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Any correspondence will be sent to the editor:  
Museum Arad  
Piata George Enescu 1, 310131 Arad, RO  
e-mail: ziridava2012@gmail.com

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# Dental Indicators of Stress and Diet Habits of Individuals Discovered in the Ossuary of the Medieval Church in Tauț (Arad County)\*

Luminița Andreica

**Abstract:** The present study presents the analysis of certain bio-cultural factors on bone fragments. The skeletons were recovered from a medieval ossuary in Tauț (Arad County). Some pathological afflictions, such as the large number of teeth lost antemortem, tooth cup-shape wear and the large number of interproximal cavities led to the conclusion that the diet of these individuals mainly consisted of cereals.

**Keywords:** ossuary, cavities, *cribra orbitalia*, diet, agricultural system.

## Introduction

The human remains under analysis were discovered during archaeological excavations performed in 2006 in the northern area of the Gothic church researched in Tauț “La cetate” (Arad County). Systematic archaeological research on this site started in 2002, when the area enclosed by ramparts was partially cleared of vegetation. During the 2003 excavations specialists have identified an early medieval necropolis (dated to the 11<sup>th</sup>–12<sup>th</sup> centuries) over which two churches were built during different stages. The first church was originally built in the Romanesque style, but during a later stage, when the congregation grew, the Romanesque church was significantly extended and turned into a Gothic monument. The community decided to establish an ossuary in the northern area annexed to the Gothic church, probably because the burial area around the church was used up. One could enter the ossuary from the church’s nave<sup>1</sup>.

Thus, in the present study we attempt at performing a preliminary anthropological analysis that aims at reconstructing the diet of individuals buried in the church yard.

### Materials and methods

The bone materials employed in this study were recovered from an ossuary, thus a collective secondary burial.

In the case of such burials, a large number of skeletal remains are often missing. In the same time, it is obvious that some bones can be easily lost during transportation.

Thus, the following fragments were recovered from the ossuary: 28 skulls, 10 mandibulae, 33 femora, 29 tibia and 20 humeri. Each skull was numbered and, when possible, according to texture and gender, the mandibles were attributed to skulls C 03, C 04, C 05, C 09, C 25 and C 26.

## Gender and age diagnosis

In order to identify the gender of the discovered individuals, I analyzed the traits of each skull, such as the prominence of the glabellae, of the nuchal crests, of the *superciliary arches* and of the mastoid bones<sup>2</sup>. W. Bass’s recommendations were employed in the identification of gender according to the characteristics of the mandibulae<sup>3</sup>. The synostosis degree of skull sutures<sup>4</sup>, the obliteration of the interpalatine suture<sup>5</sup> and dental wear were employed as indicators in establishing age according to methods provided by T. White and P. Folkens<sup>6</sup>.

\* English translation: Ana M. Gruia.

<sup>1</sup> Mărginean, Rusu 2010.

<sup>2</sup> Acsádi, Nemeskéri 1970.

<sup>3</sup> Bass 1987.

<sup>4</sup> Lovejoy, Meindl 1985.

<sup>5</sup> Bass 1987.

<sup>6</sup> White, Folkens 2005.

As for pathology, analogies were identified from D. Ortner, W. Putschar<sup>7</sup>.

### Paleo-demographic considerations

7.14 % of the bone material belonged to adolescent individuals. The highest number of deaths was recorded among the young adult category, with a percentage of 28.5 %. From the lot from Tauț, six individuals reached ages between 36–45 years old, while a percentage of 25 % lived beyond 46–55. Five individuals were identified in the adult-senile category (Fig.1).

Age	Men	Women	Unidentified	Total
4–12	–	–	–	–
13–20	1	–	1	2
21–35	3	5	–	8
36–45	4	2	–	6
46–55	4	2	1	7
► 56	2	3	–	5

Fig. 1. Distribution of individuals found inside the ossuary according to age and gender.

### Pathological observations

Data provided by dental elements is highly relevant not only in the study of infectious diseases, but also in the analysis of physiological alterations (destructions) during tooth formation. Through such analyses one can extract pieces of information on the state of oral health of the population under investigation and in some cases such data reflects life details during childhood or adult age.

Oral pathology allows, among other things, for the approximation of an individual's diet, the way his food was prepared and the nutrition and subsistence strategies of human groups in the past. As J. R. Lukacs indicated<sup>8</sup>, one must certainly take into account the fact that gender, age and last but not least social status are variables that influence the analysis and interpretation of the distinct pathological manifestations of teeth.

Thus, in the present paper, in order to estimate the degree of oral health and in order to identify the diet of individuals found inside the ossuary, I performed the following analyses: the evaluation of diseases affecting their teeth (cavities, antemortem dental loss), as well as their bone tissue supporting the teeth (abscesses, periodontal diseases).

The percentage of antemortem tooth loss is relatively elevated, representing 35.7% of the minimum number of individuals. The highest incidence is recorded among female individuals. Such lesions are traditionally associated to the cariogenic process, though one must not forget that this process can take place following traumatism, strong dental abrasion, or the retraction of dental alveoli due to periodontal afflictions<sup>9</sup>.

Teeth more likely to suffer from antemortem dental loss are Molar 1, Molar 2 and Molar 3, while incisors and canines are usually less affected (Fig. 2). One of the explanations for this is the fact that molars are more involved in mastication, in the grinding of food, thus they wear out sooner than teeth on the anterior arcade. Another reason might be the potential retention of food particles in the interproximal areas of the molars. This might lead to the formation of the dental salt plaque, a focus of cariogenic bacteria.

The fact that the first molar is the tooth with the highest frequency of antemortem loss in both male and female individuals can be explained by its eruption prior to other molars. Thus, it can be affected sooner by cariogenic factors or other trauma that might lead to its early loss.

The distribution of postmortem dental loss shows higher frequency among anterior teeth. The type of tooth most easily lost is that with a single root, such as incisors, canines and premolars, except

<sup>7</sup> Ortner, Putschar 1981.

<sup>8</sup> Lukacs 1989.

<sup>9</sup> Lukacs 1995.

for the first upper premolar that can have two merged roots. This loss of anterior teeth can be easily explained. “Single-root teeth are less well anchored in the bone tissue and can detach easier, while molars, with their divergent roots and bigger size, are better connected to the alveolar bone and it is thus less likely for them to detach due to taphonomical modifications”<sup>10</sup>.

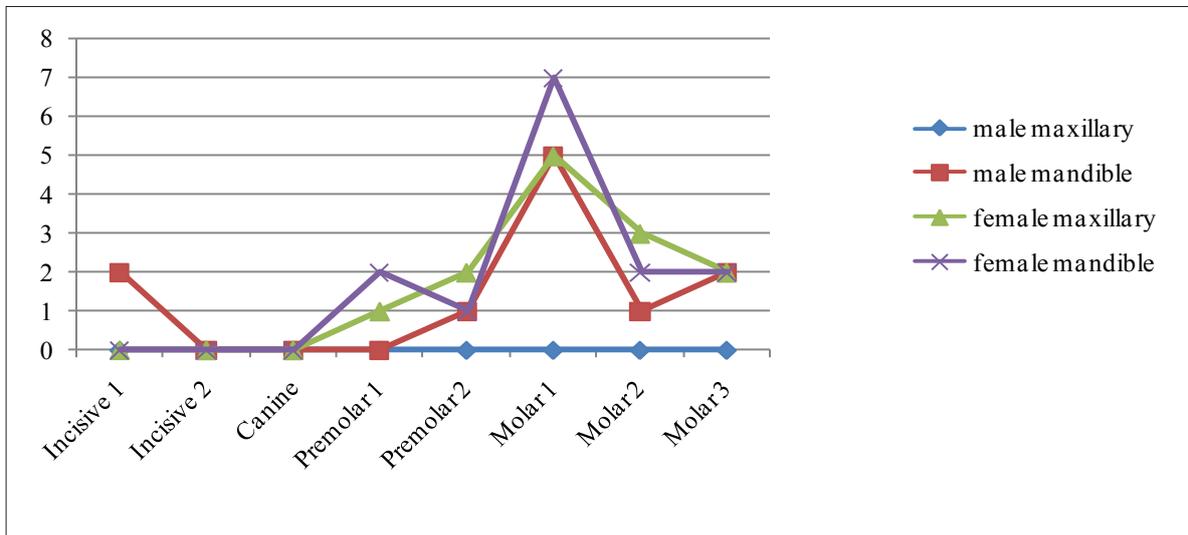


Fig. 2. Antemortem tooth loss frequency according to gender.

Dental caries are pathological afflictions caused by the interaction of several factors, among which the most significant are the following: tooth susceptibility, the presence of cariogenic microorganism and, last but not least, one must mention the buccal environment. This affliction causes the progressive destruction of dental enamel as a consequence of acid demineralization. This demineralization of the enamel is the product of sugar from consumed food fermenting<sup>11</sup>. Populations consuming higher quantities of carbohydrates show a relatively elevated frequency of cariogenic lesions as compared to populations with a smaller intake of carbon hydrate<sup>12</sup>. The present study analyzes the distribution of cavities according to the individuals' gender and age, taking into account also the type of teeth and the location of each lesion.

As for the gender distribution of cavities, I was able to identify the presence of tooth cavities in the case of five individuals, all male, with ages between 30 and 45.

The subsequent step consisted in the analysis of each tooth's different surfaces in order to see which dental items were more affected by the cariogenic phenomenon. I thus analyzed the distribution of lesions located on the grinding surface (occlusal caries) as compared to those on all other dental surfaces (non-occlusal caries). Such observations led to the conclusion that the individuals found in the ossuary from Tauț presented a significant number of non-occlusal caries (Pl. 2/3, Pl. 2/4). This elevated frequency indicates that this population consumed types of foods that easily accumulate between the inter-proximal surfaces of teeth, especially the posterior ones, where the removal of remains was more difficult.

As for the main lesions of the buccal apparatus, it has been concluded that a final factor must also be taken into consideration. If one analyzes independently cavity frequency and antemortem dental loss, he/she can easily ignore the connection between the two pathological manifestations. Because of this, the two lesions have been unified into a single indicator labeled as overall dental lesion that allows for the partial abstraction of results on the oral pathology of individuals inside the ossuary. Following the incidence of overall dental lesions according to gender, the following graph (Fig. 3) indicates that female individuals show a higher percentage of pathological afflictions, but that the difference is not significant.

On the basis of these indicators, one can conclude that women were not less affected by the cariogenic process, but that they lost their teeth antemortem earlier and to a larger degree.

<sup>10</sup> Robledo Sanz 1998, 206.

<sup>11</sup> Lukacs 1989.

<sup>12</sup> Larsen *et al.* 1991.

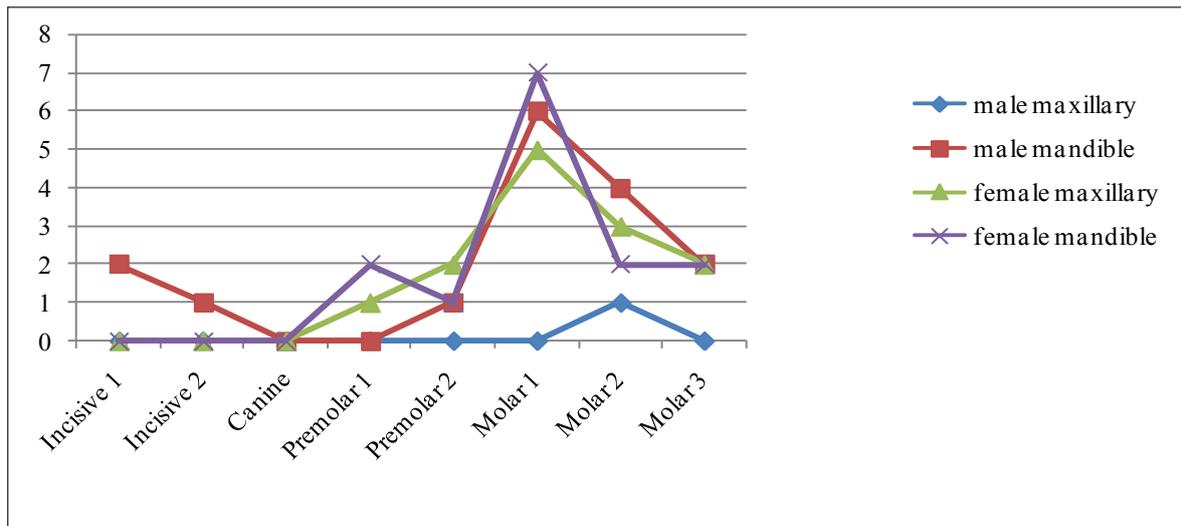


Fig. 3. Overall dental lesions (cavities+antemortem tooth loss) according to gender and dental elements.

There are several hypotheses as to the deteriorating oral health of female individuals: the fact that they consumed smaller quantities of proteins and larger quantities of carbohydrates than men. One can also explain this gender difference by accepting the fact that women also partially chewed food given to children during the weaning period. “On the other hand Walker provides as a significant explanation the early eruption of dental items in women, a fact that suggests that teeth are thus exposed for longer periods to the cariogenic activity”<sup>13</sup>.

Among the pathological afflictions that affected the bone tissue supporting dental items, in the present study one can mention abscesses and paradontitis.

“The abscess is a pathological condition characterized by the destruction of the alveolar bone caused by different infectious agents. This pathology can be the result of cavities or the consequence of severe tooth wear, traumatic processes and/or periodontal diseases”<sup>14</sup>. Abscesses are in fact the destruction of the alveolar bone. In general, this destruction can be seen as a circular depression with rounded edges, different than all other postmortem destructions of the bone.

As for the individuals from Tauț, this pathological affliction was only encountered in the case of a single male individual who died between 25 and 30. The abscess is present on the mandible, around Molar 1 right, above the mental foramen. The entire crown of Molar 1 is also destroyed (Pl. 2/1, Pl. 2/2).

Posterior teeth show a higher percentage of abscesses, especially the first molars<sup>15</sup>. This hypothesis is verified by the present study. Since there is only one case of abscess, one cannot draw conclusions on its frequency according to gender and age.

Paradontitis is another pathological affliction encountered among individuals from the lot in Tauț.

The periodontium is a dynamic structure composed of tissue surrounding and supporting dental items, interdependent with them. The tissue includes the gum, the periodontal ligament, the alveolar cement and bone, which are united through blood vessels and allow for the normal function of the periodontal tissue<sup>16</sup>.

Studies in paleopathology only note the stages of the alveolar bone, a structure undergoing constant processes of remodeling as a result of its adaptation to functional needs, mainly mastication and the reorientation of teeth following antemortem losses. Undoubtedly, surface alterations can also take place as a consequence of different factors, leading to the degeneration of the dental support<sup>17</sup>. “Some of the risk factors of this advanced periodontal disease can be severe mastication, the consistency of ingested foods, the lack of oral hygiene and a person’s gender and age”<sup>18</sup>.

<sup>13</sup> Robledo Sanz 1998, 215.

<sup>14</sup> Robledo Sanz 1998, 227.

<sup>15</sup> Robledo Sanz 1998.

<sup>16</sup> Holmstrup 1996.

<sup>17</sup> Molnar, Molnar 1985.

<sup>18</sup> Robledo Sanz 1998, 229–230.

Three such cases were identified in two male individuals with ages between 35–55, while another was encountered in the case of a 40–50 years old woman. If this periodontal disease causes the reduction of dental support and the retreat of the gum, the surface of the dental item remains more exposed to cariogenic agents.

*Enamel hypoplasia is another pathological affliction of the dental apparatus encountered in the present study.*

*Research of dental hypoplasia is highly significant in the analysis of a certain population's way of life. Hypoplastic alterations take place during the formation of dental crowns and this is why certain nutritional problems that individuals suffered during childhood can be observed.*

*“In 1984 Goodman and his collaborators were the first investigators of dental enamel hypoplasia during weaning. They noted the strong connection between the onset of hypoplastic lesions and the moment of dietary change from maternal milk to solid food. The risk of this alteration appears during this critical time that marks the passage to a more solid diet, with a lower percentage of proteins”<sup>19</sup>.*

Two cases of hypoplasia were encountered; one in the case of a mature adult individual, aged 45–55, showing two lines of hypoplasia on the right maxillary canine and another on the isolated mandible 07 that belongs to a woman around the same age as the male individual. Since only two such cases were noted among this group, one cannot follow its incidence according to gender. The only conclusion that can be drawn is that these two individuals survived the above mentioned infantile episode.

*Cribra orbitalia* is the last pathology to be analyzed here in the attempt to identify the type of diet of individuals recovered from the ossuary in Tauț. It manifests itself at the level of orbital palates. “This pathological element can be the result of nutritional anemia, following iron deficiency caused by a diet based on millet and wheat” (Campillo 2004, 230). Cereals contain iron but also fibers, phytates, phosphorous and tannins that inhibit iron absorption<sup>20</sup>.

Four cases of *cribra orbitalia* were identified, located on both orbital palates (Pl. 1/1; Pl. 1/2). Such pathological cases was encountered in a young male adult, a female senile adult, an adolescent and a 35–45 years-old woman.

## Conclusions

The stage of dental stress indicators and the pathological affliction caused by iron deficiency in the body contributed to the reconstruction of the subsistence mode of a number of individuals re-inhumed in the ossuary of the church in Tauț.

Recorded data on dental items allowed for the observation that there was a rather elevated percentage of antemortem tooth loss but also a high number of interproximal cavities associated to the loss of tooth crowns, i.e. the most serious affliction among dental lesions.

Undoubtedly, an economy most probably based on agriculture led to an increased percentage of carbon hydrate in the diet and on food easily remaining in the interproximal spaces between dental items and thus generating the cariogenic process<sup>21</sup>. A diet based on cereal intake also causes cup-shaped tooth wear<sup>22</sup>. This type of dental wear was encountered in certain individuals from the ossuary in Tauț (Pl. 1/3; Pl. 1/4).

In the case of this population, this type of diet is also supported by the presence of *cribra orbitalia* that can be the result of nutritional anemia following a deficit of iron in the organism. These results are not surprising since during the medieval period agriculture and animal husbandry probably held preponderance among the economical activities of this community.

## Luminița Andreica

“Francisc Rainer” Anthropological Institute Bucharest

Bucharest, RO

hera\_suzuki@yahoo.com

<sup>19</sup> Robledo Sanz 1998, 234.

<sup>20</sup> Bothwell *et al.* 1979.

<sup>21</sup> Robledo Sanz 1998.

<sup>22</sup> Neskuts *et al.* 1992.

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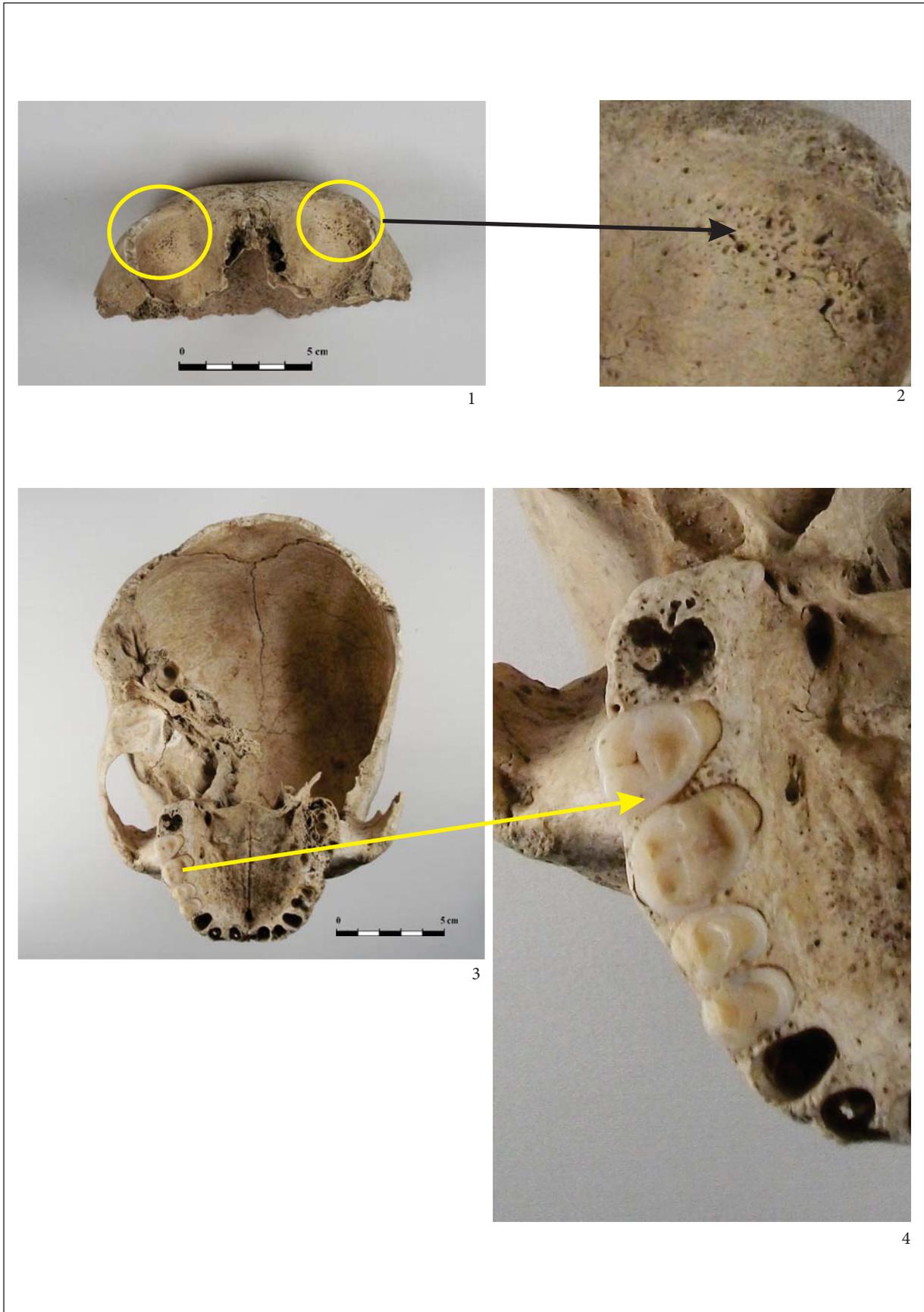


Plate 1. 1–2. *Cribrā orbitalia*; 3. the skull-inferior view; 4. left arch of the maxilla-dental wear in cup.

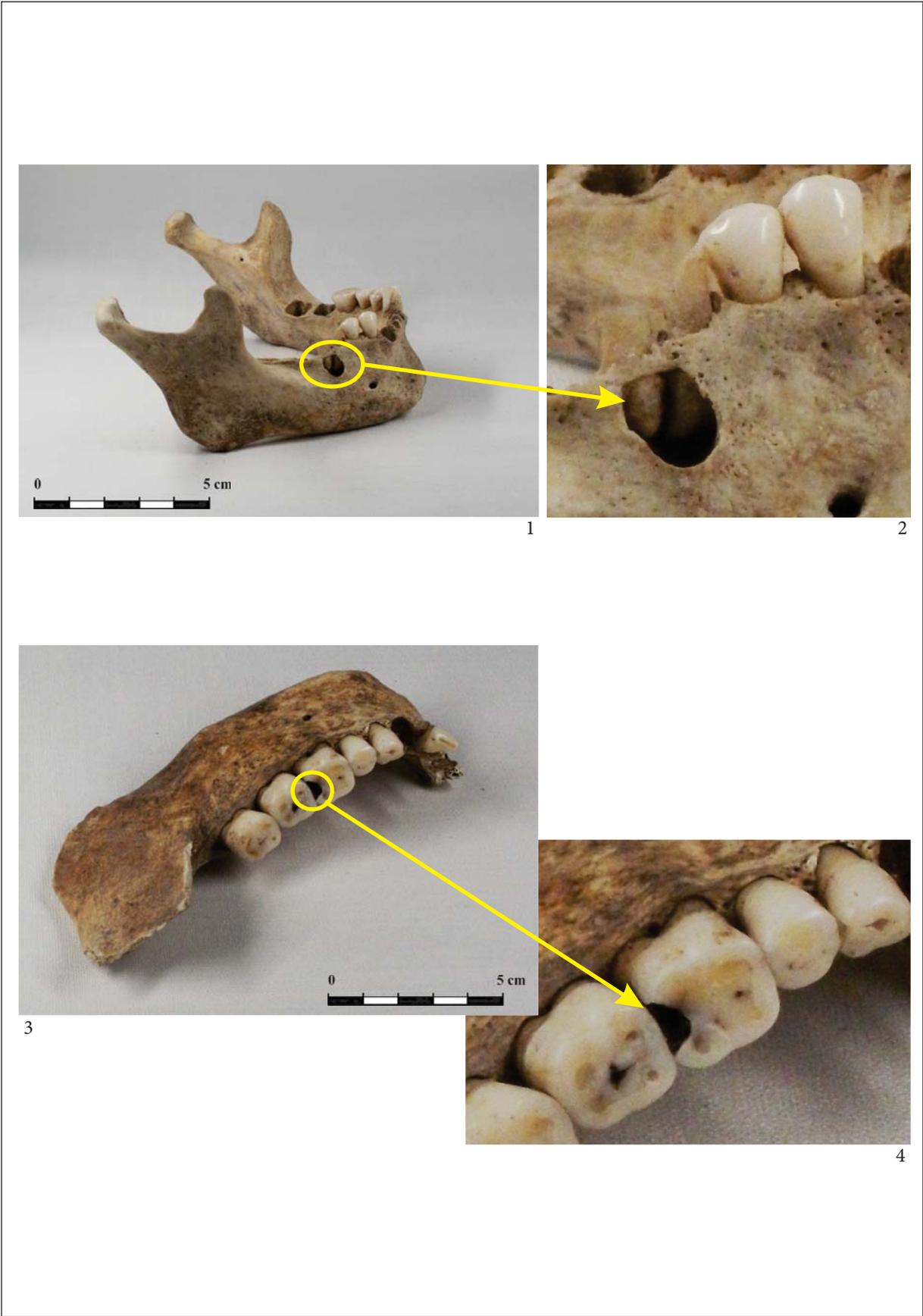


Plate 2. 1. Mandible-lateral view; 2. the arrow shows the abscess; 3. left mandibular body with an nonocclusal carie at M1, M2; 4. nonocclusal carie in detail.