cm, quite enough to penetrate the two heel bones and secure a hold within the wood. Actually, after the shaft bent, the total length of the nail in a straight line was only 12 cm (Pl. 19:C). The fact that the head of the nail overlapped the external surface of the right calcaneum by 2 cm, and that the thin plaque of wood was found straight, further suggest that the nail did not enter properly into the wood of the cross.

Some observations made during the study of the bones provide more information on the 'coup de grâce'. In removing the body from the cross, the unhooking of the forearms would have presented no difficulty. But the peculiar situation of the nail transfixing the feet and bent within the cross complicated this normally simple task. On the right talus an almost horizontal sectional cut can be observed where the top of the upper articular surface had detached. This section was obviously created by a sharp tool (axe or hatchet), the cut being coarser on the lateral side of the bone and finer on the medial side (Pl. 21:C). This must surely be related to a post mortem amputation of the feet, technically imposed by the peculiar attach-

ment of the nail to the wood. We believe that this cut was made only after several abortive attempts had been made to extract the nail. As the nail was loose, yet well-anchored within the wood by its bent end, and as the legs were broken, the only practical way to detach the body would have been to cut the feet off and then to remove the entire complex (nail, plaque of wood and feet) from the cross.

In the region of the broken legs many large, dark spots were observed (see Pl. 23:B). We assume that these spots are the extant traces of the ritual anointing performed directly on the naked bones, prior to their reburial in the ossuary.

#### CONCLUSIONS

An initial anthropological approach to the first material evidence of a crucifixion does not exclude a certain emotional concern. We must remember that the act of crucifixion was performed on many thousands of Jews and Gentiles, before and after Jesus of Nazareth. This form of punishment was a customary one in Phoenician and, later, in Roman law.

The present anthropological study demonstrates that the man in question was marked before birth, at birth and by his death. The exceptional conditions of his crucifixion have preserved the material evidence for this statement.

The thirty-four other skeletal remains recovered from the 15 ossuaries excavated in the burial caves at Giv'at ha-Mivtar are of considerable anthropological and historical significance. On the one hand, they are indicative of the physical characteristics of the inhabitants of Jewish Jerusalem in the last centuries before the destruction of the Second Temple; and on the other hand, there is significance in certain peculiar pathological and traumatological marks found on these skeletal remains, which probably relate to the stirring events of that epoch.

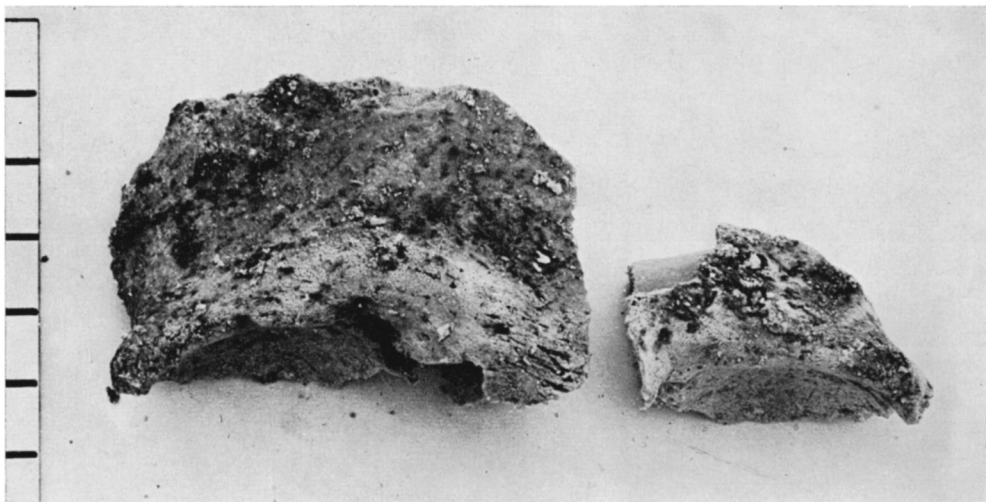
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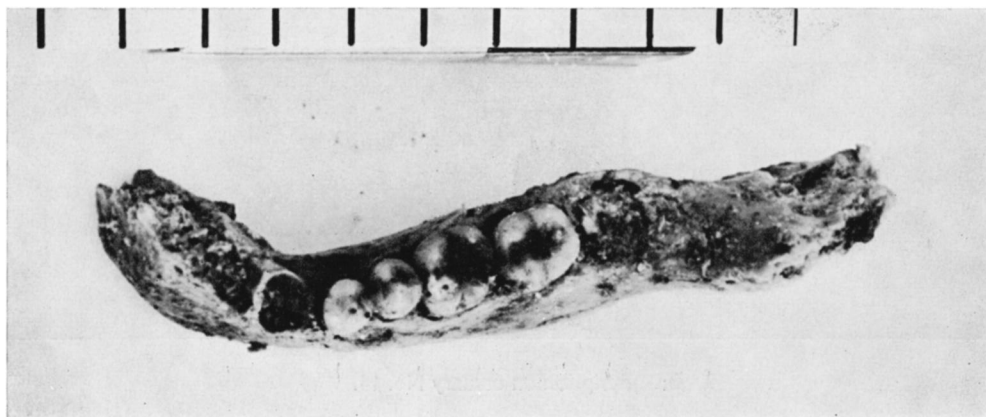
PLATE 18



A: I/1. Dog humerus.



B: I/1A. Frontal bones.

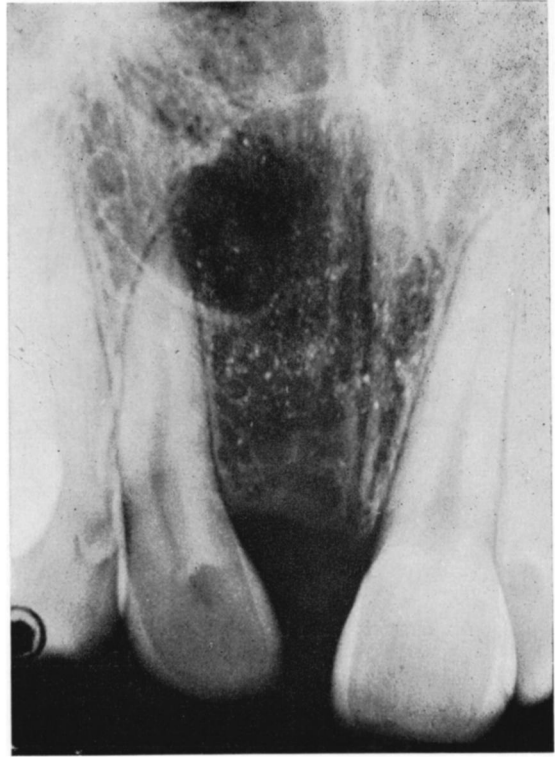


C: I/1B. Left horizontal ramus of the lower jaw.

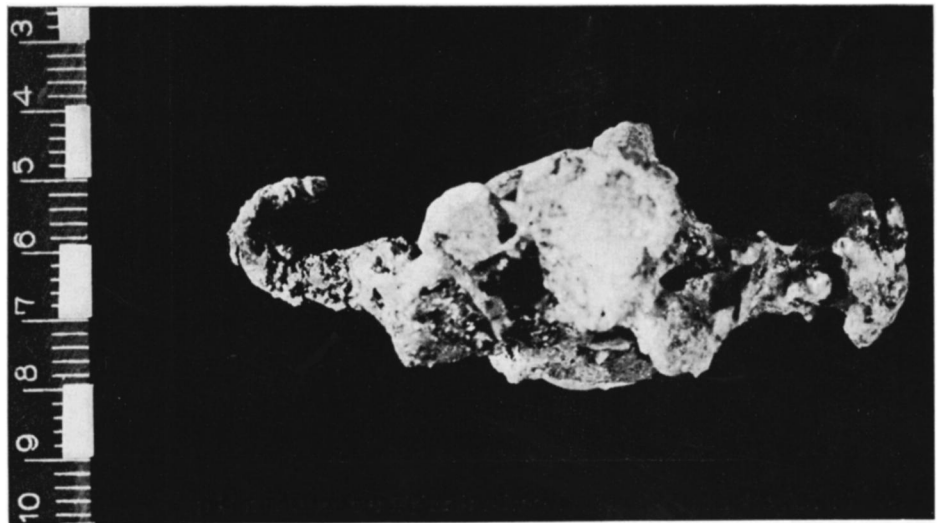




A: I/4A. Radiographical picture of the region of the upper incisors, showing the overthrown first right upper incisor.

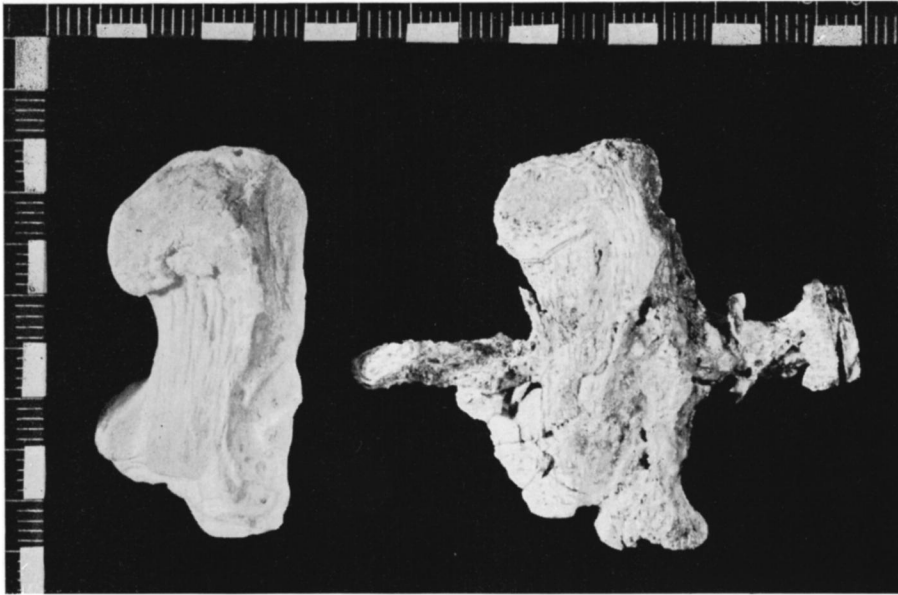


B: I/4A. Radiographical picture of the same region as A, but showing the right palatal cleft after removal of the overthrown tooth.

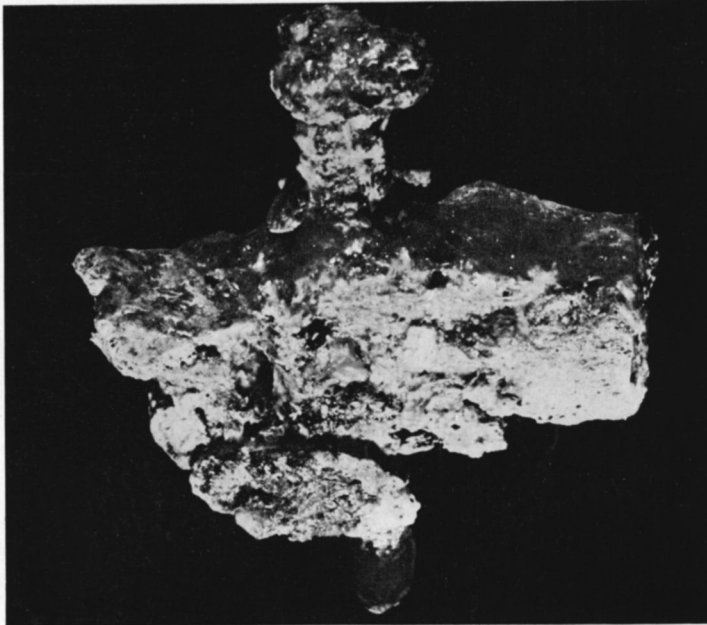


C: I/4A. The calcanean bones as discovered, with coating of thick calcareous crust.

**PLATE 20**



**A: The calcanean bones after a first attempt of reconstruction, in comparison with an actual left calcanean bone.**



**B: Left calcanean bone together with the right sustentaculum tali;  
proximal view.**



A: Actual left calcanean bone, demonstrating the place of perforation from the lateral side.

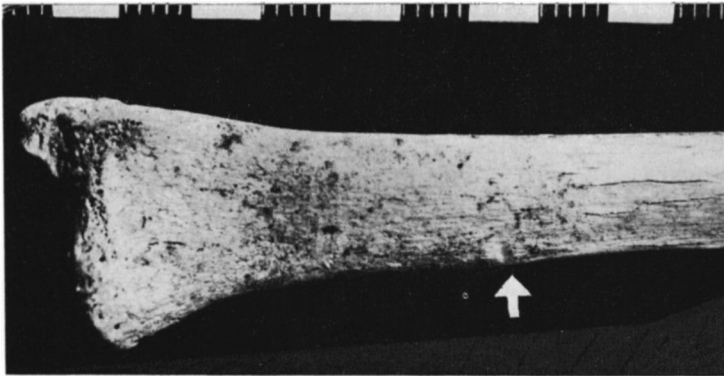


B: Head of the iron nail, showing the remnants of the wooden plaque.

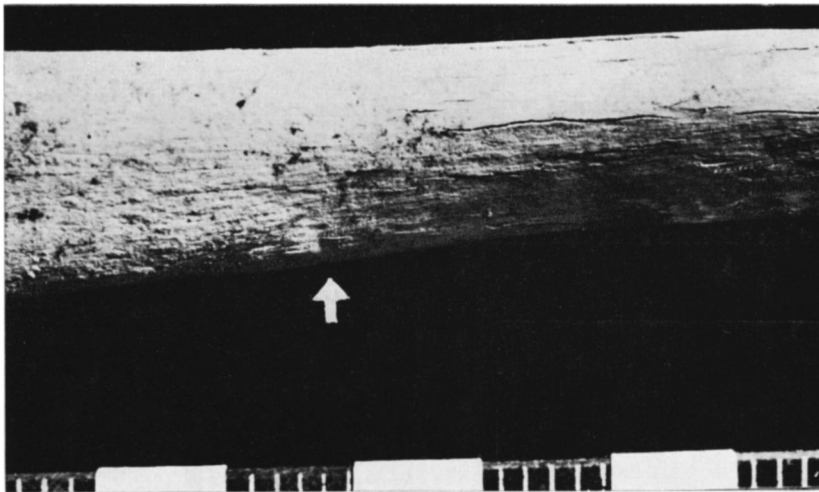


C: Complete restoration of the calcanean and other tarsal bones; proximal view.

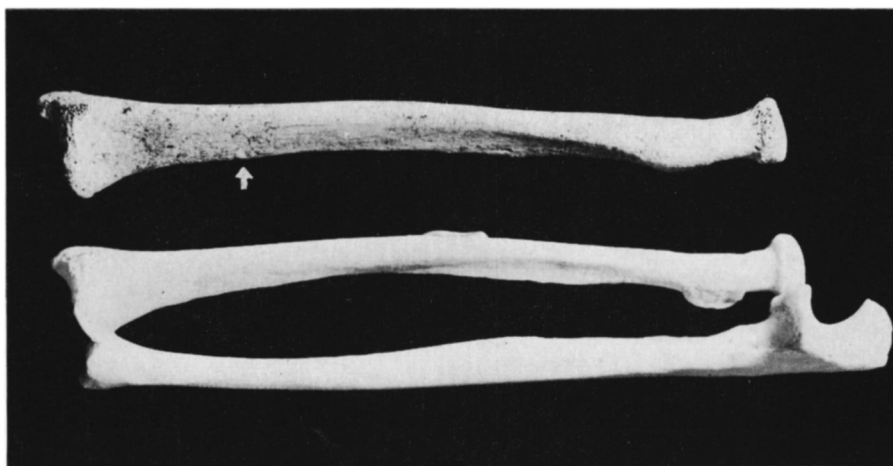
PLATE 22



A: Distal end of the right bone, showing the scratch produced by friction between the bone and the nail.



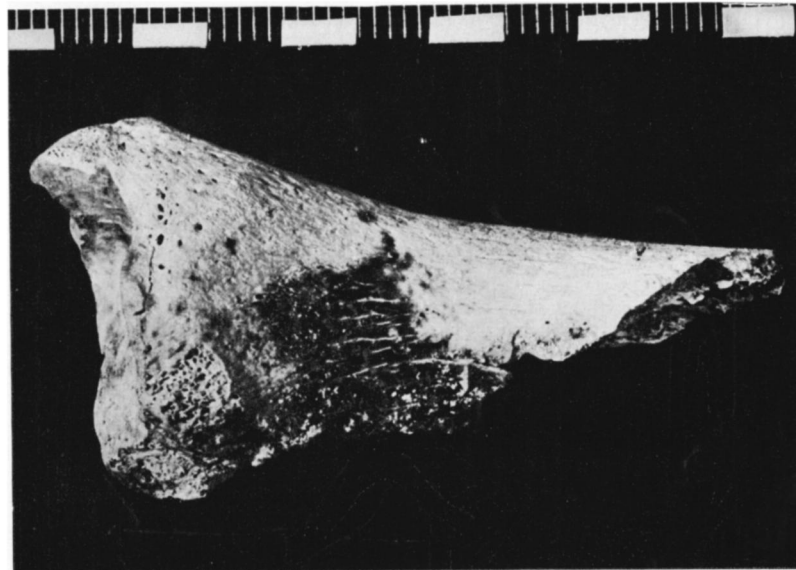
B: Detail of A.



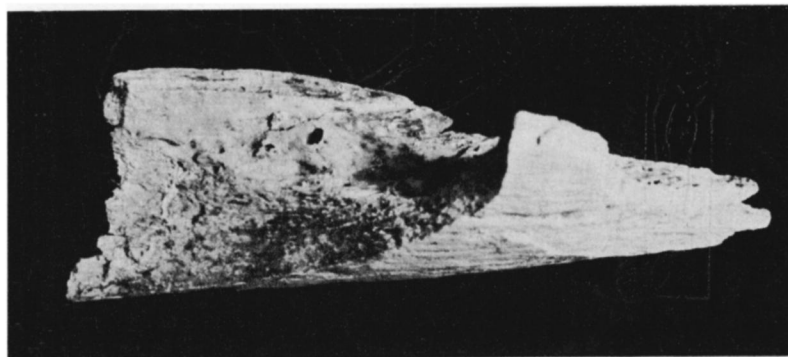
C: Complete right radial bone of I/4A, in comparison with two actual bones of the same length.



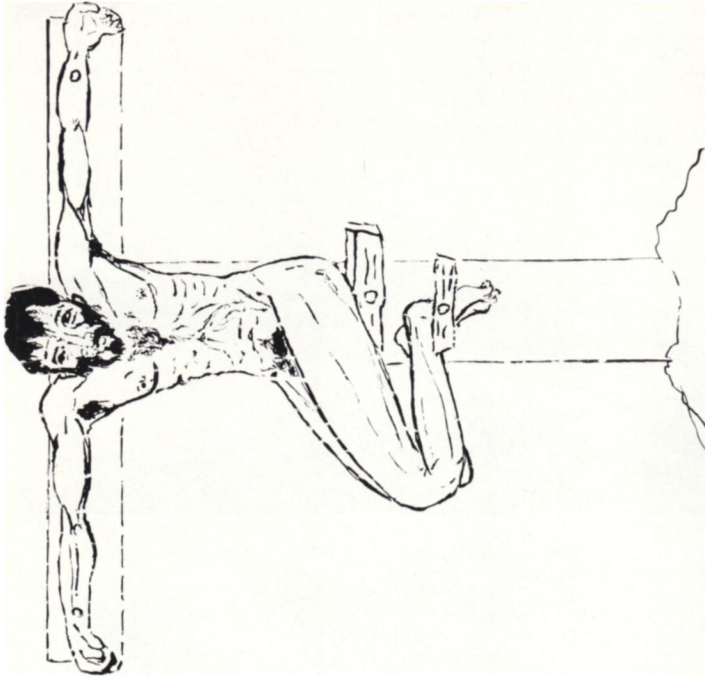
A: Broken bones of the left shin.



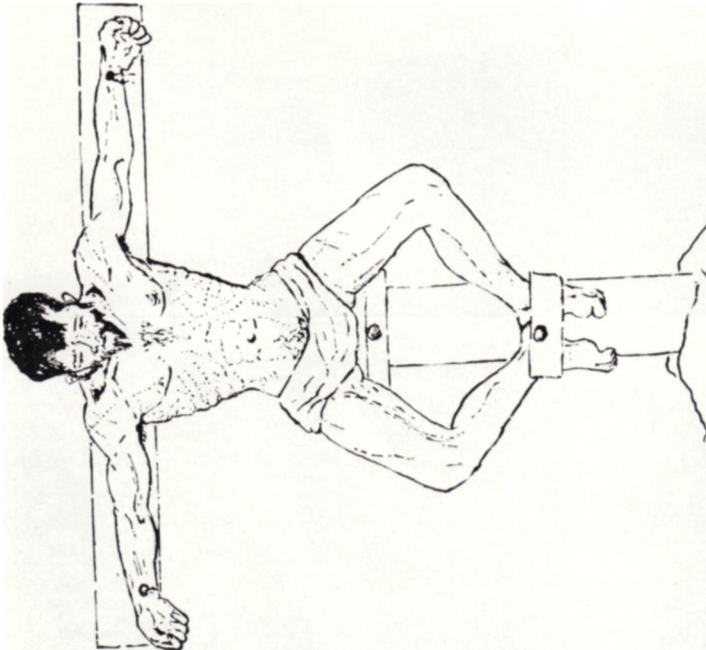
B: Splinter of the right tibia.



C: Splinter of the right tibia, showing a dark spot.



B : Crucifixion with legs adjacent  
(final restoration).



A : 'Open position' crucifixion  
(initial restoration).