



FRANÇOISE LE MORT, DOMINIQUE GAMBIER

## CUTMARKS AND BREAKAGE ON THE HUMAN BONES FROM LE PLACARD (FRANCE). AN EXAMPLE OF SPECIAL MORTUARY PRACTICE DURING THE UPPER PALAEOLITHIC

**ABSTRACT:** *Skeletal remains from at least 24 individuals (adults and children), including essentially cranial bones, were uncovered from the site of Le Placard (Charente - France) at the end of the nineteenth century, during the excavations conducted by A. de Maret. Contrary to conclusions drawn by some prehistorians, they all belong to a same cultural level, very likely the first part of the Magdalenian. Cultural modifications were observed on this material and partly studied by Breuil and Obermaier (1909). A full study of the bones allowed us to point out a special mortuary practice including defleshing of the skulls, breakage of at least some of them in order to give them a particular shape, and, probably, a protective treatment.*

**KEY WORDS:** *Mortuary practice - Cutmarks - Breakage - "Cranial goblets" - Magdalenian - France.*

The Le Placard cave is located on the left bank of the Tardoire river at a place called Rochebertier, not far from the town of Angoulême (Charente - France). After several soundings, the site was systematically excavated by A. de Maret from 1877 to 1889. The deposits included one Mousterian, two Solutrean, four Magdalenian and one Neolithic levels (de Maret 1879 a and b; Chauvet 1899; de Mortillet 1906).

Many human skeletal remains showing numerous cultural modifications were uncovered in the Upper Palaeolithic levels. Due to the excavation techniques in use at the time, their stratigraphic position is only roughly known. According to Hamy (1889), Hervé (1893), Breuil and Obermaier (1909), Breuil (1909, 1912), and de Sonneville-Bordes (1959), some of them would have been found in the Solutrean levels, the others in the Magdalenian levels. In fact, several arguments suggest that all the human skeletal remains belong to the same cultural level, very likely the first part of the Magdalenian: the data left by de Maret (information written on the bones, handwritten notes quoted by Breuil), the homogeneity in the morphology and stage of fossilization of the bones, and finally, the similarity of the cultural modifications. The most complete skull uncovered

in the cave was described by Hamy (1889) as Magdalenian. In fact, several reasons such as its good state of preservation, its colour and appearance, as well as its morphology lead us to think that it is very likely more recent.

### MATERIAL

The sample includes 47 skeletal specimens and 50 teeth which are either present in the jaws or isolated. Some of the bones probably belonged to the same individual because of their colour, thickness, stage of fossilization, and the pattern and stage of synostosis of the cranial sutures; for children we may add a similarity between the dental ages. Some other bones might also be related to the same individual but some additional evidence would be needed to prove it. Therefore, the minimum number of individuals is 24 (16 adults and 8 children) and the maximum 54 (42 adults and 12 children).

The children are represented by 5 pieces of cranial vault, 3 incomplete mandibles, 2 parts of maxilla, and 21 isolated teeth. Their age was determined according to criteria presented by D. H. Ubelaker (1978) for

individuals whose mandible or maxilla parts had survived. The age of 5 children could be determined. Two died at the age 2 to 5 years, two others at 6 to 11 years, and the last one at 7 to 12 years.

The adult remains include 2 calvaria, 8 calvae, 8 pieces of cranial vault, 9 incomplete mandibles (two out of the nine mandibles belonged to adolescents), 4 parts of maxilla, 14 isolated teeth, 1 fragment of cervical vertebra, 1 right humerus, 1 right femur, 1 left fifth metatarsal, and 2 phalanges (the detailed inventory of the material will be made available to those interested). The lack of pelvis and the fragmentary condition of the skulls do not enable determination of sex, except for one skull (number 56022 is written on the skull but Breuil and Obermaier, 1909, call it skull number I) which could be that of a male adult considering its large dimensions, its well-developed supra-orbital ridges, and its heavy nuchal muscular reliefs. The age of the adult individuals at the time of death cannot be determined because of the fragmentary nature of the material.

The age data show no children under the age of two. This lack of very young children has been observed in many other Magdalenian sites. Three reasons could explain it. These immature bones, being more fragile, may have been destroyed by natural processes. They also may not have been recovered during the excavation. Finally these data could imply that the young children were not treated as the adults and older children were after death.

#### PRESERVATION

The percentage of postcranial bones is 14 % for the adults and 0 % for the children. The base of the skull is never preserved. For the face, only 6 isolated maxillae were found.

For the cranial bones of the adults, the percentage of element representation, that is the observed minimum number of a skeletal element divided by the expected number of the same element, based on the minimum number of individuals (Villa et al. 1986a), is comparable to that of buried adults recovered from French Magdalenian sites, except for the temporal and occipital bones, the base of the skull, and the maxillae (Table 1). Those differences appear to be quite normal considering that these parts of the skull were intentionally broken (see p. 192). On the other hand, the percentage of element representation for postcranial bones is comparable to that of "non-buried" French Magdalenians; these include all the individuals represented by isolated or scattered bones without marks of any intentional post-mortem treatment (Table 1). These data very likely indicate that the skulls from Le Placard received a special protection which would explain their high percentage of preservation.

#### MORPHOLOGY AND PATHOLOGY

All the crania are dolichocranic with generally weak muscular markings. These features fit well into the variation of Magdalenians (Gambier, in press). The state of preservation of the material did not allow a non-metrical study to examine possible relations between the individuals.

According to Breuil and Obermaier (1909), one cranium (I, No. 56022) belonged to a hydrocephalic individual. This interpretation, based on the high cranial volume, the presence of a metopic suture, ossicles in the

lambdatic area, and an occipital bun, is questionable. Though rather high, its measurements fit into the variation of the Upper Palaeolithic individuals. Regarding the ossicles and the occipital bun, these are also present in the other Upper Palaeolithic specimens. The single unquestionably pathological bone is a maxillary portion, which shows a lesion in the area of the first right molar tooth socket.

TABLE 1. *Percentage of element representation for adult bones from Le Placard compared to those of buried and non buried adults from the French Magdalenian sites (data come from Gambier et Le Mort, in press)*

| Element                 | Buried Adults | Non buried Adults | Adults from Le Placard |
|-------------------------|---------------|-------------------|------------------------|
|                         | MNI = 10      | MNI = 84          | MNI = 16               |
| Frontal bone            | 80            | 19                | 50                     |
| Right parietal bone     | 80            | 17.8              | 81                     |
| Left parietal bone      | 100           | 13.1              | 68.7                   |
| Right temporal bone     | 80            | 4.8               | -                      |
| Left temporal bone      | 80            | 3.5               | 6.2                    |
| Occipital bone          | 80            | 4.8               | 43.7                   |
| Base of the skull       | 70            | 2.4               | -                      |
| Right and left maxillae | 70            | 14.3              | 25                     |
| Mandible                | 100           | 22.6              | 43.7                   |
| Upper teeth             |               |                   |                        |
| Lower teeth             | 54            | 53.9              | 56.6                   |
| Vertebrae               | 30.8          | 0.44              | 0.05                   |
| Clavicle                | 60            | 0.5               | -                      |
| Scapula                 | 60            | 0.5               | -                      |
| Humerus                 | 85            | 1.5               | 3.1                    |
| Radius                  | 70            | 1                 | -                      |
| Ulna                    | 75            | 1                 | -                      |
| Carpals                 | 15            | -                 | -                      |
| Metacarpals             | 11.5          | 0.1               | -                      |
| Hand phalanges          | 15.7          | 0.3               | 2.2                    |
| Pelvis                  | 40            | 0.5               | -                      |
| Sacrum                  | 30            | -                 | -                      |
| Femur                   | 85            | 0.5               | 3.1                    |
| Patella                 | 55            | 0.5               | -                      |
| Tibia                   | 65            | 0.5               | -                      |
| Fibula                  | 65            | 1                 | -                      |
| Talus                   | 30            | 0.5               | -                      |
| Calcaneus               | 35            | -                 | -                      |
| Other tarsals           | 47.5          | 0.1               | -                      |
| Metatarsals             | 9             | 0.7               | 0.3                    |
| Foot phalanges          | 5.7           | 0.17              | 0.44                   |

#### CULTURAL MODIFICATIONS

The human remains from Le Placard show two kinds of cultural modifications, cutmarks and intentional breakage. Those modifications were pointed out by de

Maret (handwritten letter quoted by Breuil and Obermaier, 1909), who suggested an interpretation of the skulls as "cranial goblets". Later on, they were partly studied by Breuil and Obermaier (1909) who agreed with this interpretation. Breuil and Obermaier (1909) also pointed out that one of the skulls (I, No. 56022) was burnt adjoining a hearth. Numerous brown, yellowish and purplish spots can be observed on its exocranial and endocranial surfaces. Nevertheless, these spots may be due either to manganese or iron oxide, or to fortuitous burns. Nothing proves that the skull was intentionally burnt.

In order to achieve a complete study of the cultural modifications on the remains from Le Placard, we examined all the Upper Palaeolithic human bones recovered from the cave.

## CUTMARKS

### a) Method

The surface of all the cranial and postcranial bones was examined under a light microscope at  $\times 10$  to  $\times 40$  magnification. To distinguish tool marks from marks produced by natural processes (sedimentary scratches, root marks, rodent and carnivore tooth marks), we considered their number, anatomical location, orientation, layout, regularity or irregularity, and morphology.

Root marks and sedimentary scratches may be identified rather easily. Root marks are sinuous and ramified (Pei 1938; Binford 1981; Baud 1982). Sedimentary scratches can be straight, but none of them ever show regular patterns or any special anatomical location and orientation. Their arrangement seems haphazard.

Differentiation between tool marks and tooth marks is more difficult. Teeth may leave regular and parallel grooves just as tools do. Nevertheless, their location, layout, and to a greater extent, their morphology allow us to identify them.

Rodents create shallow, parallel, or subparallel grooves with flat bottoms and blunt edges. Under a microscope, these appear to have a slightly sinuous and irregular pattern. Striations inside the grooves can be

observed (Shipman 1981; Shipman and Rose 1983). Carnivore tooth marks are often sinuous; they have a blunt cross-section and a constant width; their ends are not sharpened, and there is no striation inside the grooves (Shipman 1981; Shipman and Rose 1983; Eickhoff and Herrmann 1985). On the other hand, sharp lithic or metallic tools make narrow grooves, with, in most cases, an acute cross-section and highly-sharpened ends. Split ends and striations inside the grooves can also be observed (Potts and Shipman 1981; Shipman 1981; Shipman and Rose 1983; Eickhoff and Herrmann 1985).

The incisions fitting the description of tool marks were considered to be prehistoric under the following conditions: they should have contained embedded matrix and/or were partly covered by concretions, and/or had the same colour and condition as the surrounding bone surface. Those which had the morphology of tool marks but did not meet these criteria were judged to be recent. During microscopic inspection of the material, the anatomical location, orientation, layout, and length of all the cutmarks were mapped.

### b) Results

Tables 2 and 3 summarize the results of the microscopic examination carried out on the surface of the cranial bones and mandibles for cutmarks. None was found on the postcranial remains.

Almost all crania and cranial fragments (Table 2) show cutmarks in the areas covered by the occipito-frontalis muscle (18 out of 20 specimens) and the temporalis muscle (9 out of 10 specimens for right and left sides). The crania on which incisions were not found in these areas are represented by very small fragments or are partly covered by concretions which prevent full observation. The cutmarks are not exactly symmetrical on both sides of the sagittal plane but, if they appear on one side, they also do on the opposite side in the same area except for two specimens which bear many concretions. There are numerous cutmarks connected with the occipito-frontalis muscle on the anterior surface of the frontal bone in the supraorbital area. There are rather few on the occipital bone, except for one fragment. Cutmarks connected with the occipito-frontalis muscle are not very dense on the parietal bones

TABLE 2. *Cutmarks on the Le Placard skulls*

| Location                                      | NS1 | NS2 | NSC | NSR1 | NSR2 | NSCR | NSL1 | NSL2 | NSCL |
|---|-----|-----|-----|------|------|------|------|------|------|
| Area covered by the occipito-frontalis muscle | 0   | 20  | 18  | 0    | 20   | 17   | 0    | 17   | 15   |
| Area covered by the temporalis muscle         |     |     |     | 0    | 10   | 9    | 0    | 10   | 9    |
| Maxilla corpus (subcutaneous muscles)         |     |     |     | 0    | 4    | 3    | 0    | 3    | 1    |

NS1 : Number of specimens on which the area is fully preserved.

NS2 : Number of specimens on which the area is partly preserved.

NSC : Number of specimens with cutmarks.

NSR1 : Number of specimens on which the right half of the area is fully preserved.

NSR2 : Number of specimens on which the right half of the area is partly preserved.

NSCR : Number of specimens with cutmarks on the right half of the area.

NSL1 : Number of specimens on which the left half of the area is fully preserved.

NSL2 : Number of specimens on which the left half of the area is partly preserved.

NSCL : Number of specimens with cutmarks on the left half of the area.

(Pieces belonging to a same individual were counted as one specimen).



where they are often located above the temporal lines. Similarly, we find numerous cutmarks linked to the temporalis muscle on and below the temporal lines of the frontal and parietal bones (Figure 1).

The frequency of marks on the maxillae and mandibles is lower than on the cranial vault (Tables 2 and 3). On the maxillae, the incisions are located in the area covered by the subcutaneous muscles (Table 2). Mandible cutmarks are found on the ascending ramus: in the areas covered by the masseter and medial pterygoid muscles, and along the anterior edge on both external and internal faces, where the temporalis muscle attaches. They are also found on the mandibular corpus, on its external face in the area covered by the subcutaneous muscles, on its internal face, and on the inferior edge of the mandibular symphysis where the mylohyoid, geniohyoid, genioglossus and digastric muscles attach (Table 3). Marks on mandibles are not always found at all



FIGURE 1. Cutmarks located on and below the anterior part of the right inferior temporal line (skull No. 61388).

these places, but when they do appear, they are located in these areas.

Most of the cutmarks are found in series including 2 to 15 parallel to subparallel incisions. Some of them appear as isolated grooves. The space between 2 marks of the same series varies from less than 1 mm to 5 mm, but is usually about 1 mm. The minimum length of the incisions is 0.5 mm; they are usually short, but their maximum length may reach 38 mm on the crania and 15 mm on the mandibles. Some of them are relatively deep, large, and very clear; some others are superficial and only visible when magnified.

The study of cutmarks distribution on the Le Placard crania and mandibles allows us to put forward a hypothesis as to the procedures for dismembering and defleshing the heads. Marks appearing on the internal face of the mandible show that the anterior muscles of the neck were cut; they could have been made when separating the head from the neck and could be dismemberment marks (in the classification of Binford, 1981). On the occipital bone, the insertions of the nape muscles are generally not preserved; we are unable to know if these muscles were also cut. The presence of dismemberment marks in the masticatory muscle attachment sites, on the crania and mandibles, could indicate that the mandibles were artificially separated. Cutmarks on the maxillae and on the external face of the mandibular corpus are very likely skinning marks (in the classification of Binford 1981) and could mean that these bones were cleaned by removing the subcutaneous muscles. On the cranial vault, there are numerous skinning marks in the supra-orbital area and above the temporal lines. Therefore, the scalp may have been severed in its anterior and lateral areas and then pulled away. We have no information concerning its posterior area since this part of the cranium is rarely preserved and usually incomplete.

This amount of cutmark evidence has not been described on cranial bones from a Palaeolithic site until now. The cutmark distribution on the Le Placard specimens is different from the configuration of

TABLE 3. Cutmarks on the Le Placard mandibles

| Location  | NSR1 | NSR2 | NSCR | NSL1 | NSL2 | NSCL | Severed Muscles  |
|---|------|------|------|------|------|------|--|
| External face of the ascending ramus. Area covered by the masseter muscle.            | 1    | 3    | 2    | 0    | 1    | 1    | Masseter muscle  |
| External face of the ascending ramus, along the anterior edge.                        | 1    | 3    | 1    | 0    | 1    | 1    | Temporalis muscle                                      |
| Internal face of the ascending ramus, along the anterior edge.                        | 1    | 3    | 1    | 0    | 1    | 0    | Temporalis muscle                                      |
| Medio-posterior area of the ascending ramus internal face.                            | 1    | 3    | 1    | 0    | 1    | 0    | Medial pterygoid muscle                                |
| External face of the mandibular corpus.   | 4    | 6    | 5    | 0    | 10   | 5    | Subcutaneous muscles                                   |
| Internal face of the mandibular corpus and inferior edge of the mandibular symphysis. | 4    | 6    | 5    | 0    | 10   | 3    | Mylohyoid, geniohyoid, genioglossus, digastric muscles |

- NSR1 : Number of specimens on which the right half of the area is fully preserved.
- NSR2 : Number of specimens on which the right half of the area is partly preserved.
- NSCR : Number of specimens with cutmarks on the right half of the area.
- NSL1 : Number of specimens on which the left half of the area is fully preserved.
- NSL2 : Number of specimens on which the left half of the area is partly preserved.
- NSCL : Number of specimens with cutmarks on the left half of the area.

cutmarks described on more recent prehistoric cranial bones, such as those from the Neolithic site of Fontbrégoua in France (Bouville 1982; Villa et al. 1986 a and b) and from the Chalcolithic site of Alfacar in Spain (Botella 1973). The skulls excavated at these sites, as well as several early Plains Indian skulls from the Grover Hand Burial Mounds in South Dakota (Bass and Phenice 1975) show cutmarks extending antero-posteriorly near the sagittal plane. The distribution of cutmarks observed on the Le Placard crania does not resemble either any of the usual configurations on skulls from which the scalp was removed; such an operation usually involves circular incisions which may be carried out above or below the ears (Hamperl 1967).

#### INTENTIONAL BREAKAGE

All the cranial remains from Le Placard are incomplete. As mentioned above, the base of the skull and the face are never preserved. Some specimens were broken during the excavation or after; their broken edges are white, clean, free of matrix, and unweathered. The others show old breaks (no refitting of specimens showing old breaks was possible), which do not meet these criteria. Some of the old breaks have an unusual appearance which very likely means that they were made intentionally.

Considering the appearance of the breaks, we can classify the cranial specimens in three categories:

- 1 calvarium, 1 calva and 5 pieces of cranial vault show no specific break and their edges are either sutures, new breaks, or probably natural breaks.

- 1 calvarium, 2 calvae and 8 pieces of cranial vault could have been intentionally broken. Some of their broken edges seem too regular to have been broken by natural processes but the fragmentary condition of the specimens does not enable us to assert it.

- 5 calvae show specific breaks. Three of them (No 61388, 56023, 56021; B, E, H for Breuil and Obermaier, 1909) bear regular breaks of various lengths (their maximum chord length is 7.7 cm) often forming an arc; the broken edges are perfectly straight, the external lamina, diploe, and internal lamina are exactly at the same level. The edges of two other calvae (No 61387, 61390; C, G for Breuil and Obermaier, 1909) are made of numerous small regular breaks which seem to be the result of a series of blows struck all around the cranial vault.



FIGURE 2. "Cranial goblet" (skull No. 61387).

These two kinds of breaks are very different from those usually found on prehistoric skulls. Therefore, in view of the particular shape of these calvae, we think it highly probable that they were deliberately broken to give them the shape of "goblets" (Fig. 2).

Three explanations for the condition of the cranial remains from Le Placard are as follows:

- all the specimens could have been intentionally broken in order to give them a special shape, but their state of preservation does not allow us to demonstrate such modifications;

- all the specimens could have been broken in order to give them a special shape, but some of them may have only been "sketched" out,

- finally, the Magdalenians may have selected only a few of them to be shaped as "cranial goblets".

#### CONCLUSION

The cranial remains from Le Placard were dismembered and defleshed with tools. Then, at least some of them were broken in order to give them the shape of "cranial goblets". Finally, they seem to have received a particular protection. In the present state of knowledge, Le Placard seems to be the only Palaeolithic, and especially Magdalenian, site where such a treatment of the human bones could be demonstrated. The Magdalenian human remains from Isturitz (Pyrénées atlantiques), that we are studying at present, received a particular treatment which does not seem very different at the present stage of our study (Gambier, 1990; Buisson and Gambier, 1991). This treatment leads us to think that, in this site, the skulls, or at least some of them, had a special value. The use of these "cranial goblets" has been the subject of varied hypotheses but, for the moment, none is demonstrable. They could be compared to items used for libations by Tibetans during religious ceremonies (Poplin 1976; Thomas 1980) but there is no evidence that they were used in this similar way.

The study of the cultural modifications on the human bones from Le Placard confirms, if necessary, that elaborate mortuary practices, different from burials, existed during the Upper Palaeolithic.

#### ACKNOWLEDGEMENTS

This study was carried out within the C.N.R.S. UA 376; it was supported in part by a grant from the Fondation de France. We would like to express our thanks to H. Delporte and J. P. Mohen, former and present directors of the Musée des Antiquités Nationales (Saint-Germain-en-Laye) and J. J. Cleyet-Merle, curator of the Palaeolithic Department, for allowing us to examine the material in their care. We are particularly grateful to D. Buisson and G. Pinçon for their friendly assistance while we studied the Le Placard collection in the museum. Thanks are also given to M. Hourvitz for her help with the manuscript.

#### REFERENCES

- BASS W. M., PHENICE T. W., 1975: Prehistoric Human Skeletal Material from Three Sites in North and South Dakota. In: *The Sonata Complex and Associated Sites on the Northern Great Plains*. Ed. R. W. Neuman. Pp. 106-140. Lincoln,



- Nebraska State Historical Society, Publications in Anthropology 6.
- BAUD C. A., 1982: La taphonomie. La transformation des os après la mort. *La Mort dans la Préhistoire. Les Dossiers / Histoire et Archéologie* 66: 33-35.
- BINFORD L. R., 1981: *Bones. Ancient Men and Modern Myths*. Academic Press, New York. 336 p.
- BOTELLA M. C., 1973: Restos humanos eneolíticos con incisiones de la provincia de Granada. *Anales del Desarrollo* 17: 401-423.
- BOUVILLE C., 1982: La mort violente. Les massacres. *La Mort dans la Préhistoire. Les Dossiers / Histoire et Archéologie* 66: 36-41.
- BREUIL H., 1909: Le gisement quaternaire d'Ofnet (Bavière) et sa sépulture mésolithique. *L'Anthropologie* 20: 207-214.
- BREUIL H., 1912: Les subdivisions du Paléolithique supérieur et leur signification. *Congrès International d'Anthropologie et d'Archéologie Préhistorique*. Geneva, 14: 165-238.
- BREUIL H., OBERMAIER H., 1909: Crânes paléolithiques façonnés en coupes. *L'Anthropologie* 20: 523-530.
- BUISSON D., GAMBIER D., 1991: Façonnage et gravure sur des os humains d'Isturitz (Pyrénées atlantiques). *Bull. Soc. Prehist. Fr.* 88/6: 172 - 177.
- CHAUVET G., 1899: Statistique et bibliographie des sépultures préromaines du département de la Charente. *Bulletin Archéologique*, Paris.
- EISKHOFF S., HERRMANN B., 1985: Surface Marks on Bones from a Neolithic Collective Grave (Odagsen, Lower Saxony). A Study on Differential Diagnosis. *Journal of Human Evolution* 14: 263-274.
- GAMBIER D., 1990: Les vestiges humains du gisement d'Isturitz (Pyrénées atlantiques). Etude anthropologique et analyse des traces d'action humaine intentionnelle. *Antiquités Nationales* 22: 8 - 26.
- GAMBIER D., in press: Les Magdaléniens de France. *Actes du colloque "Le peuplement magdalénien", Chancelade, octobre 1988. Ed. CTHS*.
- GAMBIER D., LE MORT F., in press: Diversité du traitement des os humains au Magdalénien: exemple du gisement du Placard. *Actes du colloque "Le peuplement magdalénien", Chancelade, octobre 1988. Ed. CTHS*.
- HAMY E. T., 1889: Nouveaux matériaux pour servir à l'étude de la Paléontologie Humaine. *Congrès International d'Anthropologie et d'Archéologie Préhistorique*, Paris, 10: 432-439.
- HAMPERL H., 1967: The Osteological Consequences of Scalping. In: *Diseases in Antiquity*. Eds. D. Brothwell and A. T. Sandison. Pp. 630-634. Springfield, C. C. Thomas.
- HERVE G., 1893: La race des troglodytes magdaléniens. *Revue de l'Ecole d'Anthropologie* 3: 173-188.
- MARET de A., 1879a: Fouilles dans la grotte du Placard. *Matériaux pour l'Histoire de l'Homme* 14, 2<sup>e</sup> série, t. 10: 33-34.
- MARET de A., 1879b: Stations préhistoriques de la grotte du Placard, près de Rochebertier (Charente). *Congrès Archéologique de France*, 46<sup>e</sup> session, Vienne: 162-178.
- MORTILLET de A., 1906: La grotte du Placard (Charente) et les diverses industries qu'elle a livrées. 2<sup>e</sup> Congrès Préhistorique de France, Vannes: 241-265.
- PEI W. C., 1938: Le rôle des animaux et des causes naturelles dans la cassure des os. *Palaeontologia Sinica* 7, série D, 64 p.
- POPLIN F., 1976: Utilisation des cavités naturelles osseuses et dentaires. In: *Méthodologie appliquée à l'industrie de l'os préhistorique*. Colloques internationaux du CNRS N° 568. Pp. 111-118. Paris, Editions du CNRS.
- POTTS R. B., SHIPMAN P., 1981: Cutmarks made by stone tools on bones from Olduvai Gorge. *Nature* 291: 577-580.
- SHIPMAN P., 1981: Applications of Scanning Electron Microscopy to Taphonomic Problems. *Annals of the New York Academy of Sciences* 376: 357-386.
- SHIPMAN P., ROSE J., 1983: Early Hominid Hunting, Butchering and Carcass-processing Behaviors: Approaches to the Fossil Record. *Journal of Anthropological Archaeology* 2: 57-98.
- SONNEVILLE-BORDES de D., 1959: Position stratigraphique et chronologique relative des restes humains du Paléolithique supérieur entre Loire et Pyrénées. *Annales de Paléontologie* XLV: 19-51.
- THOMAS L. V., 1980: *Le cadavre*. Complexe, Bruxelles. 220 p.
- UBELAKER D. H., 1978: *Human Skeletal Remains. Excavation. Analysis. Interpretation*. Washington, Taraxacum.
- VILLA P., BOUVILLE C., COURTIN J., HELMER D., MAHIEU E., SHIPMAN P., BELLUOMINI G., BRANCA M., 1986a: Cannibalism in the Neolithic. *Science* 233: 431-437.
- VILLA P., COURTIN J., HELMER D., SHIPMAN P., BOUVILLE C., MAHIEU E., 1986b: Un cas de cannibalisme au Néolithique. *Gallia Préhistoire* 29/1: 143-171.

Françoise Le Mort, Ph.D.  
 CNRS  
 Centre de Recherche Français de Jérusalem  
 B. P. 547  
 91004 Jérusalem - Israël

Dominique Gambier, Ph.D.  
 UA 376 du CNRS  
 Laboratoire d'Anthropologie  
 Université de Bordeaux I  
 Avenue des Facultés  
 33405 Talence Cédex - France