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RELATION OF IUFAA TO PERSONS FOUND BESIDE HIS SHAFT-TOMB AT ABUSIR (EGYPT)

ABSTRACT: Skeletal remains of Iufaa found inside his intact Shaft-tomb at Abusir in 1998 by the Czech Institute of Egyptology have been compared with two adult skeletons unearthed in a corridor adjoining the Shaft-tomb, discovered in 2001. Craniometrics show a striking proximity of an old male Nekawer and a mature female Imakhetkherresnet. At the same time, the young adult male Iufaa, due to the very broad and low neurocranium and broad face, reveals a two and half bigger distance from both of them. If only splanchnocranic dimensions (except bizygomatic breadth) were compared, the three persons appear very close, Iufaa resembling more Nekawer (both males) than Imakhetkherresnet (female). Similarities between the three individuals can also be detected in cranial indices, cranial profile angles, cranioscopic features and postcranial skeleton (cranial variation of the spine and foramen arcuale atlantis*). Craniometric comparison was not possible in a fourth person, male Padihor, found in another tomb 25 m east of Iufaa's tomb, because of the fragmentary state of his skull. However, on the skeleton as well as in his body build and stature no features similar to any of the other three persons were revealed, making thus his blood relationship with them improbable. The anthropological results are discussed in light of the archaeological and textual evidence.*

KEY WORDS: Shaft-tomb of Iufaa – Shafts 1/R/01 and 2/R/O1 – Skeletal remains of Iufaa, Nekawer, Imakhetkherresnet, and Padihor – Kinship analysis – Horizontal stratigraphy – Textual evidence – Abusir – 26th Dynasty

INTRODUCTION

In 1994 the expedition of the Czech Institute of Egyptology, Charles University Prague, directed by L. Bareš, started investigation of a second Shaft-tomb at Abusir, located closely to SSE of the Shaft-tomb of Udjathorresnet which had been excavated in the preceding seasons (Bareš 1996, 1999). During the 1996 season its burial chamber was opened and found to be intact, containing a complete funerary equipment (Bareš, Smoláriková 1997). In the following season, in February 1998, both the huge outer rectangular limestone and the inner anthropoid schist sarcophagus were opened. In the remnants of a wooden coffin, disintegrated by high humidity, decayed mummy of the lector priest Iufaa "administrator of the palaces", was found. Preliminary reports on X-ray examination of the mummy, removal of remnants of its wrappings, infested by moulds, and analysis of the skeletal remains of Iufaa were published elsewhere (Strouhal 1998, Bareš, Strouhal 2000, Strouhal 2001).

During the 2001 season, the area east of Iufaa's tomb was investigated (Bareš *et al.* 2002). Besides a structure that served the mortuary cult of Iufaa, another smaller shaft tomb 25 m to the E from IU's tomb (1/R/O1) and a sloping trench and shaft (leading to a 26 m long descending corridor) 4 m to the E from it (2/R/O1), were discovered (*Figure 1*). In them, three new burials were found, identified by names inscribed on coffins, shabtis or canopic jars.

Similarly to the shaft-tomb of Iufaa, the newly discovered tombs were dated to the end of the 26th Dynasty, shortly before 525 B.C.). They are either roughly contemporaneous, or tomb 1/R/O1 could be slightly younger than tomb 2/R/O1 (Bareš, pers. comm.).

MATERIAL AND METHODS

The aim of the paper is a comparison of the skeleton of Iufaa (further: IU, excavation No. 97/R/98) with the skeletons of the three newly discovered burials.

Burial 140/R/O1 laid in a well preserved wooden double coffin belonging to lady Imakhetkherresnet (further IM, bearing no titles) placed at the dead end of the descending corridor connected with shaft 2/R/O1 (*Figure 1*).

Some time after her burial was closed by a partition wall, burial 139/R/O1 in an anthropoid coffin which was destroyed by humidity, was found in front of the first burial. It belonged to a male Nekawer (further NE, addressed as "God's father"). In connection with the second burial the partition wall of the first burial was dismantled and its bricks were probably used to close the access to both burials.

A third burial (132/R/01) of another male Padihor (further PA, bearing the title "Royal acquaintance"), disturbed and displaced by tomb robbers, was found in front of the entrance to its burial chamber from the 12 m deep shaft 1/R/01.

The three mentioned individuals were mummified, as evidenced by black spots and patches of resin preserved on several bones, but owing to the humidity in the corridors, wrappings and soft tissues mostly disintegrated and mere skeletons have been preserved.

Of them the skeleton of IM is almost complete and well preserved, being protected by its coffins. On the other hand, some postcranial bones of NE, because of their gracility, are broken and partly defective, in spite of the fact that both burials were not disturbed by tomb robbers.

In distinction to it, of the skull of PA only fragments survived (*Figure 6f*), as the right half of the *squama frontalis*, posteromedial quarter of the right *parietale*, anterolateral quarter of the left *parietale*, anterior edge of the right *temporale* connected with part of the *sphenoid*, the *squama occipitalis* and anterior third of the mandibular body from R M_1 to L P_1 (not included in the picture). From the postcranial skeleton, whose bones are partly defective, nine vertebrae, sternum, R clavicle and several small bones are missing.

After cleaning and mending broken bones the three skeletons were examined cranio- and osteoscopically and measured by usual cranio- and osteometric techniques aimed at kinship analysis. They were subjected also to a palaeopathological analysis described in another paper (Strouhal 2003).

EXCEREBRATION

The brain of IU was removed through a hole in the *lamina cribrosa* of the ethmoid bone (anteroposteriorly 15 mm, transversally 25 mm) and by this operation the anterior wall of the *sphenoid sinus*, the upper tree quarters of the nasal septum and the upper and middle *conchae* were removed. The posterior half of the braincase and its top were filled with resin, which stiffened with projections and humps.

Brains of IM and NE were also removed by piercing a hole into the *lamina cribrosa* of the ethmoid bone. Due to thin bones of NE, this opening was enlarged secondarily (anteroposteriorly 45 mm, transversally 15 mm), while the original small round hole (diam. 10 mm) survived well in IM. Melted resin was poured into the cerebral cavities of both skulls, where it stiffened as filling of their occipital thirds, 40–50 mm thick, displaying horizontal levels as skulls lay with their occiputs down.

The technique of excerebration and the amount of resinous filling in both IM and NE are similar, suggesting the probability that the operation was performed by the same embalmer within a short time period.

In PA no nasal cavity survived and only dark brown spots, but not patches of black resin, were found in the left orbital roof and inner surface of the *squama frontalis*, while inner surface of *squama occipitalis* retained its ochre colour. Brain removal and resinous filling appear thus as improbable in this individual.

GENERAL DATA ON THE INDIVIDUALS

The skeleton IU is that of a medium robust male with predominance of male features, but less developed muscular relief on upper than on lower extremity bones. He died according to fissures due to incomplete fusion of apophyses of the *cristae iliacae* and of the *ramus ascendens* of the left pubis, relief of the *symphysis pubica* (stage 4 of Todd 1920) and youngish character of the *facies auriculares* (Lovejoy *et al.* 1985) at the age of 25–30 years, notwithstanding the very intense decay of his dentition and progressed fusion of his cranial sutures.

The skull and skeleton of NE are decisively male (except the wide and open *incisura ischiadica maior*), but they show several signs of senile atrophy or emaciation. Bones are long but gracile, especially the occipital squama, mastoids, claviculae, humeri, antebrachial bones, *fossae supra-* and *infraspinata* of the scapulae, the iliac wings etc. The relief of muscular attachments betrays the once strong development of muscularity. According to the fully fused cranial sutures (outside as well as inside), except the still opened *suturae squamosae*, flat upper and deeply depressed lower halves of the *facies auriculares* (*facies symphysiales* missing) and progressed degenerative arthritis of most joints, age at death points to the range of 55–65 years.

The skeletal remains of IM are of an unequivocal adult female with gracile body build but without any signs of osteoporosis. Her muscular relief was relatively well developed. Medium deep *sulci praeauriculares* reveal her child-bearing history. Progressed fusion of cranial sutures (C_2, S_1, $L_{1–2}$ and pterion), the *facies symphysialis* of Todd's stage 8, the smooth and slightly concave *facies auriculares* with a slight rim and a moderate degree of degenerative arthritis suggest an age at death of 35–45 years.

FIGURE 1. Sketch plan of Iufaa's Shaft-tomb (R), tomb of Padihor (R_1), tombs of Nekawer and Imakhetkherresnet (R_2) and the sanctuary east of the Shaft-tomb (drawn by K. Smoláriková).

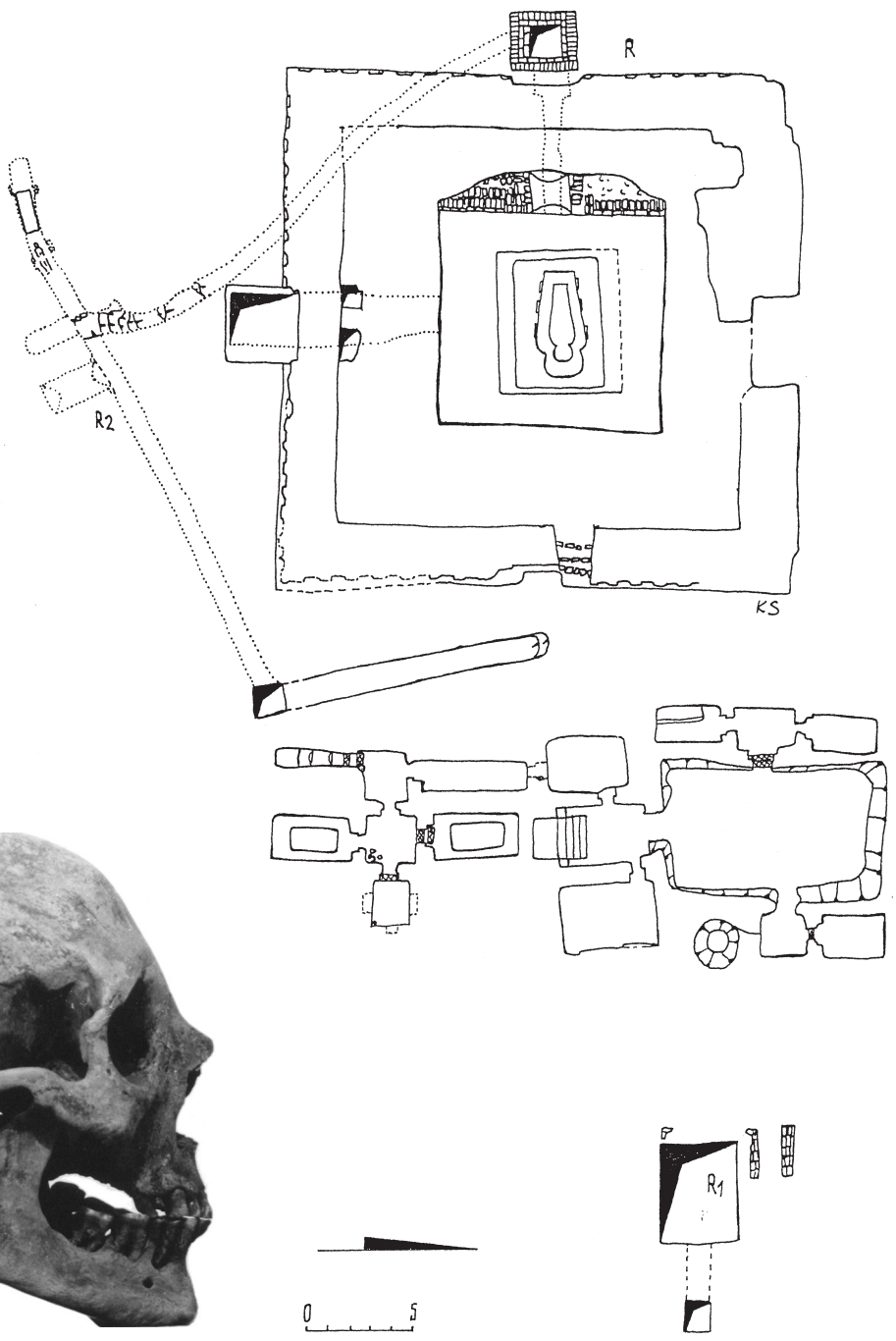


FIGURE 2. Triangles expressing mean distance between Iufaa (IU), Nekawer (NE) and Imakhetkherresnet (IM) in (LEFT) neurocranial measurements with bizygomatic breadth of the face (– – –), in splanchnocranial measurements, in all calvarial measurements (– • – • –) and (RIGHT) in mandibular measurements.

The skeleton of PA displays very thick-vaulted cranial fragments and a fairly robust skeleton but with medium developed muscular relief. His male features are very distinct according to secondary sexual features of the skull and hip bones. His extremity bones are very long. According to the *facies symphysialis* (Todd's stage 5), *facies auriculares* (depressed, billowed, uneven, drawn downwards) and several other features, PA died aged between 28 and 32 years.

CRANIOMETRIC COMPARISON

A battery of 32 craniometric measurements (22 on calvarium and 10 on mandible; *Table 1*), were compared in the three individuals (IU, NE, IM). Cranial fragments of PA did not furnish enough data for the analysis. Already comparing values of each measurement separately, they are greater in young male IU (and in only two preserved with the other young male PA) then the smaller values of the remaining two persons, of which the old male NE appears closer to the medium aged female IM than to the male IU.

To elucidate their mutual position, totals of their measurements were analysed by calculation of a mean distance (*MD*) between pairs of individuals, expressed as square root of the mean square distance:

$$MD = \sqrt{\frac{(\sum d_{1-x})^2}{n}}$$

MD ... mean distance between two individuals,
Σ ... sum of differences (d_{1-x}) between pairs of used measurements,
n ... number of measurements.

Measurements of the calvarium were analysed not only as a whole ($n = 22$), but also divided into two components, viz (1) neurocranic measurements together with the bizygomatic breadth of the face ($n = 9$), and (2) the remaining splachnocranic measurements ($n = 13$). Mandibular measurements (except mandibular angle) were tested separately ($n = 8$).

Results are drawn in the form of four triangles (*Figure 2*). The first triangle (– • – • –) compares all measurements of the three calvaria. Calvaria of NE and IM are close to each other (*MD* 4.9 mm), in spite of being of different sexes. Calvarium of IU is twice more distant. It stands closer to male calvarium of NE (7.8 mm) than to that of female IM (8.9 mm).

In neurocranic measurements together with breadth of the face (– – –), IU is still more distant from the other two calvaria (11.5 mm and 12.3 mm, respectively). This is caused by IU's exceptionally large breadth and low height measurements (platycrany). The greater distance between IU (male) and IM (female) than between IU and NE (both males) is based on sexual difference in skull length of the former pair.

Splanchnocranic measurements except facial breadth are very similar in all three individuals. IU fits very close to them, naturally more to male NE (3.3 mm), than to female IM (5.3 mm). This is caused by facial, upper facial and nasal heights, greater in the males (IU, NE) than in the female (IM). Exceptionally narrow interorbital distance of both NE and IM contrasts which the larger one in IU, connected with his generally great breadth dimensions.

Already according to this analysis, the three individuals can be considered as biologically related. The differing

TABLE 1. Craniometric data. M = male, F = female, B = breadth, mand. = mandibular, no. according to Martin and Saller 1957, + = according to Giles and Elliot 1963, ++ = from the lowest point of the left orbit perpendicularly down to the lowest point of *processus zygomaticus* of maxilla, # = projective measurement on mandibulometer, (..) = value diminished by atrophy.

No.	Measurement	M IU	M NE	F IM	M PA
1	Cranial length	186	183	170	–
5	Basis length	95	97	95	–
7	Foramen magnum length	39	39	35	–
8	Cranial breadth	147	137	138	–
9	Min. frontal breadth	103	96	97	110?
11	Biauricular breadth	131	112	112	–
13.1	Max. mastoid breadth	134	119	120	–
16	Foramen magnum breadth	31	29	27	–
17	Basion-bregma height	120	131	127	–
–	Mastoid height +	29	28	25	–
40	Facial length	86	92	91	–
45	Zygomatic breadth	138	120	119	–
47	Facial height	119	121	108	–
48	Upper facial height	76	77	69	–
48.1	Height of alveol. part	23	25	20	–
–	Height of zygoma ++	23	17	18	–
50	Ant. interorbit. breadth	23	17	16	29?
51	Orbital breadth	44	43	44	–
52	Orbital height	37	40	37	–
54	Nasal breadth	26	24	24	–
55	Nasal height	54	53	48	–
60	Maxilloalveolar length	58	56	52	–
61	Maxilloalveolar breadth	(50)	(54)	56	–
65	Condylar B of mandible	132	115	113	–
66	Bigonial B of mandible	98	83	73	–
68.1	Mandibular length	111	101	96	–
69	Symphyseal height	32	31	28	30
69.1	Height of mand. body	32	27	27	29
69.3	Thickness of mand. body	12	10	9	11
70a#	Height of ramus mand.	59	51	50	–
71	Minim. B of ramus mand.	33	30	31	–
79	Mandibular angle	121	127	121	–

TABLE 2. Cranial indices. M=male, F=female, No. according to Martin and Saller 1957, transv. = transversal, mand. = mandible, thick. = thickness, i. = index, + = Hrdlička 1920, ++ = modified (50:45), # = modified (68.1:65).

No.	Index	M IU	M NE	F IM
1	Length-breadth of skull	79.0	74.9	81.2
2	Length-height of skull	64.5	71.6	74.7
3	Breadth-height of skull	81.6	95.6	92.0
– +	Mean height of skull	72.1	81.9	82.5
13	Transv. frontoparietal	70.0	70.1	70.3
33	Foramen magnum	79.5	74.4	77.1
38	Facial	86.2	100.8	90.8
39	Upper facial	55.1	64.2	50.0
41	Orbital	84.1	93.0	84.1
46++	Interorbital	17.2	14.2	13.4
48	Nasal	48.1	45.3	50.0
60	Gnathic	90.5	94.8	95.8
62#	Breadth-length of mand.	84.1	87.8	85.0
63	Index of mandibular ramus	55.9	58.8	62.0
64	Breadth index of mand.	74.2	72.2	64.6
66	Height-thick. i. mand.body	37.5	37.0	33.3

TABLE 3. Profile angles of the skull. No. according to Martin and Saller 1957, M = male F = female, + = from glabella to maximum protrusion of frontal squama.

No.	Profile angle	M IU	M NE	F IM
72	Total	82	81	80
73	Nasal	84	82	85
74	Alveolar	78	74	72
–	Frontal +	63	67	83
76	Zygomatic	106	121	129
78	Sagitt. orbital entrance	86	84	90

platycrany of IU, correlated with his broad face and large interorbital distance, could have been an individual feature, congenital anomaly or pathology affecting only himself, but not his two relatives.

Mandibular measurements express well the usual sexual differences; at the same time, however, because of age involution, the old male NE resembles closely the mature female IM (mean distance only 4.2 mm). Similarly as in neurocranic measurements, IU mandibular measurements are more distant from both of them, twice from male NE (9.5 mm), but – due to sexual differences – three times from female IM (13 mm).

TABLE 4. Cranioscopic data. M-S = Martin and Saller 1957, E = Eickstedt 1944, 1 = feeble, 2 = medium, 3 = strong.

Feature	M IU	M NE	F IM	M PA
Skull robusticity	3	2	1–2	3
Glabella (M-S)	1–2	2	1–2	2–3
Arcus superciliaris (E)	1	1	0	3
Nasofrontal transition	straight	sl. arched	straight	sl. arched
Spina nasalis ant. (M-S)	2	2?	3	–
Linea temporalis	1	1	0–1	1
Crista supramastoidea	2	1	0	–
Profile of forehead	oblique	oblique	vertical	oblique
Protuber. occip. externa (M-S)	2	1	0–1	2
Sulcus sagittalis	+	+	+	0
Proc. mastoideus thickness	2–3	2	2	–
Incisura mast. volume	2	1–2	2	–
Nuchal muscular relief	2	1	0–1	2

TABLE 5. Spinal measurements.

Vertebra	M IU	M NE	F IM	M PA
C_1	–	69	66	–
C_2	38	37	35	37
C_3	10	11	10	–
C_4	11	11	11	–
C_5	10	11	10	–
C_6	12	12	11	–
C_7	14	13	14	12
T_1	16	15	15	13
T_2	18	16	16	15
T_3	16	16	16	17
T_4	17	–	14	16
T_5	16	16	17	–
T_6	17	–	18	16
T_7	13	–	17	–
T_8	19	18	18	–
T_9	20	18	19	19
T_{10}	21	19	20	–
T_{11}	21	19	22	–
T_{12}	24	22	25	–
L_1	–	24	27	24
L_2	26	26	28	26
L_3	26	27	28	26
L_4	25	–	28	27
L_5	sacralized	?	sacralized	?

Of the 16 cranial indices (*Table 2*), five are dissimilar between all three individuals, namely the length-breadth index of the skull (mesocrane in IU, at upper edge of dolichocrany in NE, brachycrane in IM), the facial index (mesoprosopic in IU, hyperleptoprosopic in NE, leptoprosopic in IM), the upper facial index (leptene in IU, hyperleptene in NE, mesene in IM), the interorbital index (broad in IU, narrow in NE, medium in IM) and the index of the mandibular ramus (ascending row from IU through NE to IM).

Three other indices are similar with NE and IM, as the length-height index of the skull (chamaecrane in IU, orthocrane in NE and IM), the breadth-height index of the skull (very tapeinocrane in IU, metriocrane in NE and IM) and the mean height index (very low in IU, medium high in NE and IM).

Three indices are closer in IU and IM, as the orbital index (mesoconch in IU and IM, hypsiconch in NE), the nasal (mesorrhine in IU and IM, leptorrhine in NE) and the breadth-length index of the mandible.

Two indices expressing sexual differences are similar in IU and NE, as the breadth index of the mandible and the height-thickness index of the mandibular body (to which also PA's value 37.9, not included in *Table 2*, suits well).

The three remaining indices (the transversal frontoparietal index, the *foramen magnum* index and the gnathic index) are similar in all three individuals.

TABLE 6. Osteometric data. No. according to Martin and Saller 1957, L = length, B = breadth, H = height, L' = left, R = right, (..) = value influenced by pathology, ant. = anterior, cf. = circumference, diaph. = diaphysis diam. = diameter, for. nutr. = foramen nutritium, glen. = glenoid, low. = lower, max. = maximum, mid-diaph. = middle of diaphysis, min. = minimum, thickn. = thickness, + = including diameter of acetabulum, ++ = without acetabulum.

No.	Bone Measurement	M IU		M NE		F z		M PA	
		L'	R	L'	R	L'	R	L'	R
	Sacrum								
2	Ant. straight L		125		–		99		–
5	Ant. upper B		111		–		119		108
6	Max. arch H		28		–		21		–
	Scapula								
1	Height	–	–	–	–	131	132	–	–
2	Breadth	109	–	–	–	91	92	–	–
9	Acromion B	46	42	31	32	31	31	36	37
10	Acromion L	27	25	22	22	21	22	24	(29)
12	Glen. cavity L	37	37	34	–	32	30	43?	–
13	Glen. cavity B	27	27	21	–	22	22	29?	–
	Clavicle								
1	Length	164	167	143	150	137	143	140?	–
6	Cf. in middle	35	36	28	28	28	27	36	–
	Humerus								
1	Length	331	337	–	–	283	287	–	335
4	Low. epiph. B	62	60	–	53	52	52	66	65
7	Min. cf.	60	59	51	51	47	49	58	60
8	Caput cf.	138	138	121	122	118	118	–	145
	Radius								
1	Maximum L	269	270	232	240	213	212	270	270
3	Minimum cf.	38	37	31	32	29	29	39	40
	Ulna								
1	Maximum L	293	300	–	–	232	233	–	–
3	Minimum cf.	32	30	–	–	26	27	32	36
	Hip bone								
1	Pelvic H	208	212	–	–	186	188	224	224
12	Ilium B	165	166	–	–	151	150	185?	–
15	Ischium H+	104	104	92	–	89	91	110	112
17	Pubis L++	69	–	–	–	65	63	–	76
18	Symphysis H	39	–	–	–	35	36	–	–
22	Acetabular max. diam	52	53	47	(47?)	48	49	54	56
33	Pubic angle		70		–		80		55?
	Femur								
1	Maximum L	–	461	424	432?	414	408	–	486
2	L in natural position	–	460	420	428?	411	406	–	485
6	Sag. diam. of mid-diaph.	28	30	27	27	26	26	31	31
7	Trans. diam. of mid-diaph.	29	28	22	21	20	20	26	26
9	Upper transv. diaph. diam.	31	31	31	31	30	29	28	30
10	Upper sagitt. diaph. diam.	25	26	23	24	22	21	28	27
20	Cf. of caput	139?	140	126	(134)	126	126	151	150
21	Condylar B	78	78	–	–	69	70	82	83
	Tibia								
1	Whole L	–	–	–	–	327	(317)	405	400
8a	Max. diam. at for. nutr.	36	38	–	31	26	25	34	35
9a	Transv. diam. at for. nutr.	25	26	–	21	19	19	22	22
10b	Min. cf. of diaph.	75	74	66	66	62	(65)	74	75
	Patella								
1	Maximum H	37	38	36	37	32	–	–	–
2	Maximum B	40	41	37	–	34	–	–	–
3	Max. thickn.	17	19	18	19	16	–	–	–
	Fibula								
1	Maximum L	–	–	–	–	310	(320)	–	–
4a	Minimum cf	33	33	29	30	30	31	37	–
	Talus								
1	Length	55	55	51	52	50	51	–	–
2	Breadth	39	40	36	36	35	35	–	–
3	Height	30	30	–	27	26	26	–	–
	Calcaneus								
1	Maximum L	76	74	–	–	68	69	–	–
3	Minimum B	28	28	–	–	25	24	–	–
4	Height	44	44	–	–	36	36	–	–

TABLE 7. Postcranial indices. M = male, F = female, L' = left R = right, L = length, B = breadth, H = height, robust. = robusticity, pilastr. = pilastricus, platmer. = platymericus.

Bone	**M**		**M**		**F**		**M**	
Index	**IU**		**NE**		**IM**		**PA**	
	L'	**R**	**L'**	**R**	**L'**	**R**	**L'**	**R**
Sacrum								
L-B (5:2)	88.8		–		120.2		–	
cord-H (6:2)	22.4		–		21.2		–	
Clavicle								
robust. (6:1)	21.3	21.6	19.6	18.7	20.4	18.9	25.7	–
Humerus								
robust. (7:1)	18.1	17.5	–	–	16.6	17.1	–	17.9
caput-L (8:1)	41.7	40.9	–	–	41.7	41.1	–	43.3
Radius								
robust. (3:1)	14.1	13.7	13.4	13.3	13.6	13.3	14.4	14.8
Ulna								
robust. (3:1)	10.9	10.0	–	–	11.2	11.6	–	–
Hip bone								
B-L (12:1)	79.3	78.3	–	–	81.2	79.8	82.6	–
ischiopubic (17:15)+	66.3	–	–	–	73.0	69.2	–	–
Femur								
robust. (6+7:2)	–	12.6	11.7	11.2	11.2	11.3	–	11.8
pilastr. (6:7)	96.6	107.1	122.7	128.6	130.0	130.0	119.2	119.2
platymer. (10:9)	80.6	83.9	74.2	77.4	73.3	72.4	100.0	90.0
caput-L (20:1)	–	30.4	29.7	–	30.4	30.9	–	30.9
Tibia								
cnemic (9a:8a)	69.4	68.4	–	67.7	73.1	76.0	64.7	62.9
robust. (10b:1)	–	–	–	–	19.0	–	18.3	18.7
Fibula								
robust. (4a:1)	–	–	–	–	9.7	–	–	–

Also five of the six profile angles of the skull (*Table 3*) betray likeness of the three individuals. This concerns the total profile angle of all of them, the nasal profile angle of IU and IM, the alveolar profile angle of NE and IM, the frontal profile angle and the orbital entrance profile angle of IU and NE (IM differing because of her female sex). The only mutually dissimilar, diminishing value of the zygomatic profile angle from IU through NE to IM, is connected not only with sexual, but also with ageing features, shifting the old male NE closer to the adult female IM than to the young male IU.

CRANIOSCOPIC COMPARISONS

Also several cranioscopic features reveal similarities between the three individuals (*Table 4, Figures 3–5*). It concerns their feeble glabella (Broca 1–2), not existing or slight *arcus superciliares* (Eickstedt 0–1), fluent nasofrontal transition, medium *spina nasalis anterior* (Broca 2–3), concave nasal bridge, rhombic and slightly rounded orbits, feeble *lineae temporales* (0–1, developed only on the *frontalia*, not *parietalia*), feeble to moderate *crista supramastoidea* (in IU and NE, not developed in IM), feeble *protuberantia occipitalis externa* (Broca 1–2, in IU and NE, not developed in IM), more or less apparent *sulcus sagittalis* and medium (IU) or feeble (IM, NE) nuchal muscular relief with a slight torus (IU, NE, not developed in IM).

To these features a developmental anomaly, the biparietal thinness (Hauser, De Stefano 1989: 83–84, Barnes 1994: 146–148), marked very strongly in IU, in moderate degree in NE (but missing in IM), has to be added. Its frequency has been reported between 0.4–1.3 % (Breitinger 1982).

COMPARISON OF SPINES

From the postcranial skeleton, spine yields further arguments for kinship of the three individuals (*Table 5*).

Spines of IU and IM show the so-called "cranial variation". It concerns a vertebra, transitory in shape and position of its articular facets, the upper ones of the thoracic type and the lower ones of the lumbar type. This concerns in IU the left side of T_{11} and the right side of T_{12} and in IM both sides of T_{11}.

This variation includes in both persons also sacralization of L_5 whose fusion is clearly visible on the posterior side of the sacrum, which has, as consequence, 6 sacral segments instead of the usual 5 (*Figure 6a–d*).

In the spine of NE the transitory vertebra is the usual T_{12}. The last two lumbar vertebrae have not been preserved and of the sacrum only the first segment survived. Thus it cannot be decided if the same cranial variation was present also with this individual.

TABLE 8. Osteoscopic data. 1 = feeble, 2 = medium, 3 = strong, 33 = very strong, manubr. = manubrium, L = left, R = right, Todd = Todd 1920, M.-S. = Martin and Saller 1957.

Bone	**M**	**M**	**F**	**M**
Feature	**IU**	**NE**	**IM**	**PA**
Sacrum				
basality	hyperbasal	hyperbasal	hyperbasal	hyperbasal
Sternum				
manubr.-corpus synostosis	0	–	+	0
Scapula				
robusticity	1	1	1	3
Clavicle				
curvature	2–3	3	3	2–3
facies costoclavicularis	0	1	1	0
muscular relief	2–3	3	3	1–2
Humerus				
tuberositas deltoidea	2	3	1–2(L)2(R)	2–3(L)3(R)
muscular relief	2	3	2	3
septal perforation	+	0	+	0
Radius				
curvature	2	2	2	2
crista interossea	2	3	2	2–3
tuberositas radii	1	2–3	2	2–3
Ulna				
curvature	1–2	–	2	2
crista interossea	2	3	1(L)2(R)	1(L)2(R)
muscular relief	2–3	3	2	1
Hip bone				
robusticity	2–3	1	1–2	3
crista iliaca	2–3	–	2	3
tuber ischiadicum	2–3	3	2	3
sulcus praeauricularis	0	0	2	0
incisura ischiadica	narrow J shape	wide arch	wide arch	narrow J shape
crista phallica	3	–	1	33
arcus ventralis	0	–	+	0
subpubic region	angle	–	arch	angle
facies symphysialis (Todd)	4	–	8	5
Femur				
pilaster (M.-S.)	2–3	3	3	3
tuberositas glutea	33	33	33	33
trochanter tertius	0	0	0	0
fossa hypotrochanterica	0	0	0	0
linea intertrochanterica	0–1	0–1	2(L)1(R)	0–1
tubercle on its upper edge	0	3	2	1(L)2(R)
Tibia				
robusticity	2–3	1–2	1–2	3
linea musculi solei	1(L)3(R)	3	1(L)2-3(R)	1
facies orientalis	0	–	0	+
Fibula				
robusticity	2–3	1–2	1–2	3
fluting	2–3	1	1–2	1

Another anomalous structure – the *foramen arcuale atlantis* (*Figure 6e*) – developed on the right side of the posterior arch in both NE and IM, while in IU only its posterior thorn survived.

It can still be added that Schmorl's nodes, an often occurring anomaly, were not present on any vertebra of the three individuals.

OSTEOMETRY

Osteometric measurements (*Table 6*) show greatest length values in young adult males IU and PA, while the old male NE has mostly smaller dimensions especially of humeral and femoral heads, approaching those of the medium aged female IM. All four persons were most probably right-hand

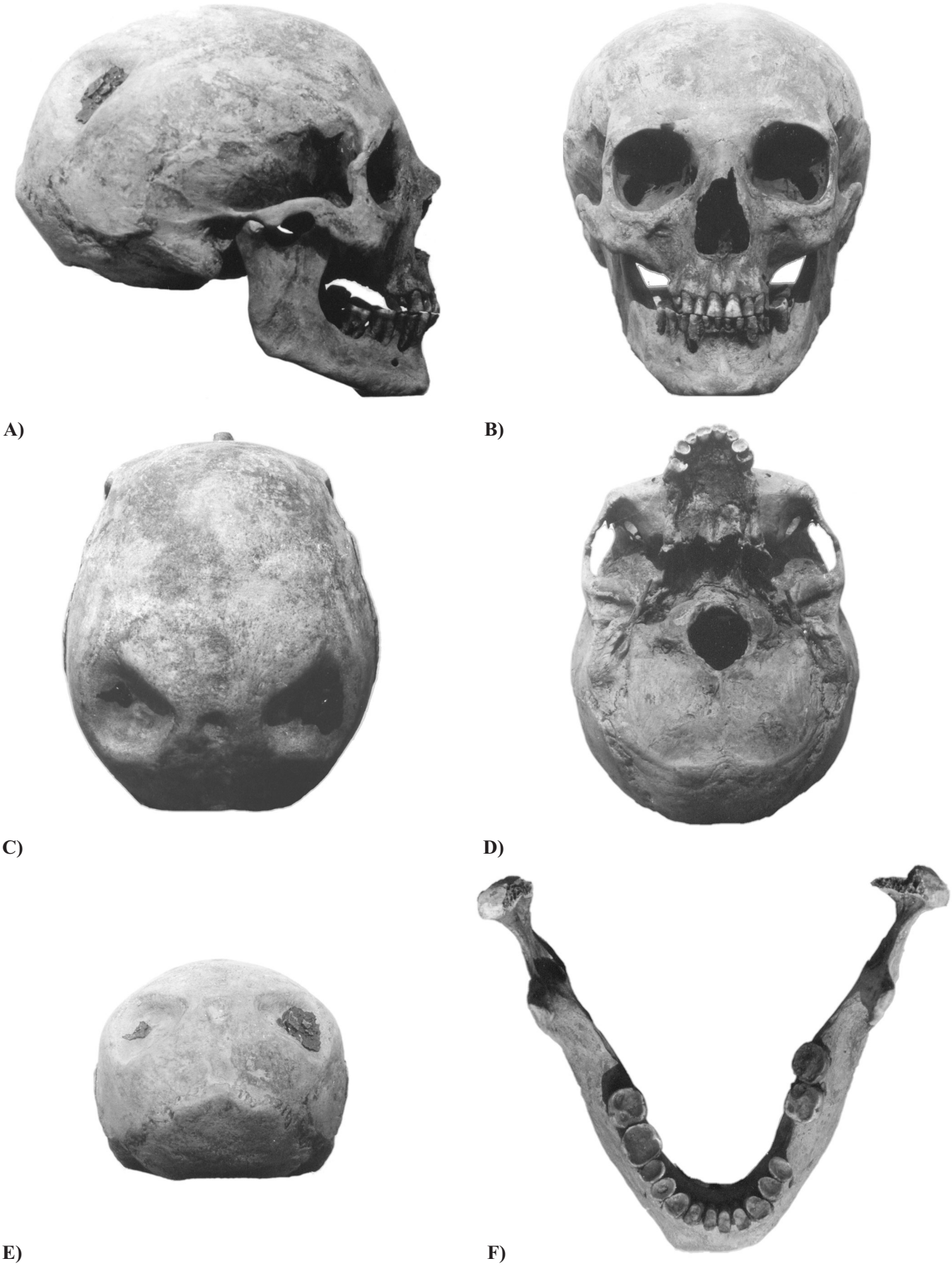


FIGURE 3. Skull of Iufaa in A) lateral, B) frontal, C) vertical, D) basal, E) occipital norms and F) his mandible in vertical view. Photo E. Strouhal.

A)

B)

C)

D)

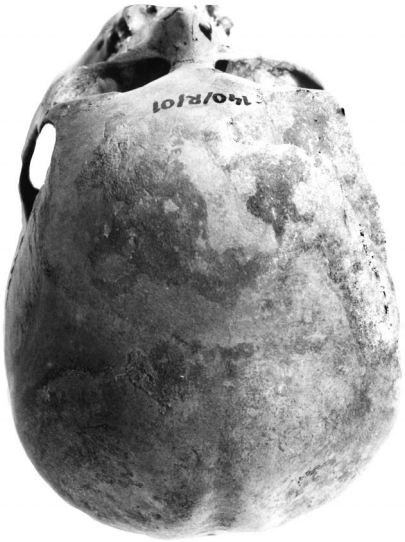
E)

F)

FIGURE 4. Skull of Nekawer in A) lateral, B) frontal, C) vertical, D) basal, E) occipital norms and F) his mandible in vertical view. Photo K. Choděra and E. Strouhal.

A)

B)



C)

D)

E)

FIGURE 5. Skull of Imakhetkherresnet in A) lateral, B) frontal, C) vertical, D) basal norms and E) her mandible in vertical view. Photo K. Choděra.

sided (IU according to humerus and ulna, NE according to radius, IM according to humerus and PA according to ulna).

For evaluation of the 16 computed postcranial indices (*Table 7*) the data for each of the both sexes of the Late Period – Early Ptolemaic secondary cemetery in the Mastaba of Ptahshepses at Abusir were used (Strouhal, Bareš 1993).

The seven indices expressing robusticity show in the young IU small values in the clavicle and humerus, very small ones in the radius and ulna, but a medium one in the femur (values of tibia and fibula missing). The other young PA displays medium values in the clavicle, femur and tibia, small in the humerus and radius. The old NE has a very gracile clavicle and radius and a gracile femur. The medium aged female IM shows a gracile clavicle, humerus, radius and femur, a very gracile ulna and medium robust tibia and fibula.

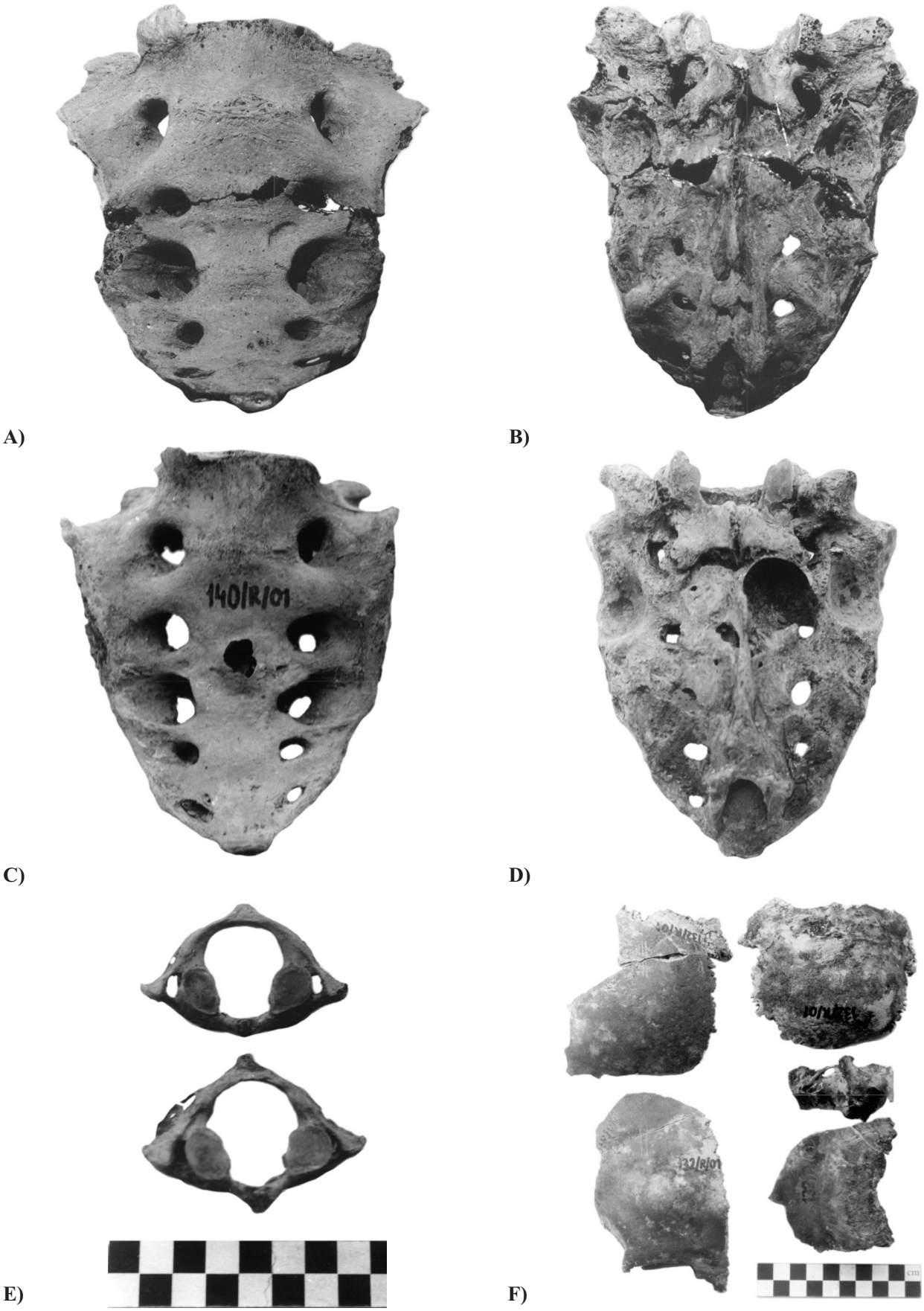


FIGURE 6. Sacrum of A) Iufaa and B) Imakhetkherresnet in anterior view. Sacrum of C) Iufaa and D) Imakhetkherresnet in posterior view. E) Atlas of Imakhkheretresnet (above) and Nekawer (below) in vertical view. F) Fragments of skull of Padihor. Photo E. Strouhal.

Of the two indices expressing robusticity of the caput, IU shows capita of both humerus and femur to be small, PA medium, NE *caput femoris* small and in IM both capita medium.

Of the seven indices expressing shape, the length-breadth index of the 6-pieces sacra (with L_5) expresses the sexual difference between small value of male IU and big value of female IM, while the cord-height index is in both cases medium.

The breadth-length index of the hip bone is big in IU as well as in IM, but very big in PA. The ischiopubic index of IU and IM expresses the usual sexual difference.

The pilastric index betrays a small (left, further L) to medium (right, further R) pilaster in IU, but big (L) to very big (R) one in NE, big one in PA and very big one in IM. The platymeric index displays platymery of IU, hyperplatymery (L) and platymery (R) in NE, hyperplatymery in IM, but lower edge of stenomery (L) and eurymery (R) in PA. The cnemic index is mesocnemic in IU as well as in NE (R), eurycnemic in IM, but mesocnemic (L) and at the edge of platycnemy (R) in PA.

Also in these comparisons IU, NE and IM appear mutually closer than any of them with PA.

Statures reconstructed according to the tables by Trotter and Gleser (1952) for Afroamericans whose proportions suit best to those of the Ancient Egyptians (Strouhal and Bareš 1993), yielded for IU 170.1 cm, NE: 159.4 cm, IM: 151.5 and for PA 173.1 cm. The mutually most similar persons, NE and IM, express thus a tendency to low growth in distiction from a tendency to higher stature of the remaining ones, IU and especially PA.

OSTEOSCOPY

Osteoscopic features of the four persons (*Table 8*) complement their characteristics (excluding pathological changes, reserved for another paper, see Strouhal *et al.* 2003).

Robusticity, expressed by the above mentioned indices, had to be complemented osteoscopically in the scapula, hip bone, tibia and fibula. It was slight or slight to medium in both NE and IM, while medium to big in IU (except the gracile clavicle) and big in PA. Humeral septum was perforated in IM, but also in IU, not in the other two males. Pilaster of all persons was of Martin-Saller's grade 3 (2–3 in IU).

Features expressing development of muscularity are in IU mostly medium, except the curious asymmetric development of the *linea musculi solei*. NE retains, notwithstanding his old age, still a strong muscular relief, except for feeble fluting of the fibula. IM has medium to feeble muscular relief, except for a strong one on the clavicle. In PA also medium or feeble relief prevails, except for stronger relief on the humerus and radius. In femoral relief of all persons, strong development of the *tuberositas glutea* contrasts with feeble development of the *linea intertrochanterica* and a tubercle on its upper edge, except a strong one with NE. Curvature of clavicles is medium to big in IU and PA, but big in NE and IM, while those of the radii and ulnae are medium in all (in IU slight to medium). Not developed *facies costoclaviculares* (IU, PA) or only slight ones (NE, IM) reveal a feeble physical stress in upper extremities and thoracic regions.

All sacra were hyperbasal (in IU and IM connected with sacralisation of L_5). Features of the hip bones are as expected according to sex appurtenance of the persons, except for the slightly femalish form of the *incisura ischiadica* in NE.

Synostosis of the *manubrium* and *corpus sterni* in IM was probably a congenital feature. It could have been present, but did not survive in NE, not occurring in both other males.

DISCUSSION

The skeletons of NE and IM appear most similar in spite of their different sex and age (actually the senile age of NE made him more "femalish" looking). The probability of their blood relationship approaches certainty. Archaeologically it corresponds with the close position of their coffins in the western end of the corridor of shaft 2/R/01.

Greater craniometric distance of IU from the other two persons was caused by platycrany, connected with an increase of facial and interorbital breadths. It was either an individual feature, congenital anomaly or pathology. It does not exclude, however, his relationship with NE and IM.

At the same time, the craniometrically more distant IU and IM shared the same mother Ankhtysy, whose name has been recorded in texts in both IU's tomb as well as on IM's coffin (Bareš *et al.* 2002). Their brother-and-sister relationship may thus be considered as proved.

Also NE was a close relative of the two other persons. Theoretically he could have been their father, or another brother, or even a son of IM.

In an attempt to unveil this question, horizontal stratigraphy combined with the data on age at death of the three persons can be used (*Figure1*).

From the layout of the burial complex, it is clear that IU started to build the giant Shaft-tomb at the moment when he earned a socially important position. During the construction of the tomb, which lasted for several years, his older sister IM died being 35–45 years old. Perhaps because the Shaft-tomb was not yet ready or it was intended solely for IU, shaft 2/R/01 with its straight, almost 26 m long corridor diverging from the southern limit of the Shaft-tomb, had to be quickly excavated for her. After her burial, a light partition wall of unfired mud bricks was built to close her burial.

It appears probable that bricks of this wall, of which only few were found in their original place, were dismantled and reused after her burial to close an additional burial of NE who reached the quite high age at death of 55–65 years.

Our supposition that short time elapsed between both burials is based on the fact that two shabtis of NE were

found on the coffin of IM and that the manner of excerebration of IM and NE was similar.

Probably after closure of this second burial a curved, steeply descending lateral branch connected the main corridor of shaft 2/R/O1 with the west shaft of IU's shaft-tomb. It was probably excavated to provide an easier and quicker access to Iufaa's burial chamber (Bareš *et al.* 2002).

IU was the youngest of the three persons who died unexpectedly (proved by the unfinished state of his tomb decoration) being only 25–30 years old. After his burial the tomb was closed including access to the corridor at the bottom of shaft 2/R/01 which was blocked by a stone wall.

If the above mentioned horizontal stratigraphy of the burials were valid and burials of IM and NE occurred soon after each other, NE, who was 10–30 years older at death than IM, could have never been her son. At the same time the difference of 25–40 or more years between the ages at death of IU and NE, makes NE being an older brother of IU (and IM) improbable. Consequently, NE could have been most probably the father of IM and IU. Curiously enough, however, no father's name was found in both IU's and IM's textual record.

Written evidence revealed that IM's grandfather, most probably in her mother's line, was a certain Herakhbit (Bareš *et al.* 2002). If NE was her and IU's father, a possibility exists that their paternal grandfather could have been the builder of the neighbouring, firstly built Shaft-tomb of Abusir, Udjathorresnet. This could be echoed by the name of god Resnet contained in his and IM's name.

PA can be excluded as blood-related to IU and IM not only from the anthropological point of view, but also on the written evidence of his mother with a different name Nedjem-Bastet-en-Iret (Bareš *et al.* 2002).

For a definitive solution of the relationship of members of the IU's family we have to wait until excavation work in and around his shaft-tomb will be completed. An application of modern analytical methods (serology, DNA) is presumed.

CONCLUSION

In the corridor of shaft 2/R/O1 near Iufaa's Shaft-tomb, two mummies, preserved as skeletons, were found. Both proved to be biologically related to Iufaa. Of them, the mature female Imakhetkherresnet was his sister (attested anthropologically and by the same name of their mother), while the very old male Nekawer could have been most probably their father. Another male Padihor from the more distant Shaft 1/R/O1 was found biologically distinct from each of the three mentioned individuals, being born to a mother of a different name.

REFERENCES

BAREŠ L., 1996: The Shaft tomb of Iufaa at Abusir. *Göttinger Miszellen* 151: 7–17.

BAREŠ L., 1999: *Abusir IV. The Shaft Tomb of Udjathorresnet at Abusir*. Universitas Carolina Pragensis, The Karolinum Press, Prague.

BAREŠ L., SMOLÁRIKOVÁ K., 1997: The Shaft tomb of Iufaa at Abusir. *Göttinger Miszellen* 156: 9–26.

BAREŠ L., STROUHAL E., 2000: The Shaft-tomb of Iufaa – Season of 1997/98. *Zeitschr. f. ägypt. Sprache u. Altertumsk.* 127: 5–14, plates II–V.

BAREŠ L., DVOŘÁK M., SMOLÁRIKOVÁ K., STROUHAL E., 2002: The shaft-tomb of Iufaa at Abusir in 2001. *Zeitschr. f. ägypt. Sprache u. Altertumsk.* 129: 97–108.

BARNES E., 1994: *Developmental Defects of the Axial Skeleton in Paleopathology*. Univ. Press of Colorado, Niwot, Colorado, pp. 146–148.

BREITINGER E., 1982: Depressio biparietalis circumscripta. I. Zwei Fälle aus dem awarenzeitlichen Gräberfeld von Zwölfaxing bei Wien. *Archäologia Austriaca* 66: 141–153.

BROTHWELL D. R., 1972: *Digging up Bones*. 2nd edition, British Museum, London.

EICKSTEDT E., 1944: *Die Forschung am Menschen. Teil 2, Physiologische und morphologische Anthropologie*. Enke, Stuttgart.

GILES E., ELLIOT O., 1963: Sex determination by discriminant function analysis of crania. *Amer. J. of Phys. Anthrop.* 21: 53–68.

HAUSER G., DE STEFANO G. F., 1989: *Epigenetic Variants of the Human Skeleton*. Schweizerbart, Stuttgart.

HRDLIČKA A., 1920: *Anthropometry*. Philadelphia.

LOVEJOY C. O., MEINDL R. S., PRYBECK T. R., MENSFORTH R. P., 1985: Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *Amer. J. of Phys. Anthrop.* 68: 15–28.

MARTIN R., SALLER K., 1957: *Lehrbuch der Anthropologie*, *Band I.* 3. Auflage, Fischer, Stuttgart.

STROUHAL E., 1998: Odhalené tajemství neporušeného sarkofágu. *Česká antropologie* 48: 10–11.

STROUHAL E., 2001: Three mummies from the Royal Cemetery at Abusir. Egyptology on the threshold of the 3rd millennium. *Proceedings of the 8th Intern. Congress of Egyptologists, Cairo 2000* (in press).

STROUHAL E. *et al.*, 2003**:** Palaeopathology of Iufaa and persons found besides his Shaft-tomb at Abusir (Egypt). *Internat. J. of Osteoarchaeology* (in press).

STROUHAL E., BAREŠ L., 1993: *Secondary Cemetery in the Mastaba of Ptahshepses at Abusir*. Charles University, Prague.

TODD T. W., 1920: Age changes in pubic bone I. *Amer. J. of Phys. Anthrop.* 3: 285–334.

TROTTER M., GLESER G. C., 1952: Estimation of stature from long bones of American Whites and Negroes. *Amer. J. of Phys. Anthrop.* 10: 463–514.

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