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A CASE OF SEVERE METASTATIC CARCINOMA IN A LATE MEDIEVAL CALVA FROM PETROV, BRNO (CZECH REPUBLIC)

ABSTRACT: *An extensive multiple osteolytic process permeating the bones of an isolated calva, discovered in a layer of rubbish found during excavations in the interior of the Cathedral of SS. Peter and Paul in Brno, the capital city of Moravia, has been examined macroscopically, radiographically, by CT, histologically and by SEM. All these procedures disclosed a process compatible with a lytic metastatic carcinoma of unusual extent, which suggests that the afflicted old male must have been cared for by his relatives and others.*

KEY WORDS: *Cathedral of SS. Peter and Paul – Brno, Moravia – Late Middle Ages – Extensive diffuse osteolytic metastases – Carcinoma of soft tissue*

INTRODUCTION

One of the dominant buildings of the historical centre of the Moravian capital, Brno, is the Cathedral of SS. Peter and Paul, which stands atop a small rise called Petrov. In 1991–92 the interior of the church was investigated by archaeologists, in connection with the installation of an underground heating system (Unger, Procházka 1993). They discovered that the site of the cathedral had already been inhabited in the Late Stone and Bronze Ages (3000–4000 years ago), and afterwards from the transition between the 12th and 13th centuries A.D., in connection with the construction of the first, Romanesque-style church here. This church had a single nave, a crypt in its apse, and a choir. In the middle of the 13th century it was rebuilt into a three-nave Gothic basilica with a polygonal presbytery and two towers in the west front. Several other reconstructions followed, especially after the Thirty Years' War, when the church was heavily damaged by fire during the Swedish siege of Brno in 1643. In the 18th century the interior of the church was refurbished in Baroque style, and in 1777 it became a cathedral, i.e., the seat of a bishop.

At the turn of this century it was completely reconstructed in the neo-Gothic style, as is seen in its current appearance (Stránecký 1940).

During the salvage excavations a great number of human skeletal remains were found, attesting to the burial function of the interior of the church. Because the burials were deposited in a limited space from the 13th up to the 18th centuries, almost all the graves were heavily disturbed. The contents of some of them were dispersed without anatomical connection in several layers of rubble fill.

MATERIAL AND METHODS

Altogether 289 human remains from individual graves and a further approx. 370 individuals represented by loose bones (calculated by skulls and skull fragments) were examined at the laboratory for medical anthropology of the Institute of Anatomy in Brno. Of the remains found in the graves, 204 were adults, of which 126 were males, 36 females and 39 of undetermined sex, due to the fragmented state of the remains. There were, moreover, the

remains of 4 fetuses and 84 immature individuals, of which 13 were newborns, 26 infants I, 18 infants II and 7 juveniles, while in a further 20 cases determination of the precise age was not possible because of the poor state of preservation.

In contrast to this demographic distribution, it was not possible to process the loose bones found in the rubbish. All of them were, nevertheless, examined from the palaeopathological point of view, and all the specimens revealing pathological changes were separated. Among the human remains originating in a layer of rubbish dated by archaeological artifacts to the 14th–15th centuries was revealed the calva of an adult with extensive pathological changes, which became the object of the present study.

Macroscopic description, standard radiography, computer tomography, light histology and electron-scanning microscopy were used in the investigation.

RESULTS

State of preservation

Only a damaged calva has survived, with the lower edges of the frontal scale as well as the right lateral and the lower parts of the occipital scale all broken off.

Age determination

The cranial sutures are completely obliterated from the inside. From the outside, the coronal suture is apparent in the middle parts of both its halves, while remnants of the sagittal and lambdoid suture have been preserved in places. These features suggest an advanced age for the individual, in the range above 50 years.

Sex determination

The calva is of medium thickness (5 mm on the right parietal boss, 6 mm on the left one). The parietal bosses are not prominent, the nuchal muscular relief is outstanding, but the *protuberantia occipitalis externa* is only of grade 1 of Broca (Martin, Saller 1959). Sex determination, based on such a limited amount of features, the first of which could have been influenced by the disease, can be only tentative. We may only suggest the slightly greater probability of the male sex.

Macroscopic description

Viewed from outside, the whole calva is permeated with osteolytic foci and porotic areas (Figures 1–2). Viewed from inside, most of the surface appears diffusely porotic, with less osteolytic foci (Figure 3).

The osteolytic foci have some common features, such as less definite delimitation. Their outlines are not circular or oval, but irregular and tipped, surrounded by areas of fine pitting. Their edges have been undermined in places, thus showing the spread of the process in the diploe. No apparent newly-formed bone can be found in their proximity. Altogether seven osteolytic foci and two areas of pitting can be discerned on the *lamina externa*, as follows:

1. A medium-sized perforation of irregularly rhomboid outline with tips (10×6 mm), situated 53 mm posterior to the coronal suture and close to the left of the sagittal suture.

2. A small, irregularly star-shaped perforation (4×5 mm), apparent more dorsally, 67 mm posterior to the coronal suture and close to the right of the sagittal suture.

3. An opening shaped like a rectangular triangle (sides 9 mm, hypotenuse 11 mm) on the left half of the lambdoid suture, 19 mm left of the lambda. It has straighter and sharper edges than the other foci, and could have been enlarged secondarily in place of a focus situated in the diploe and apparent from inside the calva, into which a bit of the denticulation of the suture was, also secondarily, impressed.

4. A circular depression (not perforating the inner lamina) can be found 39 mm left of the lambda, close to the anterior edge of the suture (diameter 5 mm, depth 1 mm). Its bottom forms the thick spongiotic bone of the diploe.

5. An irregularly oval perforation of all three layers of the bone (5×4 mm) occurs 24 mm right of the lambda at the anterior edge of the lambdoid suture. On the inner lamina this perforation is marked as an oval defect (9×6 mm) confluent with another circular defect (diameter 4 mm) which does not penetrate the outer lamina. The edges of the defects are irregularly frayed.

6. Another irregularly rounded perforation is situated 57 mm right of the lambda and 19 mm anterior to the lambdoid suture. It penetrated through the diploe to the inner lamina by a smaller oval perforation (5×4 mm) and merged with two further defects situated medially (9×7 mm, 5×3 mm).

7. A crescent-shaped defect (5×2 mm) of the outer lamina can be detected 12 mm caudally of the *protuberantia occipitalis externa*. It ends within the coarsened trabeculae of the diploe, not penetrating the inner lamina, as it lies on the site of the *protuberantia occipitalis interna*.

8.–9. Other foci of the same process manifest themselves as smaller or larger clusters of tightly-packed fine to medium-sized pitting in the outer lamina, of which two larger ones can be seen on the right parietal bone (Figure 2). The first of them, occupying an area of 30×30 mm, lies 35 mm lateral to the sagittal suture and 30 mm posterior to the coronal suture. The second one, of circular outline (diameter 20 mm), is situated 13 mm right of the sagittal suture and 29 mm anterior to the lambdoid suture.

Smaller and less well-defined areas of similar character can also be found on other places of the outer lamina.

In the inner lamina (Figure 3), besides foci penetrating from the outside, other, relatively extensive islets of pitting situated in the bregmatic region, along the *sinus sagittalis superior* and in the *protuberantia occipitalis interna* can be discerned.

Besides these, there are defects of the inner lamina that have no connection with the foci described in the outer lamina, dispersed along at least ten places on the inner

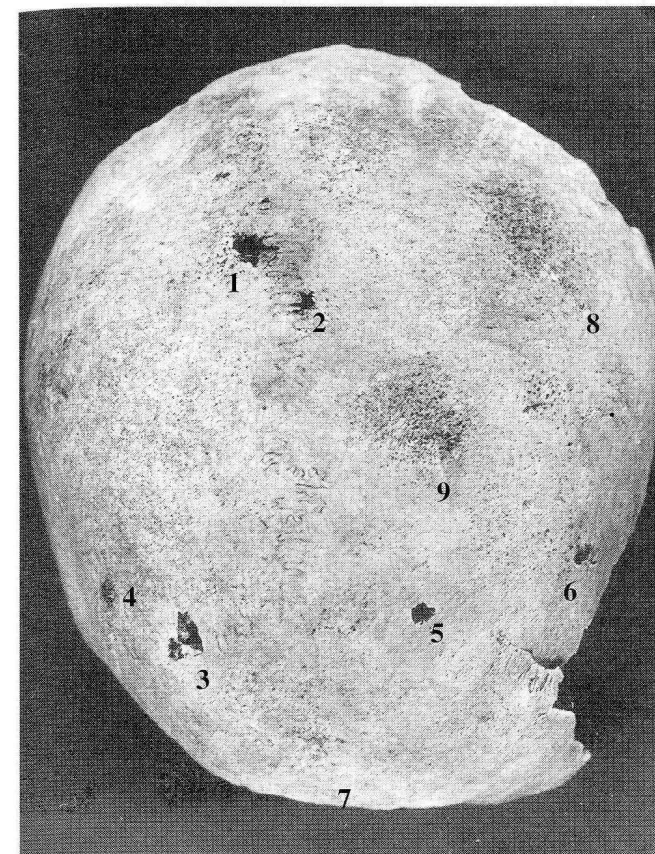


FIGURE 1. Calva of an old male in vertical view.

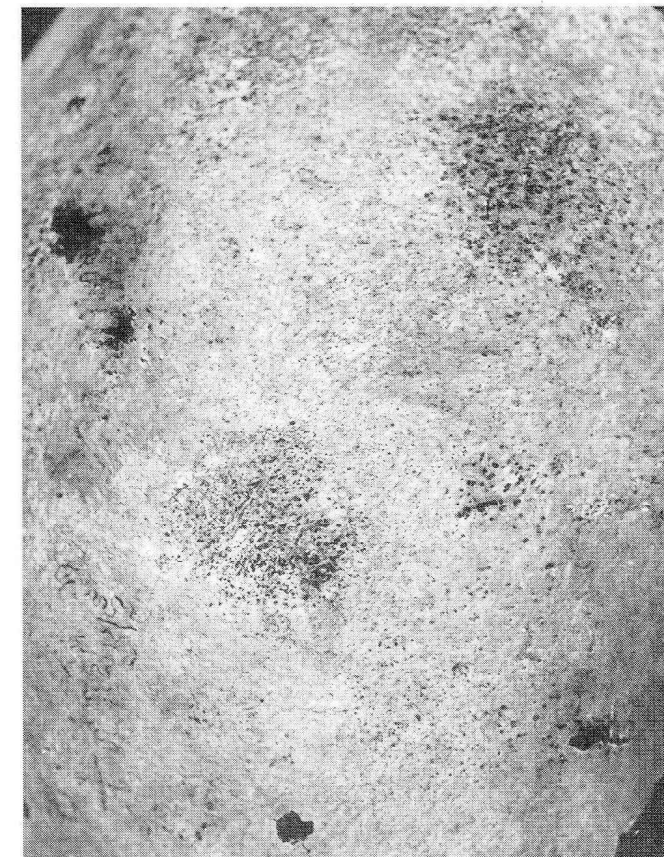


FIGURE 2. Detail of the pathological changes on the right parietal bone.

FIGURE 3. The same calva in basal view, showing pathological changes to the interior of the braincase.

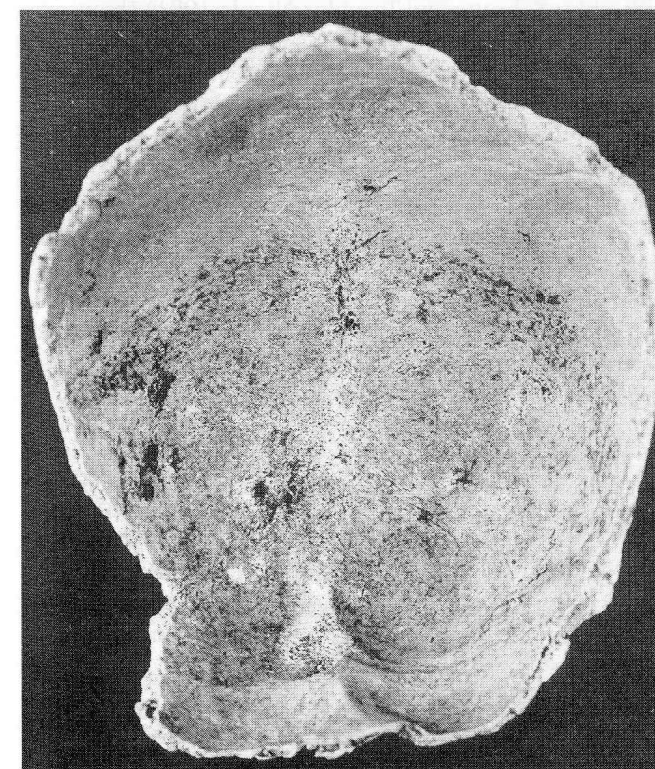
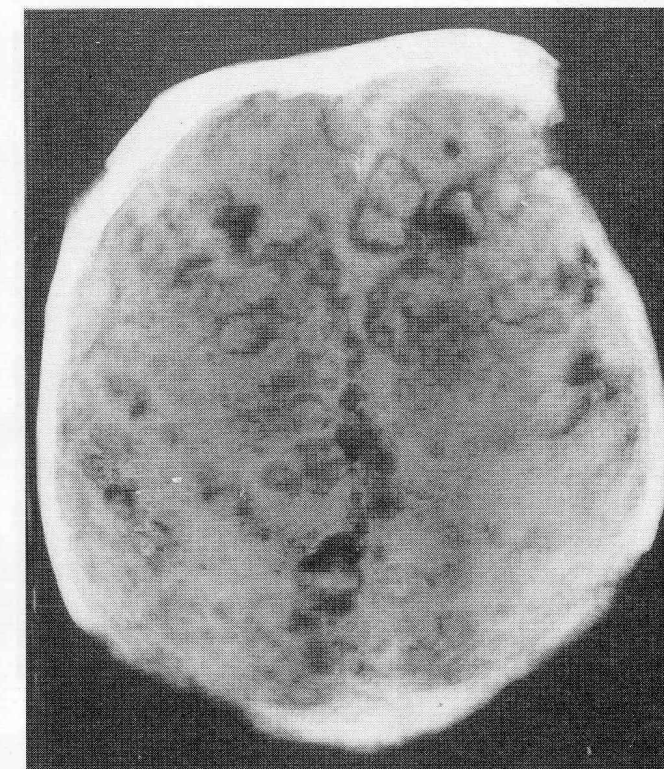


FIGURE 4. Axial radiograph revealing spotted character of the shadow, with lucid and ring-shaped foci.



surface. They mostly have an outline which is irregular, fissure-like, star-shaped, oblong or square, yet almost always tipped. The biggest of them (10×6 mm) lies on the right parietale 44 mm lateral to the sagittal suture and 40 mm anterior to the lambdoid suture, and merges with further irregular defects lateral to it.

Standard radiography

In all three projections (posterior-anterior, lateral and axial, the last one in *Figure 4*) the structure of the bony shadow appears as spotted, with some medium-sized, not sharply delimited foci of complete lucidity and curious ring-shaped formations. In the centre of the latter are preserved remnants of the original bony tissue, while the transparent ring-shaped zone marks its destruction. Generally, the bone shadow is permeated by a quantity of small foci with unsharp limits, merging together in places.

CT picture

The calvarial bones are, generally, extensively and tightly packed with a quantity of small to larger foci in the diploe (diameter 1–11 mm), with not very sharply-defined edges. They have a definite osteolytic character, without any reaction in the vicinity (*Figure 5*). They either do not perforate the laminae, or destroy only the outer or inner lamina, or perforate the whole thickness of the bone. In no place was a change of the shape of the calva caused by expansion of the process was revealed.

Light histology

The trabeculae of the spongiotic bone reveal destruction on thin-sections (*Figures 6 and 7*). Howship lacunae – places left by the original location of large cells (osteoclasts) engaged in the destruction of the bony tissue

– are apparent on their surface. In thin-sections dyed with toluidin blue, the trabeculae are blue and the remnants of cellular matter on their surface violet. Some of the trabeculae retained their original lamellar structure and a small number of lacunae for the osteocytes.

SEM

In the foci, the compact layer was removed, and thick, irregularly devoured spongiotic trabeculae were exposed (*Figure 8*). The trabeculae are covered over their whole surface with a number of Howship lacunae, in which osteoclasts and other cells were originally situated (*Figure 9*). In the lacunae, remnants of cellular membranes have survived (*Figure 10*).

Diagnostic conclusion

The changes described in all aspects of our examination are characteristic of a malignant process with multiple destructive foci, virtually without reactive response from the organism, very probably a lytic metastatic carcinoma. The peculiarity of the case is in the extensive dissemination of the metastases in the cranial bones, which were surely accompanied by similar afflictions to the remaining parts of the skeleton, which have not survived. This afflicted male could not have survived to such an advanced stage of this malignant disease without care from his relatives and other people.

DISCUSSION

A similar case of a mature adult (33–55-year old) female from grave 7/1984 of the Late Roman (4th–5th cent. A.D.) cemetery at Linz (Austria, former Roman Lentia, Wiltshke-Schrotta and Teschler-Nicola 1991) shows circular perforations on its cranial vault and large zones with outstanding “worm-prickle-like” porosity. The corticalis is very thin, resulting in the spongy appearance of the bone. The edges of the defect are moth-like denticulated. A zone of porous newly-formed bone was deposited on the temporal scale. Further osteolytic defects with denticulated edges, radiographically unsharp, were found in the vertebra, costae, corpus sterni, pelvis, scapulae and clavicles, and the proximal halves of humerus and femur. The authors did not decide whether this was a case of osteolytic metastatic carcinoma or of multiple myeloma. In our opinion, the former diagnosis seems more probable.

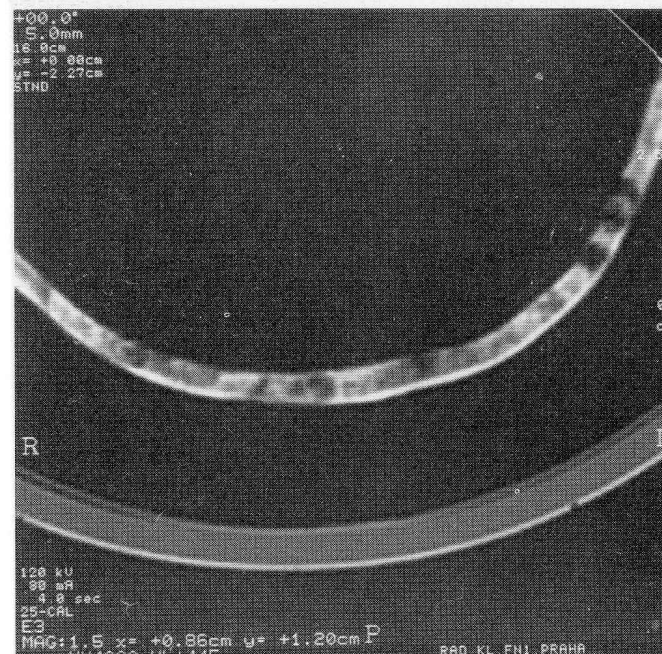


FIGURE 5. CT section of the calva, extensively tightly-packed with lytic foci of different sizes in the diploe, either not penetrating, or penetrating one or both of the laminae.

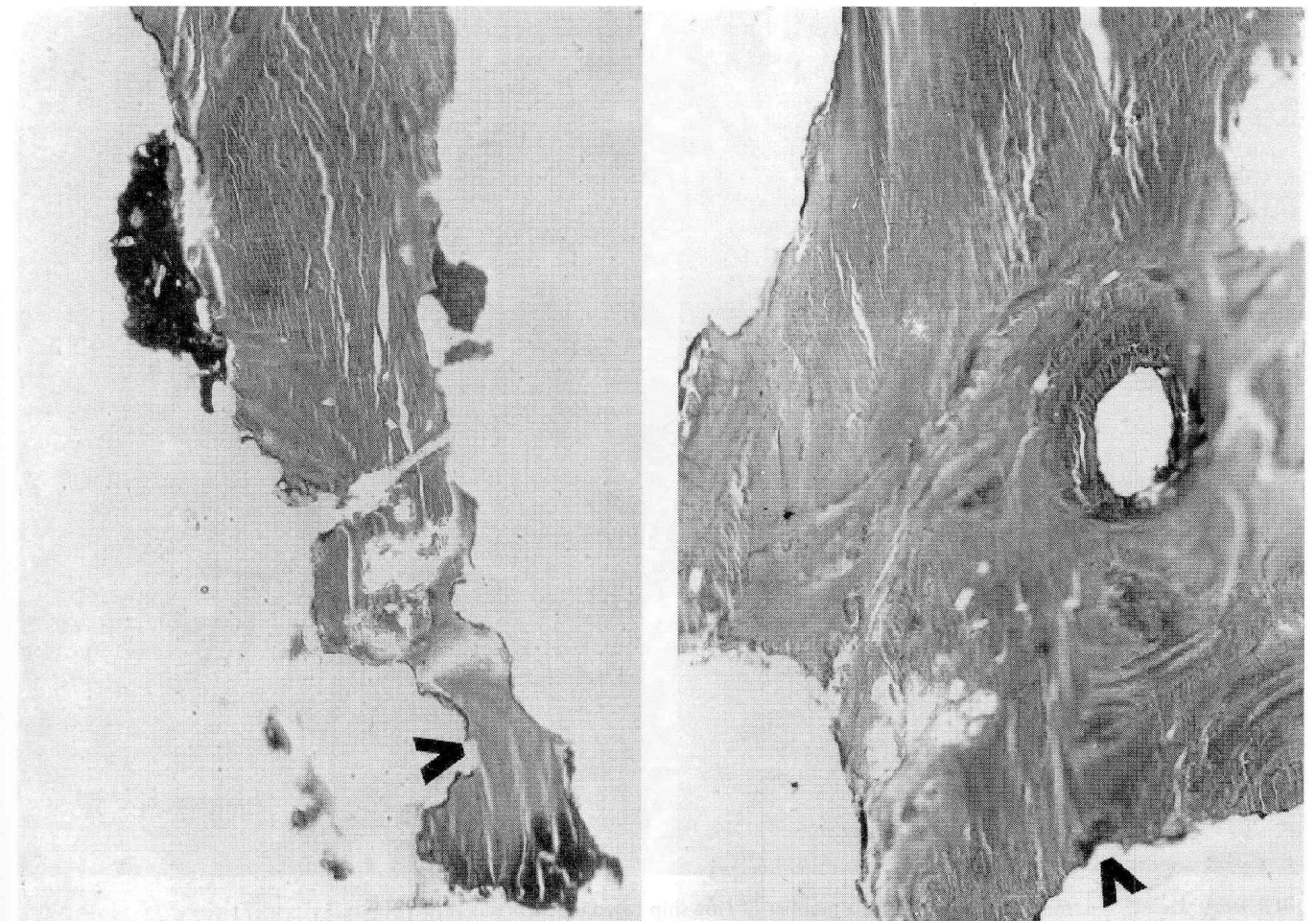
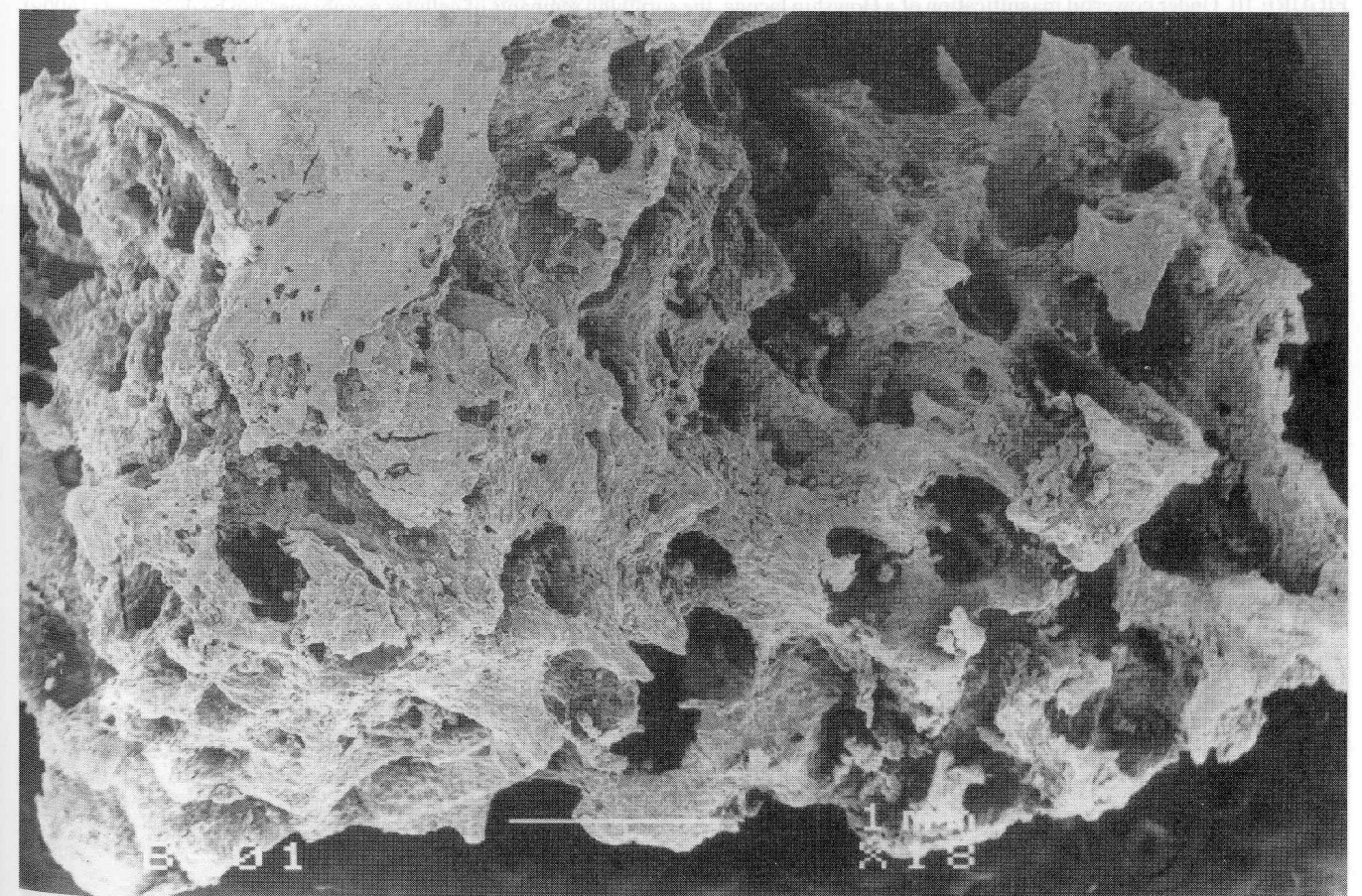


FIGURE 6. A spongiotic trabecula, dyed with toluidin blue, has been gnawed by osteoclasts originally present in the Howship lacunae (V), and retains a mass of darkly-stained cellular elements on its surface (63×). →

FIGURE 7. Lamellar structure, lacunae after osteocytes and Howship lacunae are better evident with greater magnification (160×). →

FIGURE 8. SEM picture captures the transition between an edge of the gradually-destroyed outer lamina and the thick, irregularly-devoured spongiotic trabeculae of a focus (18×). →



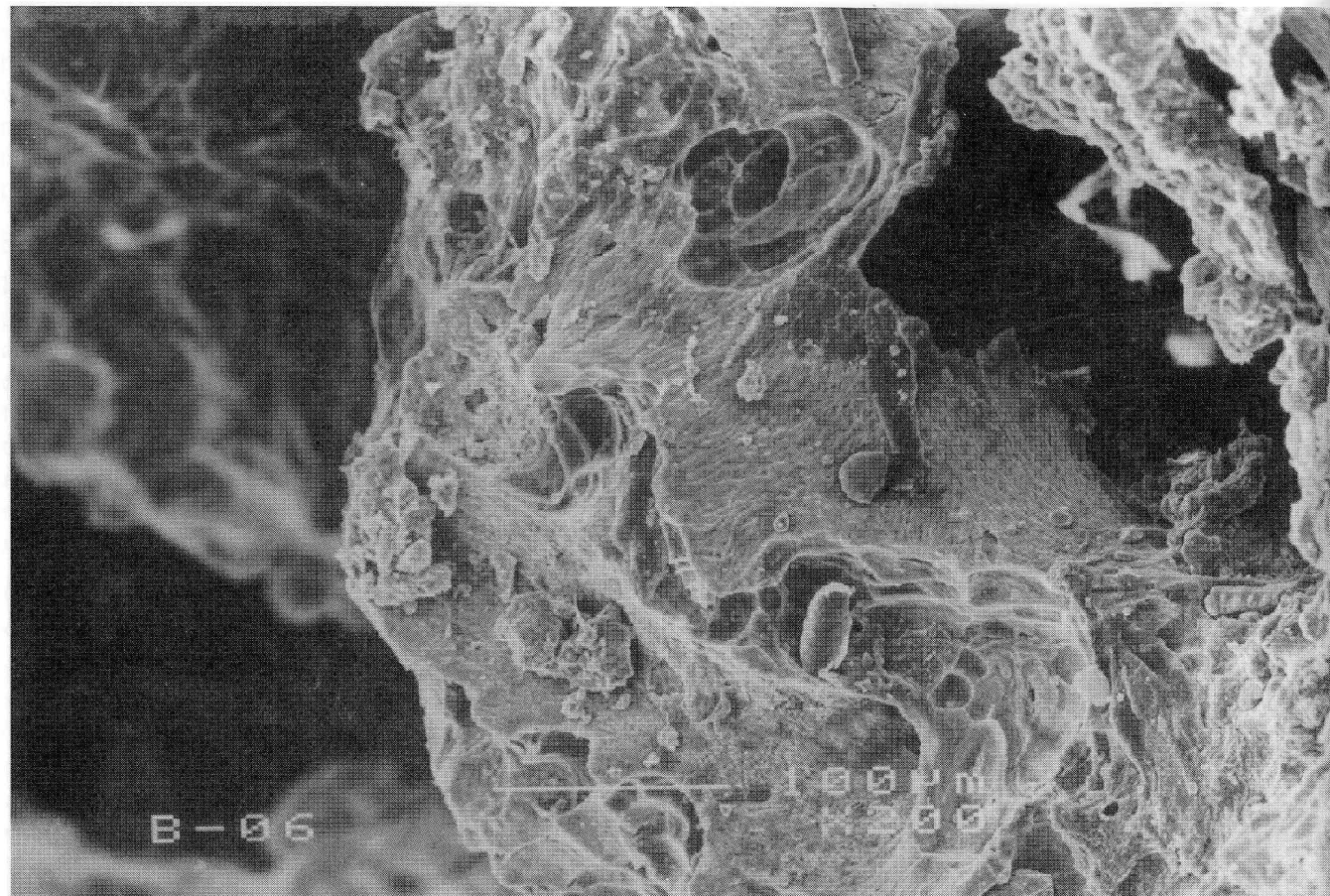
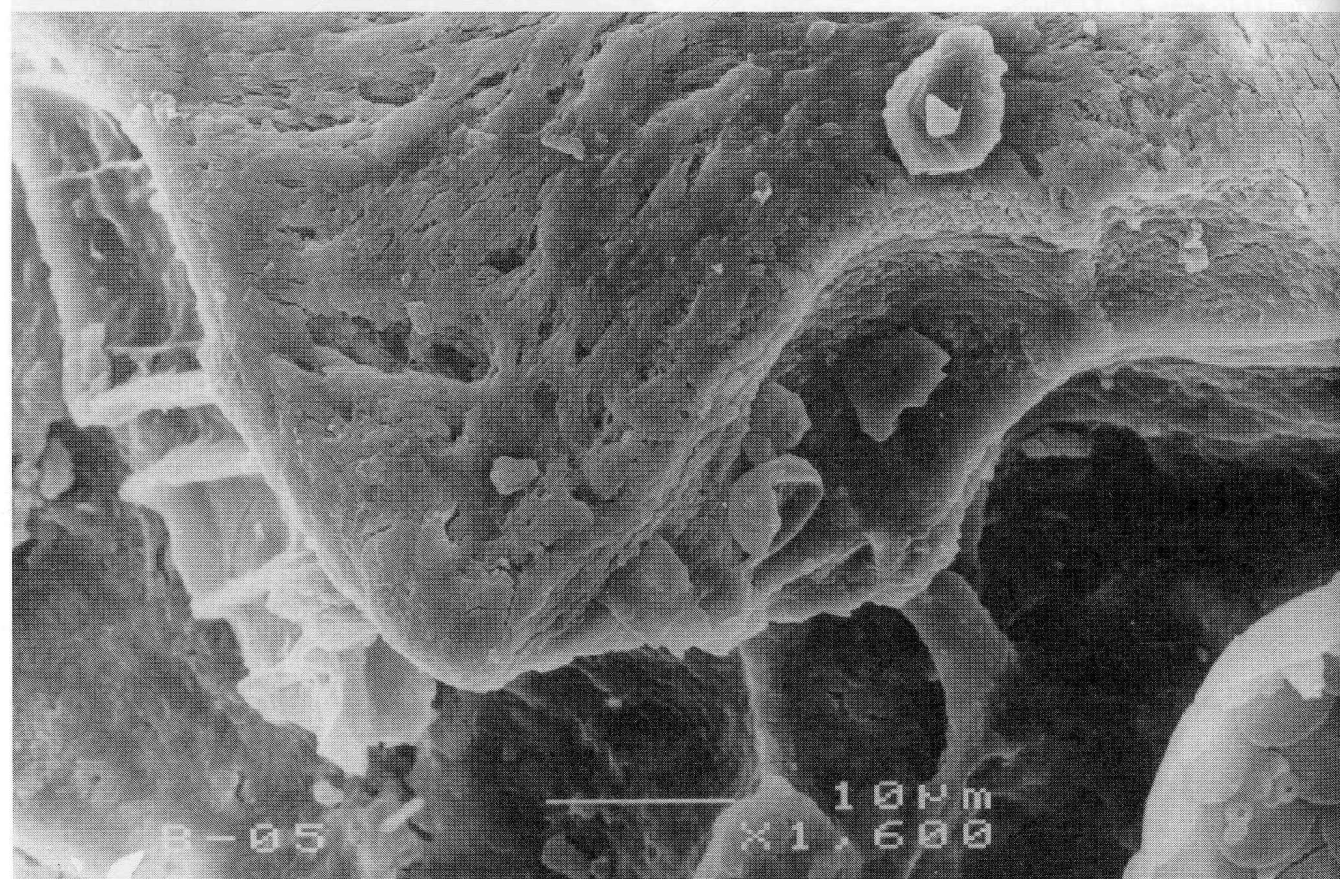


FIGURE 9. Detail of a trabecula covered with a number of Howship lacunae (200×).

FIGURE 10. Under powerful magnification of a Howship lacuna, the surviving remnants of cellular membranes can be discerned (1600×).



Among 105 well-documented and plausibly-diagnosed cases of malignant tumours in the Old World as found in the literature and recorded by one of us, more than half (56 cases, 53.3%) were cases of metastatic carcinoma. Of these, far more (42 cases, 71.2%) were lytic than osteoblastic and mixed ones (17 cases, 28.8%) (Strouhal 1995). The case described from Petrov in Brno has been included among them, together with other two recently-detected cases from another Moravian Late Medieval – Early Modern site, Křtiny (Strouhal *et al.* 1996).

Our research on malignant cases in the archaeological record and older anthropological collections continues, with the aim of showing occurrences of different kinds in various times and regions of the Old World in the past.

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