

Variations in Number of Teeth and Asymmetry of the Skull in the Wolf

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Analysis was made of the teeth in 234 wolf skulls obtained from Polish territory and from the eastern part of the Białowieża Primeval Forest (USSR). Authors describe three groups of deviations from typical tooth pattern in wolves: polydonty, oligodonty and others types of tooth anomalies occurring when the normal number of teeth was present. There is a similar frequency of polydonty and oligodonty in Lublin voivodship and more southern voivodships Kraków and Rzeszów. In different geographical regions were observed a particular deviations from the teeth pattern, e.g., bilateral occurrence of additional I^{12} in skulls from the Białystok voivodship and the eastern part of Białowieża Primeval Forest; the bilateral absence of M_3 found only in the south Poland and bilateral skeweness of P^3 occurred only in wolves from Lublin voivodship. An increased number of teeth occurs more often in males than in females.

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1. PURPOSE OF THE STUDY, MATERIAL

The purpose of this study is to trace the occurrence of deviations from the normal tooth pattern (42 teeth) in the wolf, (*Canis lupus* Linnaeus, 1758), depending on sex and geographical region, and also to describe two cases of asymmetry in wolf skulls.

The material available from Poland consisted of 41 wolf skulls from the collection in the M. Curie-Skłodowska Univ., Lublin (UMCS), 98 wolves collected by the Mammals Research Institute of the Polish Academy of Sciences at Białowieża (MRI) and 95 wolf skulls originating from the eastern part of the Białowieża Primeval Forest and kept in the Zoological Museum of Moscow State University (MGU). In this last case use was made of notes on tooth anomalies (cases of polydonty only), made by one of us (TB) when this series was studied in Moscow.

In part of the material derived from the former Lublin voivodship¹ (UMCS material) the additional teeth had been removed, making it possible to examine the roots of these teeth. The remainder of tooth anomalies were examined only from the exterior, since the majority of skulls derived from collections of other

¹ Use has of necessity been made in this study of the larger areas of former voivodships, as they were before the administrative reform of 1975.

institutes or private persons and studied when shown at trophies exhibitions. The sex of the specimen was usually given with the skull, but in part of the material sex was identified on the basis of dimensions and appearance of the skull. It was only in 16 cases (out of over 200) that it proved impossible to determine sex. The skulls of adult and young wolves with a complete set of permanent teeth were used for the study.

2. RESULTS

In the study material the total number of teeth varied within limits of 40 to 44. Deviations were found from the tooth pattern typical of the wolf in 25 cases (10.7%) (Table 1). In this connection slight variants in differences in teeth were not taken into account, and also cases were omitted in which it was assumed that absence of teeth was due to mechanical injury.

It proved possible to distinguish three groups of deviations from typical tooth pattern in wolves: (1) increased number of teeth (polydonty) observed directly or concluded on the basis of the distinctly preserved alveoli, (2) decreased number of teeth — oligodonty; (3) other types of tooth anomaly occurring when the normal number of teeth were present.

More interesting cases of anomalies are described below in details: Wolf no. 833 has double I^2I^3 on both sides. This is a variant analogical with that described by Dolgov & Rossolimo (1964) in specimen no. S-55020 from the eastern part of the Białowieża Primeval Forest. In specimen no. 833 the left I^2 is set almost completely vertically to the sagittal plane of the skull (Fig. S, Plate I). Additional incisors are of almost normal size and there are traces of wear of the occlusal surface, particularly on the left one, where dentine is clearly exposed. An additional anomaly in this specimen is the marked sideways slant of P_4 on both sides (Fig. 2).

In specimen no. S-53795 the left M^3 is supernumerary, as can be concluded only from the preserved alveolus. This diagnosis has been confirmed by an independent record made by Dr. A. L. Ruprecht in 1968.

Wolf no. 14/Lu, inspected at the hunting exhibition, had an additional P^1 with a crown in the shape of an irregular oval, 5.6 mm in diameter.

Two individuals (nos. 9 and 2 UMCS) have additional premolars in the right mandible. In the first case the additional tooth has turned about 60° round its own axis in the alveolus towards the median side, in relation to the long axis of the tooth row (Fig. 3). This has caused P_2 to shift slightly backwards about 2 mm in comparison with P_2 of the left mandible. Its appearance has not visibly affected the position or altered the shape and dimensions of P_1 . It is most similar to the

Table 1
 Variability of teeth pattern of *Canis lupus* Linnaeus, 1758.

Number & Coll.	Sex	Place and date of killing	Description	Total No. of teeth
Supernumerary teeth				
S-55034, MGU	M	Eastern part of Białowieża Forest, III 51	l. »double« P_1	(43)
S-55020, MGU	M	Białowieża F. II 51	l.+r. double I^2I^2	44
833, MRI	M	Białystok voiv.	l.+r. double I^2I^2	44 ^{1,2}
S-55026, MGU	M	Białowieża F. III 49	r. tooth between P^1 and P^2	43
S-53780, MGU	M	Białowieża F. I. 51	r. P_1 between C_1 and P_1	43
S-53797, MGU	M	Białowieża F. I 49	l. P between P_1 and P_2	43
S-55788, MGU	F	Białowieża F. I 51	l. P between C_1 and P_1	43
S-53795, MGU	F	Białowieża F. III 49	l. M^3 (alveola) r. P^1 between P^1 and P^2	43
14/Lu., MRI	?	Sosnowica, 1966		43
9, UMCS	M	Kijowiec, XII 61	r. P_1 between P_1 and P_2	43 ³
2, UMCS	M	Międzyrzec, X 61	r. P_1 between P_1 and P_2	43 ⁴
40, UMCS	M	Janów Lubelski, II 69	l. M_4	43 ⁵
78/Kr., MRI	M	Muszyna, II 56	l. P_1 between C_1 and P_1	43
840, MRI	M	Rzeszów voiv., 60—65	r. P_1 between C_1 and P_1	43
107967, MRI	F	West Bieszczady Mts.	r. P_1 between C_1 and P_1	43
107969, MRI	M	West Bieszczady Mts.	r. P_1 between C_1 and P_1	43
Missing teeth				
70/01., MRI	F	Gierdawy, III 58	l. M_3	41
27, UMCS	F	Kryńszczak, XII 67	l.+r. M_3M_3	40 ⁷
28, UMCS	F	Pobołowice, XII 67	l. M_3 ; M_2 with 3 roots	41 ⁶
7/Kr., MRI	F	Muszyna, 66	l.+r. M_3M_3	40
43/Kr., MRI	?	Nawojowa, XII 68	r. M_3	41
796, MRI	M	Dobcza, II 53	l.+r. M_3M_3	40
111945, MRI	M	Brzegi Dolne, XII 69	l.+r. M_3M_3	40
798, MRI	M	Polska	r. P_3	41
Another teeth anomalies				
13/Lu., MRI	M	Sosnowica, 1956	l.+r. not completely erupted P^1P^1	(42)
19, UMCS	M	Józefów, XII 61	l.+r. skewed P^3P^3	
4, UMCS	M	Lubycza Królewska, VII 64	l.+r. skewed P^3P^3	42 ⁸
31, UMCS	M	Lipa, I 68	l.+r. skewed P^3P^3	42
6, UMCS	M	Lublin voiv.	P^4P^4 »with 3 roots«	42
Another skulls anomalies				
14, UMCS	M	Sobibór, III 62	asymmetry skull's constitution ⁹	
25, UMCS	F		asymmetry skull's constitution, shape ¹⁰	

Lu. — voiv. Lublin, Kr. — voiv. Kraków, Ol. — voiv. Olsztyn, M — males, F — females, l. — on the left, r. — on the right, voiv. — voivodship, 1—10 Reference to the numbers of figures shown in Plates I—II.

latter, but is slightly smaller (length measured on cingulum is 1 mm smaller, and height of tooth 2 mm shorter). Its crown is also of a less complex shape. The root is similar to a cone and does not exhibit the characteristic lateral flattening. In its distal part there is a very slight swelling. In the second case the supernumerary premolar does not differ from P_1 in respect of shape and dimensions of the crown (Fig. 4). It has caused the teeth adjoining it to move slightly apart. Immediately below the neck of the tooth there is unusual enlargement of the root (1 mm larger in comparison with P_1), which is markedly buccally bent halfway along its length. Sulci indicating the division of the root into two parts run along the lingual and buccal side.

Skull no. 40 has as many as four molars in the left mandible (Fig. 5). Specimen no 78/Kr has an additional tooth situated in front of the true P_1 in the left half of the mandible. The two teeth are separated by an interval of about 2 mm, and the maximum diameter of the supernumerary P_1 was 4.8 mm. Skull no. 840 (MRI) has a similar additional right lower premolar situated between C_1 and the P_1 , with a simplified conical crown, 4.8 mm long and 4.5 mm wide. This tooth protrudes from the alveolus to a height of 6.2 mm and its occlusal surface is clearly worn. It has caused constriction of the tooth row and its simultaneous elongation by 1 mm (measurement from P_1 to M_3).

The skull labelled coll. no. 107967 (MRI) is a trophy from the collection of W. Pepera, M. Sc. In the right half of the mandible it has an additional P_1 , with the apex directed lingually. Another skull, no. 107969, from the same collection, has an additional P_1 with the apex pointing backwards and root visible from the exterior. In addition right P^2 and P^3 are missing, without any trace of alveoli, but this may have been caused by mechanical injury (?). This is an adult wolf with only slight degree of tooth wear.

In oligodont dentition repeated cases of unilateral absence of M_3 (e.g., mandible no. 28, Fig. 6) or absence of the last molars on both sides (mandible no. 27, Fig. 7) were observed. Bilateral absence of M_3 occurred in 4 cases. One of these skulls was determined as a probable bastard of wolf with a dog (no. 111945, Table 1), killed in the field. In this specimen in place of M_3 alveoli there are only small shallow foramina about 1.5 mm in diameter, not indicating that they could have been what was left after loss of the teeth. We have considered this as a case of oligodonty².

² In the MRI collection at Białowieża there is also skull no. 837,F, ad. *Canis familiaris*, shot in May 1965, in the area of the Forest Administration Unit of Gładyszów, Rzeszów voivodship, and incorrectly identified by a hunter as a wolf. Both M_2 and M_3 are missing from the preserved right mandible of this specimen. There are no traces of alveoli, the bone is completely smooth in this

In wolf no. 798 of unknown origin there is no right P_3 or traces of its alveolus, while the bone from the side of the right half of the mandible is more pitted than that from the side of the left P_3 . We considered this to be a case of probably natural oligodonty.

Wolf no. 13/Lu exhibits an interesting tooth anomaly (Table 1), P^1 on both sides exhibiting retarded development (only just protruding from the alveoli). The left tooth, the larger of the two, is about 3.5 mm high. During the animal's life these teeth probably did not protrude above the gum, and did not therefore participate in biting. The surface of their enamel is matt.

In skull no. 4 (UMCS) P^3P^3 are situated obliquely in comparison with the situation of these teeth in most wolves. Usually the line forming the extension of the long axis of the crown of P^3 runs between prosthion, and the proximal margin of the alveolus of the canine tooth on the opposite side, and forms with the long axis of the skull an angle of 20° — 40° . In this case the angle attains a value of 70° for the left, and 80° for the right tooth (Fig. 8). The skewed position of P^3P^3 is accompanied by reduction of about 4.5 mm in the distance between P^2 and P^4 from both sides of the maxilla, in comparison with the mean value for skulls of similar size. In addition accumulation of bone tissue can be seen in the form of protuberances in the median and lateral walls of the alveoli. Changes connected with the turn of P^3P^3 round the axis running through the root and crown also occur in the two other specimens (coll. UMCS 19 and 31, Table 1). In these skulls the teeth referred to are situated obliquely and also asymmetrically in relation to each other, but deviations do not attain the degree observed in the individual no. 4.

Anomalies of a different kind, are asymmetries of the skulls. They were found in two animals: no. 14 (Fig. 9) and no. 25 (Fig. 10). They have several deformed bones in the splanchno- and neurocranium (*praesphenoideum*, *basisphenoideum*, *basioccipitale*, *processus zygomaticus*, *palatinum*, *vomer*, *pterigoideum*). Changes in the bones are accompanied by distortion of the skull in the sagittal plane (to the right). In the case of no. 25 distortion is connected with the slight turn of the braincase to the left in relation to the facial part.

Regional differences in frequency of polydonty are considerable

place, with only one very small nutritive foramen. There is nothing to suggest that the missing teeth had been lost secondarily. The absence of the left mandible made it impossible to determine if this anomaly had been bilateral. Mention is made of this case, as the bastard killed in Bieszczady Mts. four years later indicates that crossbreeding takes place in the Rzeszów voivodship between wolves and large wolf-like dogs which have gone wild. Furthermore the similarity of the anomalies merits attention.

(Table 2) but they are statistically insignificant (Chi-square test). In the Lublin voivodship and the southern voivodships Kraków and Rzeszów, both polydonta and oligodonta occur in approximately uniform proportions.

A number of teeth deviating from the normal tooth pattern in wolves occurs twice or even three times more often in males than in females in samples from different regions. The numbers are too small, however, to permit of accurate statistical calculations of samples. The difference in the number of tooth anomalies in males and females is statistically insignificant ($\chi^2=1.406$; $0.2 < p < 0.3$).

Table 2

The frequency of the anomalies in wolves' skull according to geographical regions.

Type of anomaly	Olsztyn, Białystok and eastern part of Białowieża Forest N=125		Lublin		Kraków, Rzeszów		Poland		Total	
	n	%	n	%	n	%	n	%	n	%
Supernumerary teeth	8	6.4	4	6.9	4	10.8	—	—	16	6.8
Missing teeth	1	0.8	3 ¹	5.2	4	10.8	1	(7.1)	9	3.9
Total	9	7.2	7	12.1	8	21.6	1	(7.1)	25	10.7

¹ Including specimen no. 13/Lu. with not completely erupted P^1P^1 .

3. DISCUSSION

Variation in the number and position of teeth, analysed *e.g.*, by Colyer (1936), Döcke (1959), and Reinwaldt (1963, cited after Dolgov & Rossolimo, 1964), Deadern (1960), Dolgov & Rossolimo (1964) and Ruprecht (1965, 1978) is qualitatively similar in different species of *Carnivora*, but frequency of particular tooth patterns may fluctuate within wide limits. It was found, for instance, that polydont set of teeth occur more often in foxes (3.5%) than in wolves (1.8%).

The cases observed of particular deviations from the normal tooth pattern in wolves merit closer attention, since although their frequencies in different regions appear to be statistically insignificant, they would appear to depend on the geographical region. For instance, an analogical anomaly of bilateral occurrence of additional I^2I^2 in male wolves was observed in skulls from the Białystok voivodship and the eastern part of the Białowieża Primeval Forest (USSR). The bilateral absence of M_3 was found only in the south of Poland, but this anomaly was not observed in material from the north of Poland ($n=22$) available

for a repeat examination. The three similar cases of bilateral skeweness of P^3 occurred only in wolves from the Lublin voivodship.

Similar results giving statistically non-significant differences in the tooth pattern of *Mustela putorius* Linnaeus, 1758, depending on sex, and population (Białowieża and Rzeszów) were obtained by Ruprecht (1978). A statistically highly significant difference was, however, observed in the frequencies of oligodonty in female polecats depending on age. The small amount of material available prevented us from checking differences depending on the age of the wolves.

All these particular and yet diverse differences would appear to show that at least some teeth anomalies in wolves can be treated as features of the morphotype, important in regional studies of different populations (cf. also Yablokov, 1978).

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ZMIENNOŚĆ UZĘBIENIA ORAZ ASYMETRIA CZASZEK U WILKA

Streszczenie

Przeprowadzono analizę uzębienia 234 czaszek wilków pochodzących z terenu Polski oraz we wschodniej części Puszczy Białowieskiej (ZSRR). Stwierdzono występowanie 25 przypadków (10,7%) odmiennego typu uzębienia, wśród których można wyróżnić: polidoncję, oligodoncję oraz inne typy zmienności, występujące przy zgodnej z wzorem liczbie zębów. Odmiennie warianty uzębienia, zwłaszcza polidoncja, częściej występują u samców niż u samic (Tabela 1). Na terenie wo-

jewództwa lubelskiego oraz województw południowo-wschodnich: krakowskiego i rzeszowskiego, ilość przypadków polidoncji i oligodoncji jest zbliżona (Tabela 2).

Na uwagę zasługują przypadki szczególnych anomalii uzębienia wilka powtarzające się na tym samym terenie: dodatkowe I^2I^2 (Ryc. 1) stwierdzone u samców wilków z terenu województwa białostockiego oraz ze wschodniej części Puszczy Białowieskiej; cztery przypadki braku M_3M_3 (Ryc. 7) stwierdzone na terenie południowo-wschodniej Polski; wystąpienie skośnie osadzonych P^3P^3 (Ryc. 8) — trzy przypadki z terenu województwa lubelskiego. Opisano dwa przypadki asymetrii czaszek wilków z terenu województwa lubelskiego.

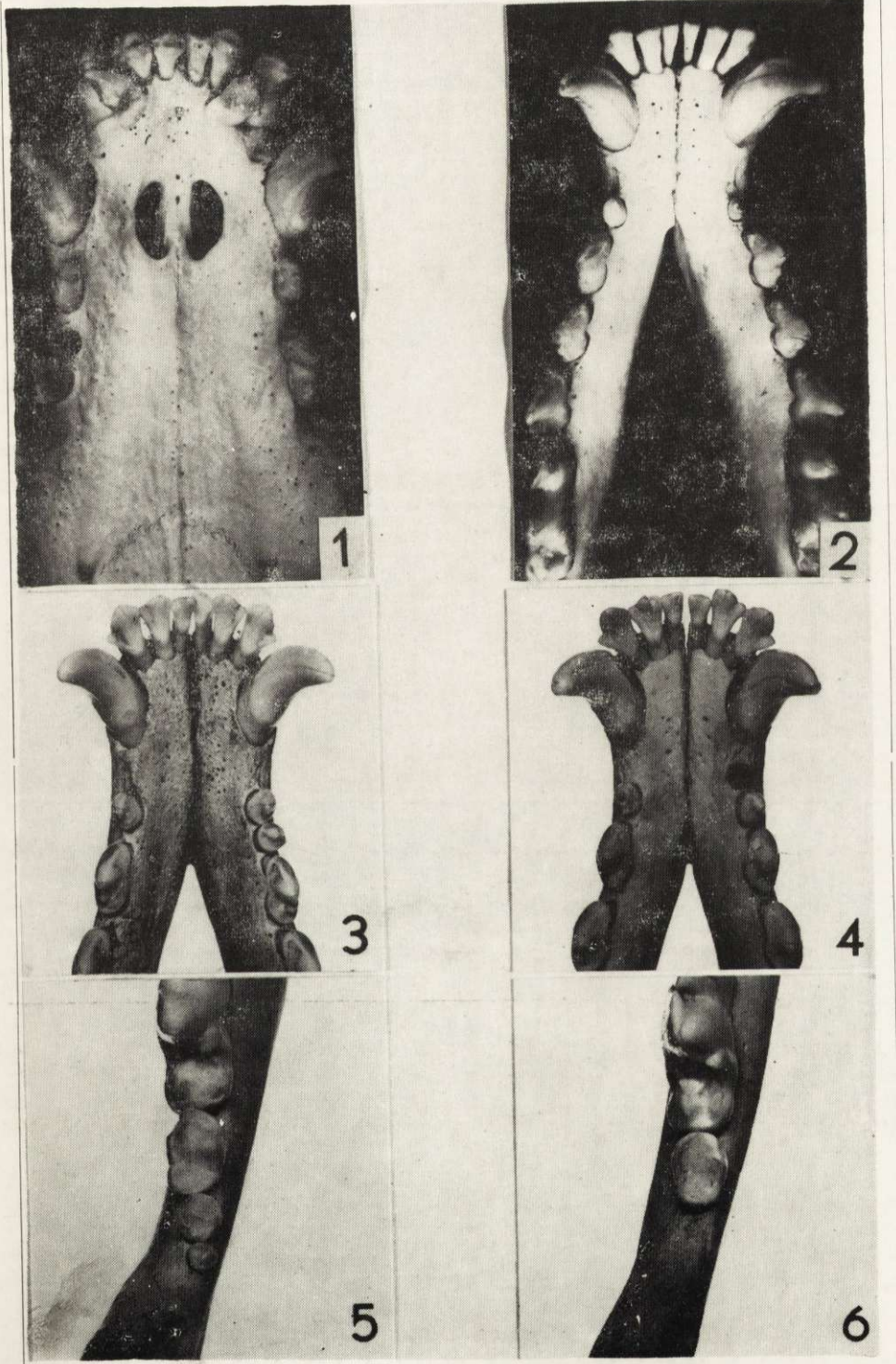
EXPLANATION OF PLATES I—II

Plate I

- Fig. 1. Skull of wolf no. 833. Supernumerary I^2I^2 .
 Fig. 2. Mandible of wolf no. 833. P_4P_4 slanting sideways.
 Fig. 3. Mandible of wolf no 9. Supernumerary P_1 between P_1 and P_2 .
 Fig. 4. Mandible no. 2. Supernumerary P_1 between P_1 and P_2 .
 Fig. 5. Specimen no. 40. Part of the left mandibular bone with visible M_4 .
 Fig. 6. Specimen no. 28. Part of the left mandibular bone without M_3 , unilateral retention.

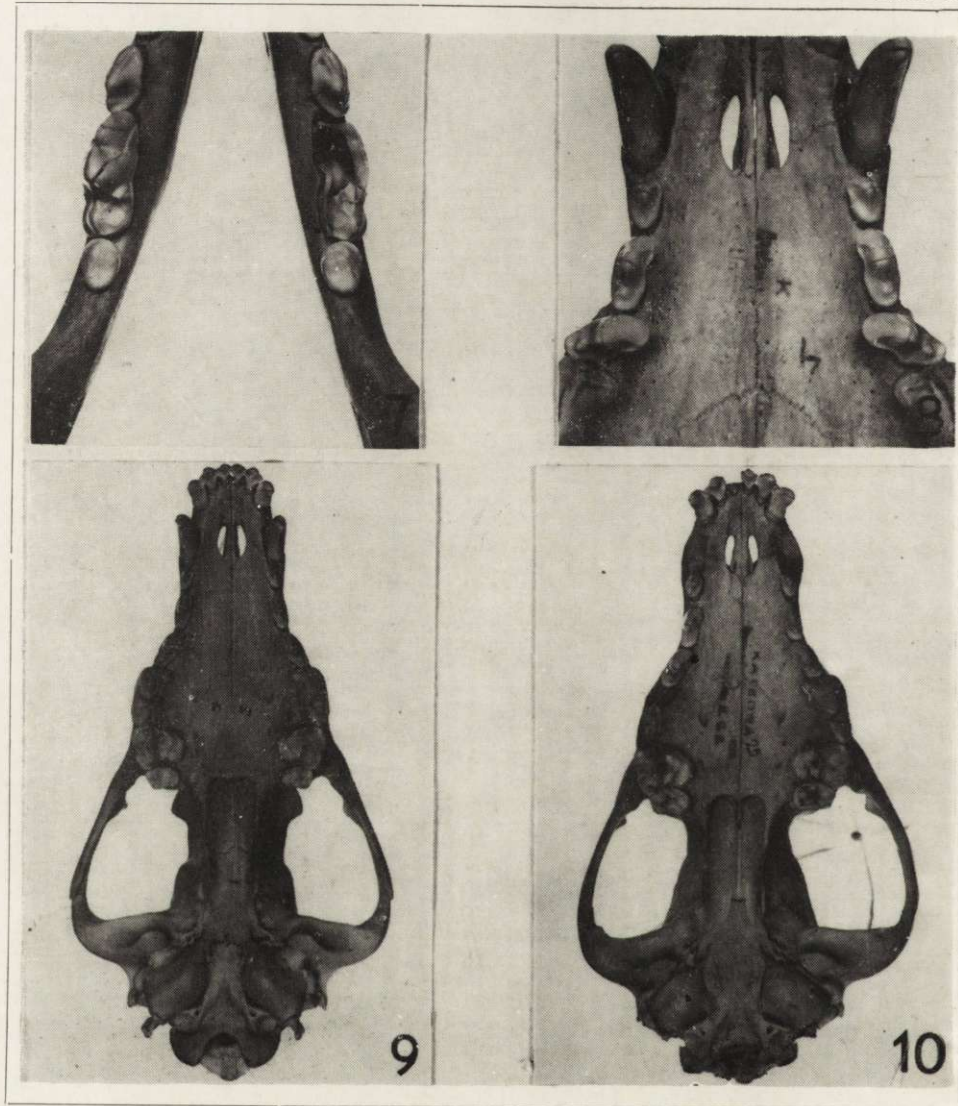
Plate II

- Fig. 7. Mandible no. 27. Bilateral retention of M_3M_3 .
 Fig. 8. Skull no 4. Jaw with anormally positioned P^3P^3 .
 Fig. 9. Skull, no. 14 with assymetrical structure.
 Fig. 10. Skull no. 25 with assymetrical structure.
 Detailed description in text.



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