Anthrop. Közl. *48;* 145–152. (2007)

MUTILATIONS AROUND THE FORAMEN MAGNUM EXAMINED BY SCANNING ELECTRON MICROSCOPE (SEM)

László Szathmáry[1] *and Imre Beszeda*[2]

[1]University of Debrecen, Department of Evolutionary Zoology and Human Biology, Debrecen,
[2]University of Debrecen, Department of Solid State Physics, Debrecen, Hungary

Abstract: *The authors examined the surficial formations referring to post mortem trephination on the foramen magnum on one 8th century human skull and on two 10th century human crania by applying direct visual inspection and scanning electron microscopy method. Their control samples consisted of three 4–10th century skeletal finds which were most assuredly and undoubtedly gnawed by micromammals. According to the authors' judgement, the surface shapes, which were earlier considered to be the results of human interventions, are not at all different from the anatomical formulae caused by micromammals. Namely, they could only find evidence which contradicted post mortem human surgical intervention on the foramen magnum.*
Keywords: *Foramen magnum; Mutilation; Scanning electron microscopy; 8th and 10th century; Hungary.*

Introduction

The examination and evaluation of mutilations on the human foramen magnum have long been a special field of research in both paleoanthropology and historical ethnography. Among researches of trustworthy anatomical knowledge, Blanc is the first to be mentioned, who identified cuttings and fractures made by humans on the Neanderthal-like skull dating back to the end of the Middle-Paleolithic dug up in Monte Circeo (1958). This was the first authentic description that had called the attention of professional circles to post mortem surgical interventions at the edge of or around the foramen magnum. In the meantime, similar cranial finds coming from Humahuaca culture in South America were published (Vignati 1953, Cigliano 1959). Thereafter accounts of crania excavated in Australia, New Guinea and Melanesia were rendered by Henschen (1965) and Maxia (1967), who depicted a cutting technique which was different from those applied in the cases mentioned above. While Ullrich (1978) was much more inclined to suspect the peculiarities of cannibalism on examining the skulls from Krapina dating from the end of Würm.

In the Carpathian Basin, skulls mostly dating from the time of the Hungarian conquest and from the Arpadian age are widely known (Kiszely 1970, Éry 1977, Szathmáry 1983, Lőrinczy and Kiszely 1985). 29 cases of the same age are mentioned in Grinaeus's general work (1996). On the account of their similar chronological position and their geographical closeness, the crania dug up in Bohemia and published by Stloukal and Vyhnánek (1967) are also worth mentioning. Whereas we merely have knowledge of a few doubtful cases from the prehistoric age (Copper Age, Bronze Age, Celtic period and Late Avar period) of the Carpathian Basin (Szathmáry 1978, 1979).

In the present paper, we wish to afford a new approach to the authenticity of the mutilations on the cranial finds from Tiszántúl, Hungary, dating back to the 8th century

and to the 10th century by using SEM images. Whether mutilations were caused by humans or not cannot be decided reliably by applying visual inspection merely.

Therefore the question is whether the examined phenomenon is the result of human interventions or it bears the toothmarks of micromammals (like voles, shrews etc). Micromammals are known to have preferred and still to prefer the skulls of entombed humans or of any deceased animals as their dwelling places. They gnaw any cranial parts of compact substance (e.g. the supraorbital arch, the zygomatic arch, the outer surface of the head or the nuchal eminencies) besides the edge of foramen magnum. Therefore the marks left by gnawing can usually be identified on the skeletal finds of both fossil and subfossil mammals.

Material and Methods

In the course of the analysis, we attested the mutilations on the foramen magnum either in photos or in drawings (Table 1, Figs 1–3).

We used the same method in the case of the control samples, which were undoubtedly proved to bear the marks left by micromammals (Table 2, Figs 4–6).

The samples involved in Tables 1 and 2 were analysed by applying a surface examination method (scanning electron microscopy; SEM). The cardinal point of this method is that the specimen is scanned by an electron beam focussed on the surface. The signal received from the sample, after detection and amplification, is used to modulate the intensity of the electron beam which scans synchronously with the beam on the specimen on a monitor (CRT) to form an image. The surface topography can be most easily imaged by the secondary electrons (SE) which we get from the thin layer under the surface of the specimen (cf. Reimer 1985).

Table 1. Mutilations around the foramen magnum on the examined human cranial finds from the 8th and 10th century.

Locality	Grave number	Century	Illustrations
Rakamaz-Strázsa dombi dűlő	6	10th	Figs 1, 2, 8
Rétközberencs-Paromdomb	Skeleton I	10th	Figs 3, 9
Szécsény	–	8th	Fig. 7

Table 2. Control samples: historical skeletal finds gnawed by micromammals.

Locality	Position	Century	Illustrations
Hajdúdorog-Gyúlás	In grave number 36, on a mammal's limb bone	10th	Fig. 6
Tiszadob-Sziget	In grave number 22, at the edge of the foramen magnum of a mammal	5th	Figs 4, 10
Tiszakarád-Inasa	In grave number 9, on the outer surface of a human skull	4–5th	Figs 5, 11

The surfaces examined varied between 0.5 cm and 0.7 cm, while their maximum depth was 1.0 cm. The bones were fixed on the sample-holders with a sort of adhesive conducting electricity then, surfaces to be examined were DC sputtered with a very thin layer of gold of a few nm width. For our experiments we used an AMRAY 1830I scanning electron microscope. The photos taken were magnified 20x, 80x and 300x in SE mode.

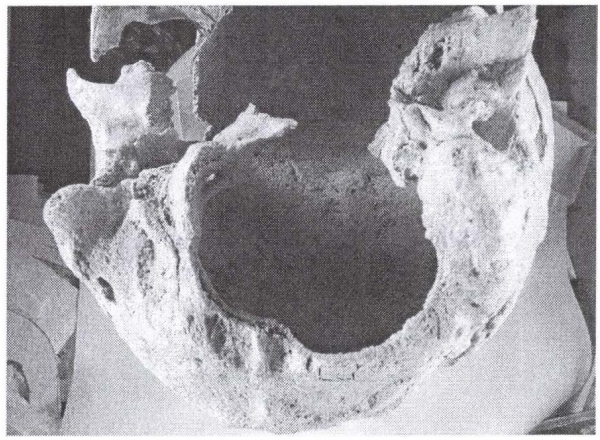

Figure 1: A photo of the human cranial find excavated in grave number 6 in the 10th century cemetery in Rakamaz-Strázsa dombi dűlő.

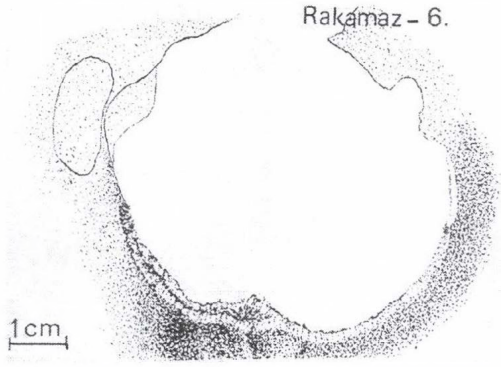

Figure 2: A drawing of the human cranial find excavated in grave number 6 in the 10th century cemetery in Rakamaz-Strázsa dombi dűlő.

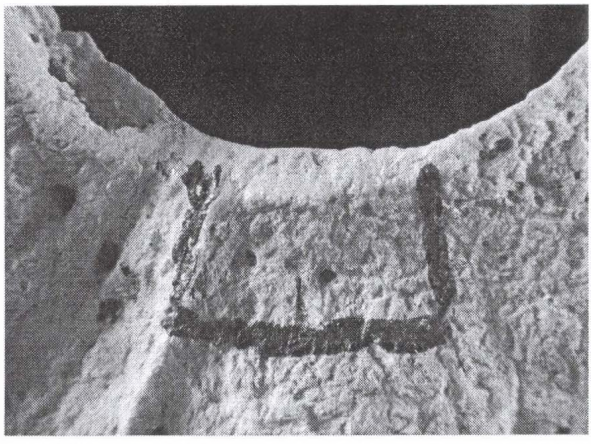

Figure 3: Moments referring to mutilations around the foramen magnum of the human Skeleton I from Rétközberencs-Paromdomb.

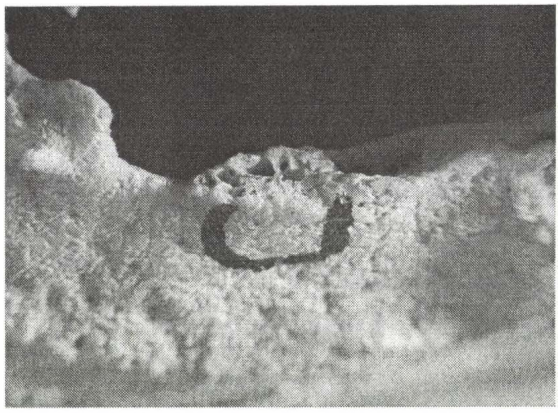

Figure 4: A control sample: a detail, with micromammal toothmarks, from the edge of the foramen magnum of a mammal's skull belonging to grave number 22 in the 5th century cemetery in Tiszadob-Sziget.

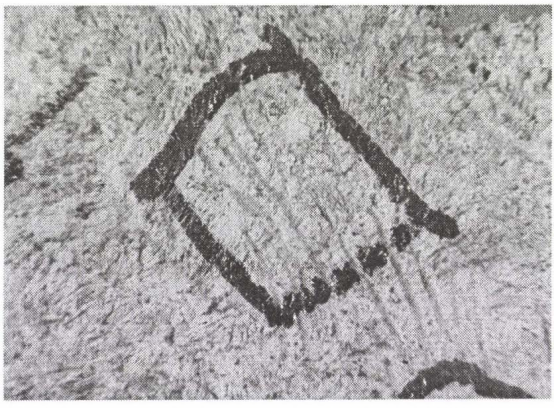

Figure 5: A control sample: a photo of micromammal toothmarks identified on the outer surface of a human skull excavated in grave number 9 in the locality of Tiszakarád-Inasa (4–5th century).

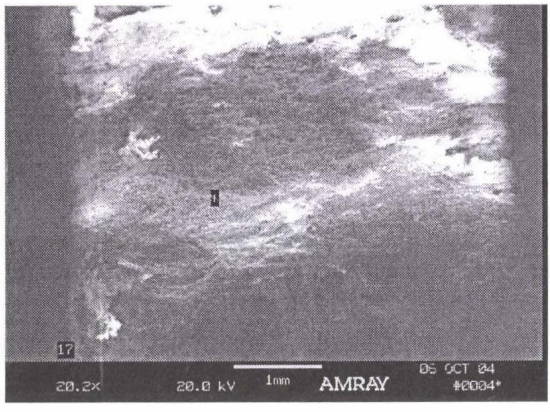

Figure 6: A control sample: decomposed micromammal toothmarks observed on mammal bones excavated in grave number 36 in Hajdúdorog-Gyúlás (SEM image).

Results

Of the various images, the ones magnified 20 times could be considered to be the most authoritative as the brims of the troughs and the surfaces between them were distinctly visible and could be identified definitely. The enlargements of a larger scale than these, on the other hand, overstressed the surficial shapes brought about artificially by washing and restoring the bones, and concealed the information about the mutilations which were important for us to estimate the surfaces in question rather than set them off.

In the image of the 8th century skull from Szécsény (Szathmáry 1978) magnified 20 times, all of the washtub-shaped troughs with definite symmetrical edges on either side could be registrated and the same evidence could be discovered on the 10th century cranial finds (Fig. 7) as well. As a representative illustration, besides the skull from Szécsény, we are publishing the picture of the cranium of an individual buried in the number 6 leader's grave in Rakamaz-Strázsa dombi dűlő (Fig. 8), who also had symbolic trephinations made at four various times (Szathmáry and Guba 1999, Szathmáry and Marcsik 2006). The cuttings demonstrated in Figure 8 are of washtub-shaped showing no definite will to push on cutting in either direction. Instead, the marks seem to refer to a steady motion in vertical direction. The same characteristics are exhibited by find number 1 from Rétközberencs dating from the age of the Hungarian conquest (Fig. 9).

And now let us have a look at the control samples in the case of which the possibility of human intervention could unambiguously be excluded.

From the viewpoint of zoological control, one of our relevant finds was a fracture from the skull of a mammal belonging to grave number 22 dating back to the 5th century coming from Tiszadob-Sziget. Here, the mutilations at the edge of the foramen magnum, which look similar visually, could be observed on a find which dates from a previous age and which, in this way, can be considered indifferent (Fig. 4). The SEM images make it clear that the troughs are similar to those borne by the 8th century and 10th century crania. The dimensions of the recesses between the brims do not differ essentially from those on the human skulls of the 8th and 10th century mentioned before (Figs 7–11). Neither does the structure of the cranial surface gnawed by micromammals and known from the localities of Tiszakarád-Inasa (4–5th century) as well as Hajdúdorog-Gyúlás (10th century) represent any difference from the before-mentioned human samples.

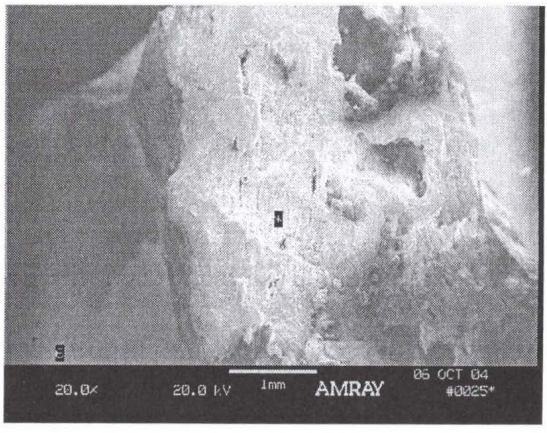

Figure 7: A SEM image of the 8th century human cranial find from Szécsény.

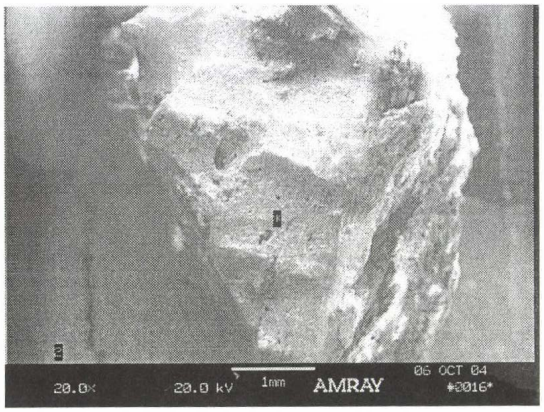

Figure 8: A SEM image of the 10th century human cranial find from Rakamaz-Strázsa dombi dűlő.

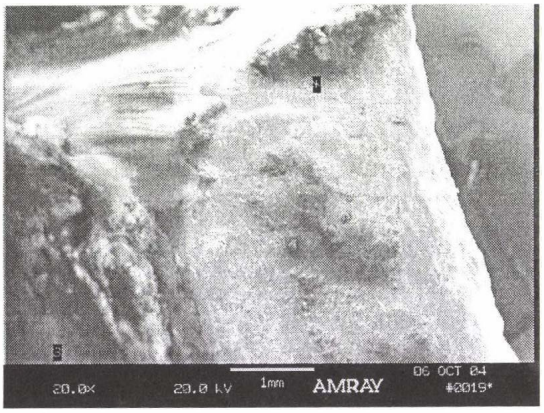

Figure 9: A detail, with decomposed washtub-shaped recesses, from the foramen magnum of the human Skeleton I from Rétközberencs-Paromdomb (SEM image).

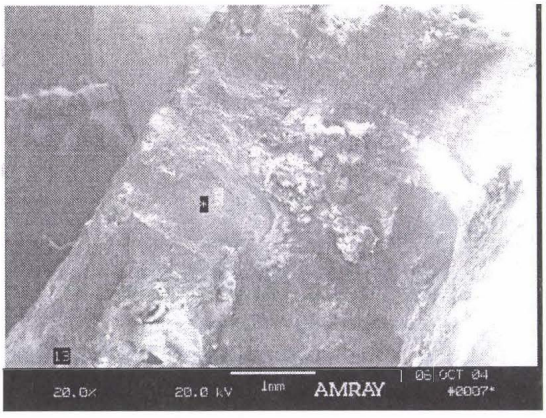

Figure 10: A detail, with micromammal toothmarks, from the edge of the foramen magnum of a mammal's skull excavated in grave number 22 in the 5th century cemetery in Tiszadob-Sziget (SEM image).

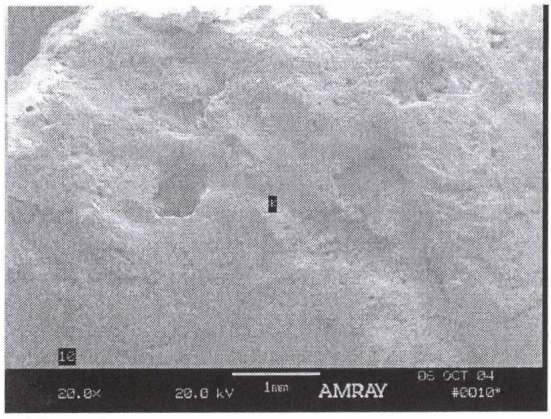

Figure 11: Washtub-shaped alternating recesses as micromammal toothmarks on the occipital bone of a human skull excavated in grave number 9 in the 4–5th century cemetery in Tiszakarád-Inasa (SEM image).

Conclusion

The results of our sounding experiments suggest that the mutilations at the edge of the foramen magnum do not embody human ambitions either in the 8th century or in the 10th century, instead they seem to be phenomena caused by micromammals. This raises well-founded doubts about prehistoric finds of similar character.

The genuine result in the development of a field of research is if it rises above its former observations. Thus an author can assume that he or she can correct his or her misapprehensions. As the co-author (Szathmáry, László) of this paper, I believe I can do it now so as to open a debate to help further research.

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Levelezési cím: László Szathmáry
Mailing address: University of Debrecen
Department of Evolutionary Zoology and Human Biology
H-4010 Debrecen
POBox 3
Egyetem tér 1
Hungary
szathmary@tigris.klte.hu