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## A RECONSIDERATION OF THE PŘEDMOSTÍ PELVES (GRAVETTIAN, CZECH REPUBLIC)

**ABSTRACT:** *Four adult pelves from the Gravettian Předmostí site are examined in the light of the data collected from a few recent samples originated from Europe. A comparison between fossil early modern humans and the Kebara 2 individual is then conducted in order to establish the distinction of the Central European fossil hominids.*

**KEY WORDS:** *Předmostí – Upper Palaeolithic – Gravettian – Pelvis*

### INTRODUCTION

More than 70 years after its discovery, the Předmostí hominid sample from Moravia remains the best documentation available for the knowledge of individual variation among European Upper Palaeolithic hominids. Indeed from the site 13 adult and 16 non-adult skeletons were recovered (Matiegka 1934, Jelínek 1992) and this allows a quite exhaustive study of the skeletal morphology and a unique evaluation of age and sex-related changes. The Předmostí skeletons have been discovered with a Gravettian archaeological context dated by radio-carbon to  $26320 \pm 240$  BP (Absolon, Klíma 1978). They are considered as contemporaneous with the Dolní Věstonice finds (Jelínek 1976), which are dated to  $25800 \pm 170$  BP (Smith 1984).

The material was destroyed during World War II but the description given by Matiegka (1934-1938) on 27 of the individuals permits a comparative analysis between the Předmostí and other hominids.

In this contribution the Předmostí hominids are compared primarily to two distinct series of recent human pelves from Europe, the first being of a single origin ( $n = 100$ ), the second including 430 individuals from three different collections in order to enlarge the statistical analysis. The metric characteristics of the Předmostí pelves

are evaluated using scatter plots relative to several pelvic morphometrics. In addition the Předmostí hominids are compared to a few relatively complete fossil specimens deriving from Middle and Upper Palaeolithic sites in Europe and the Near East in order to establish a potential distinction.

### MATERIALS AND METHODS

Among the Předmostí hominids, four adults had a pelvis well preserved for whom a sexual assignment was given by Matiegka (1938) following the criteria commonly employed in sex estimation of recent skeletal populations. According to this author, Předmostí 4 and 10 are probably two females, respectively ca. 30 – 35 years and 20 – 30 years old, while Předmostí 3 is a man of ca. 35 – 40 yrs at death and Předmostí 14 a relatively old man. The individual ages at death were estimated by Matiegka on the basis of the cranial and dental data. Interestingly, a discordance in age estimation for Předmostí 4 seems to exist as Matiegka (1938: 46) emphasized the fact that the iliac crest and the sciatic tuberosity were not completely fused on the specimen. The 3, 4 and 14 Předmostí specimens are described by the author as robust while the last one, Předmostí 10 is gracile.

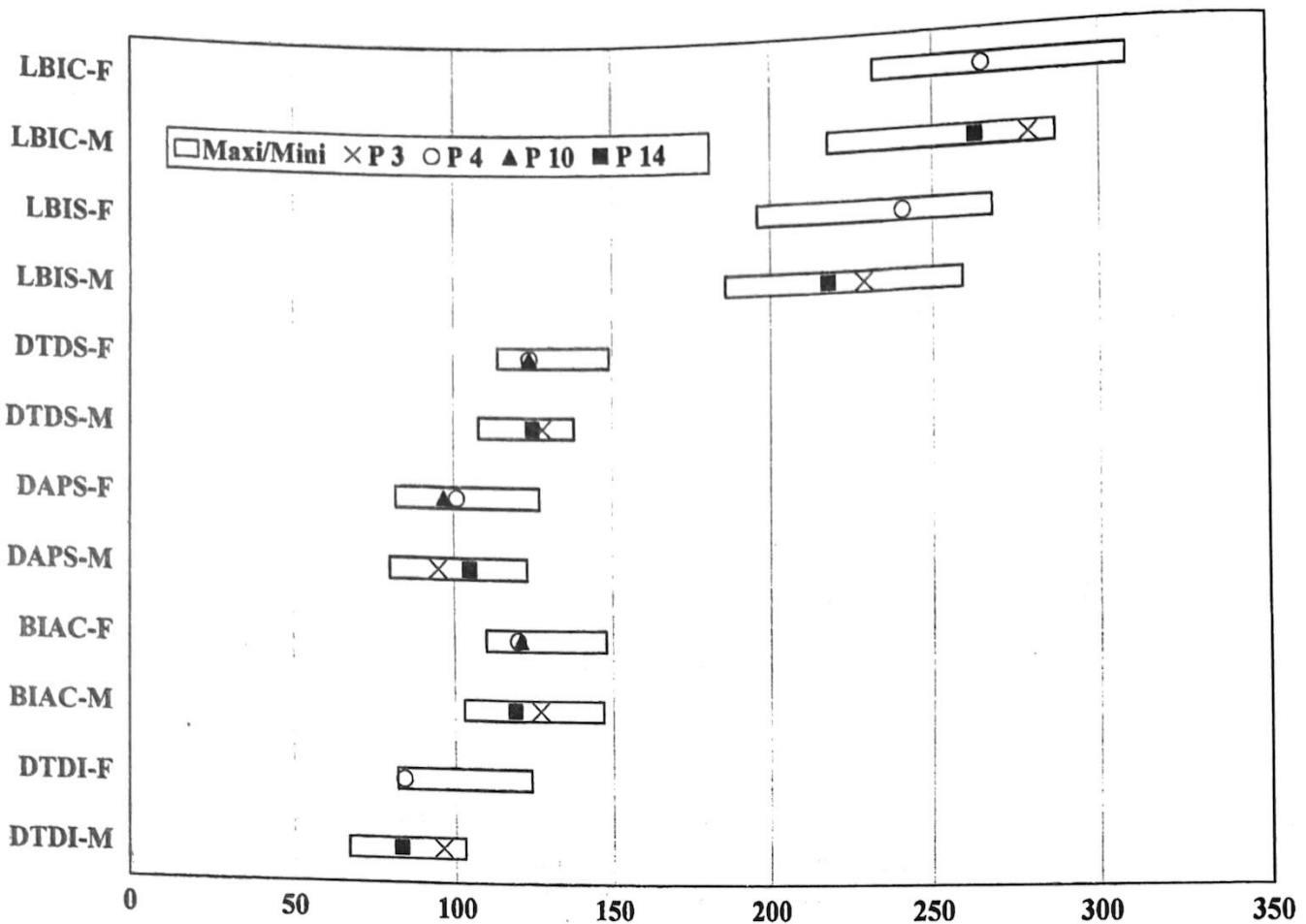


FIGURE 1. Variation in the pelvic dimensions (see text for abbreviations) of the Předmostí hominids (P3, P4, P10, P14). Comparison with a modern sample from Europe (Coimbra,  $n = 100$ ; F = females, M = males).

The pelvic morphometrics of the Předmostí males and females are first evaluated on the basis of a reference sample of 100 individuals that includes 50 females and 50 males from the Coimbra sample (Brůžek, unpublished data). The set of 6 variables employed are the maximum pelvic breadth – LBIC (M 2 – Bräuer 1988), the anterior upper spinal breadth of the pelvis – LBIS (M 5 – Bräuer 1988), the transverse diameter of the pelvic inlet – DTDS (M 24 – Bräuer 1988), the antero-posterior diameter of the pelvic inlet DAPS – (M 23 – Bräuer 1988), the biacetabular breadth – BIAC (M 7 – Bräuer 1988), and finally the bispinous transverse diameter of the pelvic outlet – DTDI (M 8 – Bräuer 1988).

The Upper Palaeolithic hominids included in the comparison are three individuals from Europe: Sungir 1 (Khriassanova 1984); Kostenki 14 (Guerassimova 1987), Menton (Verneau 1906) and one from the Near East: Ohalo 2 (Hershkovitz *et al.* 1993). In addition three Middle Paleolithic individuals selected for their significance in the discussion concerning differences between Neanderthal and early modern human pelves, i.e. Kebara 2 (Bar-Yosef *et al.* 1986), Skhul 4 and 9 (McCown, Keith 1939) are employed in the study. Within the Neanderthal sample Kebara 2 is unique as its pelvis is virtually complete and

such a state of preservation allows to evaluate its total functional morphology. This is the reason why attention is focussed by scholars on this individual. Reference is made to this individual here but this does not mean that Kebara 2 can be considered as the holotype of the Neanderthal population.

The morphometric data of the fossil record are based upon the description made by the different scholars (Guerassimova 1987, Brůžek, Novotný 1993, Brůžek's unpublished data). Indeed most of the Middle and Upper Palaeolithic pelves are incompletely preserved. Six new variables are thus selected in order to allow a fruitful comparison: the pelvic height – DCOX (M 1 – Bräuer 1988), the iliac breadth SCOX (M 12 – Bräuer 1988), the acetabulo-symphyseal pubic length PUM (M 14 – Bräuer 1988), the maximum ischium length ISM (Thieme, Schull 1957), the greater sciatic notch breadth<sup>1)</sup> AB (Novotný, 1975) and finally the ischio-pubic index ( $PUM \times 100/ISM$ ).

<sup>1)</sup> After Novotný (1975), the breadth of the greater sciatic notch is defined as the distance from the top of tubercle of the pyramid (A) or when absent from the posterior inferior iliac spine (A') to the base of sciatic spine (B).

TABLE 1. Comparative pelvic morphometrics for the Předmostí adult hominids, other early modern humans and the Kebara 2 Neanderthal (measurements in mm).

	DCOX	SCOX	PUM	ISM	AB	PUM × 100/ISM
Sungir 1 (a)	227	155		107.0	46.9	
Předmostí 3 (b)	226	160	70.4*	117.2	44.1*	60.1
Předmostí 4 (b)	213	147	66.0*	101.6*	46.0*	65.0
Předmostí 10 (b)	206		69.3*	102.5*	43.2*	67.6
Předmostí 14 (b)	218	153	69.0*	110.9*	56.2*	62.2
Kostenki 14 (c)	196	152			46.0*	
Menton	215	165		107.0		
Skhul 4	216	164	75.5	109.1	46.0	68.7
Skhul 9			84.0	104.0		80.8
Ohalo 2	224	157	78.4	107.4	45.0	73.0
Kebara 2	226	154.5	88.0	101.2	38.0	86.9

(a) Brůžek and Novotný (1993)

(b) Matiegka (1936)

(c) Guerassimova (1987)

abbreviations defined in the text

\* predicted from original measurements using least-squares regression (cf. text)

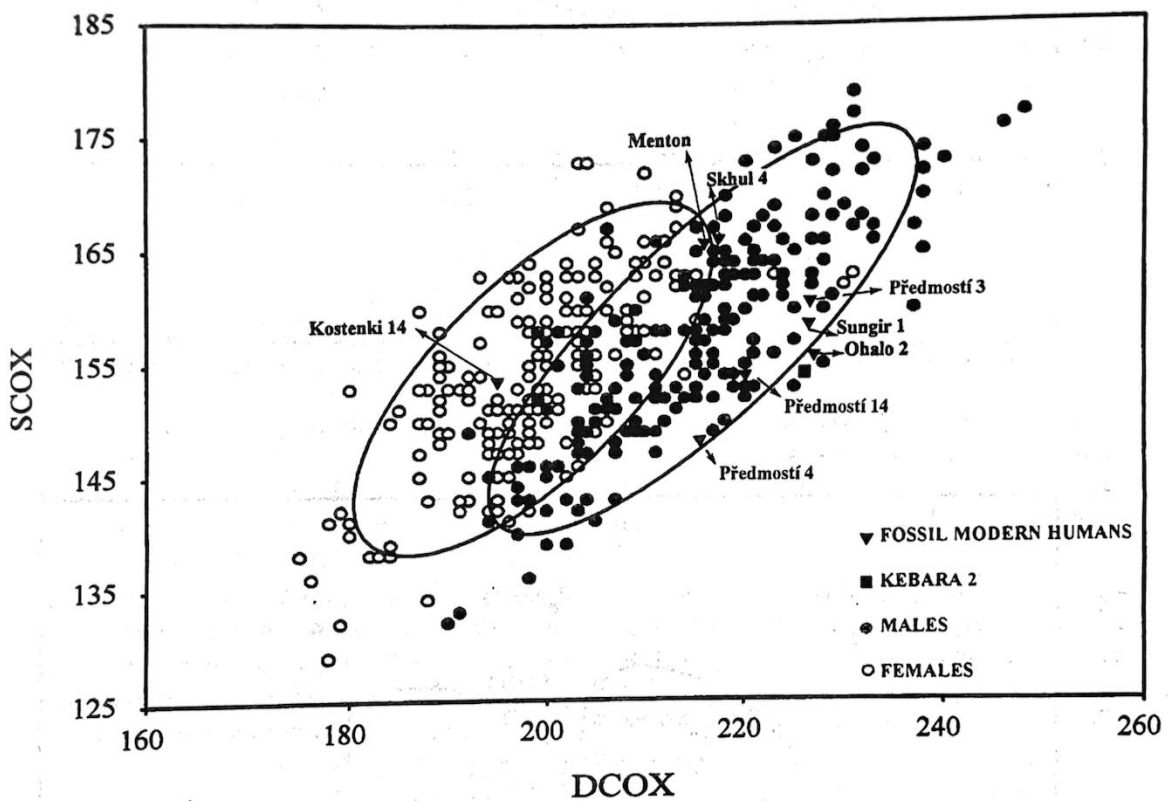


FIGURE 2. The Předmostí pelvis on a scatter plot of iliac breadth (SCOX) versus pelvic height (DCOX) in a recent sample (n = 430) of known age and sex from Europe (measurements in mm).

The two former variables illustrate the overall morphology of the *os coxae*. The acetabulo-symphyseal length, the sciatic height and the ischio-pubic index give information about one morpho-functional aspect of the pelvis, while the latter one is documented by the sciatic notch breadth. These two aspects served as criteria in the discussion of the total morphological pattern of the pelvis. A large series of known age and sex pelvises coming from three different recent collections (Brůžek 1991, 1992) hold in Coimbra, Paris and London (n = 430) is used in the statistical analysis.

From the measurements given by Matiegka (1938) some of the variables selected for the present study are

estimated. The acetabulo-symphyseal length (PUM) is predicted from the pubic length (PUMA) given in Matiegka's table XXVI as measurement 12 (equivalent to M17) using a least-squares regression based on our recent sample (for males  $PUM = 0.700 PUMA + 9.546$ ; for females  $PUM = 0.641 PUMA + 15.456$ ). The maximum ischium length (ISM) is predicted from the ischium length (ISMA) given by Matiegka (measurement 13, M15), using a formula regression (for males  $ISM = 1.046 ISMA + 19.871$ ; for females  $ISM = 0.882 ISMA + 29.286$ ). The sciatic notch breadth (AB) is calculated following a regression formula employing the original measurement

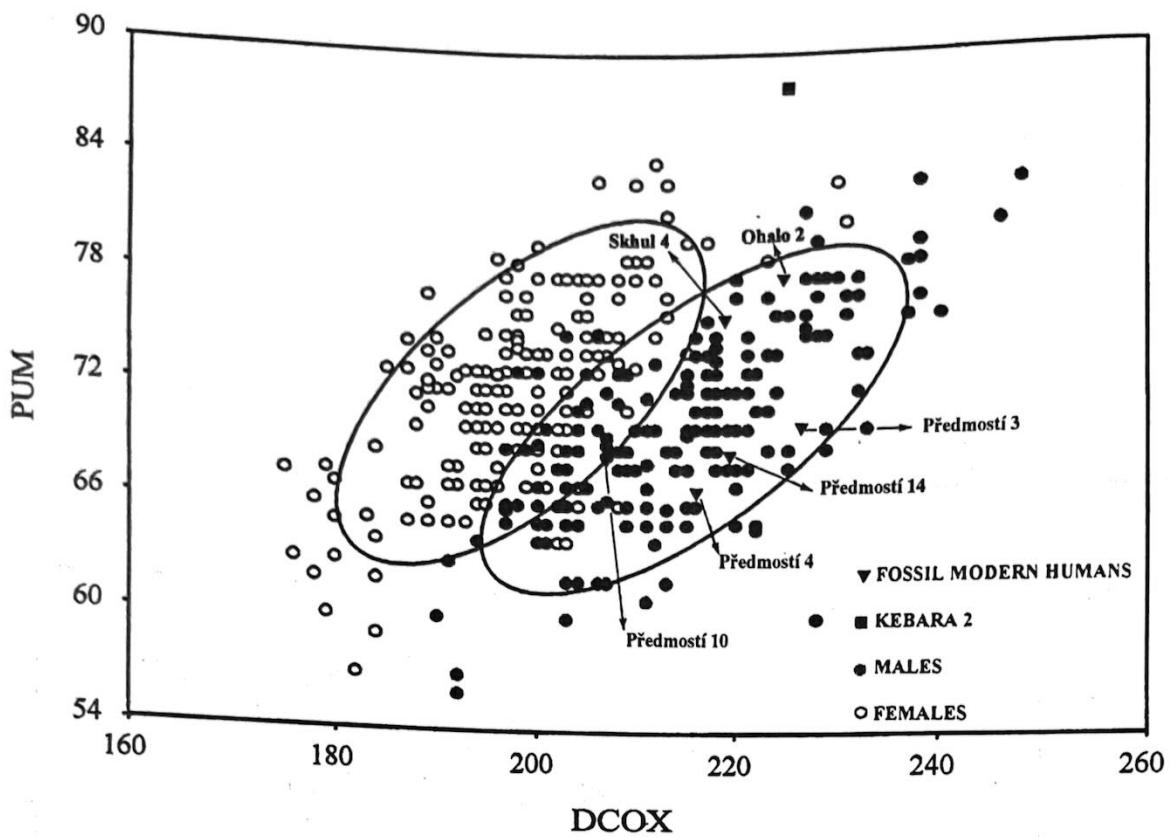


FIGURE 3. The Předmostí pelvis on a scatter plot of acetabulo-symphyseal pubic length (PUM) versus pelvic height (DCOX) in a recent sample ( $n = 430$ ) of known age and sex from Europe (measurements in mm).

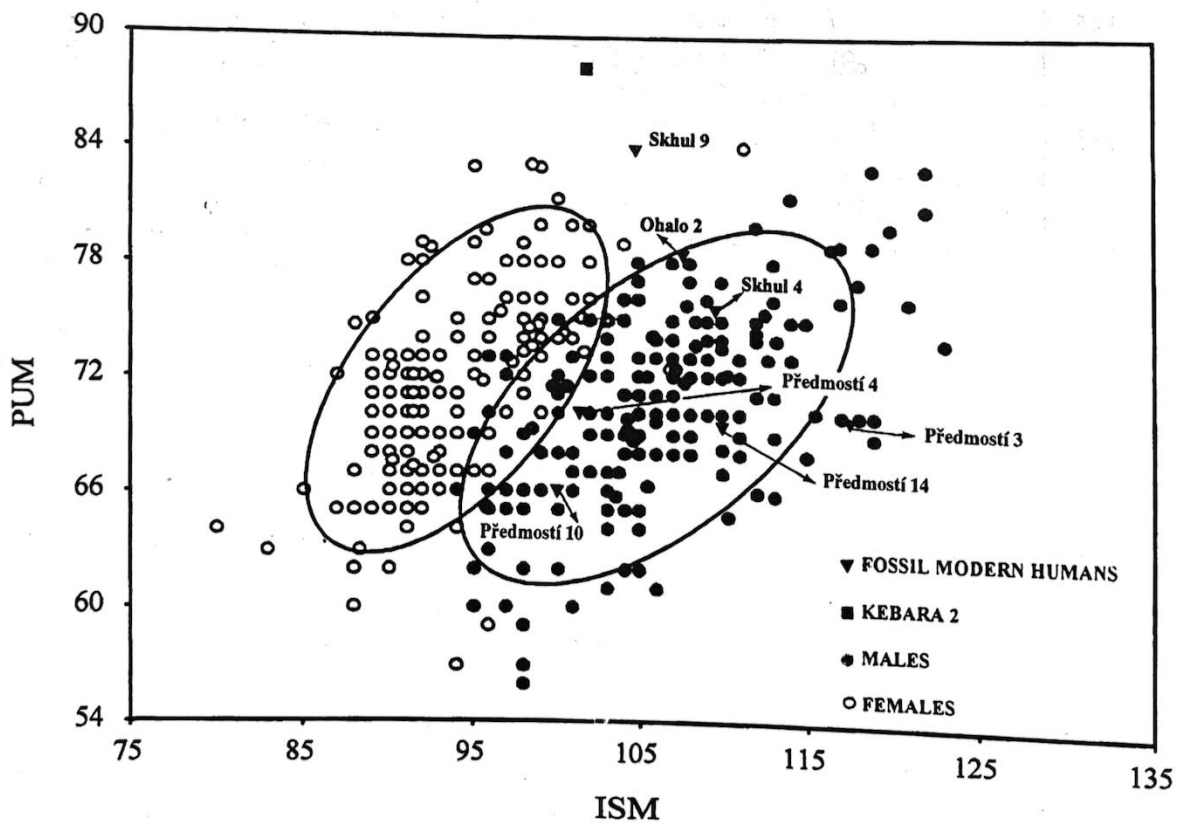


FIGURE 4. The Předmostí pelvis on a scatter plot of acetabulo-symphyseal pubic length (PUM) versus maximum ischium length (ISM) in a recent sample ( $n = 430$ ) of known age and sex from Europe (measurements in mm).



(measurement 19 equivalent to M 31) designated here as AMB (for both males and females:  $AB = 0.931 AMB - 4.278$ ).

The *Předmostí* pelvic variables and those from other European and Near Eastern hominids are presented in *Table 1*. The fossil pelves are compared using scatter plots relative to three groups of variables in order to evaluate the distinctiveness of the *Předmostí* hominids versus recent and Late Pleistocene individuals.

## THE PŘEDMOSTÍ ADULT PELVIC MORPHOLOGY

In the monograph devoted to the *Předmostí* sample, Matiegka (1938) gave a detailed description of the adult pelvic morphology based upon several dimensions. According to this author, all the *Předmostí* individuals had iliac blades very thin in the posterior region of the iliac fossa (range of variation for the thickness between 0.5 and 2.9 mm) and in this feature contrast with the two Neanderthal specimens available at the moment (La Chapelle-aux-Saints and Krapina). Interestingly the thinner iliac blade is measured on the more robust individual, *Předmostí* 3 (0.5 mm). The iliac crest is described as markedly curved on all the bones. The anterior inferior iliac spine is claimed to be massive and not sharp. Finally Matiegka also mentioned a greater sciatic notch wide and shallow, an acetabulum oval-shaped, not especially large and the dimensions of the obturator region falling within the range of variation of recent Europeans.

The first analysis (*Figure 1*) based upon six measurements following Martin's definitions (Bräuer 1988) applied to the Coimbra series shows that all the *Předmostí* individuals are within the range of the modern hominids. There is no apparent contradiction between the sex estimation proposed by Matiegka (1938) for the four *Předmostí* specimens and their location within the frequency distribution of the Coimbra males and females.

## THE PŘEDMOSTÍ PELVES WITHIN THE LATE PLEISTOCENE SAMPLE

By contrast with the previous analysis based on complete pelves, a comparison is conducted between the *Předmostí* pelvic morphometrics and other fossil hominid data using a selection of six variables (*Figures 2 to 6*).

Matiegka mentioned that the *Předmostí os coxae* were relatively narrow regarding their total height. Indeed on a scatter plot of iliac breadth versus pelvic height (*Figure 2*) the three complete *Předmostí* pelves (*Předmostí* 3, 4, 14) exhibit a relatively small breadth compared to the height. They appear in this combination of traits closer to Sungir 1, Ohalo 2 and Kebara 2 than to other early modern humans (i.e. Skhul 4, Kostenki 14, and Menton).

The scatter plot of the acetabulo-symphyseal length versus the pelvic height (*Figure 3*) shows that the four

*Předmostí* adults are within the distribution of recent males with relatively short superior pubic ramus, although one individual *Předmostí* 4 is within the overlapping of males and females distribution. The central European individuals differ from the Near Eastern ones (Skhul 4 and Ohalo 2) which have longer superior pubic ramus. By contrast with the Kebara 2 Neanderthal, the two Near Eastern modern humans remain within the distribution of recent males.

The distinction between the *Předmostí* individuals and other hominids can be analyzed on the scatter plot of the acetabulo-symphyseal length versus the sciatic length (*Figure 4*). Three of the *Předmostí* individuals (4, 14 and 10) are within the male distribution of the recent sample, like the two Near Eastern individuals Ohalo 2 and Skhul 4. *Předmostí* 3, the most robust individual, is outside the range of distribution for the recent males with a relatively long ischium, while Skhul 9 and Kebara 2 are both outside of the modern sample distribution, sharing similarities in the relative proportions of their ischium and pubis.

Another way to evaluate the degree of elongation of the superior pubic ramus compared to the pelvis height in the *Předmostí* hominids is illustrated in *Figure 5* showing a scatter plot of ischio-pubic index versus pelvic height. Again three of the Moravian individuals (*Předmostí* 4, 10 and 14) fall within the recent male distribution and their location on the diagram confirms that they have a relatively short ischio-pubic unit. *Předmostí* 3 is again outside of the range of variation for the male sample. *Figure 5* reveals that Ohalo 2 and Skhul 4 are like most of the *Předmostí* individuals within the male distribution. With regard to its relative ischio-pubic proportions, the Kebara 2 Neanderthal specimen can be considered as unique within the entire fossil sample.

It is evident that the *Předmostí os coxae* are relatively high and narrow. The Kebara 2 pelvis, like other Neanderthal pelves (Tillier, Majo, Brůžek 1995) shows a pattern in which the medio-lateral elongation of the superior pubic ramus seems to morphologically compensate the narrowing of the greater sciatic notch. This morpho-functional compensation of the two segments implies that the pelvic inlet remains similar in size to that of modern humans, as already mentioned by Rak and Arensburg (1987), but positioned differently.

It is therefore relevant to evaluate whether in the *Předmostí* pelves the low ischio-pubic index is accompanied by an increase of the greater sciatic notch breadth. An additional comparative analysis based on a scatter plot of the ischio-pubic index versus the greater sciatic notch breadth is proposed in order to reconstruct the morpho-functional pattern of these Late Pleistocene hominids from Central Europe. Indeed the scatter diagram (*Figure 6*) illustrates that the *Předmostí* four pelves have relatively large greater sciatic notch compared to the recent male distribution. Skhul 4 and Ohalo 2 fall within the female distribution by contrast with Kebara 2. This last specimen has the narrowest greater sciatic notch. With regard to the development of the greater sciatic notch,

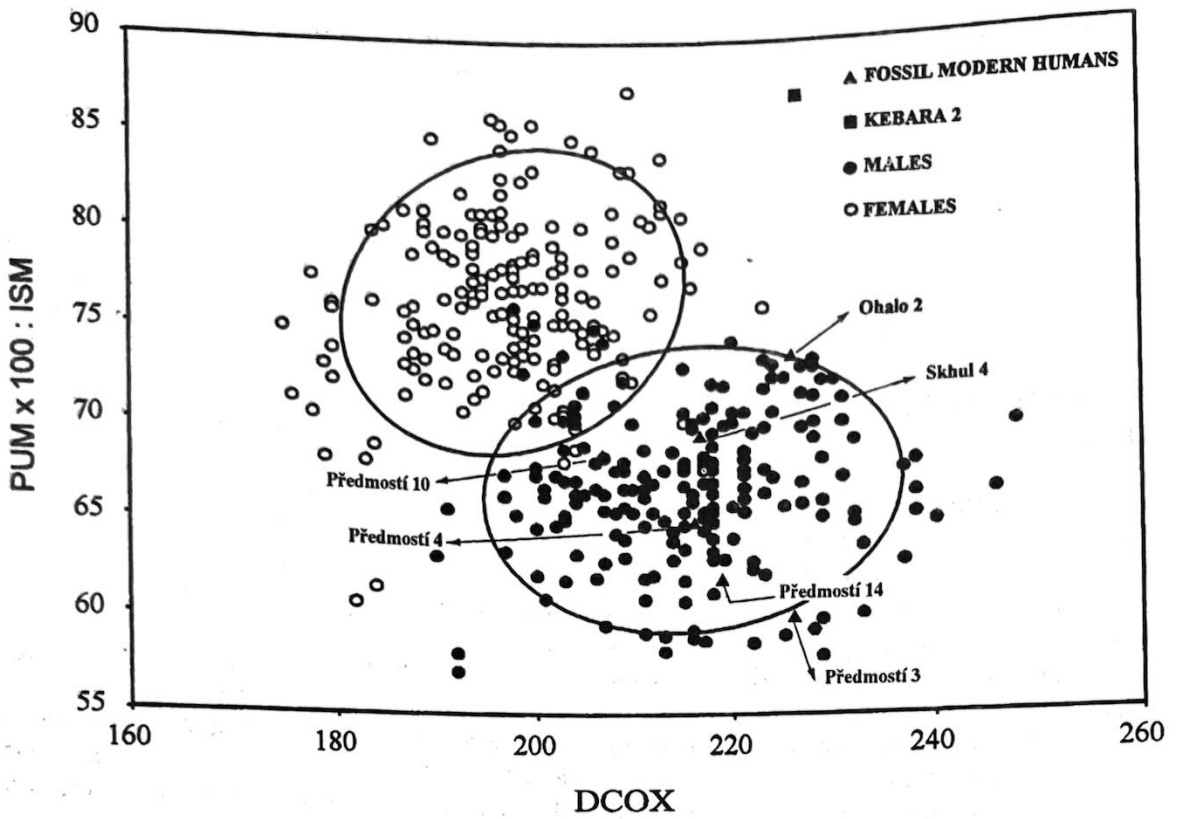


FIGURE 5. The Předmostí pelves on a scatter plot of ischio-pubic index (PUM  $\times$  100 : ISM) versus pelvic height (DCOX) in a recent sample (n = 430) of known age and sex from Europe (measurements in mm).

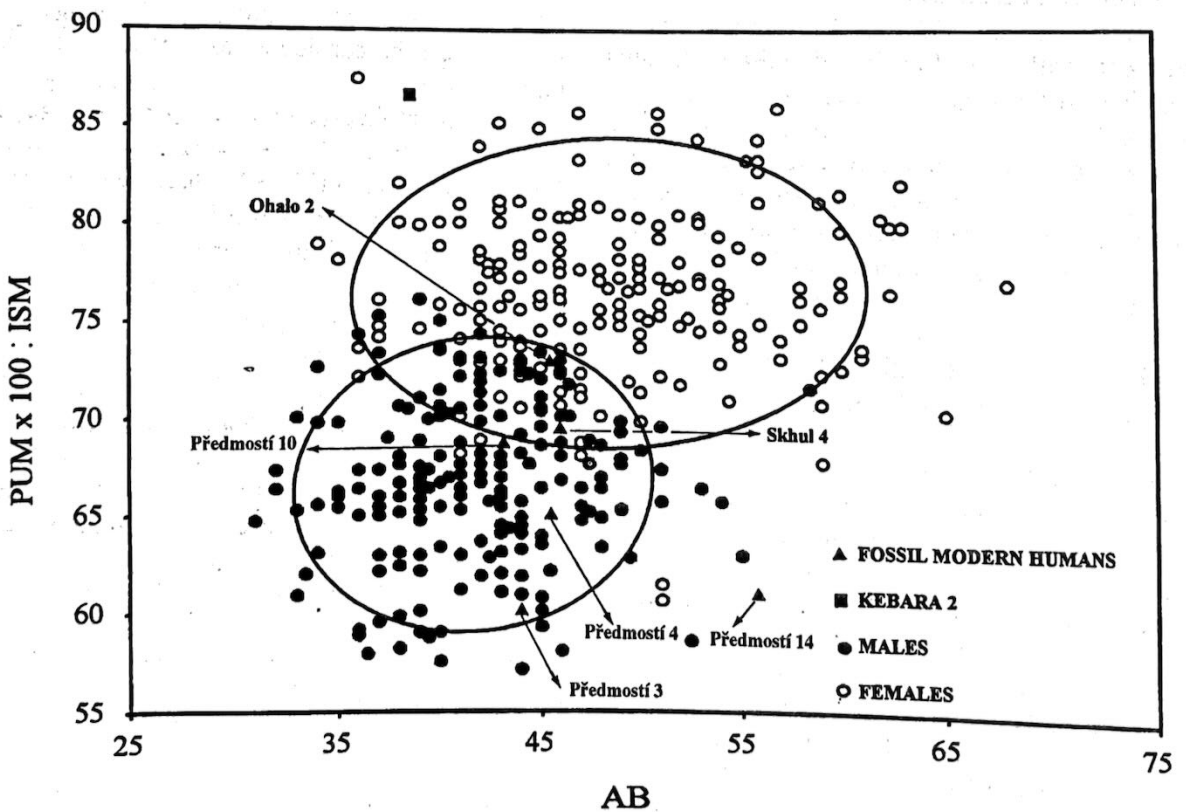


FIGURE 6. The Předmostí pelves on a scatter plot of ischio-pubic index (PUM  $\times$  100 : ISM) versus sciatic notch breadth (AB) in a recent sample (n = 430) of known age and sex from Europe (measurements in mm).

it is obvious that all the early modern humans, whatever their chronological age, geographical origin or sex assignment are, seem to be quite different from the Kebara 2 Neanderthal specimen (Figure 6).

## CONCLUSION

In the last two decades, the Předmostí adult skeletons were used by scholars in the discussion of the Neanderthal pelvic morphology (Trinkaus 1984, Rosenberg 1986, 1988). However, attention is focussed on one single variable, the superior pubic length, in order to emphasize the differences between Neanderthals and early Modern Humans.

From the present study it appears that both early modern humans and Neanderthals (at least the most complete one, Kebara 2) have high pelves by comparison with recent humans. Among the early modern human sample, the Předmostí individuals can be distinguished by their relatively short pubic ramus and wide greater sciatic notch. At this level they manifest a combination of features that is strictly at the opposite of what can be described on the Kebara 2 individual. However, from two distinct combinations of patterning the result obtained is the same with regard to the overall pelvic size. Within the fossil modern human sample, only one individual, Skhul 9 manifests a relatively long superior pubic ramus, recalling the Neanderthal configuration. Unfortunately Skhul 9 lacks its greater sciatic notch and therefore the similarities in pelvic patterning with Neanderthals cannot be accurately established.

The Předmostí adult pelves document individual variation applied to size and morphology. However, from the study of four specimens, no definitive conclusion can be raised on the patterns of sexual dimorphism, as it is illustrated for the pelvic dimensions in Figure 1. Předmostí 3, currently described as the most robust according to its cranial morphology, remains in the range of variation of the recent sample for most of its pelvic dimensions.

Given the current geochronology for Central European Upper Palaeolithic hominids and the probable contemporaneity of the Předmostí and Dolní Věstonice hominids, it would seem reasonable to expect the same conclusions from the examination of the latter material, even though it appears already from the data collected on the cranial morphology that some differences can be noticed between the two samples (Gambier 1991).

Obviously no conclusion can be raised in a discussion of the Late Pleistocene pelvic morphology if the comparative study lies in the analysis of separated morpho-functional aspects. In the same way all the skeletal parts have to be taken into consideration as far as distinction in robusticity or population homogeneity are the points debated.

Certainly at the present time, given the number of well preserved skeletal remains, the Předmostí humans remain one of the best sample relevant to the knowledge of the

biological identity of Upper Palaeolithic hominids in Central Europe.

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