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Natural Endocranial Casts of the *Mustelinae* from Węże I near Działoszyn (Poland)

[Plate XI, 7 text-figs.]

Naturalne odlewy endocranium *Mustelinae* z Węży I koło Działoszyna (Polska)

Abstract. The characteristics of the external structure of the brains of *Mustela plioerminea* STACH, *Mustela pliocaenica* STACH and *Martes wenzensis* STACH are presented on the basis of their endocranial casts. *Mustela plioerminea* STACH is related to *Mustela putorius* L. and *Martes wenzensis* STACH to *Martes zibellina* L.

INTRODUCTION

The locality Węże I is situated in the reserve Zelce near Działoszyn in the Sieradz province. There was a vertical funnel there, communicating at the bottom with a horizontal passage, which was a part of cave, and filled with deposit containing remains of big and small mammals and other terrestrial vertebrates (SAMSONOWICZ, 1934, GŁAZEK et al., 1973). In addition to the skeletal fragments, some natural endocranial casts were also preserved in the deposit. An endocranial cast of *Desmana kormosi* SCHREUDER has been described from Węże I by SYCH and RZEBIK-KOWALSKA (1972) and that of *Arctomeles pliocaenicus* STACH by CZYŻEWSKA (1978).

GŁAZEK et al. (1973) distinguished several sedimentation cycles in the deposits of the cave at Węże I. Some specimens of *Martes wenzensis* STACH and *Mustela plioerminea* STACH have been extracted from red clayed-sandy deposits and those of *Mustela pliocaenica* STACH from grey limestone (grey bone breccia). These deposits belong to the second or third cycle of sedimentation and were formed in the Pliocene.

The present paper contains a description of the endocranial casts and characteristics of the brains of *Mustela plioerminea*, *Mustela pliocaenica* and *Martes wenzensis (Mustelinae)*. These three species have been described by STACH (1959) and this paper gives some complementary remarks and/or more precise opinions on affinities between them and the other *Mustelinae*.

Anatomical terminology is that used by BRAUER and SCHOBER (1970) and

STELMASIAK (1958). Skulls of male and female *Mustela erminea* L. (99 specimens), *Mustela nivalis* L. (86), *Mustela putorius* L. (2), *Martes martes* L. (3) and *Martes foina* ERXL. (3) were used as comparative material. These specimens are in the possession of the Museum of Natural History, Wrocław University (MPUW). Latex endocranial casts have been made for these modern species.

The specimens of *Mustelinae* from Węże I belong to the Museum of the Earth (Muzeum Ziemi), Polish Academy of Sciences, in Warsaw and are marked with the symbols MZ VIII-V-355/5—9.

My grateful thanks are owed to Prof. K. Kowalski, Head of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Kraków, for granting access to the specimens described by STACH (1959) and to Prof. W. Rydzewski, Director of the Museum of Natural History, Wrocław University, for lending me the skulls of contemporary *Mustelinae* and permitting me to perform latex casts. I am also indebted to Mrs. B. Drożdż for doing photographic work for this paper.

MUSTELA PLIOERMINEA STACH 1959

Material

Incomplete skull with partly uncovered cast of endocranium of left side, MF/341/60, Inst. of Syst. & Exp. Zoology, P. A. S., Kraków (STACH, 1959, Pl. XI, Figs. 1 and 2).

Cast of endocranium without frontal and occipital regions, MZ VIII-V-355/5.

Description (Pl. XI, Figs. 1 and 2)

The following details of the external structure of the brain have been preserved in the endocranial casts of *Mustela plioerminea* STACH: seen from above, the brain of this species mildly narrowed towards the front, showing also small fragments of the palaeopalium in this position. The top line of the profile was

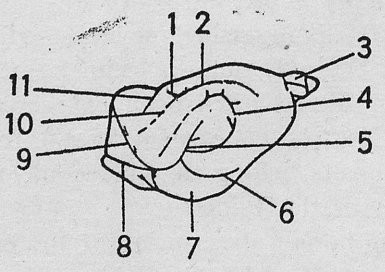

Fig. 1. *Mustela plioerminea* STACH, MZ VIII—V—355/5, Węże I, Pliocene. Endocranial cast, seen from the left side, x 1.

1. ansate sulcus, 2. lateral sulcus, 3. fragment of cerebellum, 4. suprasylvian sulcus, 5. sylvian fissure, 6. posterior rhinal sulcus, 7 pyriform lobe, 8. anterior rhinal sulcus, 9. presylvian sulcus, 10. coronal sulcus, 11. cruciate sulcus

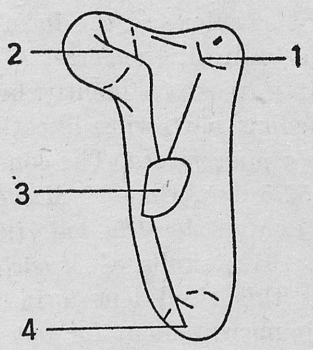

Fig. 2. *Mustela plioerminea* STACH, MF/341/60 Węże I, Pliocene. Fourth upper premolar. Diagram of crown surface, x ca 9
1. parastyle, 2. deuterocone, 3. paracone, 4. metacone

slightly bent in at the place of the cruciate sulcus and the posterior margin of the hemispheres was strongly rounded. The distinctly marked sulci are as follows: the lateral sulcus with a short posterior segment, the small ansate sulcus, the coronal sulcus, running latero-anteriorly, and the cruciate sulcus, long and somewhat deflected to the front. The medial suprasylvian sulcus had two additional oblique short furrows. The sylvian fissure was short and deep and the postcruciate sulcus had the form of a small pit situated in front of the coronal sulcus. The rostral ectosylvian gyrus was narrower than the caudal. The anterior rhinal sulcus, running along the isolated olfactory tract, joined the presylvian sulcus. The olfactory bulbs were comparatively large and so were the ethmoturbinalia.

The blood-vessels of the brain surface of *Mustela plioerminea* were represented by the anterior and the posterior branch of the medial cerebral artery. The former branch appeared anterior to the pyriform lobe and ran further along the anterior suprasylvian gyrus branching repeatedly, and the latter extended behind the pyriform lobe. The sagittal and, posteriorly, the transverse sinus occurred along and between the cerebral hemispheres and small venous vessels tended to them on the posterior surface of the hemispheres.

On the ventral aspect the casts of troughs leading to the foramen rotundum (n. V) and orbital fissure were characterized by fairly long diameters.

The greatest height of the endocranial cast of *Mustela plioerminea*, MZ VIII-V-355/5, is 14.6 mm, the greatest width 20.6 mm the width at the level of the cruciate sulcus 11.7 mm and the ratio of the greatest width to the width at the level of the cruciate sulcus 56.8.

Remarks

The presence of distinct traces of the ansate sulcus, a short posterior segment of the lateral sulcus, and the distiction of the medial suprasylvian sulcus on the endocranial cast do not permit the identification of *Mustela plioerminea* STACH with *Mustela erminea* L., the brain of which has no such sulci. On the

other hand, the arrangement of sulci and the form of the casts resemble those in *Mustela putorius* L. The brain of the ferret (THIEDE, 1966) is marked by some variation in shape; it is most frequently broadening in the front, but it may also show a conspicuous narrowing like that in the ermine, and this very sharpe occurs in *Mustela plioerminea*. The condylobasal length of the skull of *Mustela plioerminea* is 52.5 mm, that of *Mustela erminea* ranges between 32 and 53 mm and in the case of *Mustela putorius* between 51 and 71.8 mm (KOWALSKI, 1964; MILLER, 1912; skulls of *Mustela erminea* and *Mustela putorius* from MPUW). Thus this skull length in *Mustela plioerminea* STACH lies within the range of this measurement for both the ermine and the ferret.

RABEDER (1976) thinks that the species *Mustela plioerminea* described by STACH (1959) does not belong to the group *Mustela erminea* or *Mustela palerminea-nivalis*.

Mustela plioerminea differs from *Mustela erminea* also in its greater dimensions and the structure of the first upper molar. This tooth of *Mustela plioerminea* is relatively longer, more constricted in the median line, its big paracone has one edge, metacone is small and low, protocone also low and presumably damaged (without the edge), with a cingulum at the anterior and posterior lingual margins.

Although the brains of *Mustela plioerminea* and *Mustela lutreola* L. (BRAUER & SCHOBER, 1970; PILLERI, 1960) resemble each other in external structure, these species differ in the structure of P^4 and M^1. In the first of them the parastyle of P^4 is less pronounced in contradistinction to its well-developed deuterocone. Its paracone has 2 anterior edges (Fig. 2). The metacone of M^1 is distinctly smaller, its cingulum, surrounding the crown, being far better developed.

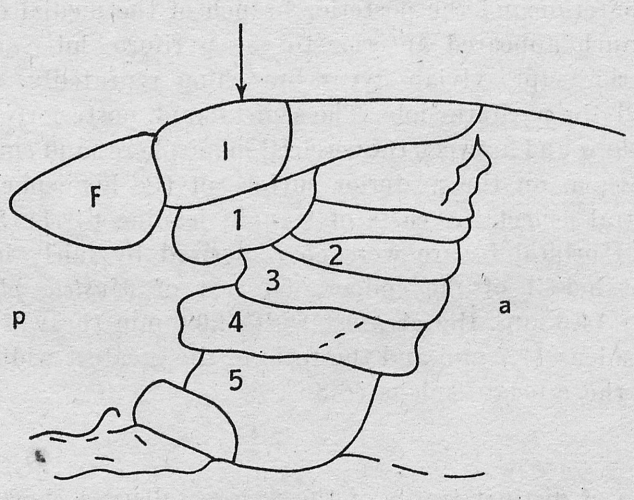

Fig. 3. *Mustela pliocaenica* STACH, MZ VIII—V—355/7, Węże I, Pliocene. A diagram of the cast of the conchae, x ca 4

1. nasoturbinale, 1—5 ethmoturbinalia, a — front, p — back. The arrow indicates the position of the postorbital process

The reduction of M^1 in *Mustela plioerminea* is intermediate between the state in *Mustela lutreola* and that in *Mustela putorius*.

Compared with modern *Mustela putorius*, *Mustela plioerminea* is a small musteline, showing a lower degree of reduction of M^1 and P^2, and its M^1 has a better developed cingulum. *Mustela plioerminea* had a good sense of smell as evidenced by its relatively large olfactory bulbs and ethmoturbinal bones (SAVAGE, 1977).

MUSTELA PLIOCAENICA STACH 1958

Material

Skull with left side of endocranial cast surface uncovered, MF/341/60, from the Inst. of Syst. & Exp. Zoology, P. A. S., Kraków (STACH, 1959, Fig. 4).

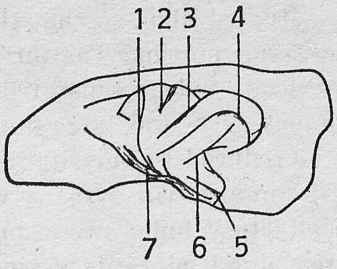

Fig. 4. *Mustela pliocaenica* STACH, MF/341/60, Węże I, Pliocene. Diagram of a fragment of the endocranial cast uncovered on the left side of the skull, x 1
1. presylvian sulcus, 2. cruciate sulcus, 3. coronal+lateral sulcus, 4. suprasylvian sulcus, 5. posterior rhinal sulcus, 6. sylvian fissure, 7. anterior rhinal sulcus

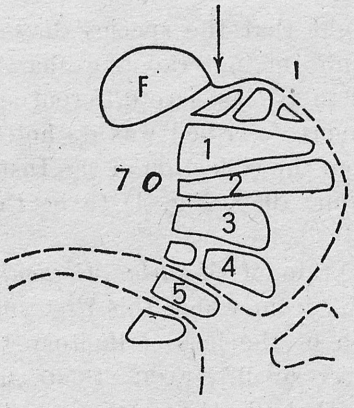

Fig. 5. *Mustela nivalis* L., No. 78 MPUW, contemporary. A diagram showing the distribution of the conchae on the right side of the skull, x ca 3. nasoturbinale, 1—5 ethmoturbinalia, 7. optic foramen. The arrow indicates the position of the postorbital process, the margin of the orbit marked with broken line

Damaged skull with endocranial cast and left tympanic bulla, MZ VIII-V 355/6.

Fragment of anterior cranial region with cast of respiratory part of nasal cavity, MZ VIII-V-355/7.

Description (Figs. 3 and 4)

Both skulls of *Mustela pliocaenica* are similar in size and show a shallow depression at one-half of the length. The brain-case, seen from above, is elongated and ovate. The endocranial casts of *Mustela pliocaenica* illustrate the following characters of the structure of the brain (Fig. 4): the hemispheres narrowed gradually to the front and the ratio of the greatest width of hemispheres to their width at the level of the cruciate sulcus was 50.6 (MZ VIII-V-355/6). The profile of the hemispheres lowered gradually towards the rear where they hardly protruded above the cerebellum. Compared with the hemispheres the cerebellum was situated high, so that the top surface of the vermis, was at the level of their posterior portion. The furrows of the cast surface are relatively well seen. The cruciate sulcus separated the big precruciate gyrus from the cruciate. The proraeus gyrus was large in area and the coronal sulcus joined the lateral, which was reduced to only its middle part. The ansate sulcus was lacking, the rostral suprasylvian gyrus was narrow and the caudal suprasylvian broader. The olfactory bulbs were big and the conchae large and elongated, their casts reaching backwards beyond the postorbital process, i. e. father than in *Mustela nivalis* (Figs. 3 and 4). On the surface of the casts there are traces of blood-vessels.

Remarks

RABEDER (1976) thought that the species *Mustela pliocaenica* STACH had been described from ununiform material and that the mandibles mentioned by STACH (1959) belonged to at least two different species; neither had it been given which of the specimens described was its holotype. Here, I assume specimen No. MF /341/ 60 from the collection of the Inst. of Syst. & Exp. Zoology, P. A. S., in Kraków (STACH, 1959, Fig. 4) to be the holotype of the species *Mustela pliocaenica*.

The structure of the brain of *Mustela pliocaenica* resembled that of the brain of *Mustela nivalis* L., from which this first species differed in its better developed olfactory region of the head (olfactory bulbs, nasal region of the skull), suggesting its better smell. STACH (1959) and RABEDER (1976) have discussed the differences and similarities in the structure of the skull and dentition between *Mustela pliocaenica*, *Mustela nivalis* and *Mustela praenivalis* KORMOS.

MARTES WENZENSIS STACH 1969

Material

Fragment of facial region of skull, MF/342/60, from the Inst. of Syst. & Exp. Zoology, P. A. S., in Kraków (STACH, 1959, Fig. 6).

Fragment of posterior part of endocranial cast without frontal region, MZ VIII-V-355/8.

Damaged skull with endocranial cast, MZ VIII-V-355/9.

Description (Figs. 6 and 7)

The cerebral hemispheres of this species were relatively broad at the front, as indicated by the high value of the ratio of the greatest width of the hemispheres to the width at the level of the cruciate sulcus, equal to 69.8 in specimen MZ VIII-V-355/8. The lateral sulcus was long, with its caudal part bent downwards. The ectolateral and ansate sulci were also present. The ventroorally arching coronal sulcus surrounded a conspicuous gyrus, which bore the short postcruciate sulcus. The cruciate sulcus ran transversely, only slightly

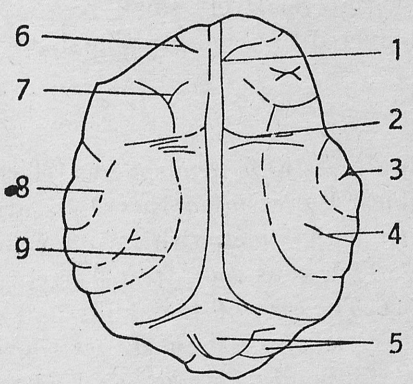

Fig. 6. *Martes wenzensis* STACH, MZ VIII—V—355/8, Węże I, Pliocene. A diagram showing a fragment of the endocranial cast seen from above, x 1
1. sagittal sinus, 2. transverse sinus, 3. sylvian fissure, 4. ectolateral sulcus, 5. cerebellum, 6. cruciate sulcus, 7. ansate sulcus 8. suprasylvian sulcus, 9. lateral sulcus

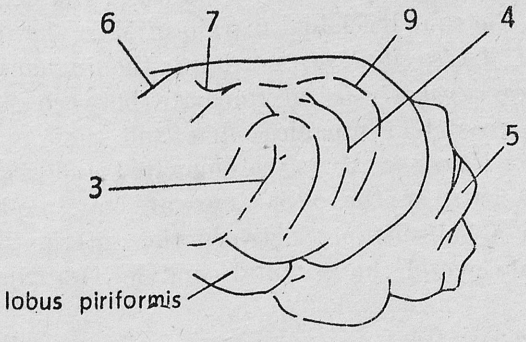

Fig. 7. *Martes wenzensis* STACH, MZ VIII—V—355/8, Węże I, Pliocene. Diagram showing a fragment of the endocranial cast seen from the left side, x ca 1. For explanation see Fig. 6

deviating to the front; on the right hemisphere of specimen MZ VIII-V-355/8 it joined the coronal sulcus. The regular arch of the suprasylvian sulcus surrounded the sylvian fissure. The rostral ectosylvian gyrus was much narrower than the caudal.

The dorsal sagittal sinus extended along the hemispheres and the pronounced tranverse sinus lay posteriorly, behind the ansate sulcus. Numerous small blood-vessels joined these sinuses. A branch of the medial cerebral artery ran obliquely across the surface of the gyrus between the ectolateral and lateral sulci; towards the front it bent, giving many ramifications.

In relation to the length of the tympanic bullae the base of skull of *Martes wenzensis* was narrow. The length of tympanic bulla of specimen MZ VIII-V-355/9 is 20.6 mm, the width 9 mm, and the length: width ratio 43.7. In the medial region the inside of the tympanic bulla was divided by bony crests transversely into four parts, varying in size (HUNT, 1974), which in the cast of the bulla is reflected by transverse furrows. The single condylar canal is preserved fragmentarily. The troughs leading to the orbital fissure and round foramen (nn. III, IV, V_1 and V_1) were relatively small across.

The cerebellum was covered to a considerable degree by the cerebral hemispheres.

Remarks

In the shape of the brain, with its hemispheres relatively broad in the front. *Martes wenzensis* resembles *Martes foina* ERXL. Its arrangement of sulci and gyri does not deviate from that met with in other species of *Martes*, except for the cruciate sulcus, which runs more transversely, and the longer caudal part of the lateral sulcus. The size of the skulls and the endocranial cast of *Martes wenzensis* is larger than this size in *Martes martes* (L.) and *Martes foina* ERXL. and agrees with that in *Martes zibellina* L. The dentition in skull No. MF/342/60 also shows features characteristic of the teeth of *Martes zibellina*: the paracone of M^1 is large and its edge is directed towards the protocone and not transversely as in *Martes martes*, the metacone is smaller, rounded and has not an edge. The shape of the labial wall and the occurrence of a corrugated cingulum on the rounded labial margin of M^1 make it similar to the corresponding tooth of *Martes zibellina*. As regards the lingual length: labial length ratio of M^1, *Martes wenzensis is* intermediate between *Martes zibellina* and *Martes martes*, whereas its tympanic bullae and their arrangement are like those in *Martes zibellina*. i. e. they are elongated and situated close to each other, the distance between the bullae measured at one-half of their length being smaller than a half-distance between the anterior margin of the bulla and the posterior surface of the occipital condyle (GEPTNER et al., 1967).

Translated into English
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STRESZCZENIE

W Wężach I koło Działoszyna obok szczątków kostnych zachowały się naturalne odlewy endocranium różnych ssaków. Z podrodziny *Mustelinae* natrafiono na odlewy endocranium *Mustela plioerminea*, *Mustela pliocaenica* i *Martes wenzensis*. Gatunki te opisał z Węży I Stach (1959).

Występujący u *Mustela plioerminea* Stach sulcus ansatus, sulcus lateralis z krótkim tylnym odcinkiem, zróżnicowanie sulcus suprasylvius różnią *Mustela plioerminea* od gronostaja. Budowa odlewu endocranium i pewne szczegóły budowy uzębienia upodobniają *Mustela plioerminea* do *Mustela putorius* L.

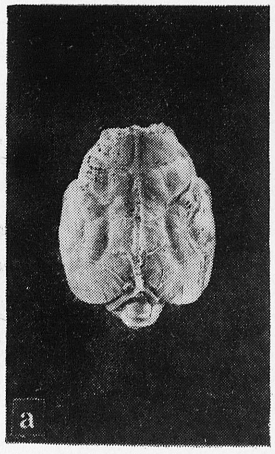
Mustela pliocaenica STACH miała mózg bardzo podobny do mózgu *Mustela nivalis* L., ale jej zmysł węchu musiał być lepiej rozwinięty (większe opuszki węchowe i małżowiny).

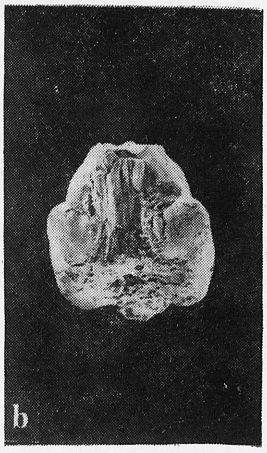
Mózg *Martes wenzensis* STACH przypomina mózg *Martes foina* ERXL. kształtem i układem bruzd. Natomiast większe rozmiary *Martes wenzensis* STACH, pewne cechy uzębienia i okolicy słuchowej czaszki są takie jak u *Martes zibellina* L.

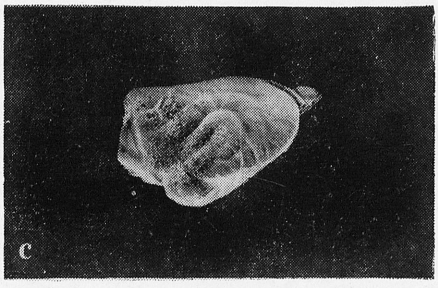
Redaktor pracy: dr B. Sychowa

Plate XI

Mustela plioerminea STACH, MZ VIII—V—355/5, Węże I pliocen, Endocranial cast x 1 (Phot. B. DROŻDŻ)
a. dorsal. view
b. ventral view
c. left side







T. Czyżewska, Endocranial...