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The Subalyuk Neanderthal remains (Hungary): a re-examination

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Abstract – The Subalyuk Neanderthal human remains were discovered more than sixty years ago and a few publications were immediately made detailing the circumstances of the discoveries and providing substantial anthropological data. As nowadays numerous Middle Paleolithic human remains are known, a re-examination of the Subalyuk fossils was done in order to discuss some aspects of their morphology and to provide some new insights into their place among the European Neanderthal sample. With 12 tables and 17 figures.

INTRODUCTION

The Subalyuk human remains were uncovered in 1932 in a cave located nearby the village Cserépfalu in Borsod county, in Northern Hungary. The human remains found during the first excavations led by DANCZA were an adult metacarpal bone at the beginning, and a few months later an adult incomplete sacrum. Following those discoveries, several adult and immature human remains appeared in an area of more than twenty square metres (Fig. 1).

In his description of the remains, BARTUCZ (1938) mentioned that the spatial distribution of the human remains was a question that he could not solve, as no observations were executed directly in the field. He also noticed that some bones were probably damaged at the time of the discovery or later during their restoration. Therefore it was hard for him to recognize any cutmarks or strong traces of animal activities that could explain the spatial dispersal. According to the author, all the adult human bones had the same relatively dark colour (recalling burnt bones at the first glance); probably they must have laid in the same soil layer and belonged to the same individual. Unlike the adult bones, the immature ones are light and this observation led BARTUCZ to assume that the child remains might have, either come from a distinct lighter layer, or have been fossilized in a different way than the adult bones.

RESTORATION OF THE HUMAN REMAINS

The adult human remains are represented by the mandible, the atlas (in three parts), three corpora vertebrae, one spine process of a thoracic vertebra, the manubrium sterni, the sacrum, the left patella, the fragment of a left second metacarpal, and a fragment of left proximal phalanx, a complete right second and a left fourth metatarsals and a fragment of a right third metatarsal (not identified previously by BARTUCZ). BARTUCZ had listed three isolated right molars, one proximal hand phalange and two proximal foot phalanges. During our present investigation we were able to identify only one proximal foot phalange, the teeth were missing and the phalanges were identified as animal bones*.

All the bones were well fossilized and they only required some cleaning. There was a fracture on the left fragmentary second metacarpal which thus appeared less complete than in the original monograph.

Only the mandible needed careful restoration. Indeed, we found that the mandible was later reconstructed in a wrong way from the two original parts sometime after BARTUCZ's report. I.e. part of the left body (broken anteriorly at the level of the first premolar alveola) was glued to the anterior part of the left ramus, the symphyseal region, the right first premolar, the two canines, and the four incisors. These parts were separated and glued again several times, and the last reconstruction was incorrect. Indeed the left side of the dental arch was not in connection with the symphyseal part and the dental arch's shape was too narrow. In addition, the three right isolated teeth were lost during this last reconstruction.

After separating the parts of the mandible, the original joining surfaces were cleaned and glued together again in order to fit with the original anatomical reconstruction. The lower part of the internal surface of the symphyseal area, as well as the anterior section of the left inferior corpus margin were consolidated with wax. Finally, the right foramen mentale became observable during the cleaning of the right body.

The immature human remains consist of an incomplete cranium (minus the basis), the two maxillae, the left isolated nasal bone, a few corpus vertebrae and several small isolated cranial fragments. According to BARTUCZ (1938), the cranium was originally broken in small parts and the nasal bone was recovered later. The remains and especially the cranium and the maxillae have been manipulated many times, again with regard to the first reconstruction made by BARTUCZ, as already mentioned by THOMA (1963: 128). It seems that a casting attempt has strongly damaged the neurocranium, as the spongious parts of the bones were found filled by silicone rubber, and the external and endocranial surfaces of the cranial bones were covered by a thick layer of varnish glue. The parietal and temporal bones were not correctly positioned. On the maxillae a huge amount of plaster was filling the anterior and inferior parts of the right bone and the dental arch was artificially narrowed. The right central and lateral deciduous incisors were placed in the

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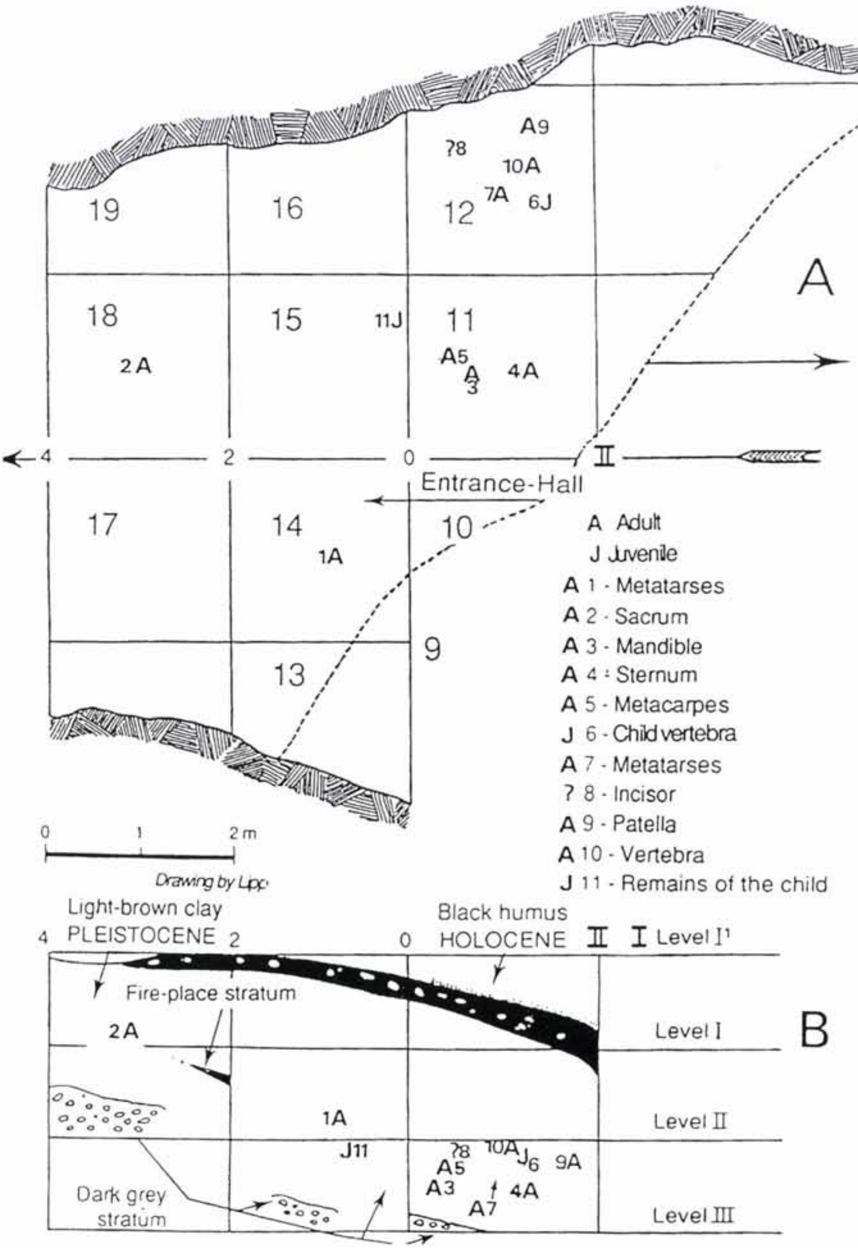


Fig. 1. Horizontal (A) and vertical (B) profiles of the Subalyuk site showing the spatial distribution of the human remains (modified after JÁNOS LIPP)

left alveola. Finally the germ of the right permanent first molar was put on the left side and the left one was unidentified.

The surfaces of the cranial bones were cleaned and the old glue was removed. The cautious cleaning of the original surfaces leads us to put the parietal and temporal bones in a better anatomical position. From the isolated small cranial fragments, a piece of the left supraglabellar region, the right greater wing of the sphenoid bone and the left *pars lateralis* of the occipital bone were recovered and put in place. All the consolidation and restoration of the cranium were made in a way that keeps the bone clearly separated from the wax in order to prepare the remains for the casting program. The new reconstruction allowed us to discuss some new aspects of cranial morphology, such as the shape of the greater wing of the sphenoid bone, the size of the foramen ovale and to approach the foramen magnum shape. However the postmortem deformation which resulted in the lateral right flattening and in the asymmetry of the supraorbital area could not be reduced.

The reconstruction of the maxillae was done after removing the ancient plaster and cleaning the bone surfaces. The teeth were positioned in their right place and the complete dental arch was then reconstructed.

THE SUBALYUK 1 ADULT HUMAN REMAINS REVISITED

1. The mandible (Fig. 2)

Adult mandibular remains are known only from two sites in Croatia (Krapina and Vindija) and one site in the Czech republic (Seduv Stul cave or Ochoz hominid) besides the Subalyuk 1 mandible among the Middle Palaeolithic central European hominids. At the time when BARTUCZ (1938) published his monograph, only the Krapina and Ochoz fossils were employed for comparative analysis (GORJANOVIC-KRAMBERGER 1906, RZEHAK 1905), in addition to the Mauer specimen and a few western European Neanderthals, e. g. Spy I (FRAIPONT & LOHEST 1887), La Ferrassie and La Quina (MARTIN 1926). BARTUCZ considered the Subalyuk mandible very similar to Spy I in some aspects. An individual age at death between 40 and 50 years was proposed for the Hungarian specimen, based on modern standard dental attrition references. On the basis of the tooth size and the symphyseal body thickness, BARTUCZ assigned the mandible to a female.

The reconstructed Subalyuk 1 mandible (Fig. 2) consists of the symphyseal portion, the anterior inferior border of the right corpus, the left horizontal ramus and the anterior border of the left ramus. When the first studies on the jaw were made (BARTUCZ 1940, SZABÓ 1935), the inferior permanent dentition was complete with the three right molars isolated from the bone. It is certainly the most complete of the central European mandibles, with Krapina 55 and 58 (RADOVCIC *et al.* 1988, SMITH 1976).

The Subalyuk jaw appears gracile on the whole, with a bony relief faintly marked. The body thickness (Table 1) measured at the symphysis and that estimated either nearby the level of the right premolars or at the left third molar, is small. The robusticity index at the symphysis (38.1) is slightly below the Krapina mean average (39.9±5.4, n = 5) and the Vindija mean average (49.5±3.1, n = 3).

Table 1. The measurements of the adult Subalyuk mandible. Comparison with other Middle Paleolithic hominids from Europe and the Levant

Mandible	Subalyuk 1		Krapina		Vindija		Regourdou	La Ferrassie 1	Spy I	Kebara 2	Tabun 2	Amud 1	Shanidar 1	Skhul V
	(1)	(2)	(3)	(4)	(3)	(4)	(5 and 2)	(6 and 2)	(7)	(8)	(8 and 9)	(8)	(8 and 10)	(8 and 9)
M 69 Symphyseal corpus height	36.0	36.7	36.9 ± 4.8	35.9 ± 4.9	30.8 ± 3.3	31.4 ± 4.4	(30.9)	39.5	38.0	42.0	(43.0)	(33.9)	37.2	36.5
Corpus height – level M3	27.0	26.0	–	–	–	–	29.9	–	–	32.7	32.3	16.0	–	–
Symphyseal corpus breadth	14.0	14.0	14.5 ± 1.1	14.4 ± 0.7	15.2 ± 1.0	15.3 ± 1.5	16.2	16.5	15.0	23.8	–	–	17.6	–
Corpus breadth – level M3	16.8	15.8	–	–	–	–	15.6	–	–	21.0	17.5	–		
Symphyseal corpus robusticity index	37.8	38.1	39.9 ± 5.4	40.6 ± 5.1	49.5 ±3.1	49.6 ± 3.2	–	–	–	56.6	–	–	–	–
Corpus robusticity index – level M3	–	60.7	–	–	–	–	–	–	–	64.2	54.1	–	47.3	–
External bicanine breadth	–	35.3*	34.6 (K.57)	–	–	–	34.1	(39.1)	–	34.9	37.7	35.5	37.0	(37.7)
Internal bi–M3 breadth	–	52*	–	–	–	–	51.1	51.0	–	55.5	48.8	58.5	56.2	47.8
M 80 (1) External bi–M3 breadth	70.0	76*	77.0 (K.58)	–	–	–	70.1	68.0	–	78.0	71.0	76.3	73.1	70.0
Dental arcade length	58.0	53.0	–	–	–	–	52.0	54.0	–	55.0	58.1	51.4	51.0	57.8
Symphyseal angle after Weidenreich	–	70.0	62.5 – 63.5	–	–	–	63.0	79.0	77.0	82.0	72.0	74.0	65.0	78.0

* left side × 2

(1) Bartucz 1938; (2)present study; (3) Smith 1984; (4) Wolpoff *et al.* 1981; (5) Piveteau 1963; (6) Heim 1976; (7) Fraipont and Lohest 1887; (8) Tillier *et al.* 1989; (9) McCown and Keith 1939; (10) Trinkaus 1983

On the anterior surface of the mandibular symphysis, under the alveolar margin, the bone is a little damaged at the level of the incisor and canine roots (Fig. 3), but it is clear that a faint *anterior incurvatio mandibulae* was developed. However, the chin eminence is smooth without distinction of the symphyseal and lateral tubercles, and the lateral profile is still retreating (Fig. 4).

On the posterior surface there is no alveolar plane. The incomplete preservation of the bone nearby the sagittal region (lacking almost one centimetre in height) precludes any conclusion on the genioglossal morphology. Moreover, there is no clear evidence of a superior transverse torus (*versus* JELINEK 1969: 482). According to SMITH (1984), a superior transverse torus affects Krapina 57 and 58, and no genioglossal fossae can be identified on Krapina jaws. However, such a fossa can be detected on Krapina 54 (authors' observation). The three Vindija mandibles manifest a genioglossal fossa more or less

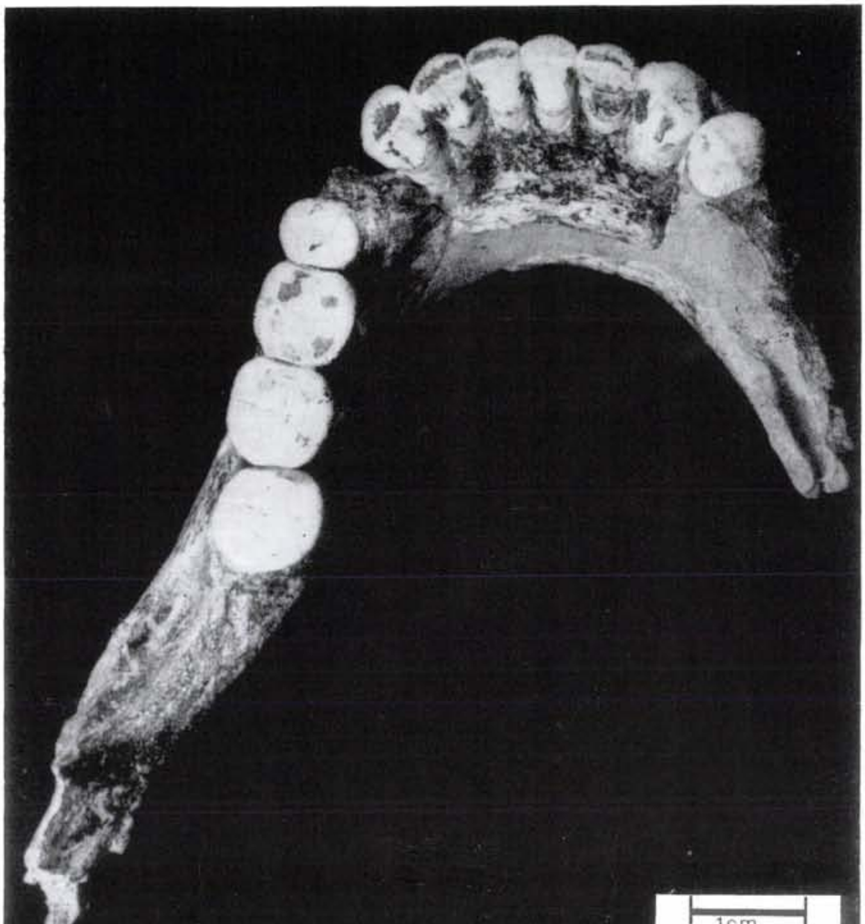
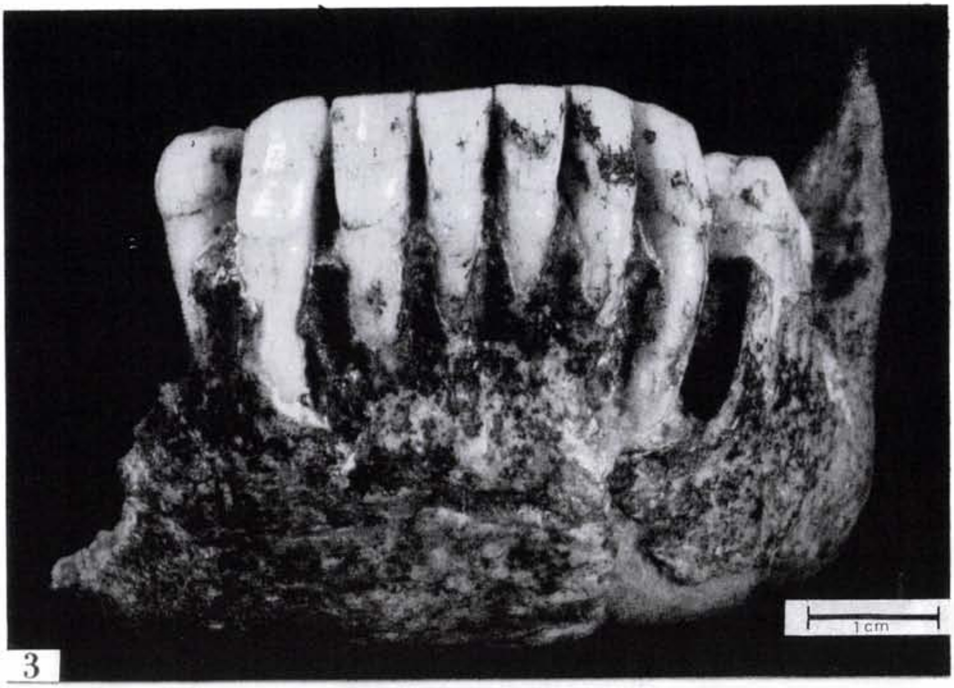
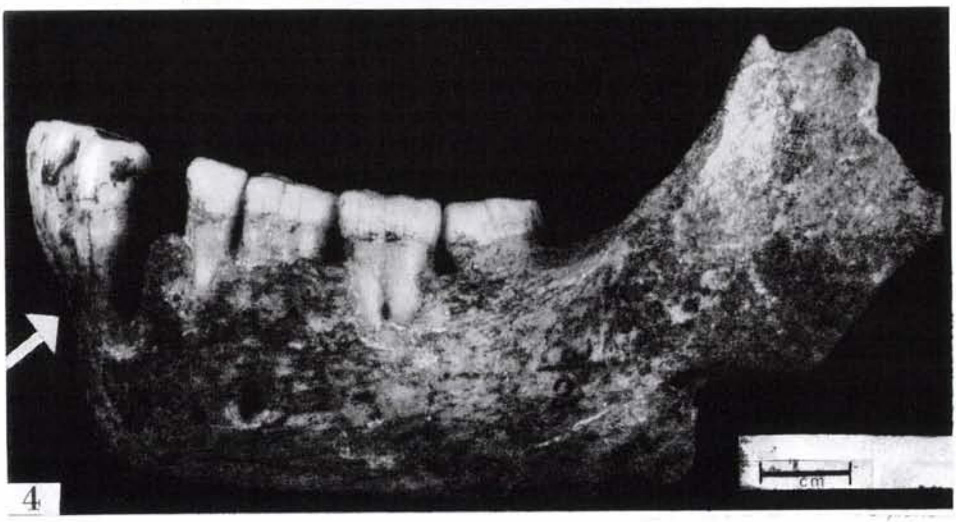


Fig. 2. The adult Subalyuk 1 mandible in superior view





Figs 3–4. 3 = Anterior view of the Subalyuk 1 mandible illustrating the symphyseal morphology; 4 = The Subalyuk 1 jaw in left lateral view. The development of the *incurvatio mandibulae anterior* is indicated by the arrow

developed, and in addition two (superior and inferior) transverse tori on two of the specimens (Vindija 226 and 231, WOLPOFF *et al.* 1981).

On the Subalyuk mandible, the right digastric fossa on the inferior edge is small, delimited by a faint muscular crest along its anterior margin and a moderately marked spine along its sagittal margin. Apparently the digastric muscles were not strongly developed. On the Krapina and Vindija mandibles, the digastric fossae are large, well marked and the interdigastric spine pronounced.

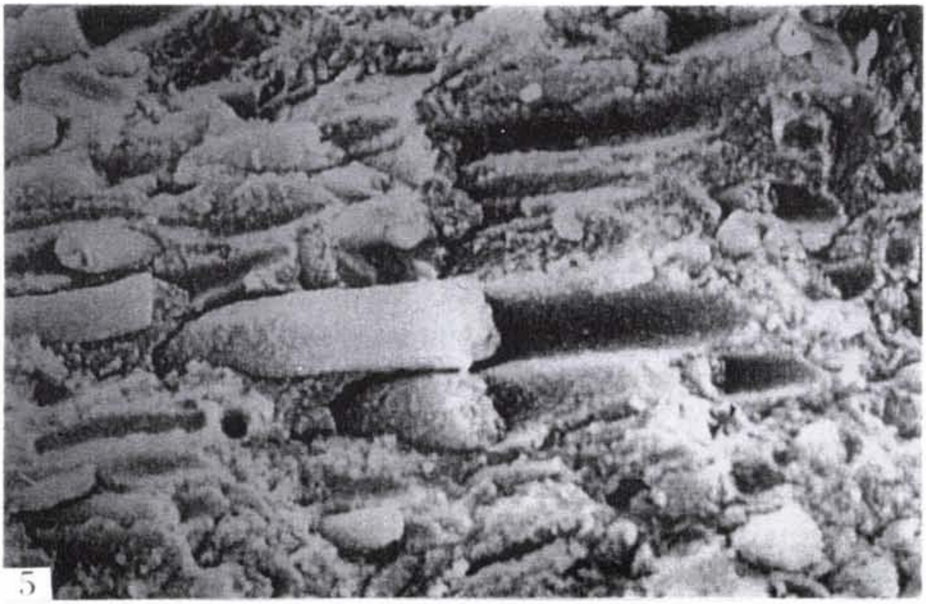
The Subalyuk mandibular corpus height (Table 1) decreases backwards from the symphyseal region to the M2–M3 level. The symphyseal height (36.7 mm), similar to the Krapina mean average (36.9±4.8 mm) is above the Vindija mean (30.8±3.3 mm). However, the Subalyuk symphyseal thickness (14.0 mm) is under the Vindija (15.2±1.0) and the Krapina means (14.5±1.1 mm). The robusticity index (37.8) at the Subalyuk symphysis remains within the range of variation of the Krapina sample (39.9±5.4) and outside the one of the Vindija mandibles (49.5±3.1).

The mental foramen is unique and large (4.9×3.7 mm) on the Subalyuk jaw. Its opening is oval-shaped and located under the mesial root of the first molar, in a low position as shown by Fig. 4 (at 12.8 mm from the inferior margin). A unique mental foramen is also present on Krapina 54, 55, and Vindija 206, while Krapina 57 (on the right side), Krapina 59 (on the left side), as well as Vindija 226 and 231 mandibles, have two mental foramina. A bilateral asymmetry of the mental foramen number is not unusual among European Neanderthals as well as among Levantine Mousterian hominids, with the exception of the Skhul and Qafzeh individuals (TILLIER *et al.* 1989).

The Subalyuk mandible is remarkable for the minimal relief on the lateral surface of its left corpus. On the medial surface, only the posterior part of a fairly marked mylohyoid line placed below the third molar is apparent. The obliquity of the ramus increases the significance of the retromolar space (*ca* 10.5 mm) between the anterior margin of the ramus and the distal surface of the third molar. This backwards orientation of the ramus also increases the distance between the third molar and the mandibular foramen, as already mentioned by BARTUCZ (1938: 73) and SZABÓ (1935: 26). This configuration is lacking on the Krapina and Vindija mandibles, but may occur in western European Neanderthal mandibles such as La Quina 9.

The mandibular foramen is V-shaped, opening backwards and upwards, and there is no lingula. This morphology contrasts with the one described on five of the Krapina specimens that exhibit a horizontal-oval shaped mandibular foramen and no lingula (KALLAY 1970, SMITH 1976), as well as three of the Vindija specimens (WOLPOFF *et al.* 1981). On the Subalyuk mandible the mylohyoid sulcus appears to have been open along its entire length.

The Subalyuk mandibular dental arch is wide (Table 1). Its external breadth measured at the canine posterior alveolus reaches 35.3 mm (Krapina 57: 34.6 mm) and 76.0 mm at the M3 alveolus by doubling the left side (Krapina 58: 77.0 mm). The dental arcade length (53.0 mm) provides a length/breadth index *ca* 69.7 for Subalyuk. This index is lower than the one known for Ochoz (73.3, VLCEK 1969) and it is under the Krapina values (WEIDENREICH 1936).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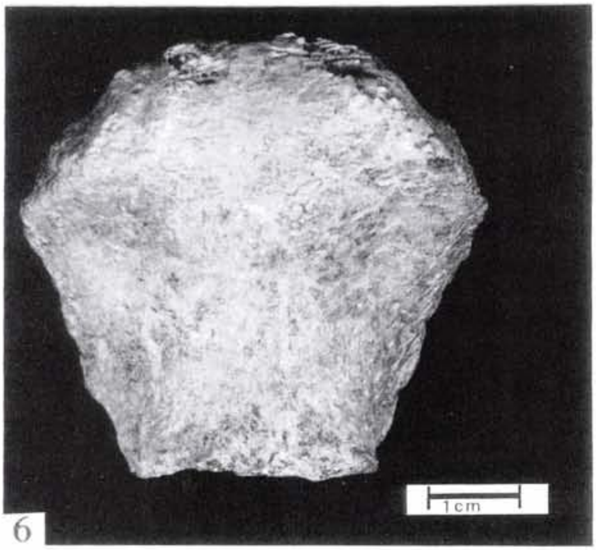

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Figs 5–6. 5 = Photograph of the scanning electron microscope analysis of the dental calculus deposits from the Subalyuk 1 first lower molar (M×7000). The bacteria of filamentous type are prevalent 6 = The adult Subalyuk 1 manubrium sterni in anterior view

The Subalyuk teeth are well preserved except for the left first premolar (lost post-mortem), the right second premolar and three molars. The occlusal dental attrition is not well pronounced: the dentine is slightly exposed on the anterior teeth and the first molar. In addition the interproximal wear is not considerable. This supports a relatively young adult age, probably inferior to BARTUCZ's previous estimation.

The tooth morphology previously described by BARTUCZ and SZABÓ manifests no peculiarities. Morphologically the Subalyuk permanent teeth are not different from other Mousterian teeth. The Subalyuk 1 anterior teeth (Table 2) with the Krapina and Vindija teeth manifest large dimensions (i.e. vestibulo-lingual breadth). All the Subalyuk teeth are not exceptionally large among the Central European sample (Table 2): their dimensions are below the mean Krapina averages, with the exception of the I2, C, and P1 breadths. The Subalyuk teeth recall the Vindija teeth. However the relatively small dimensions of the Subalyuk premolars and molars (M1 and M2) could be also partially due to the faint interproximal wear, too.

The Subalyuk mandible manifests alveolar bone resorption, all along the dental arch (*versus* SZABÓ 1935). No significant dental pathologies are evident and no dental caries present. On the Subalyuk molars, a deposit of supragingival dental calculus was well developed on the buccal surface, especially on the first left molar. A scanning electron microscope analysis of the dental calculus was performed at the Weizmann Institute in Israel (PAP *et al.* 1995). The result shows that the calcified bacteria are mainly of the filamentous type (Fig. 5). This contrasts with the previous observation made on a Levantine Mousterian hominid (VANDERMEERSCH *et al.* 1994) that indicated a prevalence of the cocci bacteria. More information on other Middle Palaeolithic individuals is requested to permit us to interpret this individual variation affecting prehistoric dental health, in terms of either local nutrition factors or immunological differences in response to the same stimuli.

The X-ray examination of the Subalyuk molars suggested that there was a moderate taurodontism on the first molar and larger pulp chambers on the two other posterior teeth. Although the roots are robust, there is no hypercementosis. X-ray examination of the Subalyuk mandible brought evidence of the lack of a fourth molar (*versus* ANTHONY & HERPIN 1935).

In conclusion the Subalyuk adult mandible manifested a mixture of plesiomorphic features (e. g. lack of a chin eminence, retreating symphysis) and features usually employed to assert Neanderthal affinities as they seem to be constant in the group (i. e. large retromolar space and backwards positioning of the mental foramen below M1). This mosaic of features is shared by the other Middle Palaeolithic mandibles from Central Europe (i. e. Ochoz, Krapina and Vindija). Within this Central European sample, the Subalyuk specimen is unique for two modern features: the presence of an incurvatio mandibulae anterior and the lack of the horizontal-oval shape of the mandibular foramen. In our opinion it is not possible to discuss accurately the sex diagnosis of the individual from the mandibular morphology, although the mandible is less robust than in other specimens.

When comparison is made with the Neanderthals from Western Europe, the Subalyuk mandible is closer to the early specimens such as Regourdou (PIVETEAU 1965,

Table 2. Meaurements of the Subalyuk 1 lower teeth (MD - mesiodistal length, BL - buccolingual breadth). Comparison to other Middle Paleolithic Hominids

		I1		I2		C		P1		P2		M1		M2		M3	
		MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL
Subalyuk 1 R (1)		5.6	7.4	6.4	8.0	7.6	10.3	7.9	9.5	–	–	–	–	–	–	–	–
(2)		5.5	7.4	6.5	8.1	8.0	9.9	7.8	9.4	–	–	11.2	10.7	–	11.5	11.4	11.5
Subalyuk 1 L (1)		5.7	7.4	6.4	8.3	7.6	10.1	–	–	7.4	9.1	10.2	10.8	10.7	11.2	12.5	11.5
(2)		5.5	7.7	6.6	7.4	8.0	9.7	–	–	6.8	9.1	10.1	10.5	11.1	11.2	12.4	11.8
Eur. Neanderthals (3)	m	5.4	7.2	6.0	7.4	–	–	7.6	9.0	7.2	8.8	11.3	10.7	11.5	11.0	11.2	10.8
	s.d.	0.7	0.2	0.5	0.4	–	–	0.5	0.9	0.7	0.9	0.6	0.8	0.7	0.8	0.9	1.6
	n	8		9		–		16		17		21		12		12	
Vindija (4)		–	–	5.0*	7.7*	7.4*	7.9*	7.8*	9.0*	–	–	11.2*	10.5*	11.3*	11.2*	11.8*	11.7*
		–	–	7.1**	7.8**	7.6**	8.3**			–	–	11.5**	11.4**	11.9**	12.3**	11.9**	11.8**
		–		2		2		1		–		3		3		2	
Krapina (5)	m	5.9	7.6	6.8	8.0	8.2	9.4	8.3	9.4	8.1	9.6	12.5	11.5	12.7	11.5	12.2	10.8
	s.d.	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.2	0.3	0.2	0.2	0.2	0.2
	n	6		9		11		10		13		14		12		10	
Middle East Neand (3)	m	5.2*	7.0*	6.4	8.1	7.7	8.9	7.3	8.9	6.9	8.9	10.6	10.7	11.0	10.9	11.6	10.9
	s.d.	5.9**	8.0**	0.4	0.5	0.2	0.5	0.2	0.4	0.5	0.5	0.5	0.3	0.4	0.2	0.5	0.7
	n	4		6		6		7		7		5		6		7	
Skhul–Qafzeh (6)	m	5.4	6.7	6.5	7.1	7.8	8.6	7.7	8.6	7.6	8.8	11.5	11.4	10.7	11.1	11.7	10.7
	s.d.	08	0.5	0.6	0.5	0.7	0.6	0.5	0.6	0.4	0.6	0.7	0.6	0.8	0.6	0.9	0.6
	n	8		7		7		6		9		6		7		5	

(1) present study; (2) Bartucz 1938; (3) Tillier's data; (4) Wolpoff *et al.* 1981; (5) Wolpoff 1979; (6) Tillier *et al.* 1989; * minimum; ** maximum

authors's observation) than to the latest ones (e. g. La Ferrassie 1, La Quina 9 and finally Saint Césaire) by its overall morphology (specifically its symphyseal morphology).

2. The manubrium sterni (Fig. 6)

The paucity of finds of sternal segments is striking among Middle Paleolithic human fossils, as it was already claimed by BARTUCZ 57 years ago. PATTE (1955) does not mention this bone at all and MCCOWN & KEITH (1939) could not compare the Mt Carmel sterna with those of other sites "for lack of evidence". This lack of fossil material is accentuated when the manubrium sterni is under study. Thus, the only fragments or complete manubria of prehistoric humans other than Subalyuk 1 are today those of Skhul IX (MCCOWN & KEITH 1939), Regourdou (VALLOIS 1965, VALLOIS & DE FÉLICE 1976), Shanidar 4 (or 6?) (TRINKAUS 1983), Krapina 117 (RADOVCIC *et al.* 1988), and Kebara 2 (ARENSBURG 1991).

The Subalyuk manubrium is well preserved (Fig. 6), although in two places the internal surface of the bone shows artificial holes (considered as probable traces of animal tooth activities by BARTUCZ 1938). The manubrium was not fused to the first sternebra and only small cortical areas are missing, especially in its dorsal aspect. In a transverse section the bone appears convex in front and concave behind. Its general shape is more square than triangular as is the norma in modern specimens, and this is the result of its broad articular surface for the sternal body.

In a ventral view the manubrium presents a clear sagittal crest ("crête en" of Rouvière) that separates deep left and right fossae for the attachment of the *pectorial major* muscle. The sternocleidomastoid muscle seems to have a very reduced surface at its origin. In the superior border of the manubrium the jugular notch was replaced by a rounded protrusion that became the highest midsagittal point of the bone. Currently the highest point of the *manubrium sterni* are the medial borders of the clavicular articular surface on each side. These surfaces are, in the sternum of Subalyuk 1, relatively flat and reduced in size.

The attachments for the first ribs are not clearly distinguished in the lateral borders. They appear as thin and short surfaces indicating a narrow costal cartilage typical at a relatively young individual.

The inferior border presents a long and rugged articular surface for the first sternebra, 28.4×12.0 mm in size. A net horizontal anterior line indicates the inclination of the angle of Lewis.

The dorsal surface is extremely concave, more than most of recent sterna. The infero-lateral borders are asymmetric, the left one presents an articular surface for the second costal cartilage while the right one is smooth.

The human sternum is extremely variable in its metric and morphological characteristics as VALLOIS & DE FÉLICE (1976) mentioned it. Table 3 shows the dimensions of the Subalyuk manubrium sterni compared to other individuals. From this table it is clear that the Subalyuk specimen, as well as that of other fossils is within the range of variation of modern humans, with the exception of the jugular notch width. Two other traits are specific of the Subalyuk sternum: the bulging shape of its superior-sagittal border at the place of the jugular notch and its extremely concave dorsal surface. This morphologic feature with some other traits, induced BARTUCZ (1940) to consider the specimen of Subalyuk as belonging to *"Homo primigenius"*, showing "primitive characters" and "different to modern man".

Table 3. Dimensions of the Subalyuk 1 manubrium sterni. Comparison with other hominids

Manubrium sterni	Subalyuk	Regourdou*	Skhul IX**	Modern***
Max. breadth	53.5 (1)	52.0	48.0	54.8 ± 5.9
Max. height	51.1 (1)	53.0	–	50.2 ± 5.2
Max.transv.diam. clavicular surface	18.4	–	–	20.0 ± 3.0
Min. A-P diam. clavicular surface	17.1	–	–	14.9 ± 1.7
First rib articular surface – height	17.8	–	–	21.0 ± 3.6
First rib articular surface – breadth	10.5	–	–	12.8 ± 2.6
Jugular notch width	27	17.0?	27.0	15.4 ± 3.7
First sternebra articular surface – trans.	28.6	–	–	26.4 ± 4.4
First sternebra articular surface – A-P	12	–	–	11.1 ± 2.7
Index breadth/height	104.6	98.1	–	109.2 ± 9.2

(1) respectively 54.0 and 50.0 according to Bartucz 1938;
* Vallois and de Félice 1976; ** McCown and Keith 1939;
*** authors' data. N =19 (13 Beduins and 6 individuals from Roman period)

Table 4. Dimensions of the Subalyuk adult atlas. Comparison with other fossil hominids and recent samples

Atlas	Subalyuk	Shanidar 2*	Kebara 2**	Skhul V***	Natufian**	Modern**
Trans. diam. between sup. art. surfaces	51.1	51.0?	50.0	46.0?	43.0 – 45.0	–
Trans. diam. between inf. art. surfaces	47.0	58.4?	47.5	47.0	40.0 – 43.5	–
Trans. diam. vertebral canal	30.2	34.0?	27.5	30.0?	24.0 – 28.0	23.5 – 39.0
Super. artic. facet – major axis	21.2	25.0?	22.0	21.0?	22.5 – 24.0	18.0 – 27.0
Super. artic. facet – 90° of above	12.1	10.0?	12.0	10.5	12.0 – 13.0	9.0 – 17.0
Inferior artic. facet – major axis	13.7	15.0 – 17.0	15.0	14.0	14.0 – 15.0	15.0 – 20.0
Inferior artic. facet – 90° of above	13.6	18.0 – 19.0	17.4	(16.5 – 19.0)	18.0 – 19.0	14.5 – 20.5

* Trinkaus 1983; ** Arensburg 1991; *** McCown and Keith 1939

VALLOIS & DE FÉLICE (1976) found that the "classic" Neanderthal of Regourdou presented a modern morphology, with a flat jugular notch and dorsal surface. These authors reject a "Neanderthal" morphology of the sternum and believe the differences between the various specimens are the consequences of a "simple variation individual". The height/breadth ratio of Subalyuk (104.6) is very close to that of modern populations given by VALLOIS & DE FÉLICE (1976) (mean 107.4) and higher than that of Regourdou (98.1), giving the former specimen a more modern shape.

3. The atlas

The first vertebra is broken into three pieces, two represented by the posterior arch and the superior and inferior articular facets on each side. The third fragment comprising the anterior arch and the odontoid articular facet is missing.

The vertebra of Subalyuk presents the same metrical and morphological characteristics of modern or ancient atlases (see Table 4). It has, however, a very low superior articular facet for the occipital condyle, a trait that is absent in other specimens examined and that seems to be specific to Subalyuk. The size (0.6 cm) and shape of the foramen transversarium as well as of the groove for the vertebral artery are normal and have not been modified by the low superior articular facet. The very thin section (0.9×0.4 cm) of the posterior arch in the midline of this vertebra seems to be gender related. The tubercle of the spinous process in the posterior arch is completely absent.

4. The sacrum (Fig. 7)

The sacrum of Subalyuk is represented by the fully fussed (*versus* BARTUCZ 1938: 85) three upper sacral vertebrae, the lateral masses, two anterior and two posterior sacral foramina on each side, a complete promontorium and a right auricle. The left auricle is missing its lower border. The right auricle extends from the upper part of the first sacral vertebra to the lower part of the third. The two articular facets for the fourth lumbar vertebra are well preserved. The second and third spinal processes are fussed. The vertebral canal is well preserved. As in most modern sacra, a large hiatus is present in the laminae of the first vertebra that permits to observe the body of the vertebra in a posterior view. This feature has been considered by TRINKAUS (1983) as the only archaic one in the sacral material from Shanidar. However, he as well as RAK (1991) believe that no specific metric or morphological features differentiate modern or ancient sacra. This assertion seems to be true also for the Subalyuk sacrum (see Table 5).

5. The patella

According to Table 6, the left patella found at Subalyuk is clearly within the range of variation of modern and ancient humans. It is somewhat smaller than that of European Neanderthals such as Spy, Krapina or La Quina but bigger than La Chapelle aux Saints.

This bone of the Subalyuk specimen does not present any specific morphological differences with that of modern humans and has no pathologies. Its ventral surface is rugged but not ossified tendinous spiculae are present. The articular surfaces are smooth and normal in their dimensions in the dorsal part. The ridge separating the larger lateral from the smaller medial articular surface is concave in the sagittal plane. In the upper

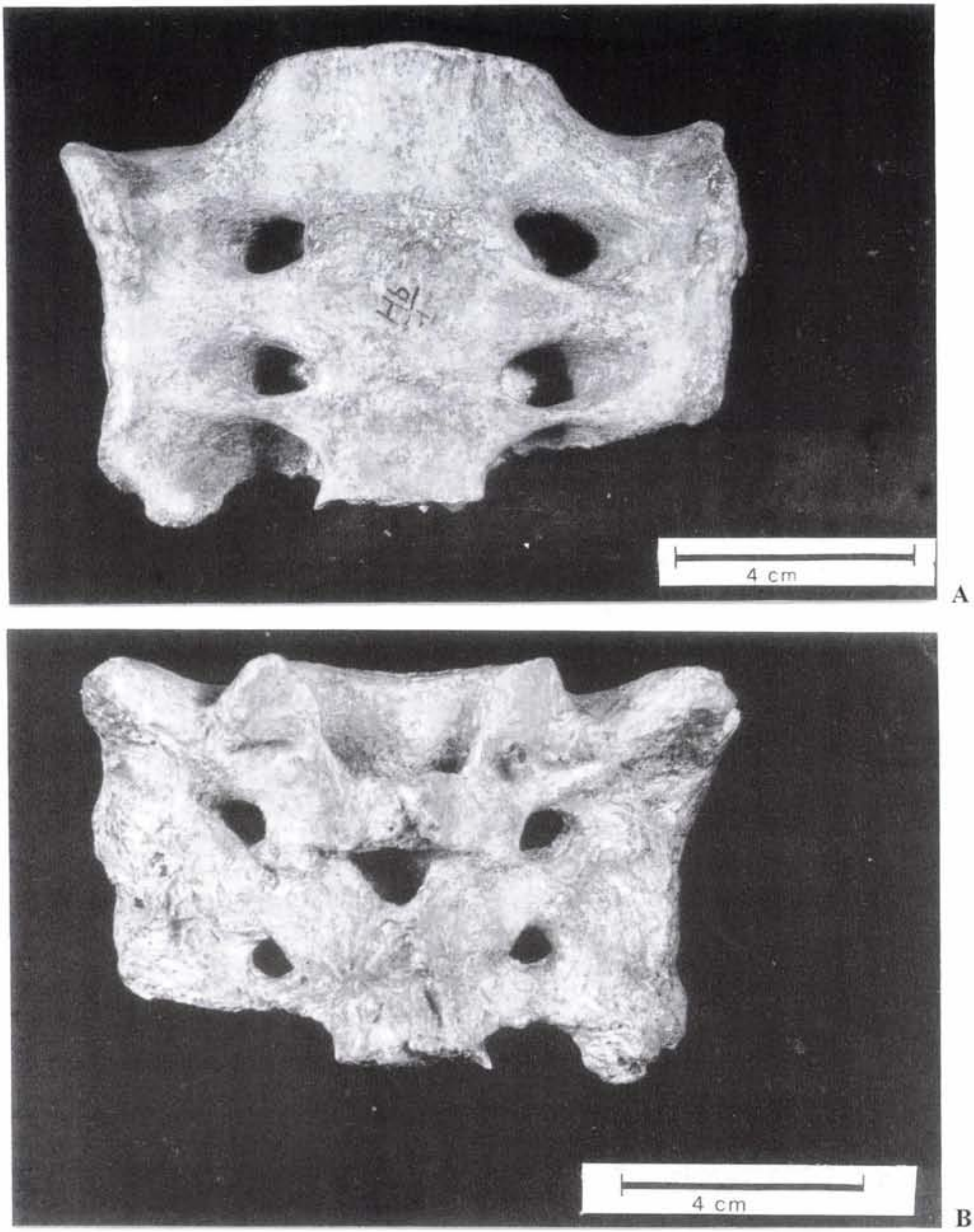


Fig. 7. The incomplete sacrum from Subalyuk 1 in dorsal (A) and ventral (B) aspects

Table 5. Dimensions of th adult Subalyuk sacrum compared to that of three other Middle Paleolithic hominids

Sacrum	Subalyuk	Kebara 2	Shanidar*	Skhul**
Sacral breadth	107.8	122.0	(104.0–117.0)	(100.0–105.0)
Sup. body surf. trans.	49.3	55.0	(47.0–60.0)	40.0
Sup. body surf. A-P	32.8	33.0	35.1	–
Auricular height	55.5	60.0?	(62.0–68.0)	–
Auricular breadth	28.5	–	40.5	–
Ventral body height S1	26.5	30.2	28.7–31.7	–
Ventral body height S2	23.3	26.8	27.0	–
Ventral body height S3	17.9	24.5	17.0–(23.3)	–
Vertebr. canal trans.	31.2	–	(38.0–39.0)	27.0–31.0
Vertebr. canal A-P	19.0	–	–	14.5–18.0
Sup. artic. facet vert.	15.1	17.8	–	–
Sup. artic. facet horiz.	15.1	22.5	–	–

* Trinkaus 1983
** McCown and Keith 1939

Table 6. Dimensions of the Subalyuk adult patella. Comparison with Middle and Upper Paleolithic hominids

	Patella	Vert. diameter	Transv. diameter	Ant.-post. diameter	Indice vert./transv.
	Subalyuk left	41.1	43.8	20.6	94.7
(1)	La Chapelle right	39.0	46.0	21.0	84.7
(2)	Spy right	46.3	52.4	24.0	88.3
(3)	Krapina	42.3–44.4	46.6–49.0	23.0–24.0	–
(4)	La Quina	43.0	48.0	–	89.5
(5)	La Ferrassie 2	42.0	42.0	19.0	100.0
(3)	Tabun I	36.0	39.0	17.0	92.3
(6)	Shanidar 1, 4, 5, 6	39.3–(49.5)	46.2–(51.1)	19.5–25.5	83.9–(107.1)
(3)	Skhul IV	49.0	46.0	21.0	106.5
(5)	Chancelade	45.0	53.0	25.0	84.9
(5)	Cro-Magnon	49.0–51.0	49.0–53.0	–	–
(5)	Modern	35.0–44.0	35.0–44.7	18.5–21.2	94.8–100.9

(1) Boule 1911, (2) Fraipont and Lohest 1887, (3) McCown and Keith 1939, (4) Patte 1955, (5) Heim 1982*b*, (6) Trinkaus 1983

half of the lateral border of this patella a smooth vastus notch is present but not so marked as in the Shanidar 6 specimen.

6. Hand and foot bones

The only hand bone is a 40.6 mm long fragment of the second left metacarpal bone. Its proximal end is almost complete measuring 16.3 mm in the antero-posterior direction and 16.8 in the transverse one.

The foot bones are represented by the fragment of one left III proximal phalange (24.1 mm) missing its distal end (the proximal end is 11.5 a-p and 12.3 mm transverse), a complete right II metatarsal, a fragmentary right III metatarsal and a complete left IV metatarsal (Tables 7–9).

The Subalyuk foot bones studied here are indeed in the range of variation of ancient as well as modern humans. The Subalyuk foot was not especially robust and cannot help in the determination of sex. The shortness of metatarsals II and IV may, however, point to a female individual. The relative homogeneity of measurements in this sample may indicate that all the bones belong to the same individual.

The right III metatarsal presents a completely healed diaphyseal fracture. This trauma seems to have affected only this bone in the case if only one individual is represented.

The small preserved portions of the left II metacarpal and left III phalanx of the foot do not make possible their full study and comparison. They seem to be very similar to the equivalent bones of modern humans.

Recent authors seem to agree on the point that the morphology and the size of modern foot bones overlap that of all Middle Palaeolithic hominids. Furthermore, all European as well as Near Eastern Mousterian populations possessed feet "which are functionally indistinguishable from those of anatomically modern *Homo sapiens*" (TRINKAUS 1975: 267). According to him the differences that BOULE (1911) and FRAIPONT & LOHEST (1887) described between modern humans and Neanderthals are only a reflection of a greater robusticity.

VANDERMEERSCH (1981) also relates the differences between the Qafzeh sample and the Neanderthals to robusticity and states that metatarsians and phalanx of Qafzeh "ne diffèrent pas des os modernes". The Subalyuk pedal anatomy may only confirm these observations. The metric and morphological study of these bones demonstrate that the remains from Subalyuk are in the range of variation found among modern populations.

GENERAL CONCLUSIONS ON THE ADULT REMAINS

The spatial distribution of the adult human remains on the site leads to the question of the recognition of more than one individual among the remains. The examination of the bones does not provide any argument to support such an assertion. All the adult remains fit in with an age at death relatively younger (25–35 years) than the one (40–45 years) previously proposed by BARTUCZ (1938). The sex estimation among fossil hominids is more difficult than the age estimation. The lack of the coxal bone makes us to be very cautious in estimating the sex on the basis of qualitative features usually employed

Table 7. Measurements of the adult Subalyuk second metatarsal compared to those of Middle Paleolithic hominids and recent samples

Metatarsal II	Subalyuk	Qafzeh 8 *	Qafzeh 8 *	Qafzeh 9 *	Qafzeh 9 *	Tabun I *	Skhul IV *	La Ferrassie I *	La Ferrassie I *	La Ferrassie II *	La Ferrassie II *	Modern **	Modern - range ***
	R	R	L	R	L	R	R	R	L	R	L		
Maximum length (M1)	70.0	79.1	79.5	74.2	–	74.0?	83.0	80.7	80.0?	68.0	68.6?	60.0–83.7	60.0–84.0
Mid. diaphysis trans. (M3)	7.8	10.0	9.1	8.9	8.6	6.5	8.2	8.5	8.7	8.0	8.3	6.0–9.5	6.0–10.0
Mid. diaphysis A – P (M4)	8.2	11.0	10.8	10.6	10.1	7.0	11.5	8.3	10.0	8.2	8.0?	7.0 – 11.0	6.0–11.5
Prox. epiphysis trans. (M6)	15.0	18.8	16.9	15.7	15.2	13.5	15.0	17.0	16.5	14.3?	17.7	–	11.0–20.0
Prox. epiphysis A – P (M7)	21.4	23.9	23.8	–	21.7	19.0	24.0	–	–	–	–	–	–
Dist. epiphysis trans. (M8)	12.0	14.1	13.8	10.9	–	9.8	12.2	–	–	–	–	–	8.0–14.5
Dist. epiphysis A – P (M9)	16.4	16.2	15.6	15.4	–	15.0	16.5	–	–	–	–	–	–

* Vandermeersch 1981; ** Ben-Ncer 1991; Volkov 1903, 1904

Table 8. Measurements of the Subalyuk adult third metatarsal compared to those of Middle Paleolithic hominids and recent sample

Metatarsal III	Subalyuk	Qafzeh 8*	Qafzeh 8*	Qafzeh 9*	Skhul IV*	Skhul IV*	Tabun I*	La Ferrassie I*	La Ferrassie II*	La Ferrassie II*	Modern**	Modern - range***
	R	R	L	R	R	L	R	L	R	L		
Maximum length (M1)	–	75.4	74.5	69.2	80.5	80.0	72.0	77.0	65.4	66.7	59.0 – 79.0	54.0 – 79.5
Mid. diaphysis trans. (M3)	8.5	–	7.4	8.4	7.5	10.0?	6.0	–	–	–	6.0 – 10.0	–
Mid. diaphysis A – P (M4)	9.0	–	10.5	10.0	11.0	13.0	8.0	–	–	–	7.0 – 11.0	–
Prox. epiphysis trans. (M6)	14.5	15.2	15.0	15.1	15.0	15.0	13.0	17.2	15.5	16.0	–	–
Prox. epiphysis A – P (M7)	20.0	23.5	22.7	21.1	21.0	21.0?	19.0	–	–	–	–	–
Dist. epiphysis trans. (M8)	–	12.5	12.2	9.9	12.0	11.0	8.3?	–	–	–	–	–
Dist. epiphysis A – P (M9)	–	16.5	16.5	15.1	16.0	16.0	14.0	–	–	–	–	–

* Vandermeersch 1981; ** Ben-Ncer 1991; *** Volkov 1903, 1904

Table 9. Measurements of the Subalyuk adult fourth metatarsal compared to those of Middle Paleolithic hominids

Metatarsal IV	Subalyuk	Qafzeh 8*	Skhul IV**	Tabun I**	La Ferrassie I**	La Ferrassie II**	Krapina A**	Modern***
	L	R	R	R	L	?	R	
Maximum length (M1)	66.0	72.1	77.0	65.1	75.6	62.1?	73.6	62.9 – 83.8
Mid. diaphysis trans. (M3)	9.0	–	11.0	9.9	12.7	9.4	9.8	9.2 – 10.9
Mid. diaphysis A – P (M4)	7.0	–	8.0	5.9	7.2	6.4	7.5	5.2 – 7.0
Prox. epiphysis trans. (M6)	20.0	21.2	20.0	17.0?	19.9	–	–	14.4 – 20.8
Prox. epiphysis A – P (M7)	13.5	12.4	12.0	14.0	17.3	15.0	15.4	9.8 – 14.4
Dist. epiphysis trans. (M8)	16.4	16.5?	15.0	12.2	18.0	–	16.8	12.9 – 17.7
Dist. epiphysis A – P (M9)	10.4	11.6?	12.8	–	13.6?	–	10.8	7.3 – 12.7

* Vandermeersch 1981; ** Trinkaus 1983; *** Courtaud 1989

to discriminate males and females in recent populations. The significance of the sexual dimorphism is not well known yet, especially in the case of the Neanderthals. We can just say that there are some traits on the mandible (e. g. overall size and lack of strong muscular attachments), as well as on the hand and foot bones, which may point to a female individual.

SUBALYUK 2: A COMPARATIVE STUDY OF PALEOLITHIC IMMATURE CHILDREN

1. The mid-facial skeleton

The mid-facial skeleton of the Subalyuk 2 child, represented by the two maxillae (the right bone more complete than the left one) and the left nasal bone, was firstly described by BARTUCZ (1938), in a monograph devoted to the Subalyuk Cave. In his short description the child was claimed to be 6–7 years old. The author mentioned the lack of a *fossa canina* on the maxilla, a wide frontal process, a large nasal aperture with a well developed and projecting anterior inferior nasal spine. The narrow and short palate were noticed as well as the archaic morphology of the teeth described as large. The similarities of the nasal bone with the only Neanderthal bone known at the moment, the La Quina H18 one, were noticed.

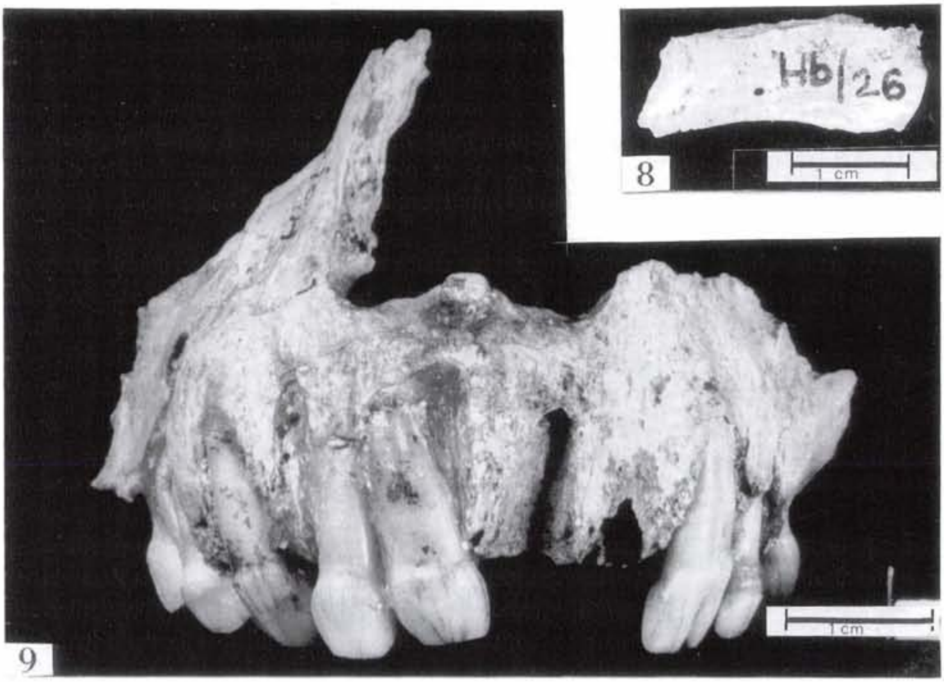
A few years later, in 1953 a short report was published by BRUSZT who focused his attention on the Subalyuk left upper deciduous canine that manifested an unusual morphology. The tooth was indeed geminate and an X-ray observation established the presence of two pulp cavities.

An exhaustive analysis of the upper dentition was further published by THOMA (1963), who mentioned that the immature Subalyuk maxilla "displays a definitely Sergi's extension type". According to the author, the main morphological differences with modern children of similar individual ages were the lack of fossa canina and lateral sulcus on the frontal process. THOMA established accurately the individual age at death for the Subalyuk "child between 3 and 4 years, perhaps nearer to the lower limit". The tooth morphology was considered as pertinent with Neanderthal affinities.

JELINEK (1969) described the isolated left nasal bone (which was not available at the moment of THOMA's report) as "markedly concavo-convex in profile", in relation to the projection of the nose.

VLCEK (1970) was the first to attempt an ontogenetic approach of the Neanderthals and included the Subalyuk 2 child in his analysis. He emphasized the fact that the Subalyuk 2 maxilla recalls the La Chapelle aux Saints adult individual in some aspects of its morphology. He also noticed that the incisive suture was still present on the Subalyuk 2 palatal surface.

The general consensus about the Neanderthal affinities of the Subalyuk mid-facial skeleton was based upon features collected from an exclusive comparison with modern



Figs 8–9. 8 = The immature Subalyuk 2 left nasal bone (anterior aspect) 9 = The Subalyuk 2 child maxillae in anterior view after restoration

Table 10. Measurements of the Subalyuk 2 maxillae and nasal bone (in mm)

Dental arch	Subalyuk 2	Pech de l'Aze (1)	Roc de Marsal (2)	Le Figuier (3)	La Madeleine (4)	Modern (5)
Internal bicanine breadth	25	27			–	
External bicanine breadth	34.3	41.5	41.4			32.7 ± 1.5
Internal bi-m1 breadth	28.1	29.7	32.5			–
External bi-m1 breadth	41	47	48.2	–	–	40.2 ± 1.5
Internal bi-m2 breadth	# 27.7	27.6	(32.2)	29	26	–
External bi-m2 breadth	# 47.3	50	52.4			45.6 ± 1.5
Dental arch length	30	33.1	33.8			27.1 ± 1.8
Max-Nasal breadth (M54)	19.5	(18.3)	21.1	19		18.1 ± 1.1(N=12)
Nasal bone						
Maximum superior breadth	7.5		(7.2)			9.4 ± 1.4
Maximum inferior breadth	9.8		11.5			12.6 ± 1.3
Maximum medial length	25		20			15.7 ± 2.3

(1) Ferembach *et al.* 1970, Tillier's data; (2) Tillier *et al.* 1989; (3) Billy 1979; (4) Heim 1991; (5) Known age sample N=10 to 12 (2-4 yrs), Musée de l'Homme; # approximately

European children. Following VLCEK's study, our purpose is to enlarge the ontogenetic analysis to fossil children of close dental ages (i. e. 3 years old) from Europe exclusively, as no data are actually available on the Dederiyeh child recently uncovered in Syria (AKAZAWA *et al.* 1995). The comparative sample includes either Middle Paleolithic (e. g. Pech de l'Azé, Roc de Marsal) or Upper Paleolithic children (e. g. Le Figuier, La Madeleine) and recent children. A re-examination of some features in the light of this comparison is thus proposed.

The Subalyuk 2 immature nasal bone (Fig. 8) shares the same concavo-convex profile with the Roc de Marsal bone; however, the former is narrower and longer. The Subalyuk nasal bone length is outside the modern human range of variation (Table 10). Unfortunately no nasal bones are available for the Upper Paleolithic juveniles.

The anterior surface of the Subalyuk 2 maxilla is not flat (Fig. 9). There is a lateral asymmetry, as the right bone is more inflated locally above and behind the deciduous canine, than the left one. It may be partially due to the strong development of the germ of the permanent canine which explains also the external oblique orientation of the deciduous canine and first molar roots on the dental arch. The lateral part of the maxilla is depressed above the deciduous molars posteriorly. Unfortunately the inferior lateral margin of the maxilla is not preserved and the anatomical connection between the maxilla and the zygomatic bone remains unknown. Though no fossa canina can be recognized (Fig. 10), the maxillary morphology of the Subalyuk child, like that of Roc de Marsal, is still different from the adult Neanderthal morphology "en extension".

The infraorbital foramen is located at 10.2 mm from the inferior orbital margin in a lower position than on Roc de Marsal and Le Figuier. Its opening is 3.5 mm high (with on almost vertical greater axis) and it is oriented anteriorly and medially. Like the Roc de Marsal one, the frontal process of the Subalyuk maxilla is wide and oriented laterally, with its anterior surface slightly convex, except along the posterior margin occupied by a small sulcus. Its breadth is almost constant from the top (13.2 mm) to the bottom (13.4 mm).

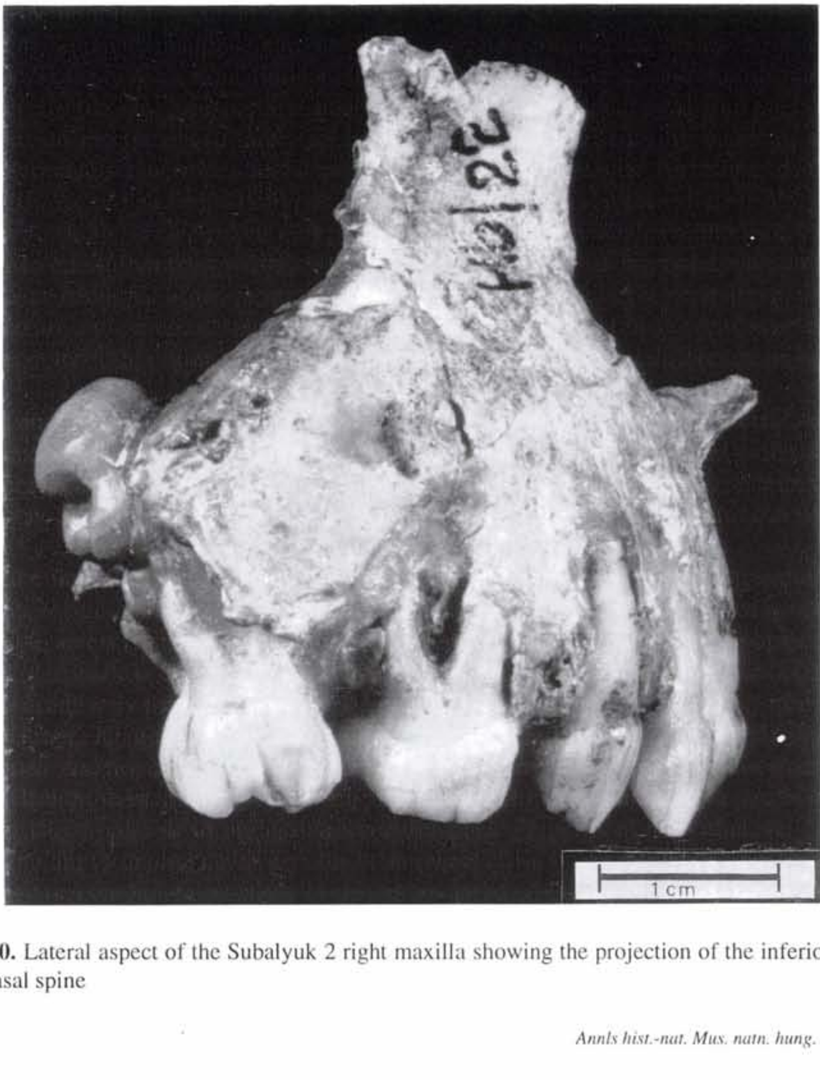


Fig. 10. Lateral aspect of the Subalyuk 2 right maxilla showing the projection of the inferior anterior nasal spine

The Subalyuk palate (Fig. 11) is shorter and narrower than the ones of Pech de l'Azé and Roc de Marsal (Table 10). This is in agreement with BARTUCZ's previous remark. Unlike Roc de Marsal (MAUREILLE 1994), Subalyuk 2 manifests an incisive suture visible only on the palatal surface of the maxilla (as shown by the preserved left bone). In this configuration, Subalyuk 2 recalls the Le Figuier child as well as many modern children of similar dental ages.

The width of the nasal aperture (Table 10) of the Subalyuk child remains within the modern human range of variation in common with Roc de Marsal and Le Figuier. The Subalyuk 2 anterior inferior nasal spine (4.8 mm long) is protruding (Fig. 9) like those of the two other fossil children.

Finally the Subalyuk 2 tooth morphology (Fig. 11) does not differ from that of all Palaeolithic children, i. e. Neanderthals and other *Homo sapiens* individuals. Shovel-shaped incisors, four-cusped upper first deciduous molar with a buccal cingulum, Carabelli pit on the second deciduous and first permanent molars, cannot be considered anymore as Neanderthal specificities (TILLIER 1979*a, b*, TRINKAUS 1983).

Dental abnormalities are rare among Palaeolithic children, e. g. Devil's Tower (BUXTON 1928, TILLIER 1983) and Malarnaud (authors' data). The Subalyuk specimen represents a unique case for the occurrence of a geminate deciduous upper canine (see Figs 9 and 11), as previously described by BRUSZT (1953). There is no trace of enamel hypoplasia or caries on the deciduous teeth beyond this feature. However, on the germs

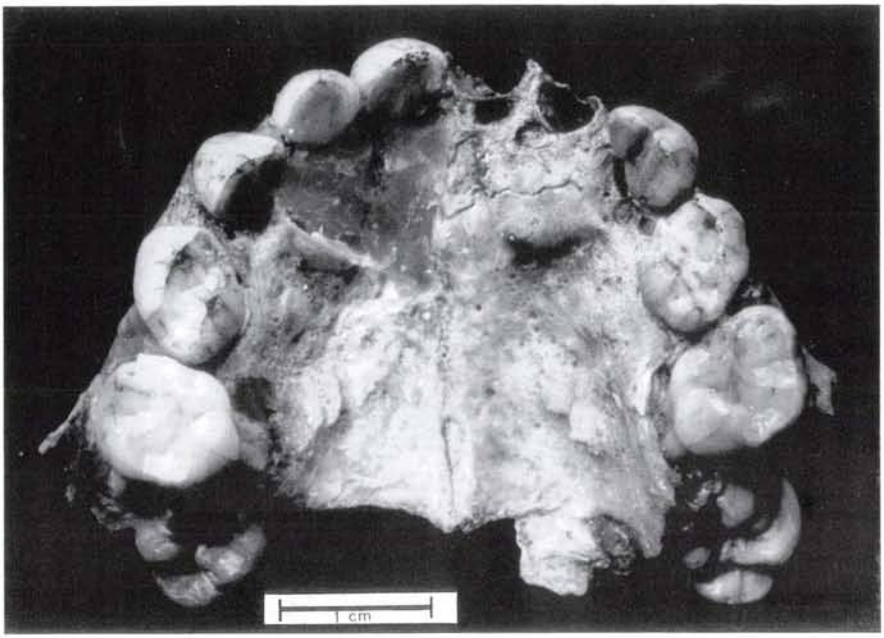


Fig. 11. The Subalyuk 2 child bony palate and the deciduous upper teeth from below. Note the interincisive suture on the left side

Table 11. Measurements of the Subalyuk 2 upper teeth (MD : mesiodistal length, BL buccolingual breadth). Comparison to young individuals with no or slight interproximal wear

	i1		i2		c		m1		m2		I1		I2		M1	
	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL	MD	BL
Subalyuk2 (1)	6.5	5.4	5.8	5.0	6.4	5.5	8.3	8.8	9.2	9.3	9.1	–	–	–	–	–
*R	6.2	5.2	5.6	4.6	5.9	5.6	8.0	9.2	8.7	9.9	9.1	6.4	7.5	7.5	10.5	11.4
*L	–	–	–	–	6.5	5.2	(7.2)	8.6	8.9	9.8	–	–	–	–	10.5	11.5
Chateauneuf 2 (2)	7.5	5.8	6.3	5.2	7.0	6.4	7.6	9.4	8.9	9.9	9.3	7.7	–	–	10.2	11.1
Pech l'Aze (2)	7.3	5.7	–	–	7.6	7.0	7.7	9.5	9.3	10.5	–	–	–	–	–	–
Roc de Marsal (3)	7.7	6.0	6.3	5.3	7.8	7.0	8.2	8.7	9.5	10.1	–	–	–	–	–	–
Shanidar 7 (4)	7.4	5.8	5.6	5.3	7.1	7.0	7.8	8.8	8.9	9.8	–	–	–	–	–	–
Kebara	1 (5)	7.7	6.2	6.0	5.3	6.6	6.2	7.3	9.4	9.4	10.3	–	–	–	–	–
Skhul I (6)	–	–	–	–	–	–	8.4	7.9	9.6	9.3	10.1	6.7	–	–	12.3	11.3
Le Figuier (7)	–	–	–	–	–	–	6.8	9.0	9.5	10.6	–	–	–	–	–	–
La Madeleine (8)	6.8	5.?	5.2	5.0	7.0	6.3	6.5	9.0	8.9	9.9	–	–	–	–	–	–

(1) Thoma 1963; (2) Tillier 1979*a*; (3) Tillier 1983; (4) Trinkaus 1983; (5) Tillier's data; (6) Tillier 1979*b*; (7) Billy 1979; (8) Heim 1991; * present study

of the permanent incisors, there is a slight indication of enamel alteration represented by a linear modification of the enamel colouration located at 4.1 mm from the cervix on the central incisor, at 2.5 mm on the lateral incisor.

Although the Subalyuk 2 deciduous teeth appear relatively small within the Neanderthal European sample (Table 11, *versus* BARTUCZ 1940), we will not agree with THOMA's assertion (1963) about a female assignment of the Hungarian fossil child. Tooth size comparison is rather more difficult for the permanent teeth as their crowns are not fully calcified.

2. The neurocranium

In his description, BARTUCZ (1938) referred to the relatively low and broad neurocranium, with the maximum cranial breadth in a low position and no parietal eminences; the occipital bone with a sagittal curvature; well marked and developed nuchal supertructures (e.g. lineae nuchae superior and inferior); the small mastoid process, the wide and deep digastric notch, the clear mastoid crest and the relatively deep mandibular fossa; the flat and receding frontal bone with a supraorbital torus, and finally large and rounded orbits.

Most of those features are commonly quoted in the literature (e. g. THOMA 1963, JELINEK 1969, VLCEK 1970, SMITH 1984) with some comments added, that qualify the degree of development of the supraorbital relief or claim the presence of an occipital bun. THOMA (1963) and later SMITH (1984) noticed that the biasteric breadth was especially large on Subalyuk 2 and that the metopic suture was a common feature with other Neanderthal children.

Today more data are available for the immature Neanderthal sample as well as for Upper Paleolithic children of known similar dental ages. A re-examination of the Subalyuk 2 fossil can provide new information on the ontogeny of Middle Paleolithic individuals from Central Europe. The Subalyuk 2 child is quite unique for this geographical area, representing a *ca* 3 years stage of development.

2.1. Cranial metrics (Table 12)

As we already mentioned it, the new reconstruction of the Subalyuk 2 cranium could not reduce the postmortem deformation. In addition it must be emphasized that there was some antemortem deformation in the postbregmatic region. The anterior fontanelle is completely closed (Fig. 12) like on Roc de Marsal. The Subalyuk parietal bones are remarkable for the clear post-bregmatic compression from the top towards the bottom which extends laterally and posteriorly (Fig. 13). The result is that the sagittal curvature of the parietal bones is flat or slightly concave in its anterior section (along *ca* 2.5 cm), becoming strongly convex up to the last section where it is flat again, forming the lambdoidal flattening already noticed by THOMA (1963) and SMITH (1984). Although this posterior flattening is common with Neanderthal children, whatever their individual age is (e. g. Roc de Marsal, Devil's Tower, Engis 2, La Quina H18, Teshik-Tash), the postbregmatic flattening displayed by Subalyuk 2 cannot be found elsewhere. Such postbregmatic cranial deformation can be partially detected only on the Upper Paleolithic child from Le

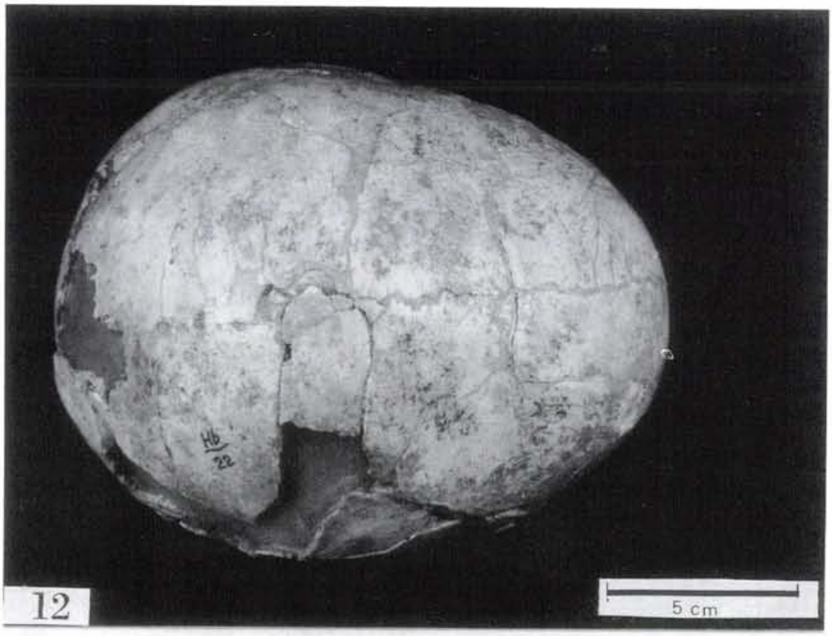
Table 12. Cranial measurements of the Subalyuk 2 child compared to other fossil children

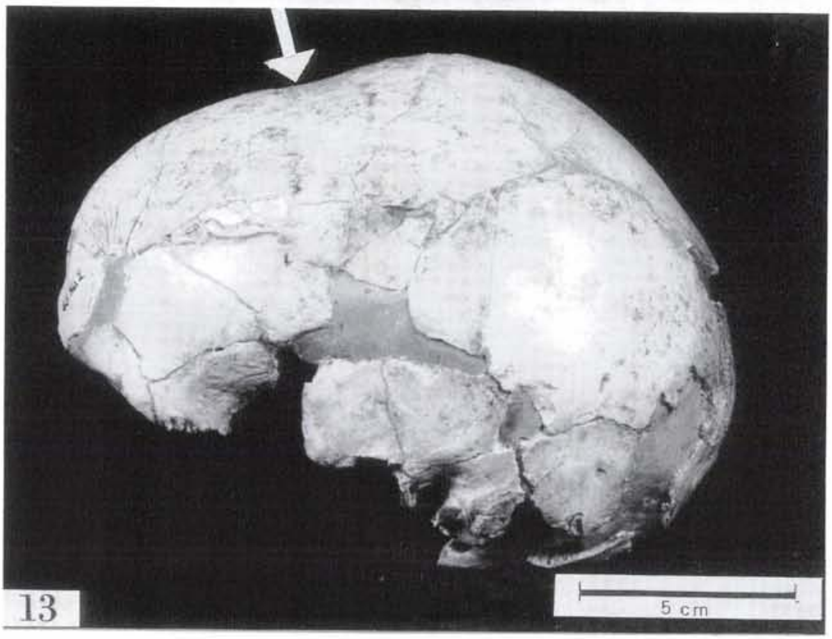
Martin N°	Subalyuk 2			Pech de l'Aze	Roc de Marsal	Le Figuier	La Madeleine	Predmosti 6	Skhul I
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(5 and 9)
M8	129	131	130	130	130	130?	131	138	121
M1	165	(163)	(164)	169?	(173)	174?	169	179	(167)
M20a	92	92	98.9	99.9	–	–	–	–	–
M11	–	–	101	92	–	–	91	–	–
M13	–	–	92	82	–	–	–	–	–
M12	–	[110-115]	112	–	108	84	105	–	106
M10	113	–	110	112	–	106	100	111	100
M9	92	89	88	86.5	94.5	–	–	89	(84)
Cranial capacity	1000/1100	–	1166 ± 102*	1192 ± 102*	1261 ± 104*	–	1262 ± 102*	–	1140
M29	–	–	(78)	90	(99)	93	–	103	(98)
M26	90	–	(95)	103	(109)	?114	–	119	(112)
M30	105	–	106	–	(93)	–	–	–	107
M27	118	–	118	–	(105)	–	–	138	114
M31	84	–	84	–	–	–	–	–	84
M28	140	–	102	–	–	–	–	121	105

(1) Bartucz 1938; (2) Thoma 1963; (3) present study; (4) Ferembach *et al.* 1970; (5) Tillier's data; (6) Billy 1979; (7) Heim 1991; (8) Matiegka 1934, 1938; (9) McCown and Keith 1939, Tillier's data; * Cocqueugniot's formulas, n.d.

Figuier. Certainly the post- and ante-mortem Subalyuk 2 cranial deformations can not be neglected as far as measurements are concerned.

The comparison of the Subalyuk 2 cranial measurements is intentionally restricted to fossil children of similar known dental ages (Table 12), either Neanderthals (i. e. Pech de l'Azé, Roc de Marsal) or early modern humans (i. e. Skhul 1, Le Figuier and La Madeleine). Unlike Skhul I, the Subalyuk 2 child is characterized by a broad and long neurocranium, a feature common to all European fossil children (Table 12). This is well illustrated by the values of the index I1 (M8/M1×100): Subalyuk 2: 79.2; La Madeleine: 77.5; Roc de Marsal: 75.1; Skhul I: 72.5. Within this European small sample, Subalyuk 2 can be distinguished by larger biauricular (M11) and biasterionic (M12) breadths. Another difference between Subalyuk 2 and *Homo sapiens sapiens* children concerns the vertical vault development although no estimation of the calotte height indices can be provided from the two Upper Paleolithic children (i. e. Le Figuier, La Madeleine used for comparison. The Subalyuk 2 auriculo-vertical index (bregma-basion height/maximum





Figs 12–13. 12 = Superior aspect of the Subalyuk 2 calvaria after restoration 13 = The Subalyuk child calvaria: left lateral aspect. The postbregmatic deformation extends antero-posteriorly and laterally (white arrow)

cranial breadth) equals 60.3, which is near the lower ends of variation of recent human samples (BRAUER in KNUSSMANN 1988: 190).

The Subalyuk 2 endocranial capacity was estimated to 1000–1100 cc by BARTUCZ (1938), using WECKLER's formula established on adult skulls. An estimation based upon recent formulas defined by COCQUEUGNIOT (n.d.) specifically for immature individuals can be proposed using the porion-bregma height. The Subalyuk 2 endocranial capacity (1166±102 cc) appears close to the Skhul 1 value. This value remains below the Roc de Marsal endocranial brain size and below the Upper Paleolithic estimations (Table 12).

2.2. *Cranial morphology*

a. The frontal bone

Unlike the *Homo sapiens sapiens* fossil children, the Subalyuk 2 child has a short and broad frontal bone. The postorbital constriction is well pronounced like on Pech de l'Azé. Within the Neanderthal immature sample Subalyuk 2 seems unique for the shortness of the frontal bone (Table 12). Its sagittal curvature (I22: 82.1) is closer to the Le Figuier one (I22: 81.5) than to that of any other Neanderthal individual (e. g. Pech de l'Azé: 88.3; Roc de Marsal: 87.8).

Like Pech de l'Azé, Subalyuk 2 exhibits a metopic suture (Figs 12 and 14). This is not a constant feature of Neanderthal children (*versus* THOMA 1963, SMITH 1984), as shown by Roc de Marsal as well as by individuals older in dental ages such as Engis 2, Devil's Tower, Teshik-Tash. The presence of a metopic suture on some Neanderthal children (including Krapina 1) reveals individual variations as it is the case among modern populations.

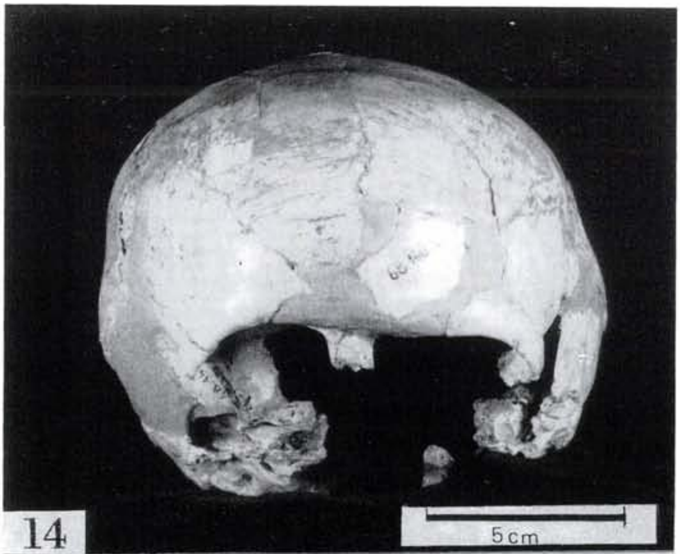
The Subalyuk 2 child manifests a faint external bulging above the orbits (Fig. 14) instead of a supraorbital torus (*versus* BARTUCZ 1940, THOMA 1963). Although the glabellar region is damaged, the existence of supraglabellar depression seems to be plausible and that the supraorbital bulge was incipient in the medial area. The supraorbital morphology displayed by the Subalyuk 2 child strongly recalls that of Roc de Marsal and differs from that of early modern children.

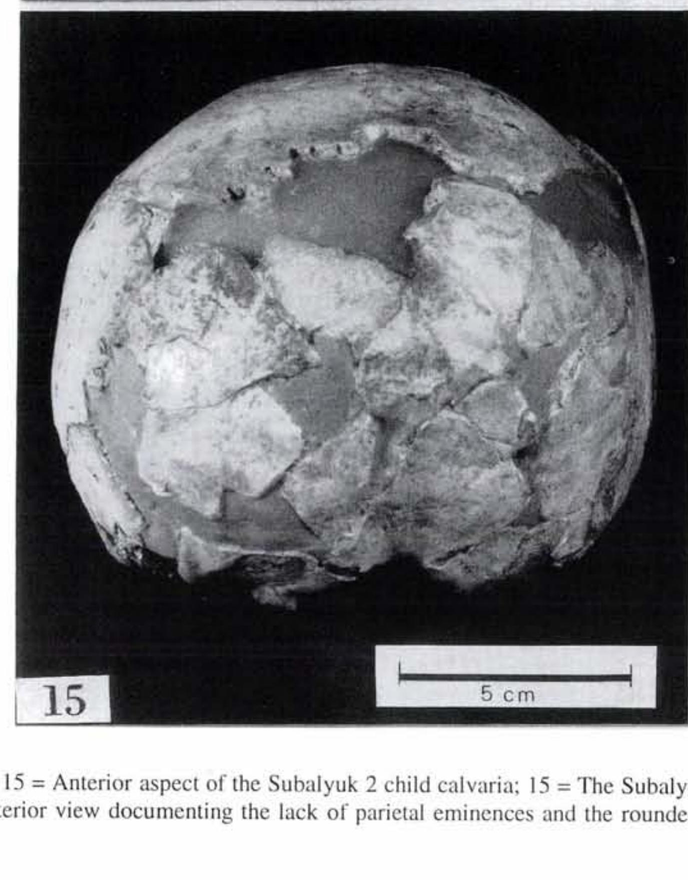
The superior margin of the Subalyuk 2 orbits is sharp in its external part and there is no supraorbital notch. This morphology is similar to the one described on other Neanderthal children (e. g. FEREMBACH *et al.* 1970, TILLIER 1983). By contrast a supraorbital notch is present on the Le Figuier child (authors' observation).

b. The parietal bone

As it was already mentioned, there is a clear antemortem deformation on the anterior part of the Subalyuk 2 parietal vault. As a result, the sagittal curvature of the bone (Fig. 13) has a strange profil which is not reflected by the I24 value (89.8). This value remains similar to the indices calculated for other fossil children (Roc de Marsal: 88.5; Skhul 1: 93.8). Unlike Roc de Marsal and Skhul I, the Subalyuk 2 child has parietal bones longer than the frontal one.

The anterior and posterior curvatures of the Subalyuk 2 parietal bone are strongly convex. No accurate evaluation of the curvature indices can be done due to the state of





Figs 14–15. 15 = Anterior aspect of the Subalyuk 2 child calvaria; 15 = The Subalyuk 2 child calvaria in posterior view documenting the lack of parietal eminences and the rounded shape of the braincase

preservation; however on the left bone, the posterior parietal arch (*ca* 96 mm) is longer than the anterior one (*ca* 79 mm).

The well pronounced lateral convexity of the parietal bone contributes to the rounded shape ("en bombe") of Subalyuk 2 in posterior view (Fig. 15), in addition to the lack of parietal eminences and the low position of the maximum cranial breadth. In a superior view this specimen shows a maximum cranial breadth posteriorly located. Like Roc de Marsal, Subalyuk 2 strongly differs from *Homo sapiens sapiens* children (e. g. Skhul I, La Madeleine and Le Figuier) in this combination of features. The examination of Subalyuk 2 confirms that the rounded shape of the neurocranium is a Neanderthal feature which appears early in ontogeny (TILLIER 1986).

c. The temporal bone (Fig. 16)

The two temporal bones of the Subalyuk 2 child are incomplete (Fig. 16). The left one can provide a good indication of the squamosal development (length = ±52.2 mm, height = 23.1 mm) and of the mastoid process size (maximum height = 9.9 mm, maximum breadth = ±9.8 mm).

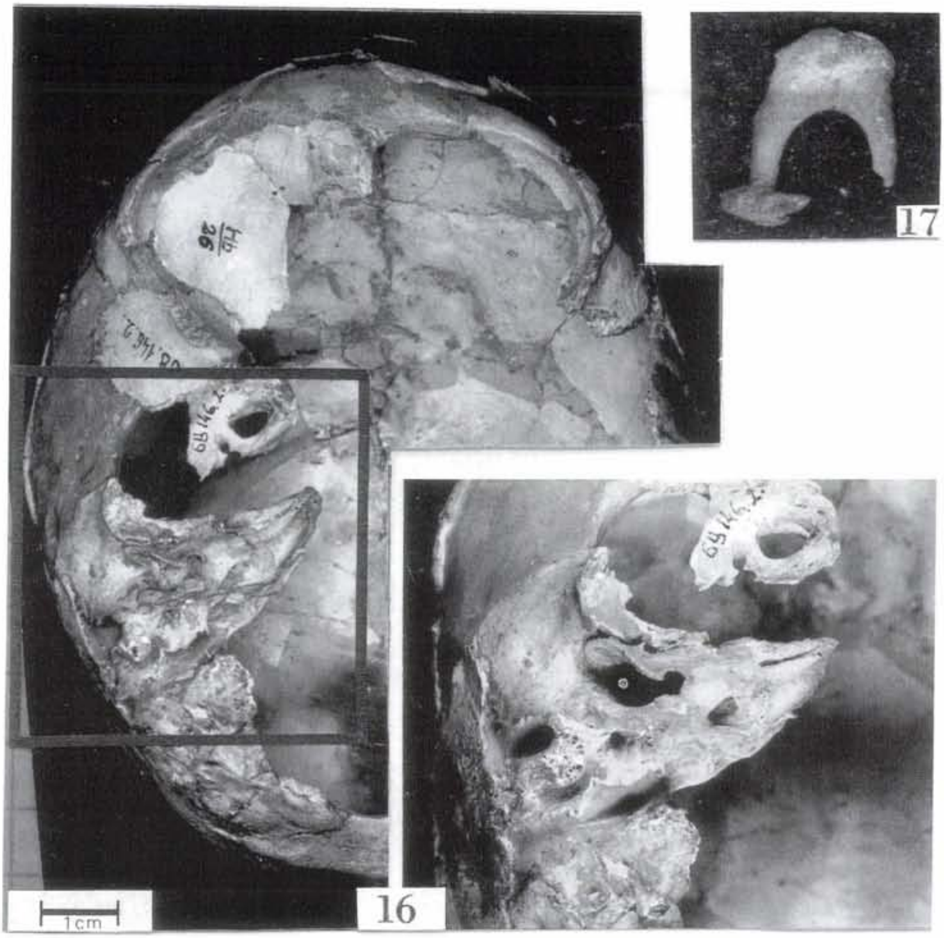
The Subalyuk 2 temporal squama shows a straight and almost vertical anterior margin while its upper margin is regularly convex and the posterior one slightly convex in a lateral view of the cranium. The external acoustic meatus does not occupy a low position compared to the mandibular fossa. On the left side a mastoid crest can be followed from the zygomatic area towards the temporal notch but it does not reach the notch. The pyramidally shaped mastoid process manifests some rugosities on its external surface. Its development is inferior to that of the juxtamastoid area. The small development of the mastoid process with regard to the juxtamastoid area is a juvenile feature common to all children; however, the mastoid process manifests an additional oblique orientation towards the sagittal plane on the Neanderthal individuals (i. e. Subalyuk 2, Pech de l'Azé, and other individuals). On Subalyuk 2 this is well illustrated by the comparison of the biauricular (M11 = 101 mm) and bimastoid (M13 = 93 mm) breadths.

Like Pech de l'Azé and Roc de Marsal, Subalyuk 2 manifests no anterior mastoid tubercle.

On the Subalyuk 2 temporal bone, the state of preservation of the mandibular fossa limits observation of its shape and morphology, but a postglenoid process was probably well developed. It is obvious that the tympanic plate largely contributes to the formation of the posterior wall of the fossa. The tympanic plate seems to be not completely ossified and there is a Huschke foramen, two juvenile features shared with other young fossil and recent children. The anterior wall of the Subalyuk 2 tympanic plate is smooth and more extended than the short posterior one. Both parts are separated by a clear crest. The shape of the external acoustic meatus cannot be defined as its inferior margin is partly missing.

The Subalyuk 2 petrous bone manifests no clear angulation with the tympanic plate (Fig. 16), although the large and rounded carotid foramen opens medially and posteriorly. The internal acoustic aperture appears elongated and the eminentia arcuata is protruding on its endocranial surface.

The inferior view of the Subalyuk 2 temporal bone presents the styloid process (only its basal location on such a young child) and the stylomastoid foramen are located at the



Figs 16–17. 16 = The Subalyuk 2 temporal region in anteror view; 17 = The unique middle ear ossicle from the Subalyuk 2 child preserved: a right stapes (M×10)

same level, the former being a few millimetres more medial. The relative position of these two structures is similar to that of La Madeleine, and differs from what can be observed on Pech de l'Azé and Skhul I, where the stylomastoid foramen is behind the styloid process and it is in continuity with the direction of the digastric notch. A medial position of the styloid process is the most common feature with Neanderthals, but its presence is not rare in other Paleolithic groups and in modern children (TILLIER's observations).

The digastric notch of the Subalyuk 2 specimen is relatively deep and narrow (*versus* BARTUCZ 1938), and like that of Pech de l'Azé it does not reach the stylomastoid foramen anteriorly. The presence of a faint bony bridge between the anterior part of the digastric notch and the stylomastoid foramen was previously described on immature Neanderthals (TILLIER 1983). It is a common feature shared by Neanderthals and archaic *Homo sapiens*.

During the restoration of the Subalyuk 2 cranium, a middle ear stapes was recovered from the right temporal bone (ARENSBURG *et al.* 1996). As the size of the middle ear ossicles is not affected by individual growth, the Subalyuk 2 stapes can be compared to two Paleolithic ossicles previously uncovered (i. e. La Ferrassie III and Darra-i-Kur), and to more recent specimens. The Subalyuk 2 right stapes (Fig. 17) is missing a part of the posterior crura and the footplate but it is otherwise intact. It is in the lower range of variation of modern humans for two of its measurements, height and length, but its breadth exceeds that of all the comparative sample (see Table 1, in ARENSBURG *et al.* 1996). The preserved anterior crura is identical to the modern one, like on La Ferrassie III. Its head has an anteroposterior elongated shape and the protruding articulation for the incudal lenticular process is missing. The complete articular capsule seems to be ossified around the bony joint. Yet from the examination of the tympanic cavity no pathological reason can be clearly established (ARENSBURG *et al.* 1996).

d. The sphenoid bone (Fig. 16)

The only parts preserved from the Subalyuk 2 right sphenoid bone are the temporal part of the greater wing and an inferior fragment with the foramen ovale and rotundum. The temporal part of the sphenoid greater wing is flat with no infratemporal crest and no sphenoid tubercle. The lack of an infratemporal crest is a common feature of Neanderthals (VANDERMEERSCH 1981).

The Subalyuk 2 foramen ovale is large (7.1×3.8 mm) like that of Le Figuier. The foramen rotundum remains opened postero-medially and it seems to be probable that a small accessory foramen was present, located more medially and posteriorly.

e. The occipital bone

The Subalyuk 2 occipital bone, unlike the Roc de Marsal one, manifests no fusion of the synchondrosis intraoccipitalis anterior. The synchondrosis intraoccipitalis posterior can still be seen in its posterior part. In our opinion these observations do not confirm an acceleration in the ossification process as claimed by HEIM (1982*a*) for Neanderthal immature occipital bones.

The Subalyuk 2 occipital squama is broad as shown by the biasterionic breadth (112 mm), long (lambda-inion arch = ±63 mm) and convex (Fig. 15). The convexity of the occipital squama, present on the Roc de Marsal child and other Neanderthal specimens, is commonly considered a Neanderthal feature, although it can be seen to a certain degree on Upper Paleolithic children (e. g. La Madeleine). This feature must be distinguished from the occipital bun which is missing on both young immature Neanderthals (*versus* SMITH 1984). The suprainiac fossa of Subalyuk 2 specimen is small and not clearly designed, unlike some other immature Neanderthals (HUBLIN 1978, TILLIER 1983).

The nuchal plane of the Subalyuk 2 occipital bone is characterized by the presence of well developed muscular attachment insertions for the rectus capitis muscles (major and minor). The lower limit of the left inferior nuchal crest is well pronounced. Only the posterior and lateral left margins of the foramen magnum are partially present and they indicate that a large and probably elongated foramen was present originally (Fig. 16). The foramen magnum is not preserved on Pech de L'Azé and Roc de Marsal. However, in Europe, an elongated shape of the foramen magnum was previously described on Neanderthal children older in individual ages than Subalyuk 2, e. g. Engis 2 and Teshik-Tash (GREMIATSKIJ & NESTURKH 1949, TILLIER 1983). A large foramen magnum is also present on some Upper Paleolithic immature individuals (e. g. La Madeleine, Grotte des Enfants à Grimaldi (?), Predmosti; HEIM 1991, GAMBIER pers. comm. n.d., MATIEGKA 1938). All those European fossil children have an antero-posteriorly elongated skull in common.

3. The vertebral centra

Four immature vertebral centra were uncovered from the site, two are cervical and two probably thoracic. It is not possible to define their position within the vertebral sequence more accurately.

The Subalyuk 2 vertebral centra seem to be very similar to those of recent children of similar developmental ages. This conforms to the previous data collected on the Roc de Marsal vertebrae (MADRE-DUPOUY 1991, authors'data) and on younger individuals such as Shanidar 7 (TRINKAUS 1983).

CONCLUSION ON THE JUVENILE REMAINS

The Subalyuk 2 child can be aligned with other Neanderthals of the same developmental age and, like them, it differs in some aspects (e. g. rounded shape of the skull in posterior view, occipital morphology, development of the supraorbital area) from early modern Humans. Subalyuk 2 seems to be distinguishable by his smaller teeth among the Neanderthal infants (like the adult Subalyuk 1). Finally Subalyuk 2 manifests some characteristics that are unique among immature Neanderthals, such as an extreme postbregmatic flattening (antemortem compression) or a geminate deciduous canine.

Within the immature Neanderthal sample from Central Europe, the Krapina 1 individual from Croatia is the most complete one that allows some comparison with the Hungarian specimen. Unfortunately the age at death of the Krapina specimen remains unknown as no teeth were preserved. Furthermore the Krapina 1 skull is restricted to parts of the frontal and two parietal bones, and an almost complete left temporal bone. However, evidence of morphological similarities and differences can be reached from the comparative analysis of the two specimens. Similarities are the metopic suture, the post-bregmatic flattening which extends laterally on the two parietal bones, and most of the features of the temporal bone. The differences refer to the frontal bone and the maximum cranial breadth that are larger on Krapina 1 than on Subalyuk 2. In addition Krapina 1 exhibits a strong angulation on the temporal bone between the tympanic portion and the *pars petrosa*, missing at Subalyuk.

FINAL CONCLUSIONS

The Mousterian remains from Subalyuk, Hungary, fill an important gap in our knowledge on the Eastern European human population at the time.

Although they are represented only by fragmentary skeletal elements, they are sufficiently significative to be considered a variant of the Neanderthal group.

The present reconstruction and study of the Subalyuk remains permit a reassessment of this material described for the first time by BARTUCZ many years ago.

The morphology of the adult and immature skeletal parts of Subalyuk 1 and 2 are generally close to that of other Eastern European Neanderthals such as those of Krapina and Vindija. However, there are some important differences that indicate the mosaic morphology and large variation of the Middle Paleolithic population. Regional/geographic adaptations are typical of ancient and modern human groups, and anatomical variations from the main Neanderthal cluster of Western Europe are not be expected. It is clear that the West European Neanderthals have the greater amount of derived traits while distant populations present more plesiomorphic and generalized characteristics. The Subalyuk human remains are not an exception to this pattern.

* * *

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