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# RECONSTRUCTION OF CLOSE BIOLOGICAL RELATIONSHIPS IN PALAEOLITHIC BURIALS

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## ABSTRACT

The methodological background provided for the ascertaining close biological relationships in prehistoric populations by means of skeletons has for long been discussed. Although no generally applicable method is available for reconstructing the genetic kinship of entire prehistoric populations (cemeteries) the results of many investigations have clearly shown that for several individuals in some cases it has been possible to obtain from morphological traits of the skulls conclusive indiciations of closely related, if not family structures. Bonnet (1919) in the book on the Upper Palaeolithic skeletons from Oberkassel, Germany, was obviously the first, who raised the question of close biological relationships in individuals from Palaeolithic burials. He concluded that the high degree of similarities and coincidences in morphological structures, in discrete traits and metrical measurements of the skull could only be interpreted on the basis of a closely related kinship. We have analyzed some of the hominid fossils from Palaeolithic burials of entire intact corpses (Spy, Oberkassel, Predmosti, Dolni Vestonice, Sungir'), but also from the Mesolithic Hoedic. The results obtained make it possible to get a more profound comprehension of the burial practices and burial rites in Palaeolithic times.

Key words : Paeolithic burials, biological relationship, epigenetic traits

## INTRODUCTION

Obviously it was Bonnet (1919), who in the book on the Upper Palaeolithic skeletons from Oberkassel (Germany) first raised the question of close biological relationships of individuals in Palaeolithic burials. He compared the skulls of the 50-60-year-old male and the 20-25-year-young female in terms of their morphological structures and metrical measurements, but also in their discrete traits. Bonnet concluded that the high degree of similarities and coincidences in characteristic features could only be interpreted by way of a close related kinship. Matiegka (1934) explained some anomalies in the large veins of the endocranium of the Predmosti skulls (Czech Republic) also as heritable familiar structures. The Mesolithic burial from Altessing (Germany) was studied by Kurth. He found many coincidences not only in the craniotype but also in the morphological

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details of the skull between the 35-year-old female and the 3.5-year-young child, which could only be understood, if mother and child were buried together in this Mesolithic grave (Kurth & Naber 1983). The investigation by Kurth has prompted the author to look for further possible indications of close biological relationships in the Palaeolithic hominid record. First results were presented in a paper at an international symposium in Xanthi (Ullrich 1983). Meanwhile Smith & Smith (1986) also observed in the Krapina Neandertal sample (Croatia) some irregularities of the internasal suture on the preserved nasal bones and suggested a close biological relationship among the Krapina hominids. Recently Vlček (1991, 1995) has stressed some morphological details in the skeletons of the triple burial from Dolní Věstonice (Czech Republic) that could only point to close genetic relationships of the three individuals : special morphological structures of the scapulae and their high position on the trunk as well as the absence of the right frontal sinus in these skeletons.

## Methodological background

The methodological background for reconstructing close biological relationships by means of skeletons in prehistoric populations has for years been under discussion.[1] Although there is still no generally applicable method for the reconstruction of the genetic kinship of entire prehistoric populations (cemeteries) the results of many investigations have clearly shown that for several individuals in some cases it is possible to obtain from the skull direct indications of family or closer related structures.[2] These indications may be obtained from :

- the general form of the skull (profiles in the frontal, lateral, superior and posterior views);
- special morphological structures (e.g. of the mandible - spina mentalis);
- epigenetic or non-metrical traits (formerly called anatomical variations);
- pathological morphostructures with obviously genetic background;
- metrical traits (dimensions, proportions);
- serological characters (e.g. ABO-system);
- reconstructed profiles of the face;
- photostereometric results.

In general, the extent of the biological relationship of individuals is inferred from the degree of similarities and concurrences apparent in the morphological and metrical structures between two or more skeletons. This can be similarly applied to the anthropological similarity-relationship-method (Ähnlichkeits-Verwandtschaftsmethode) employed for paternity affiliation and

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[1] For discussions on the methodological background for evaluating close biological relationship by means of prehistoric skeletons see e.g. Alt (1989, 1990), Alt & Vach (1991), Drenhaus (1991), Kaufmann (1986), Riscutia et al. (1973), Rösing (1986a,b), Sjøvold (1976b, 1978, 1986), Sokal et al. (1987), Szilvássy (1986), Szilvássy et. al. (1987), Ullrich (1964, 1969a,b, 1975), Wittwer-Backofen (1991).

[2] Results obtained from epigenetic traits, serological characters, metrical traits, special morphostructures, pathological traits, profiles of the skull etc. pointing to family relationships of some individuals in prehistoric populations have been presented e.g. by Alt (1989, 1990), Alt et al. (1991, 1992), Bondioli et al. (1984), Bottyán (1970), Breitinger (1980, 1987), Capasso (1986), Farkas (1970), Farkas & Lipták (1975), Kelly (1989), Kennedy (1981), Kobyliansky (1984), Köhegyi & Marcsik (1972), Lukacs (1987), Mikić (1988), Strouhal (1990, 1992), Strouhal & Jungwirth (1979), Szilvássy & Kritscher (1991), Szilvássy et al. (1987, 1988), Ullrich (1962, 1965, 1969a, 1972), Ulrich-Bochsler (1977), Winkler & Schweder (1991).

the diagnosis of biological relationships in living individuals. In both methods the groups of traits are similar. However, the crucial point in this similarity-relationship-method is how to determine the question of heredity of the morphometrical structures examined. It is generally assumed that most of these structures have a close genetic basis, but the direct genetic modus has been known only for few traits.

The most successfully applicable traits are, of course, epigenetic traits.[3] They have been extensively studied on prehistorical skeletal material and very often used as indicators of similarities and differences between human skeletal populations. There are many publications on this topic.[4] There are indications that to some extent discrete traits are indeed genetically determined[5] , although the subject is still under discussion. Sjøvold (1984) for a number of epigenetic traits had shown a significance, if low heritability, in a large series of known kinship from Hallstatt, and Lane (1977) for 33 non-metric traits in a family material which could be traced from 1776 to 1948 demonstrated that the large proportion could only be explained by the distribution of mean genetic kinship within the population. In their book on epigenetic traits of the skull Hauser & de Stefano (1989) have analyzed 65 characters and summarized the known genetic background for these traits (based on Lane 1977, Sjøvold 1984, Szilvássy 1986 and others) : for 23 epigenetic traits a hereditary character to their expression can be considered or even suggested and for another 13 non-metric traits a strong genetic determination or familial incidence is indicated, including e.g. the frontal sinus, orbital opening, maxillary sinus, parietal foramen, incae bone, palatine torus, mandibular torus, atlas bridging.

## RESULTS

We have looked into the original publications for skeletal markers on fossil human remains that suggest obviously close biological relationships for the Mesolithic Hoëdic (France) and Altessing (Germany), the Upper Palaeolithic Oberkassel (Germany), Dolní Věstonice and Předmosti (both Czech Republic) and Sungir' (Russia), the Middle Palaeolithic Spy (Belgium) and Krapina (Croatia) as well as for the Lower Palaeolithic Zhoukoudian (China).

### *Hoëdic*

The Mesolithic (Tardenoisian) cemetery Hoëdic consists of 14 skeletons (4 males, 5 females, 5 children) (Vallois & Félice 1977). In the general configuration, but also in details of the skull there is a remarkable similarity

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[3] For general publications on epigenetic traits see e.g. Berry & Berry (1967), Corruccini (1974), Czarnetzki (1971, 1972a,b), Hauser & De Stefano (1989; with full bibliography), Kaczmarek (1991), Rösing (1982), Reinhard & Rösing (1985), Sjøvold (1973, 1976a), De Stefano et al. (1983).

[4] For general publications on populations studies of epigenetic traits see e.g. Berry (1971), Birkby (1973), Brothwell (1959), Klug & Wittwer-Backofen (1983), Ossenberg (1976), Sjøvold (1976a).

[5] For general publications on the genetics of epigenetic traits see e.g.. Anderson (1968), A. Berry (1978), R. Berry (1968), Brothwell (1965), Euler & Ritter (1940), Hauser & de Stefano (1989), Kühne (1936), Rösing (1982), Sjøvold (1984), Szilvássy (1986) .

between H. 5 (male, 30-40 years) and H. 6 (male, 30-40 years) (Figs. 1 and 2). The details concern, e.g., the shape of the orbitae, especially the upper margin, ossicles in the sutura lambdoidea, sutura parieto-mastoidea and in the angle of the right parietale, squama temporalis and sphenoid, the absence of both foramina parietalia (H. 5) respectively the left one (H. 6). Both individuals, buried together in one grave, could probably represent "brothers".

It is necessary to mention that a high degree of similarity in the general morphology and in epigenetic traits (e.g. os apicis 57.1 % - usually about 3.5 %; bones in the sutura lambdoidea 75 %) is visible between other adult skulls of this cemetery, too. The assumption that probably a close biologically related group of individuals might have been buried at Hoëdic cannot be excluded.

*Altessing*

The Mesolithic burial of a 35-year-old female and a 3.5-year-young child simultaneously in the same grave pit (Fig. 3) has raised the question of whether a mother with her child could have been buried there. Kurth compared the skull of both individuals in morphological traits and found many similarities and coincidences in the shape of the skull (frontal and occipital narrow and strong konvex; narrow face), especially of the orbits, the nasal region, the vertex (transversal depression) and the mandible (angles bended inwards; two-pointed spina mentalis combined with a bipartite fossa digastrica). He concluded that probably a mother with her child were buried in Altessing (Kurt & Naber 1983).

*Oberkassel*

It is generally accepted that the old male (50-60 years) and the young female (20-25 years) in the Magdalenian ochre grave from Oberkassel had been buried together simultaneously (Verworn et al. 1919; Bauer 1989). Bonnet (1919) showed many morphological and metrical similarities and concordances between both skulls in general views and in special sections (Figs. 4 and 5) as well as in proportions. He also found many similarities in special morphological traits, e.g. the narrow frontal bones, the rectangular bregma angle, the flattening of the anterior parietal region, the shape of the foramen magnum (rhomboid), the form of the base of the nose, the absence of the fossa canina, the ramification of the arteria meningia media and many details of the mandible (gonion, fossae, incisurae). Bonnet looked at epigenetic traits, too, and discovered similarities (e.g. sutura frontalis in the female, crista frontalis media in the male) as well as in postcranial bones (e.g. slim claviculae, thick costae, strong curvature of the proximal part of the ulna). Bonnet concluded that a close biological relationship between both individuals is therefore most probable. The diagnosis "father and daughter" could be a reliable explanation.

*Dolni Vestonice*

The most popular interpretation of the Gravettian triple burial from Dolní Věstonice (Fig. 6) dated of 26,640 BP is that two males (D.V. XIII and D.V. XIV) and one female (D.V. XV) were buried simultaneously (Klíma 1991; Vlček 1991), but there are doubts about the sex diagnosis of the so-called female. Jelínek (1987,

1992a) has clearly demonstrated that D.V. XV is not an undeveloped female but a male individual.

Vlček (1991, 1995) has recently stressed some morphological details in the skeletons of the triple burial pointing to close genetical relationships :
- Aplasia of the right sinus frontalis in all three individuals (Fig. 7).
- The scapulae of all three individuals have a special shape : a partially widened spina scapulae, a concave shape of the margo medialis and a distinctively developed labium ventrale et dorsale of the margo axillaris (Fig. 8). The in situ position of the scapulae on the trunk was very high - similar to the known Sprengel syndrome.
- The claviculae of all three individuals are flattened in cranio-caudal direction.

Jelínek (1992b) has also studied the scapulae from the triple burial and concluded that the scapular spine with a triangular tubercle found in D.V. XIII and XIV (not D.V. XV) "can be found also in some other Gravettian individuals (Předmostí III-male, IV-female, X-female)" and therefore it "cannot be used as a support to the kinship idea for the three individuals in the Dolní Věstonice triple burial" (p. 50). Only a larger number of similar characteristics can, in his view, point to the probability of family relationship. "In the case of the Dolní Věstonice triple burial this situation does not exist. Although the lower edges of the orbits in DV XIII and DV XV are similar, and the acromions of the shoulder blades also have similar morphology, in kind and appearance other epigenetic characteristics do not point to a family relationship between those buried. The sinus cavities in the skull occur only on the left side of the frontal bone in two individuals (DV XIII, DV XV); in the case of the third individual they are, however formed on both sides. Such a situation is certainly not proof of kinship" (Jelínek 1992a, 218f.).

Vlček (1995) also mentioned an extraordinarily similar special shape of root patterns in left upper molars (M2 or M3) of D.V. XXXI and D.V. XXXII pointing to a familiar relationship.

A comparison of the frontal, lateral, superior and posterior views of the three skulls reveals similarities and correspondences as well as differences in a different way. Most similarities are visible between the male D.V. XIV and D.V. XV, but can also be recognized between D.V. XIV and the male skull D.V. XVI from the single burial. Between D.V. XIII and D.V. XIV as well as D.V. XV there are only a few similarities in the general views of the skull. This comparison does not necessarily support the diagnosis of "siblings". But there are, of course, similarities and concordances in many morphological traits between the skulls and postcranial bones of the triple burial, e.g. the asymmetric shape of the posterior view of the skulls, the shape of the posterior and costal rim of the scapulae, the shape of the tuberositas triangularis of the spina scapulae (Vlček 1991). Similarities and concordances also exist in epigenetic traits (e.g. the absence of the right sinus frontalis in two or three skulls) that together with the morphological results point to close biological relationships of the Dolní Věstonice triple burial individuals. But more detailed investigations are necessary to clarify the situation.

*Předmostí*

The Upper Palaeolithic Gravettian Předmostí dated 26,300 BP represents a unique mass burial site. Bone remains of about 29 individuals (13 adults - males and females -, 3 subadults and 13 children) are known. Only 5 skeletons are nearly complete or complete. All the other individuals are represented by a few skeletal parts or disarticulated bones only (Fig. 9).

Matiegka (1934) in his publication mentioned the absence of foramina perietalia in two groups of individuals : 1. group (male Př. III and Př. IX; female Př. V and child Př. IV) - both foramina are missing; these individuals also have a right turning of the sinus sagittalis superior as shown in Př. I; 2. group (male Př. XIV, female Pr. X and children Př. II and Př. VII) - the left foramen parietale is missing.

Only 10 skulls can be examined for proofs of close biological relationships. Most remarkable is the existence of the sutura metopica in 3 infantile/juvenile skulls (27.3 % - Př. II, V and VI). Př. V (15-16 years) and Př. VI (2-3 years) also have very similar profils of the lateral and superior views (Fig. 10). Skull Př. IX (male, 25-30 years) and Př. X (female, 20-25 years) show a high degree of similarity in the frontal, lateral, superior and posterior views (Fig.11 and 12) and in many morphological traits (e.g. in the dentition, cross-section of the ribs), demonstrating obviously close biological relationship. This might also be assumed between other individuals of that mass burial, e.g. between Př. I (male, 20-25 years) and Př. IX/Př. X (Fig. 12) as well as from reconstructed profiles of the face between Př. IV (female, 30-35 years) and Př. XI/Př. X Fig. 13).

The burial of a biologically closely related group at Předmostí is therefore a very probable explanation. But it is necessary to mention that the mass grave in Předmostí was not a burial place of exclusively entire intact corpses as supposed by Klíma (1991). In our opinion only very few dead were buried as entire intact corpses there; for the majority of the dead only defleshed parts of corpses or bones were buried (Ullrich, in prep.).

*Sungir'*

In Sungir', about 200 km NE of Moscow, two graves with very rich archaeological inventaries, dating back to about 25,500 BP were discovered. The most famous is the burial of a 12-13- year-young boy (Sungir' 3) and a 9-10-year-young girl (Sungir' 4). A comparison of the lateral, superior and posterior view of the skulls (Fig. 14) does not show any similarities. There are also no epigenetic traits which might point to a close biological relationship between both children as siblings.

*Krapina*

Gorjanović-Kramberger (1906) called attention to the deviation from standard of the upper part of the internasal suture in the cranium C from Krapina. Smith (1976) discovered that the same anomaly exists on all three specimens which preserve nasal bones (Fig. 15). Smith & Smith (1986) have

studied the etiology and significance of this anomaly in several modern human samples and concluded that "the most logical explanation for suture deviation ... is that it is a discrete trait" and that "the ubiquitous presence of the internasal suture/nasal bone anomaly at Krapina is evidence of close genetic relationships among the specimens exhibiting it and implies a close biological relationship for the entire Krapina hominid sample" (Smith & Smith 1986, 225).

*Spy*

The skulls of both Neandertal skeletons discovered in Spy 1886 show remarkable differences in the superior, lateral and posterior view, but similarities can be also observed between Spy II and the skull from the Neandertal (Fig. 16). These results clearly demonstrate that the contours of the frontal, lateral, superior and posterior view of the skull do not reflect only individual, but also typological similarities or differences.

*Zhoukoudian*

The *Homo erectus* site Zhoukoudian has yielded also 4 nearly complete calvaria (Weidenreich 1943). There is a high degree of similarity in the outline of the lateral and posterior view between skull X (male), XI (female) and XII (male) (Fig. 17 and 18). Epigenetic traits have been recognized with a very high frequency : os lambdoideum (50 % - Fig. 17), parts of the sutura transversa (75 % - in recent Europeans only 1.2 %), sutural bones in the sutura lambdoidea (50 %). These facts may point to a close biological relationship of individuals represented by the skulls II from Locus D and X-XII from Locus L in Zhoukoudian.

## CONCLUSIONS ON THE INTERPRETATION OF PALAEOLITHIC BURIALS

The results of this pilot study shall demonstrate that there are possibilities for ascertaining and reconstructing close biological relationships of individuals in Palaeolithic burials over a wide spectrum of characters, including the superprojection of the general views of the skull as well as epigenetic traits. It would be necessary to examine carefully the original fossil human remains and to look for hereditary and family skeletal markers, i.e. especially for extremely rare and rare traits in high expressions. Only a large number of similarities can point to the probability of family kinship. The examples given in this paper considered only a few characters that reveal the methodological implications. Further detailed studies are necessary.

From the Middle and Upper Palaeolithic, but also from the Mesolithic, some graves are known where entire intact corpses of two or more individuals had obviously been buried simultaneously. Until recently we had no idea of the biological relationships of these individuals. Current research, however, could make it possible to prove that in the Mesolithic grave at Altessing "mother and her child", in the double burial from Oberkassel "father and her adult daughter" might have been buried. Questions are arising about the natural death of both individuals or only for one of them and about the unnatural death of the other

individual. This is also the case with the children's burial at Sungir'. Both children were obviously not biologically related. There are no indications on the skeletons that one of them had been killed or died of an unnatural death. Besides the extremely rich grave furniture they have the diaphysis of an adult femur as a grave good, too.

Further implications are related to Zhoukoudian, the site which recently has again been under serious discussions (see, e.g., Binford & Stone 1986, 1987; Jia 1989). There are facts that in the cave Zhoukoudian only cleaned bones (skulls, skull fragments and few post-cranial remains) were deposited or buried. These bones resulted from interference with human corpses of the deceased carried out by Palaeolithic humans on the dead of an obviously biologically closely related group. The question of cannibalism cannot be definitively excluded for Zhoukoudian, but it is much more reasonable that the human bones were deposited there in connection with mortuary practices or burial rites (Ullrich, in prep.). It is also very probable that the Zhoukoudian cave was not a regular occupation site where Palaeolithic humans temporarily lived, but a site only occupied for celebrating mortuary practices and other rites.

These few examples should demonstrate that the efforts made to evaluate close biological relationships in connection with Palaeolithic burials may help provide a deeper and more detailed comprehension of burial practices and burial rites in Palaeolithic times.

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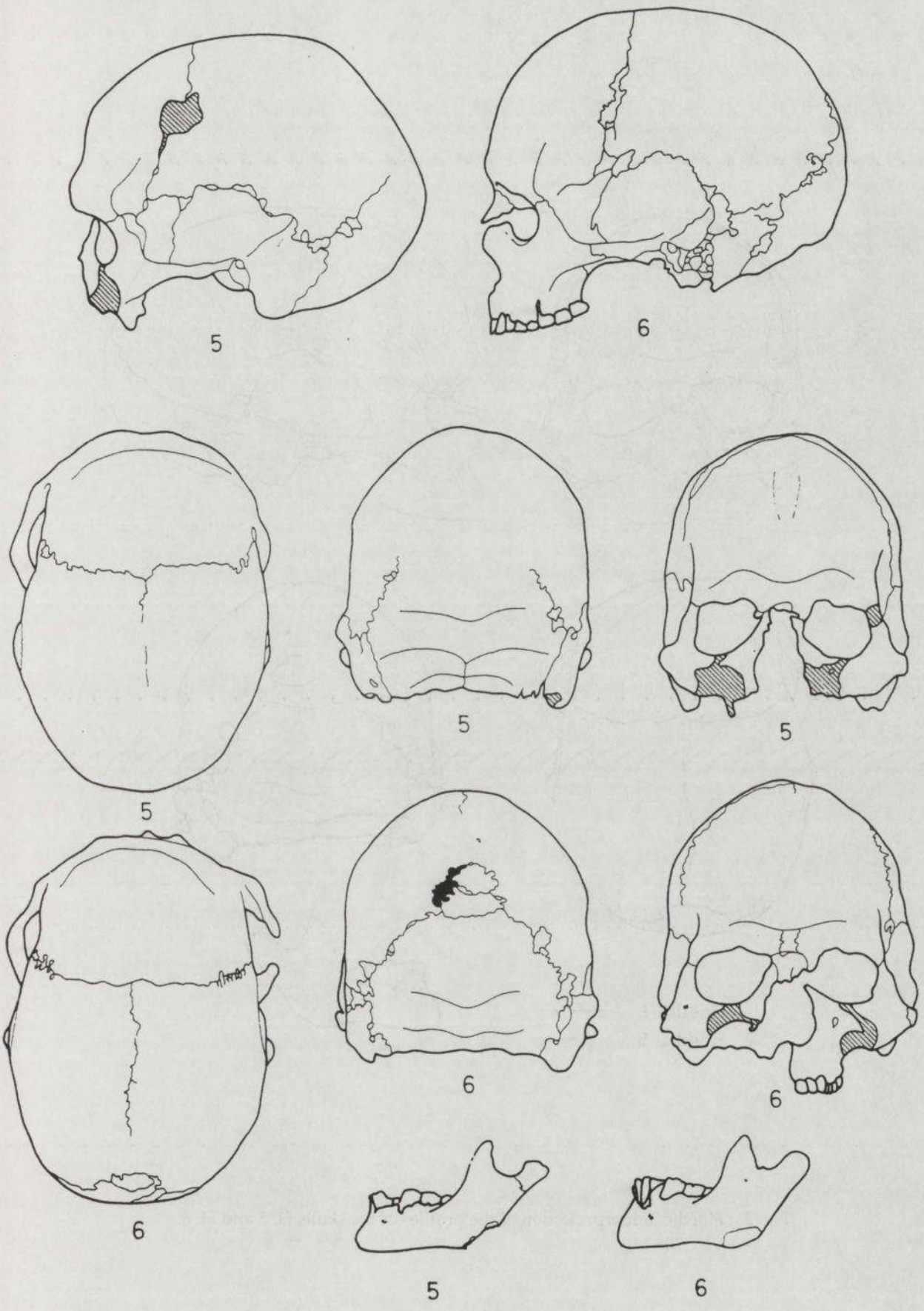


Fig. 1. : Hoëdic. Lateral, superior, posterior and frontal views of the skulls H. 5 and H. 6 (Vallois & Félice 1977).

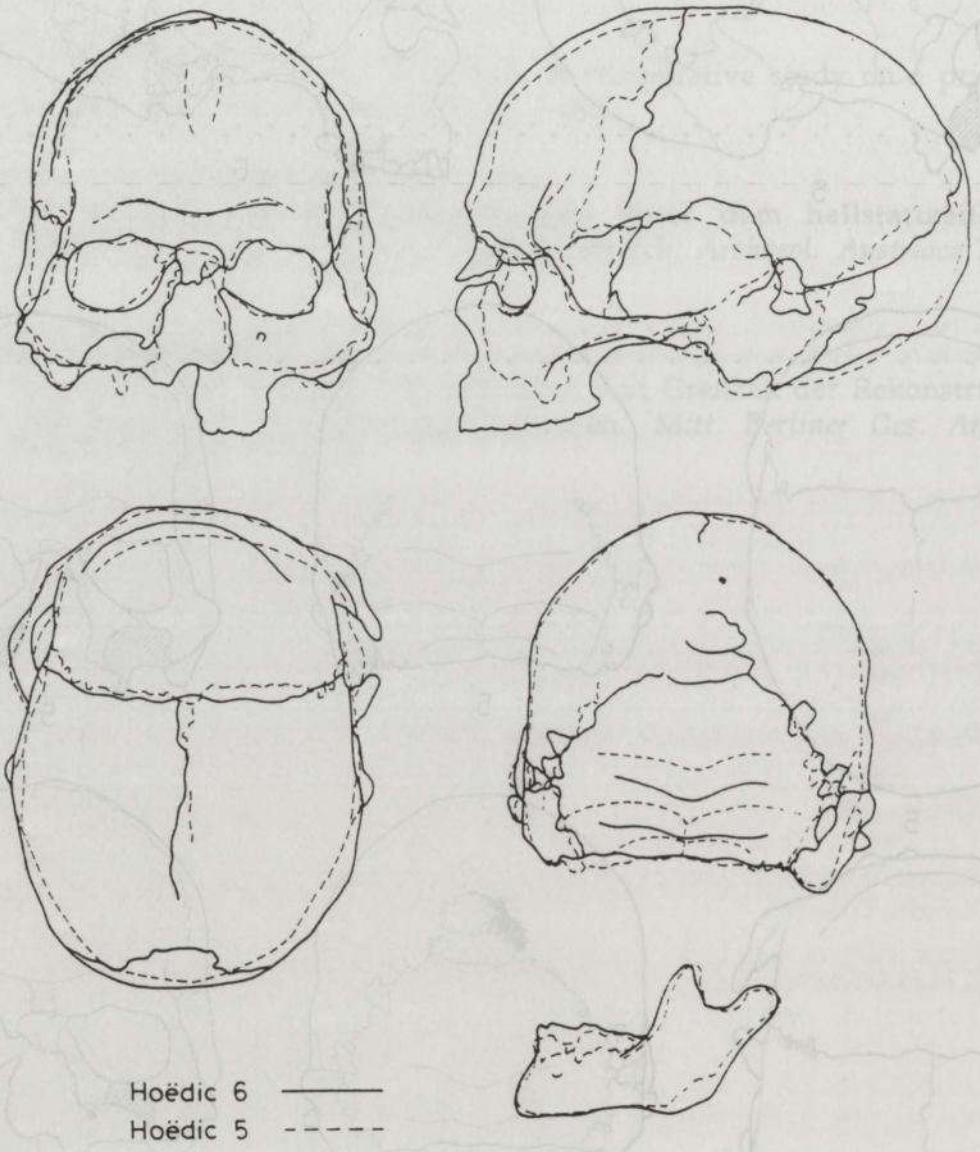


Fig. 2. : Hoëdic. Superprojection of the profiles of the skulls H. 5 and H. 6.

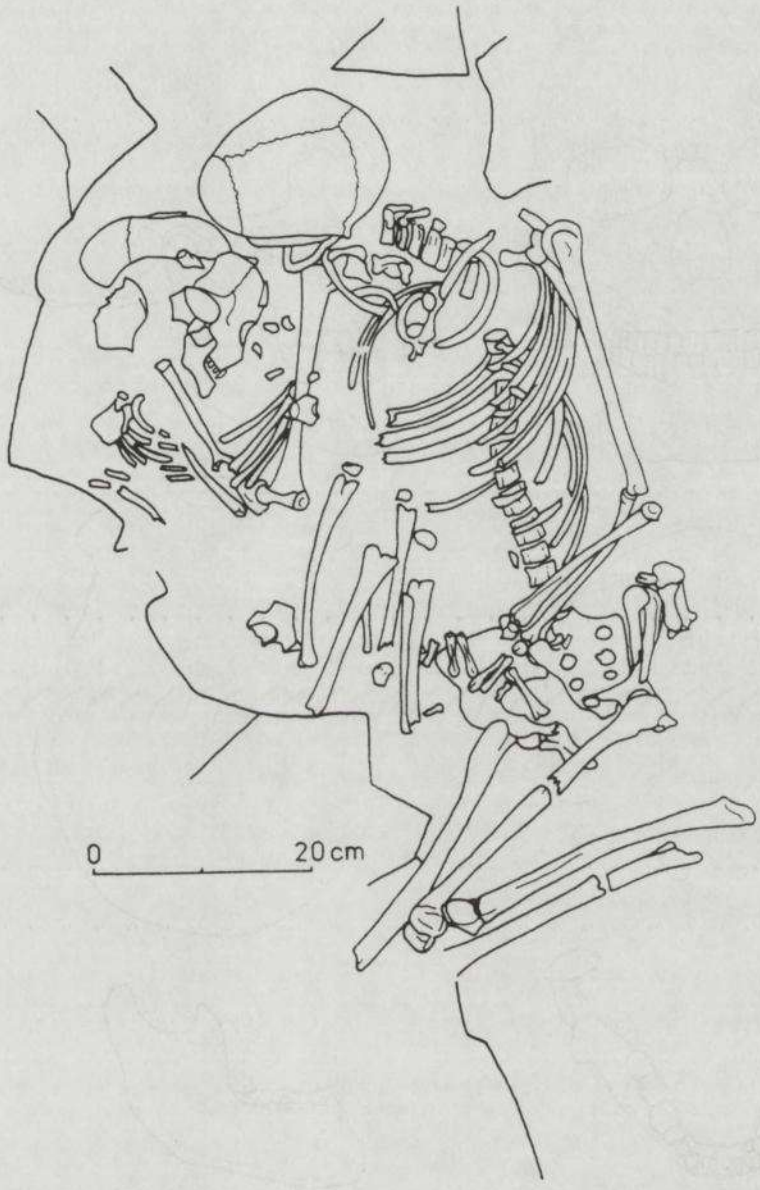


Fig. 3. : Altessing. Burial of a female and a child (Kurth & Naber 1983).

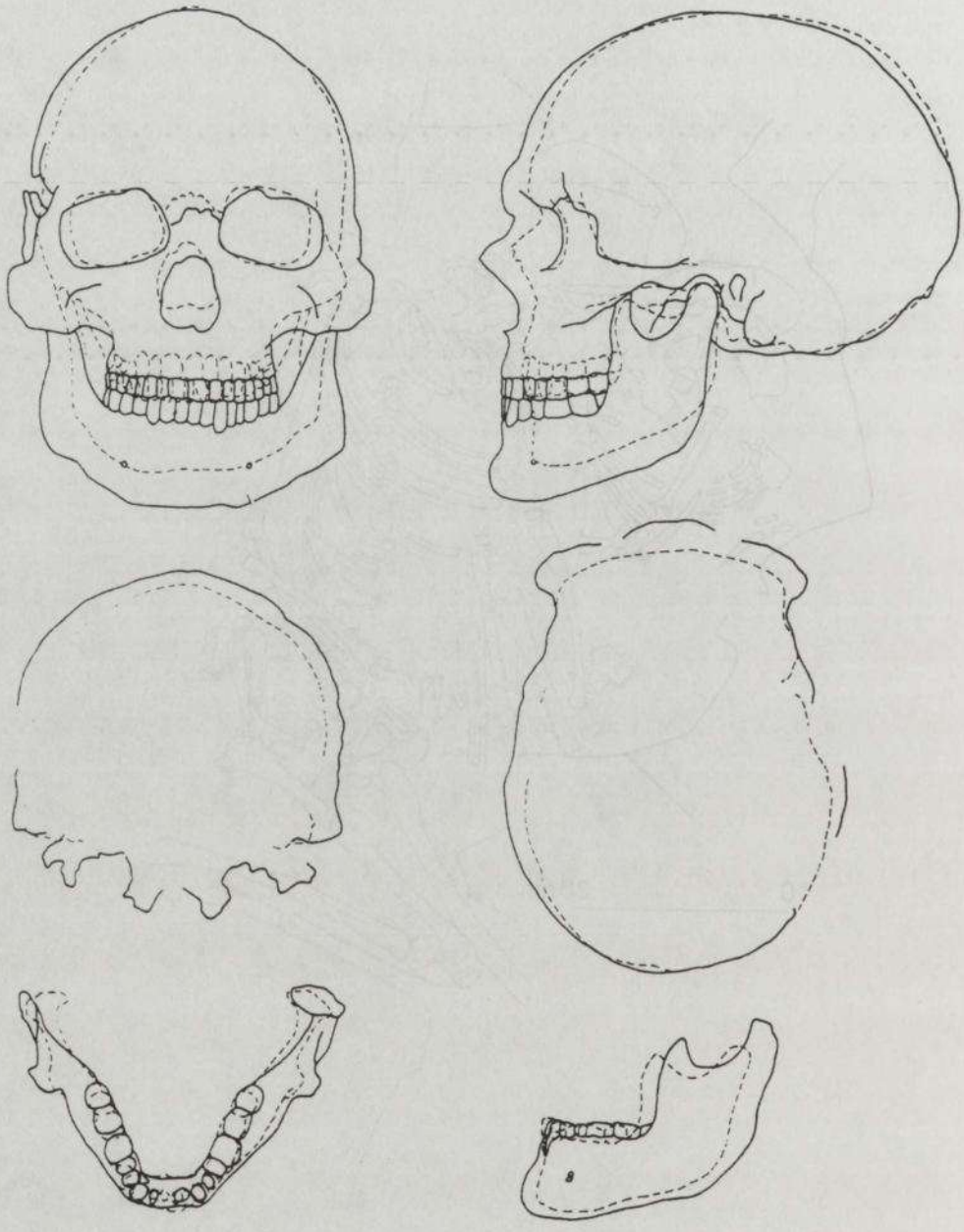

Fig. 4. : Oberkassel. Superprojection of the general views of the male and female skulls and mandibles (Verworn et al. 1919).

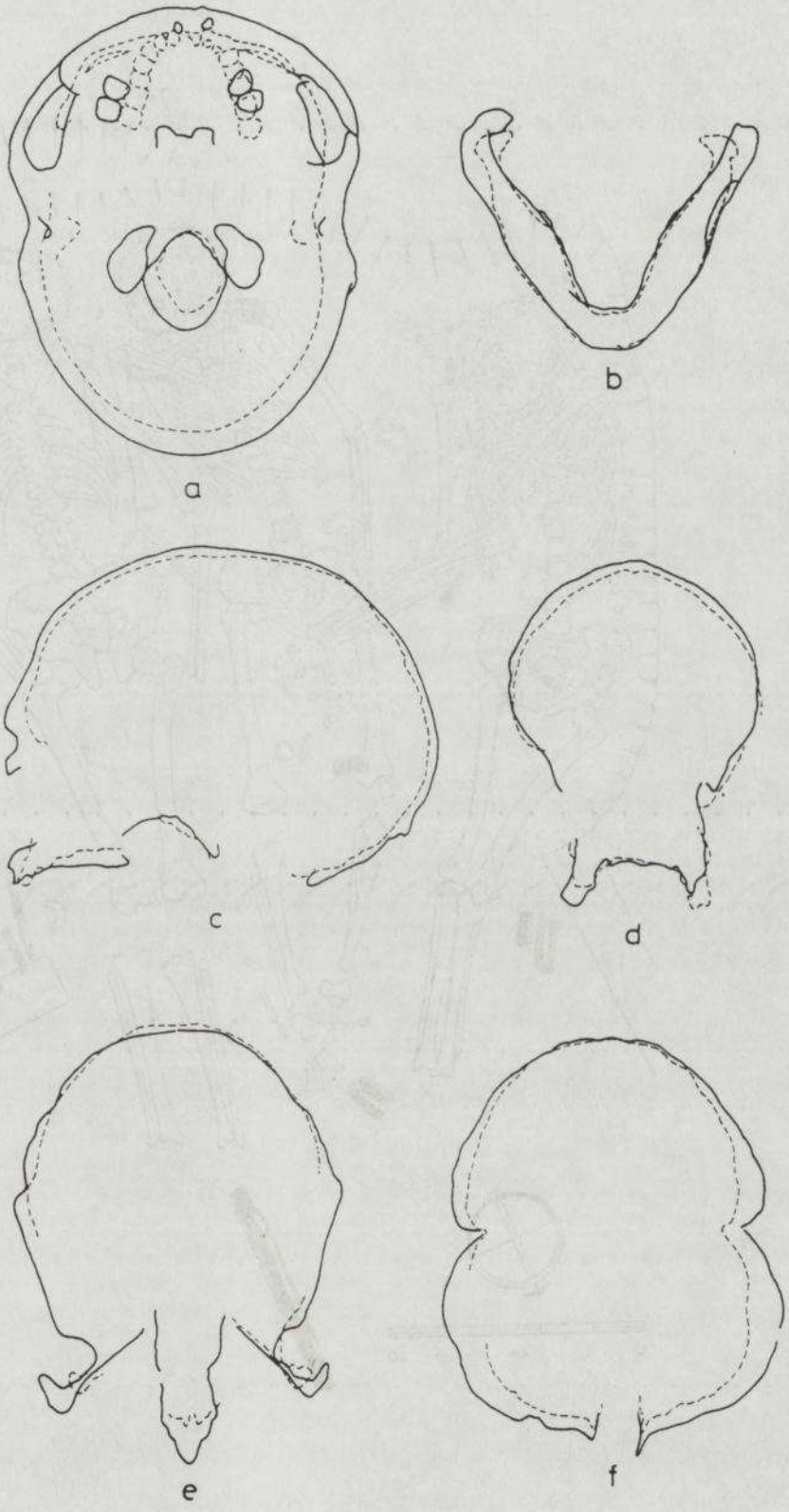


Fig. 5. : Oberkassel. Superprojections of special sections of the male and female skulls and mandibles (Verworn et al. 1919).

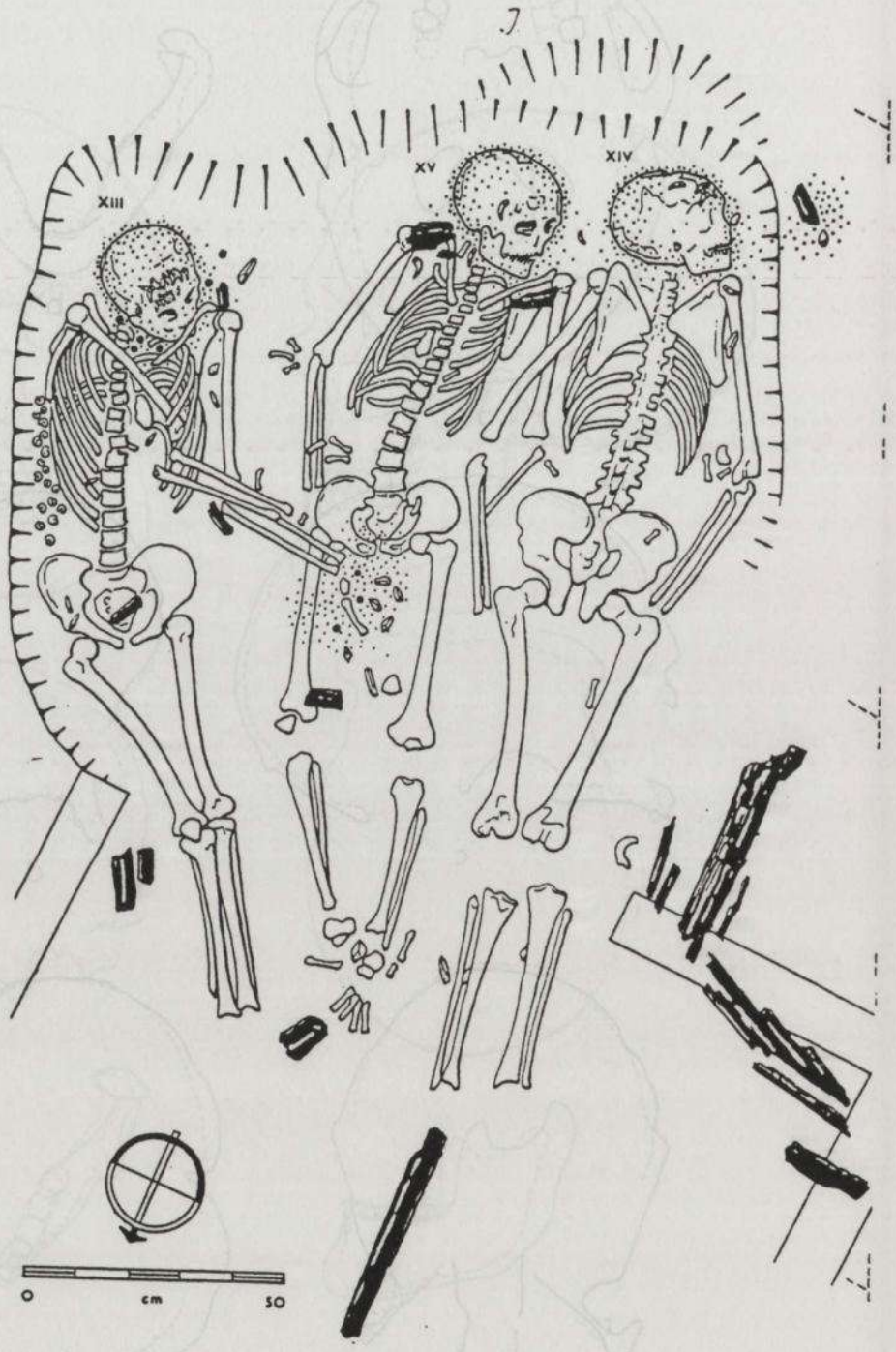


Fig. 6. : Dolní Věstonice. Triple burial (D.V. XIII-XV) (Klima 1991).

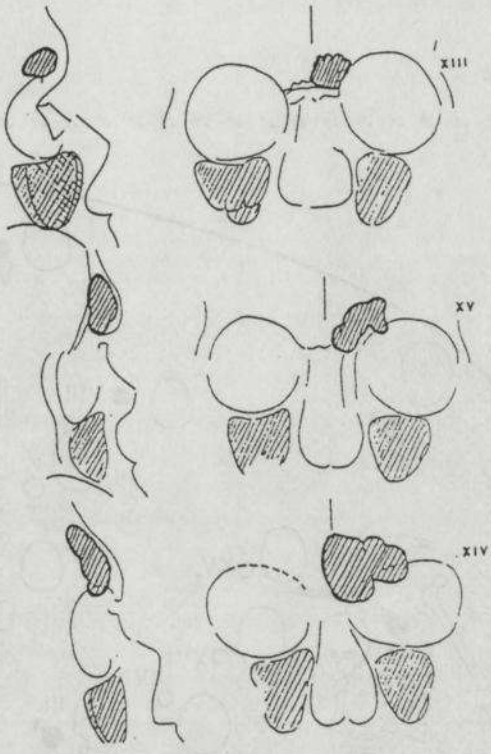


Fig. 7. : Dolní Věstonice. Absence of the right sinus frontalis in D.V. XIII-XV (Vlček 1991).

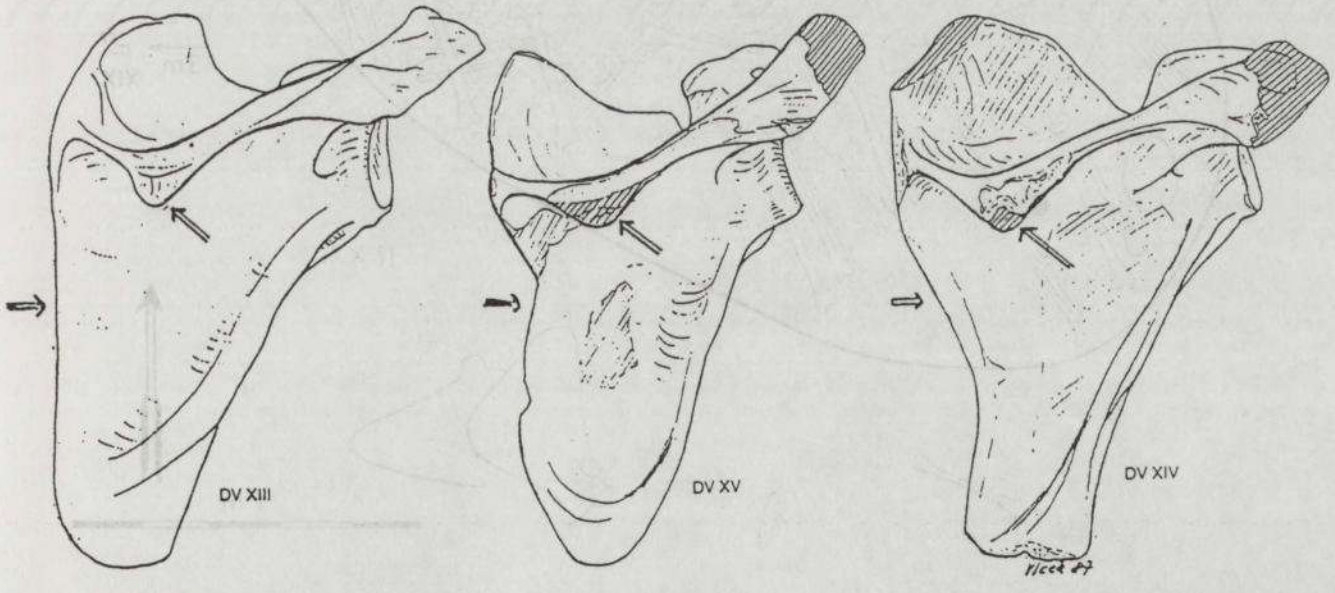


Fig. 8. : Dolní Věstonice. Shape of the right scapula of D.V. XIII-XV (Vlček 1991).

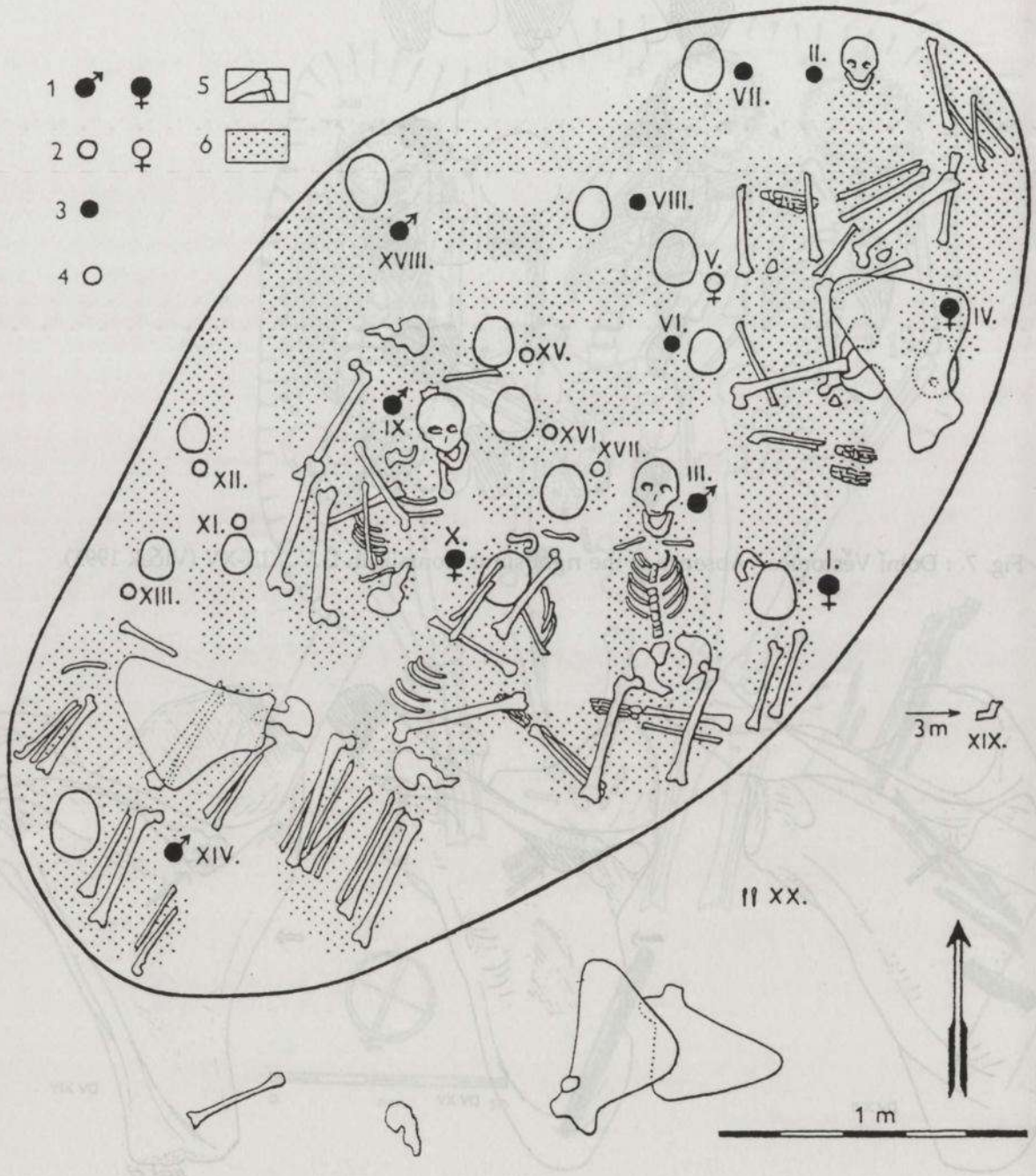


Fig. 9. : Předmostí. Reconstruction of the mass burial using dates by Maška (Klíma 1991a).

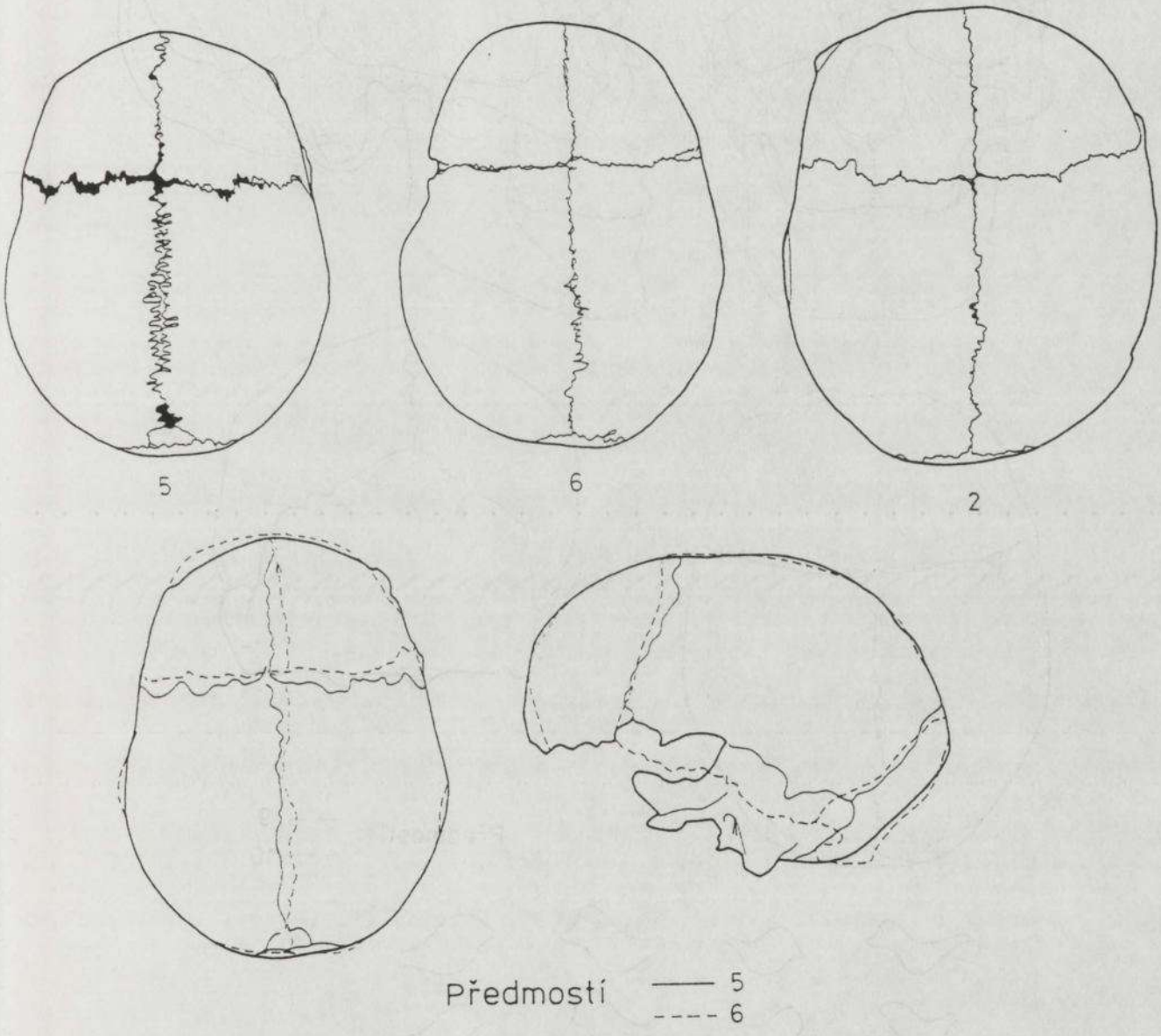


Fig. 10. : Předmostí. Sutura frontalis in Př. II, V and VI. Superprojection of the lateral views of the skulls Pr. V and Př. VI.

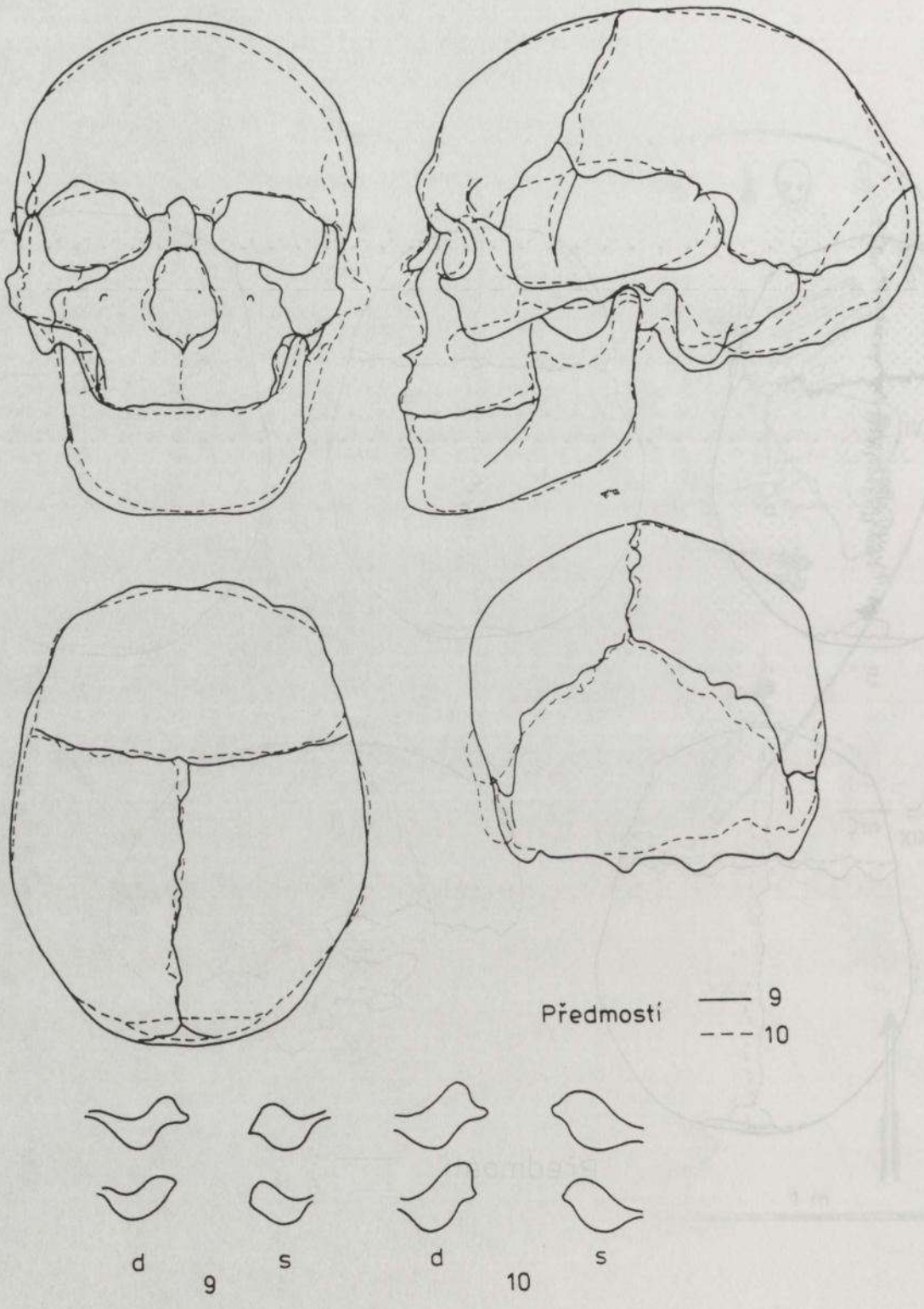


Fig. 11. : Předmostí. Superprojection of the frontal, lateral, superior and posterior views of the skulls Př. IX and Př. X. Cross-sections of ribs from Př. IX and Př. X.

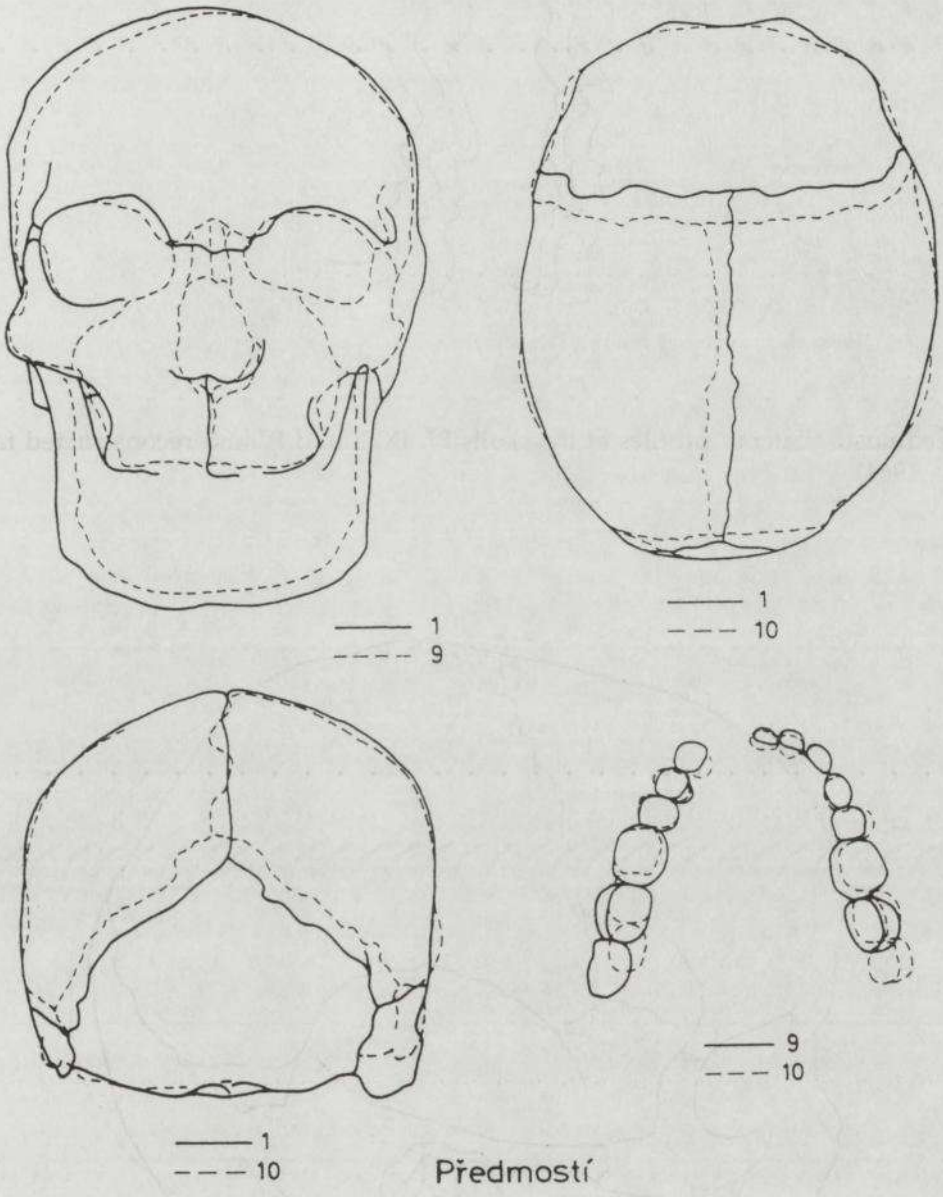


Fig. 12. : Předmostí. Superprojection of the frontal, superior and posterior views of the skulls Př. I, IX and X.

Fig. 13. : Předmostí. Lateral profiles of the skulls Př. IX, X and IV and reconstructed facial profiles (Gerasimov 1964).

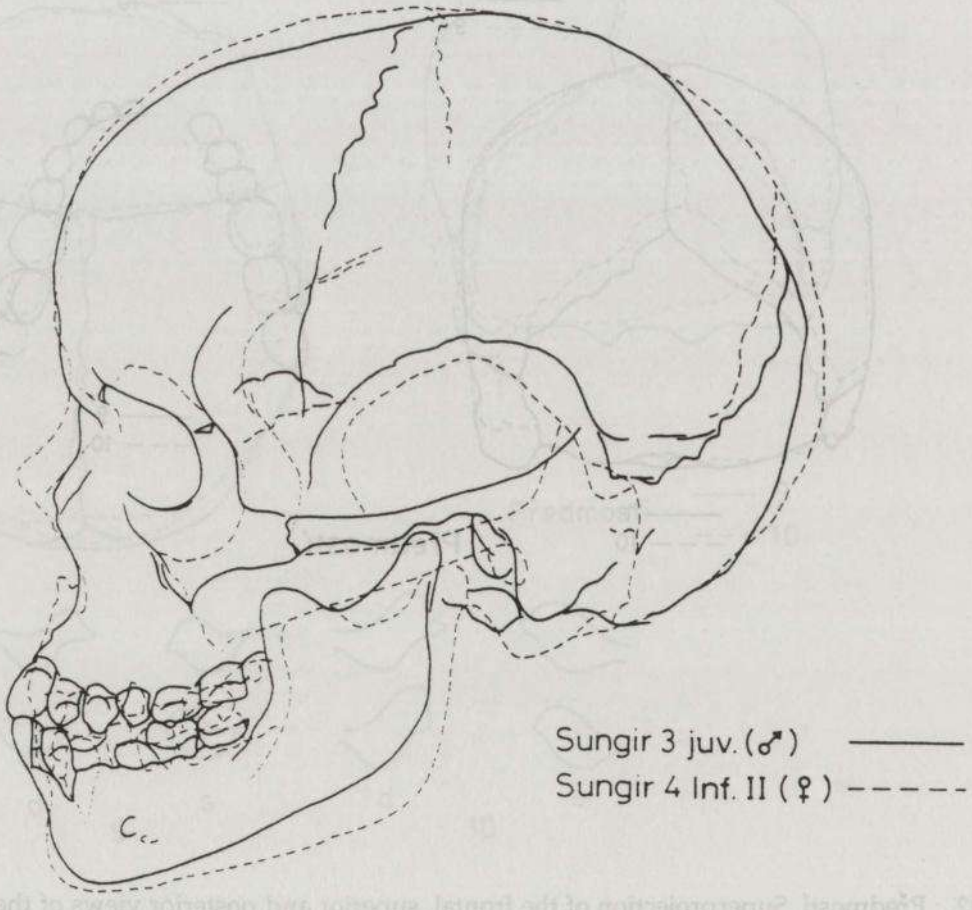


Fig. 14. : Sungir'. Superprojection of the lateral view of the children's skulls Sungir' 3 and 4.

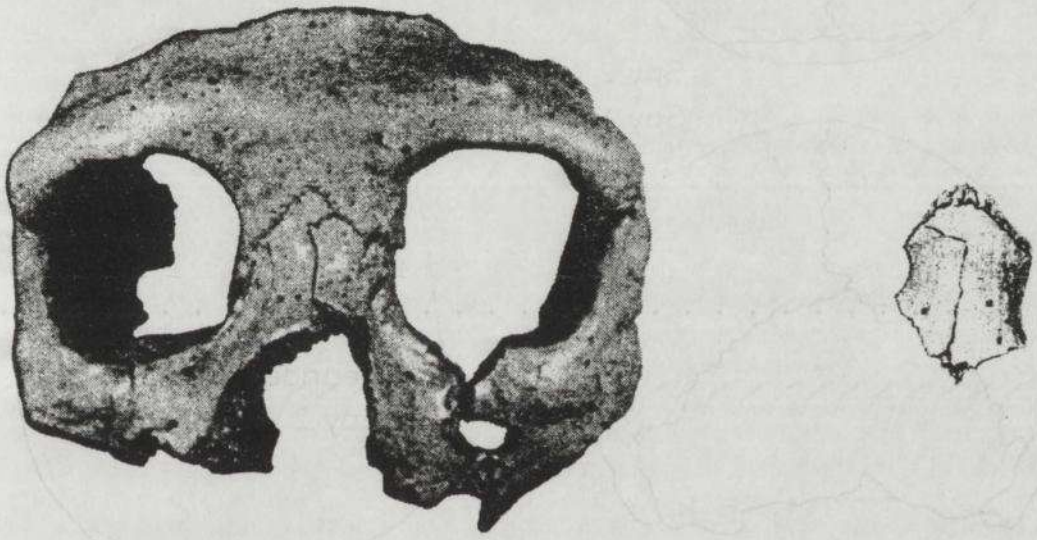

Fig. 15. : Krapina. Deviation of the superior part of the internasal suture in cranium C and unassociated nasal bones 43 (Smith & Smith 1986).

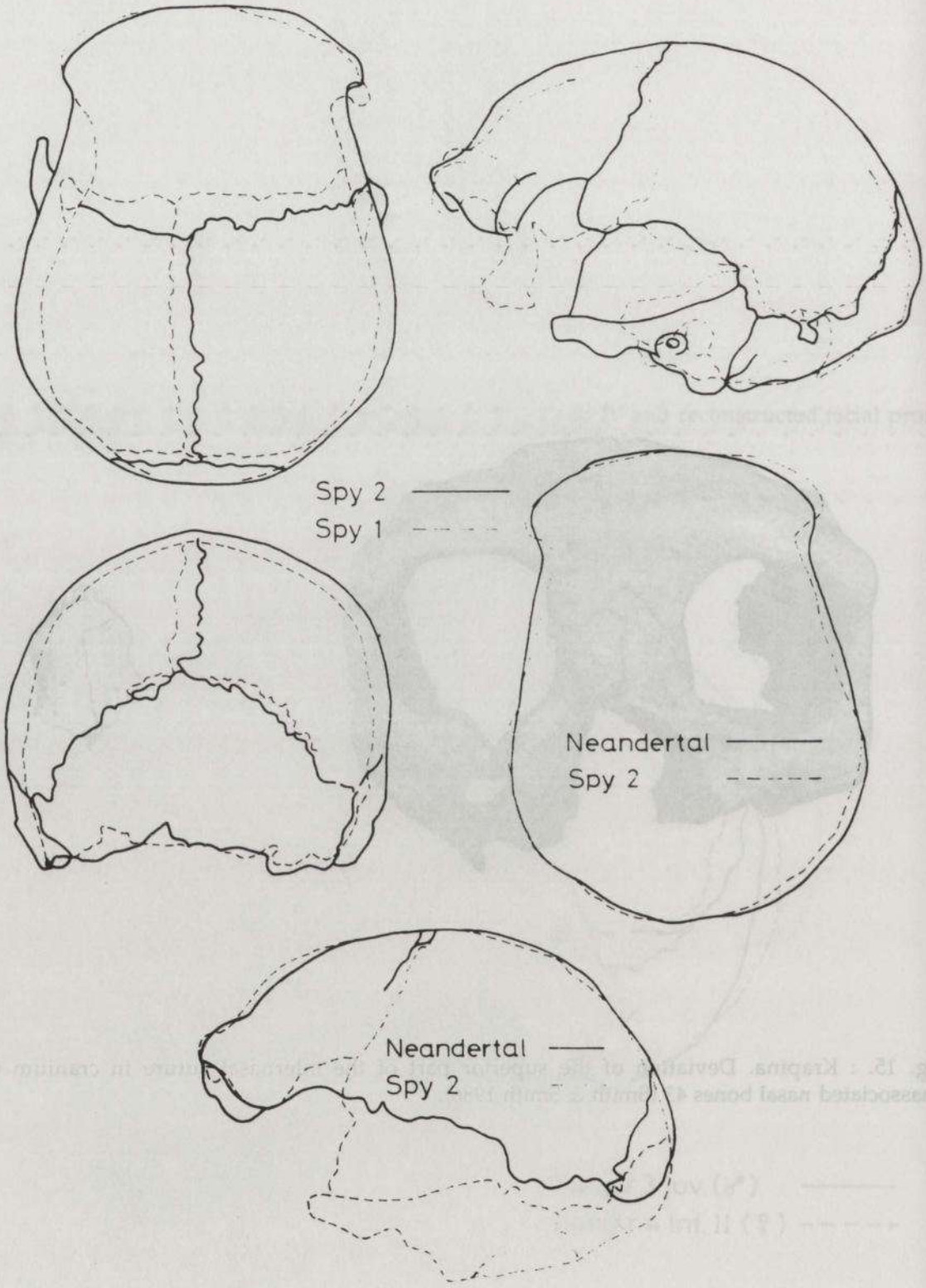


Fig. 16. : Spy. Superprojection of the superior, lateral and posterior views of skulls Spy 1 and 2 and Spy 2 and the skull from the Neandertal.

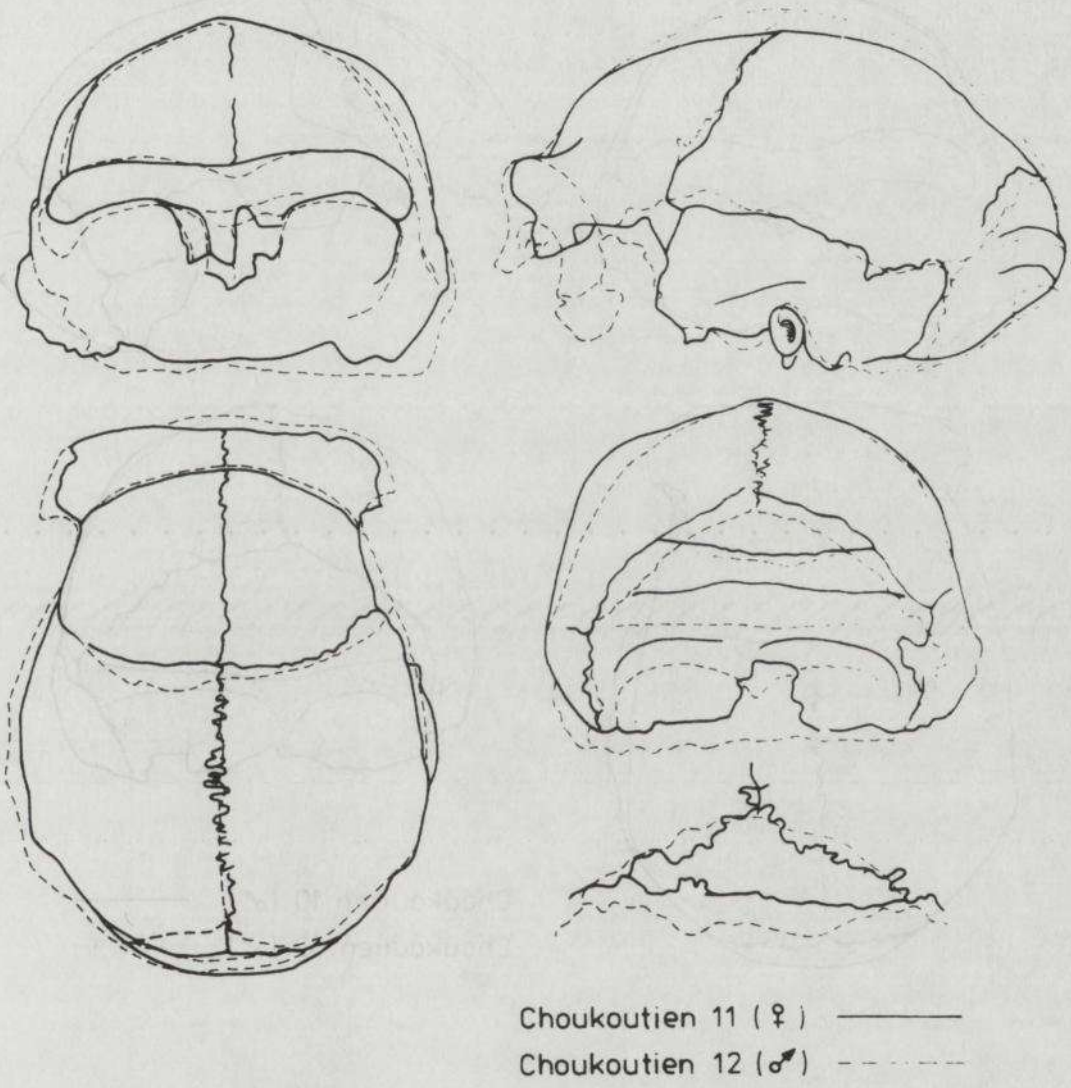


Fig. 17. : Superprojection of the general views of the skulls Zhoukoudian 11 and 12 and os lambdoideum in both skulls.

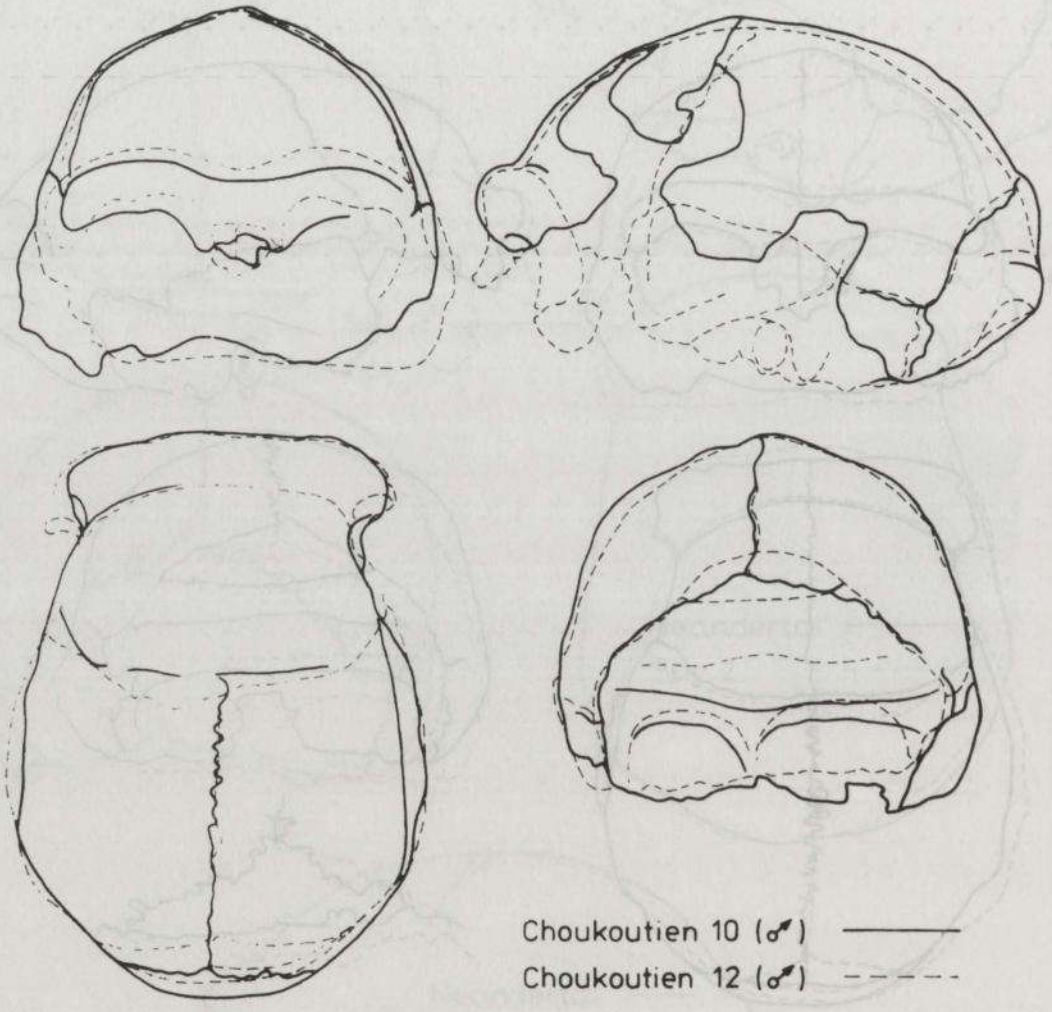


Fig. 18. : Superprojection of the general views of the skulls Zhoukoudian 10 and 12.