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The Fossil Ostrich from the Akchagil Layers of Georgia

[Pp. 1—28, pls. I—II, 2 text-figs.]

Kopalny struś w Akczagile Gruzji

Ископаемый страус в акчагыле Грузии

Abstract. This is a description of a new species of ostrich *Struthio transcaucasicus*. A slightly damaged pelvis from Kvabebi in eastern Georgia is the holotype. The remains come from the Akchagil layers (Upper Pliocene). The numerous egg-shells from the Akchagilian and Upper Apsheronian are numbered in the same species as paratypes.

I. INTRODUCTION

The workers of the Institute of Palaeobiology, Academy of Sciences of the Georgian S. S. R., discovered a locality of Tertiary mammals, unique in respect of the value and state of preservation of its fauna, in the Akchagil layers of Eastern Georgia near Kvabebi in 1955. In the Akchagil layers the fossil remains form a fairly large lenticular aggregation. Bones showing no signs of grinding by water transport, articulated, as well as skeletons found nearly whole at this locality indicate unambiguously that this is their primary deposition.

As has been shown by more recent data (BULEYSHVILI, 1960), in Southern Kachetia the Akchagil layers spread over a large area and present two facies, a continental and a marine. Basal conglomerates have developed at the bottom of the Akchagil marine beds, overlying the Shirak series with angular inconformity. The thickness of the basal conglomerates reaches several dozen metres. These conglomerates are overlain successively by stratified clays, sands, sandstones and thin layers of conglomerates. They form the marine Akchagilian, containing a rich sea fauna in the littoral zone. Stratigraphically higher the marine Akchagilian passes gradually into the continental beds, which consist of sandy clays, clayey sands, loam, and conglomerates of small thickness. These layers are several hundred metres thick and include the upper portion of the Akchagilian and the whole Apsheronian.

Typical littoral lagoon beds with an abundant sea macro- and microfauna and remains of a leaved flora, which refers them exactly to the Akchagilian, extend in the region of the Kvabebi locality.

The composition of the Kvabebi fauna is fairly rich, remains of over twenty forms being recorded. The most diverse and numerously represented animals are perissodactyls. Carnivores and artiodactyls are undoubtedly inferior to them in diversity of forms. The most interesting components of the Kvabebi fauna are a huge hyrax (GABUNIYA and VEKUA, 1966) and an equally big ostrich. The present paper is given to a description of this ostrich. In its composition the Kvabebi fauna stands next to that from Roussillon, from which it differs in the abundance of the members of the *Bovinae*.

II. DESCRIPTION

Order: *Struthioniformes* (LATHAM, 1790)
Family: *Struthionidae* VIGORS, 1925
Genus: *Struthio* LINNAEUS, 1758
Species: *Struthio transcaucasicus* sp. n.

Holotype. Pelvis NK-1055. Locality: Kvabebi, Signah region in Kachetia (Eastern Georgia). Fauna of the Akchagil age. In the possession of the Institute of Palaeobiology, Academy of Sciences of the Georgian S. S. R. in Tbilisi.

Paratypes. A large number of egg shells from the Akchagilian and Lower Apsheronian deposits in Western Azerbaydzan (Palan-Tiukan Ridge, Bozdagi near Mingechaur). In the possession of the Museum of Natural History, Academy of Sciences of the Azerbaydzhan S. S. R. and the Institute of Palaeobiology, Academy of Sciences of the Georgian S. S. R. in Tbilisi.

Diagnosis. Pelvis of large size (in some of its measurements it exceeds all the pelves of fossil ostriches of the genus *Struthio* known so far, whereas in others, on the contrary, it falls short of them). The diapophyses of the first lumbo-pelvic vertebra are less slanting than in the contemporary members of the genus *Struthio* and *S. wimani*. The small groove which extends along the ventral edge of the preacetabular part of the ilium, from the second vertebra to the front, is lacking. The height of the spinous process of the first vertebra is relatively smaller than that in the remaining members of the genus *Struthio*, whereas the width of the pelvis at the level of the first vertebra is considerably larger. As a result, the preacetabular part of the pelvis is relatively low and broad. The height of the postacetabular part of the ilium is smaller than in all the other, fossil and recent, species of the genus *Struthio*. The preacetabular part of the synsacrum is shorter than in *S. camelus*. The longitudinal axis of the acetabulum is less slanting, i. e., it forms a more acute angle with the axis of the synsacrum than in *S. camelus*.

The egg shells are on the average 2·9—3·3 mm thick, rarely somewhat thinner (2·6—2·9 mm). A transverse section shows that they consist of three layers, as in all the other members of the genus *Struthio*, but the distribution and shape of small pores are different.

State of preservation. The whole preacetabular part of the synsacrum is preserved, whereas the posterior part is broken off across the posterior margin of the second pelvicaudal vertebra. The glutean part of the ilium is crumbled off approximately at the level of the middle of the body of the first vertebra. The whole spinous crest is present, starting from the anterior ridge. Posteriorly, the renal part of the ilium is broken away at the level of the posterior margin of the second pelvicaudal vertebra. Only the basal parts of both ischia are preserved, the right part 80 mm in length, the left one 63 mm. The left pubis is broken off near the anterior margin of the obturator foramen, the right one posterior to it so that the right obturator foramen is preserved whole. Only the anterior portions of the ilioischiac incisure, adjacent to the wall which separates them from the acetabulum, are preserved on both sides. All the surfaces of fractures are old, covered with greenish loam. This fact indicates that the pelvis was buried in this incomplete state in the place where it has been found now. The pelvis is heavily deformed. The left socket for the head of the femur is somewhat more drawn out along the long axis as compared with the right socket. The right half of the pelvis, including all its components, is somewhat tilted up in comparison with the left half. This is best illustrated by the position of the left and right ischia and pubes and by the left and right lateroventral margins of the lower parts of the vertebral bodies in the preacetabular part of the pelvis. In addition, this part of the backbone, together with the diapophyses, is markedly lifted and displaced to the left, especially in the region of the first and second lumbar vertebrae. Thus, if the first vertebra is seen from in front, the strong degree of its distortion is evident at first sight. Its whole left half is lifted up in relation to the right half, whereas its spinous process remains in a vertical plane common to the whole spinous crest, and in this connection it may be used as a measure to determine the degree of deformation of the vertebral body. The left half of the anterior portion of the body in the first vertebra as well as its cranial facies has become much narrower than the left half (the width of the cranial vertebral facies is about 20 mm on the left side and 27 mm on the right side).

All the free spaces in the pelvis were filled with greenish loam. Some of the processes (diapophyses and parapophyses) were partly damaged at the preparation of the pelvis. The posterior fracture of the pelvis took place in a plane which passes obliquely cranioventrally to the midline of the pelvis and is slightly extended to the front in its right half. All the fracture surfaces of the bones in the posterior part of the pelvis (ilia, ischia, right pubis and backbone) lie in this plane. The rock in which the pelvis had been deposited may have cracked in this plane, dividing the pelvis into two. If that is the case, the pelvis underwent damage also after its deposition. Another system of cracks (fracture surfaces) lies more or less at a right angle to the previous one. The two systems intersect at the level of one-third of the renal part of the pelvis. The plane of the second system of cracks ran probably through the bases of both pubes, both pectineal processes having been broken away. In the front the pelvis is damaged in the top region of the spinous process of the first vertebra and in the anterior portions of both glutean parts, and this damage is evidently caused by bites of predators. The top and the anterior edge of the spinous process and the anterior edges of the ilia are strewn with indents, which very much resemble the signs of teeth of medium-sized predators and are situated one above another below the edge of the bone. Such signs measure up to 3 mm across and seldom somewhat more.

Description and Comparisons of the Pelvis

Data obtained from literature and two pelves of contemporary *Struthio camelus*, differing in size, from the collection of the State University in Moscow were used for comparisons.

1. Preacetabular Part of Synsacrum

This part is preserved whole, starting from the first vertebra, but it is deformed to some extent. Some diapophyses of the right halves of the lumbar vertebrae are damaged. The bodies of all the vertebrae are accreted together and the boundaries between them can be marked off by the parapophyses, which go off laterally, and the distinct widening of the ventral surface of the bodies in the region of the joint with the neighbouring vertebra. This widening is best seen on the border between the first and the second vertebra (its width is about 35 mm against 28 mm at the middle narrowing of the ventral surface of the body in the first vertebra and 18 mm at the analogous narrowing in the second vertebra. The widening of the ventral surface of the bodies on the border between the second and the third vertebra measures 25 mm and the narrowing in the third vertebra 20 mm. The measurement of the widened lower surface of the body between the third and the fourth vertebra is also about 25 mm. The other boundaries between the vertebrae are indistinguishable on their ventral side.

The preacetabular part of the backbone is relatively shorter in the pelvis of *Struthio transcaucasicus* than in the pelves of *S. camelus* being compared with it. In *S. transcaucasicus* the distance from the anterior edge of the body of the first vertebra to the craniolateral wall of the acetabulum is 143 mm, whereas in the larger pelvis of *S. camelus* it is 152 mm and in the smaller one 153·5 mm.

First vertebra. The cranial articular surface is heterocoelus, i. e., convex in the upper and lower portions with a deep horizontal depression in the middle. The smallest height of the articular surface, in the medial sagittal plane, is

19 mm, the greatest one, in the lateral parts, 26 mm (right) and about 23 mm (left). The difference in height between the opposite sides is due to the deformation of the bone. The depth of the depression in the articular surface is about 7 mm. The cranial vertebral foramen is transversely elongated (its measurements are about 9 mm in height and about 27 mm across). Both prezygapophyses are preserved whole. Their articular surfaces are positioned dorsomedially at an angle of 45° and are oval in shape; their longer, medioventral, axis measures about 20 mm and the transverse axis 14·5 mm. The parapophyses of the first vertebra are missing, but there are articular sockets for the ribs. In *Struthio camelus* the diapophyses lie loosely, i. e., they end about 3 mm before the ilium, and this is probably true of *S. trancaucasicus*, also. In the pelvis of *S. transcaucasicus* both diapophyses are preserved in the form of a flat plate, which extends laterally (slightly caudodorsally, but the upper surface of the plate tilts somewhat up cranially) from the upper part of the vertebral body. The upper side of the plate is somewhat convex towards the rear and the lower side is almost flat. The length of the diapophysis is about 61 mm, the smallest width in the middle (measured craniocaudally) 22 mm, and the thickness at this point (dorsoventrally) 9 mm. The thickening at the lateral end of the diapophysis measures 12·5 mm. In contemporary *S. camelus* the diapophyses of the first vertebra are oval in section, the craniocaudal axis being the shorter one. The craniocaudal diameter of the parapophysis of the larger pelvis of *S. camelus* is 14 mm and that of the smaller pelvis 10 mm. The dorsoventral diameter is 11·8 and 13 mm, respectively. In the large skeleton the diapophysis slopes somewhat craniodorsally and so it approximates to that of fossil *S. transcaucasicus*. The ratio of the craniocaudal diameter to the dorsoventral diameter of the diapophysis of the first vertebra is 2·44 in *Struthio transcaucasicus*, 1·11 in the large skeleten of *S. camelus*, and 0·77 in the smaller one, which indicates that the diapophysis of the first vertebra in *S. transcaucasicus* is the most flattened and craniocaudally widened, being nearly circular in cross-section in contemporary *S. camelus*. The successive spinous processes form the spinous crest, but the boundaries between particular processes are distinct, since the bony connections with which they are attached to each other are thinner than the processes themselves and, besides, between the 1st and the 2nd process there is a row of vertically arranged apertures, several millimetres in diameter. The height of the spinous process above the neural canal is over 106 mm * (the upper portion of the process was gnawed at). The width of the spinous process measured craniocaudally along the upper crest is 41 mm. The greatest thickness of the upper crest of the spinous process (measured transversely) is 18·5 mm, the thickness in the middle of the process being 12 mm. The bcdy of the 1st vertebra is longitudinally notched in the middle of the ventral surface (this notch extends to the rear over the bodies of the 2nd, 3rd and 4th vertebrae,

* This height is the shortest distance from the tip of the spinous process to the roof of the neural canal (measured perpendicularly), unlike the length of the spinous process (cf. Tables I and II), which is inclined towards the rear.

Table I

Measurements of the Pelvis of *Struthio transcaucasicus* sp. n. as Compared with those of 3 Fossil Ostriches of the Genus *Struthio* and Contemporary *Struthio camelus*

No	Description of Particular Measurements	Measurements, in mm					
		S. transcaucasicus sp. n.	*S. wimani* Lowe, 1931	*S. brachydactylus* Burchak-Abramovich, 1939	*S. karatheodoris* Forsyth Major, 1888	*S. camelus* Linnaeus, 1758 (6 specimens, after Lowe, 1931)	*S. camelus* Linnaeus, 1758 (1 spec. from Kiev)
1	Longitudinal acetabulum diameter	ca 70	65	54	62	52— 63	55
2	Transversal acetabulum diameter	ca 64; ca 61	60; 63	53	—	51— 61	46·5
3	Length of the spinous process of the first vertebra (from the base to the junction with the iliac bone)	ca 116	114	—	—	97	—
4	Length of the spinous process of the first vertebra (from the base to the top of the neural crest)	ca 138	ca 136	—	—	122	88
5	The greatest width of the preacetabular part of the pelvis at the level of the first vertebra	ca 116	82	—	—	78	94·5
6	Distance from the ventral surface of the body of the second vertebra to the neurospinal or iliac crest	ca 154	164	—	—	121—157	—
7	Depth of the iliac bone (distance from the top of the spinous crest to the middle point of the upper edge of the acetabulum)	108	110	78	—	75—107	—

8	Depth (height) of the acetabular lamina of the iliac bone (from the lateral edge of the dorsal area to the lower edge of the renal part)	ca 58	73	64	72	48—70	—
9	Width of the pelvis across the supratrochanters	146	175	107	130	103—140	115
10	Supratrochanter-neurospinous crest distance for either half of the pelvis	ca 80	74	—	65	55—79	—
11	Width of the pelvis across the antitrochanters	ca 198	ca 200	—	—	148—199	173
12	Width of the pelvis (iliac bone) at the level of the transverse process of the 2nd vertebra	ca 105	80	—	—	52—74	ca 57
13	Width of the pelvis across the bases of the antitrochanters	65	54	—	—	36—48	—
14	Length of the vertebral column from the anterior edge of the body of the first vertebra to the body of the first sacral vertebra	ca 205	—	—	—	—	—
15	Ventral length of the two true sacral vertebrae (in sagittal plane)	ca 52	—	—	—	—	—
16	The smallest width of the pelvis between the two acetabula	89	—	—	—	—	—
17	Width of the pelvis between the dorsal edges of the acetabula	ca 118	—	92	—	—	—
18	The greatest height of the pelvis in the preacetabular part	165	—	—	—	—	—

being quite small on the 5th vertebra and ending on the border with the 6th). In the cranioventrolateral corners of the cranial surface of the body of the first vertebra there are triangular areas of rough surface, on both sides, for the articulation with the vestigial ribs. The greatest transverse width of the triangle is 21 mm and the craniocaudal width 13 mm.

Second vertebra. Only the left parapophysis is preserved. The right one had probably been destroyed before the pelvis was deposited in the rock. The parapophysis is situated ventrally to the diapophysis. Between them there is an opening with its transverse (mediolateral) diameter equal to 18 mm and the vertical to 15 mm. The basal part of the parapophysis connects with the cranioventral portion of the vertebral body and its dorsomedial tip approaches the middle of the medial base of the diapophysis from below. The external end of the parapophysis, as well as that of the diapophysis, is connected to the lateral lamina of the ilium. The length of the parapophysis of the 2nd vertebra, measured along the anterior margin, is about 60 mm, the width at the medial base 21 mm, the smallest width half way along the parapophysis 9 mm and the thickness (anteroposteriorly) 6·5 mm. The plate of the parapophysis is oriented with its long axis to the outside, and it is slightly bent dorsocranially. As a result, the anterior surface of the parapophysis is slightly concave and the posterior one somewhat convex. Both the diapophyses of the 2nd vertebra are, in general, similar to those of the 1st vertebra only that they are shorter (length—about 37 mm, smallest width across medial base — about 29 mm). The plate of the diapophysis of the 2nd vertebra is turned to the outside, somewhat upwards; its surface is slightly inclined ventrocranially. In the recent ostrich the diapophyses are relatively less wide craniocaudally and flattened to a smaller degree; in the larger skeleton the smallest width is 14·2 mm in the smaller one 14 mm, the dorsoventral thickness being 7 and 8 mm, respectively.

Owing to the deformation of the pelvis of *S. transcaucasicus* under study the diapophyses of the 1st vertebra lie at different levels in relation to the spinous process. The left diapophysis tilts up at an angle of about 30° to the horizontal plane of the pelvis and forms an angle of about 60° with the spinous process. On the other hand, the right diapophysis lies rather in the horizontal plane, forming an angle somewhat larger than the right one with the spinous process. In the pelvis of *Struthio wimanii* both diapophyses are tilted up uniformly at an angle of about 45° (Lowe, 1931: Pl. 1, Fig. 1), in which it more or less approximates to contemporary *S. camelus*. Therefore, in *S. transcaucasicus* the diapophyses of the 2nd vertebra should be positioned somewhat less slantingly than in contemporary *S. camelus*, but it is hard to decide to what degree because of the deformation of the pelvis.

Third vertebra. The parapophyses of this vertebra are lacking. Either diapophysis forms a plate which tilts up, slightly inclined cranioventrally. The length of the diapophysis is 23 mm, the width (craniocaudally) about 25 mm. It is remarkably wider but thinner (dorsoventrally) than in recent *S. camelus* (in the pelvis of the larger ostrich the width of the diapophysis is about 11·5 mm and the thickness about 7 mm, in the smaller one 10 and 6 mm, respectively).

Fourth vertebra. The left parapophysis and both diapophyses are preserved in this vertebra. The parapophysis extends caudolaterally and steeply upwards (in recent *S. camelus* the upward direction is less steep). The diapophyses are directed craniolaterally.

Fifth vertebra. Both parapophyses are preserved, the diapophyses are badly seen in the depth of the cavity of the pelvis. The parapophyses of the 5th vertebra are situated much more dorsally and differ in height from the diapophyses of the 6th vertebra by 7—8 mm, whereas in *S. camelus* this difference does not exceed 4—5 mm. In *S. transcaucasicus* and *S. camelus* the parapophyses and diapophyses are situated cranially to the anterior margin of the acetabulum.

Sixth vertebra. Both parapophyses lie at the level of the anterior margin of the acetabulum, as in contemporary *S. camelus*. The diapophyses are badly seen in the depression between the processes.

2. Acetabular Part of Synsacrum

This part is made up of vertebrae 7—10 fused together and situated in the region of the sockets for the head of the femur and directly behind them. The lower surfaces of the bodies of vertebrae 7—10 form a more or less flat surface stretched along the midline. This surface is slightly concave transversely and a little convex longitudinally, which character is more pronounced in both pelves of contemporary *S. camelus* than in fossil *S. transcaucasicus*. The general outline of the surface in *S. transcaucasicus* seems to approximate more to a square than it does in *S. camelus*. The length of the surface of vertebrae 7—10 in *S. transcaucasicus* is about 45 mm, in the larger pelvis of *S. camelus* 40 mm, and in the smaller one 36 mm. The smallest width at the level of the 7th vertebra is 31, 27·5 and 29 mm, respectively. In the 7th vertebra both parapophyses lie more ventrally than those in the 6th vertebra. The difference in height between them is 10 mm in *S. transcaucasicus*, being somewhat smaller in the contemporary African ostrich (8—10 mm in the larger pelvis, about 5 mm in the smaller one). The anterior inclination of the parapophyses of the 7th vertebra in *S. transcaucasicus* is steeper (its angle is up to 80°) than in recent *S. camelus*. The passage from the anterior inclination of the parapophysis to its ventral surface is rapid and sharp in *S. transcaucasicus* and gradual and mild in contemporary *S. camelus*. The boundary between the parapophyses of the 7th and 8th vertebrae is visible owing to a depression, in *S. transcaucasicus* filled with rock, instead of which there should occur an intervertebral opening. Both parapophyses are preserved in the 8th vertebra and only the right one in the 9th, the left being damaged. The diapophyses of vertebrae 6—10 are well seen through the acetabulum in recent *S. camelus*. In *S. transcaucasicus* they are not preserved on account of their thinness or may have been destroyed at the preparation of the pelvis. In the 10th vertebra of *S. camelus* the parapophyses are short (5—

Table II

Comparison of Measurements of Pelvis and Indices Calculated on the Basis of Those Measurements for *Struthio transcaucasicus* sp. n. and 2 Other Fossil Ostriches and Different Contemporary Forms of *Struthio camelus*

No	Description of Particular Measurements and Indices	Measurements, in mm							
		Fossil Ostriches			Contemporary *S. camelus*				
		Struthio transcaucasicus sp. n.	*Struthio wimani* Lowe, 1931	*Struthio brachydactylus* Burchak-Abramovich, 1939	*S. camelus* Linnaeus, 1758 (max. value for 6 specimens, after Lowe, 1931)	*S. camelus* Linnaeus, 1758 (larger specimen from the Moscow University coll.)	*S. camelus* Linnaeus, 1758 (smaller specimen from the Moscow University coll.)	*S. camelus syriacus* (after Lowe, 1931)	*S. camelus molybdophanes* (after Lowe, 1931)
1	Height of the lateral portion of the preacetabular part of the pelvis	58	73	64	70	—	—	52	59
2	Width of the pelvis across the antitrochanters	198	200	—	199	194	176	150	172
3	Height of the glutean part of the iliac bone above the acetabulum	108	110	78	107	—	—	76	86
4	Perpendicular diameter of the acetabulum	64	62	53	61	—	—	52	53
5	Width of the intervertebral space between the 3rd and 4th vertebra	52	—	—	—	38	32	—	—

6	Height of the lateral area of the renal part across the iliolateral process	73	—	—	—	67	51	—	—
7	The smallest height of the spinous process of the 1st vertebra	ca 138	é136	—	é122	—	—	—	—
8	The greatest width of the pelvis across the lower edge of the preacetabular part of both iliac bones at the level of the 1st vertebra	ca 116	é82	—	é78	—	—	—	—
	Indices: 1:2	29·8	34·5	—	35·1	—	—	34·6	34·3
	1:3	54·6	66·3	82·0	65·4	—	—	68·4	68·6
	1:4	92	117	120	110	—	—	110	110·1
	5:6	71·2	—	—	—	56·7	62·7	—	—
	8:7	87	60·7	—	63·8	—	—	—	—

6 mm), extend craniolaterally and end freely. In *S. transcaucasicus* the parapophyses of the 10th vertebra are not preserved.

3. Sacral Vertebrae Proper (vertebrae sacrales verae)

In the genus *Struthio* the 11th and 12th vertebrae constitute the sacral vertebrae proper. The next two vertebrae (13th and 14th in succession) resemble them very much in external appearance. They have both parapophyses and diapophyses, whereas the vertebrae following them caudally (from the 15th vertebra on) have only one pair of diapophyses each. In all these four vertebrae the diapophyses extend steeply upwards and slightly to the back. The parapophyses are subperpendicular to the backbone. It is interesting that in the further caudal vertebrae (the 3rd, 4rth and so on) the diapophyses are turned steeply upwards and somewhat to the back, and thus in the same fashion as in the sacral vertebrae proper and the first two caudal ones. Unlike the two pelves of *S. camelus* used for comparisons, that of *S. transcaucasicus* has scarcely 3 vertebrae with parapophyses directed upwards and somewhat to the front. The diapophyses lie deeper than the parapophyses and project upwards and slightly to the back, in which the 4th vertebra does not differ from them. In the two pelves of *S. camelus* and in that of *S. transcaucasicus* the first three vertebrae have similar parapophyses positioned on a common bony base, whereas the processes of the 4th vertebra are more distant and isolated from the corresponding processes of the preceding vertebrae. Thus in this part of the synsacrum are distinguished two sacral vertebrae proper and two more aboral vertebrae, which, as a rule, resemble the sacral ones externally, but under the generally accepted scheme are regarded as the 1st and 2nd caudal vertebrae. This interesting morphological problem demands further analysis and studies on a larger series of pelves from recent and fossil ostriches of the genus *Struthio*. Two vertebrae and the foremost fragment of the 3rd one are in this way preserved in the caudal part of the backbone of *S. transcaucasicus*.

In the description of the pelvis of *Struthio brachydactylus* (Burchak-Abramovich, 1953, p. 43) three vertebrae with diapophyses and parapophyses and completely fused bodies were classified as sacral vertebrae on the basis of their external morphological similarity. In fact, they were, according to the generally accepted division of the synsacrum, the two sacral vertebrae proper and the first sacrocaudal vertebra fused together. On the same principle the 1st or both the 1st and 2nd sacrocaudal vertebrae might be associated with the two sacral vertebrae proper in a number of pelves of recent *S. camelus*, so much they resemble each other in external appearance.

4. Pubes and Ischia

Only basal parts of both pubic bones are preserved. The pectineal processes are completely lacking. The longer diameter of the obturator foramen is about 43 mm long, the diameter square to it being 27 mm. The ischia are represented by their basal parts only.

5. Ilia

The anterior and posterior portions of both iliac bones are damaged. The glutean part is better preserved than the renal part. In the left ilium it is obliquely broken off in front, from the lateral margin of the diapophysis of the 1st vertebra to the posterior angle of the tip of the spinous process of the 2nd vertebra; in the right ilium it is broken away to a somewhat smaller extent. The glutean part is bent in just as it is in contemporary *S. camelus*, the largest depression occurring at the level of the socket for the femural head. The inferior margin is preserved nearly whole on the right side, its anterior portion being destroyed on the left side. Lowe (1931) mentions that in the pelvis of *S. wimani* described by him a narrow sulcus runs orodorsalwards along the ventral edge of the preacetabular part of the iliac bone, anteriorly to the junction of the transverse process of the second lumbosacral vertebra. This sulcus is also present in contemporary *S. camelus*, but it is missing in *S. transcaucasicus* and probably has never existed in it.

Lowe (1931) assumes the great height of the spinous process of the first vertebra to be one of the characters distinguishing the pelvis of *S. wimani* from that of contemporary *S. camelus*, this height being 136 mm in the former and 122 mm in a juvenile specimen of the latter from Gambia (Brit. Mus. No. 356 B). On the other hand, the widths of pelvis are alike in both species (82 mm in *S. wimani* and 78 mm in *S. camelus*). However, Lowe (1931) mentions further that the differences in measurements between *S. wimani* and the above-mentioned specimen of *S. camelus* from Gambia are even smaller than those between some specimens within the species *S. camelus*. Next, he draws attention to a striking difference between the height of the preacetabular part of the ilium and the width at this level and these dimensions in the contemporary ostrich, though the measurements offered by him show no such differences. In this connection it will be interesting to compare these measurements with those of *S. wimani* and contemporary *S. camelus*. If it is assumed that the anterior portion of the pelvis of *S. transcaucasicus* is not damaged, the height of the spinous process of its first vertebra is 106 mm*, being thus smaller than in *S. wimani*. The width of the pelvis across the lower edges of both ilia at the level of the first vertebra is far greater in *S. transcaucasicus* than in *S. wimani* and *S. camelus* (see Table II). It will be seen from this table that the ratio of the greatest width of the preacetabular part of the pelvis to the height of the spinous process of the first vertebra is various: 84 in *S. transcaucasicus*, 60·7 in *S. wimani* and 63·8 in *S. camelus* (Lowe, 1931). This index for *S. transcaucasicus* does not claim accuracy, since the pelvis of this specimen may have been subject to some damage; nevertheless, if we have assumed a certain degree of deformation in this pelvis, then, judging by its configuration, the index for an undeformed pelvis will be still greater. Besides, Lowe (1931) writes about some deformation also in *S. wimani* and he states that the right side of this pelvis is somewhat crushed and displaced antero-inferiorly.

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* See the footnote on page 5.

In the pelvis of modern *S. camelus* and in *S. wimani* a crest for muscle attachment extends on the external surface of the glutean part of the iliac bone. At the top it arises from the iliac crest, descends towards the dorsooral angle of the acetabulum and passes through the preacetabular process to merge with the anterior margin of the acetabulum. On both pelvic halves this crest is slightly convex to the rear. As the external surface of the glutean part of the pelvis is partly destroyed, in the specimen of *S. transcaucasicus* it is not visible except for its middle portion, marked very poorly on the left half of the pelvis. In ostriches of the genus *Struthio* the ambient muscle is attached to a distinct prominence situated anteriorly to the pectineal process on the external surface of the preacetabular part of the iliac bone. In the preserved pelvis of *S. wimani* the corresponding segment of the surface of the ilium is missing, but LOWE (1931), basing himself on the fact that the structures of pelves of *S. wimani* and *S. camelus* are identical, regards the existence of this tubercle as unquestionable and indicative of the membership of *S. wimani* in the *Struthioniformes*. In the pelvis of *S. transcaucasicus* this tubercle for attachment of the ambient muscle is pronounced and situated near the lower edge of the external surface of the glutean part between the parapophyses of the 2nd and 3rd vertebrae of the synsacrum. It is stouter and more convex in the left half of the pelvis, its height being about 37 mm and the greater width about 27 mm. In the larger of the pelves of *S. camelus* under comparison these measurements are, respectively, 32 and 18 mm.

In *S. transcaucasicus* the middle crest between the two laminae of the iliac bones is sturdy and thick (transversely) as compared with that in the pelves of modern *S. camelus*. The anterior portion of the glutean part is damaged in both iliac bones of the specimen of *S. transcaucasicus* and, consequently, this region cannot be compared with the corresponding part of the pelvis of the contemporary ostrich. In the preserved part of the pelvis of *S. transcaucasicus* the middle crest is markedly thicker (broader) at the height of the anterior margin of the spinous process of the second vertebra than it is in contemporary *S. camelus*. Its breadth is 29 mm against 5 and 13 mm in the two pelves of *S. camelus*. The smallest transverse breadth of the middle crest (crista iliaca anterior), measured in the middle of its length, is 14—15 mm in *S. transcaucasicus* and, respectively, 8 and 10 mm in *S. camelus*. In *S. transcaucasicus* this crest, having sloped mildly over a distance up to 25 mm, lowers towards the rear on the pars dorsalis renalis. Its height above the level of the dorsorenal part is about 20 mm. In the smaller of the two pelves of *S. camelus* the sloping ridge of the crest is less distinct (height about 9 mm, length about 40 mm). In the larger pelvis of *S. camelus* there is no sloping ridge of the crest. Both pelves of *S. camelus* have a longitudinal slit between the linea iliodorsalis and crista iliaca anterior on either side of the pelvis. No such slit occurs already in the pelvis of *S. transcaucasicus* and a flattened bony bridge, an evolutional trait, has developed in its place. The crest which extends along the boundary of the posterodorsal area of the renal part in *S. transcaucasicus* is indistinct, blunt, and with rounded edges. In both pelves of *S. camelus* the transverse crest is pronounced and has sharp edges, which form a very narrow collar. It is probable that the indistinctness of the crest in *S. transcaucasicus* is to some extent connected with damage to the pelvic surface. Not unlike the crest, the iliolateral process of the pelvis of *S. transcaucasicus* is indistinct and its edges are rubbed off. Its lower angle is probably more rounded and wider (orocaudally) than in the two pelves of *S. camelus*. In these last pelves the transverse crest is slightly bent in, whereas, on the contrary, in *S. transcaucasicus* it is somewhat convex.

Antitrochanter. In the specimen of *S. wimani* (Lowe, 1931) the antitrochanters are situated at different levels. The right antitrochanter, similarly to the right supratrochanter, lies more or less normally, being only somewhat more raised upwards and inwards, which condition is presented more clearly by the supratrochanter. The corresponding processes of the left half of the pelvis have an abnormal position. They are moved considerably downwards, outwards, and somewhat to the front. The pelvis of *S. transcaucasicus* also shows some anomaly in the position of the anti- and supratrochanters; this is undoubtedly due to the deformation caused by its being crushed. The right processes are exidently displaced downwards and to the rear as compared with the left ones. Connected with this is a general distinct inclination of the whole dorsal area of the renal part to the right side. In the pelvis of *S. brachydactylus* (Burchak-Abramovich, 1953) no asymmetry occurs in the region of either antitrochanter. In *S. transcaucasicus* the antitrochanter is stouter than in both pelves of *S. camelus*, and its distance from the top of the iliolateral process is larger. The surface between the antitrochanter and iliolateral process of the pelvis of *S. transcaucasicus* slopes steeply ventrolaterally, whereas in both the pelves of *S. camelus* the upper half of this surface is inclined sharply downwards and only slightly laterad, and next it passes abruptly into an almost horizontal surface. The situation of the supratrochanter and antitrochanter in relation to each other on the surface of the pelvis of *S. transcaucasicus* is the same as in the members of the genus *Struthio*, i. e., the antitrochanter is somewhat anterior to the supratrochanter. Lowe (1931), too, mentions it in connection with the pelvis of *S. wimani*. The situation is reversed in other ratite birds *(Rhea, Dromaeus, Casuarius)*, in which the supratrochanter is pushed somewhat forward in relation to the antitrochanter. In *S. transcaucasicus* the highest point of the crest of the antitrochanter lies 3—5 mm lower than the level of the upper margin of the acetabulum. In the larger of the pelves of *S. camelus* the top of the antitrochanter approximates to the level of the upper edge of the acetabulum, and in the smaller one it is 2—3 mm above it. Thus, in the pelvis of *S. transcaucasicus* the highest point of the antitrochanter is situated lower than that in *S. camelus*. The width (height) of the intervertebral space between the 3rd and 4th vertebra, measured posteriorly to the antitrochanter, is relatively greater in *S. transcaucasicus* than in *S. camelus*, which is well illustrated by the ratio index of this measurement to the height of the lateral area of the renal part (cf. Table II.). This index is 71·2 in *S. transcaucasicus*, 56·7 in the larger pelvis of *S. camelus*, and 62·7 in the smaller one. The posterior slope of the antitrochanter in the pelvis of *S. transcaucasicus* falls towards the lateral area of the renal part at a comparatively smaller angle than it does in contemporary *S. camelus*. This angle of inclination is 40° in *S. transcaucasicus*, 60—70° in the larger pelvis of *S. camelus*, and about 90° in the smaller one. The posterior edge of the posterior wall of the acetabulum in the

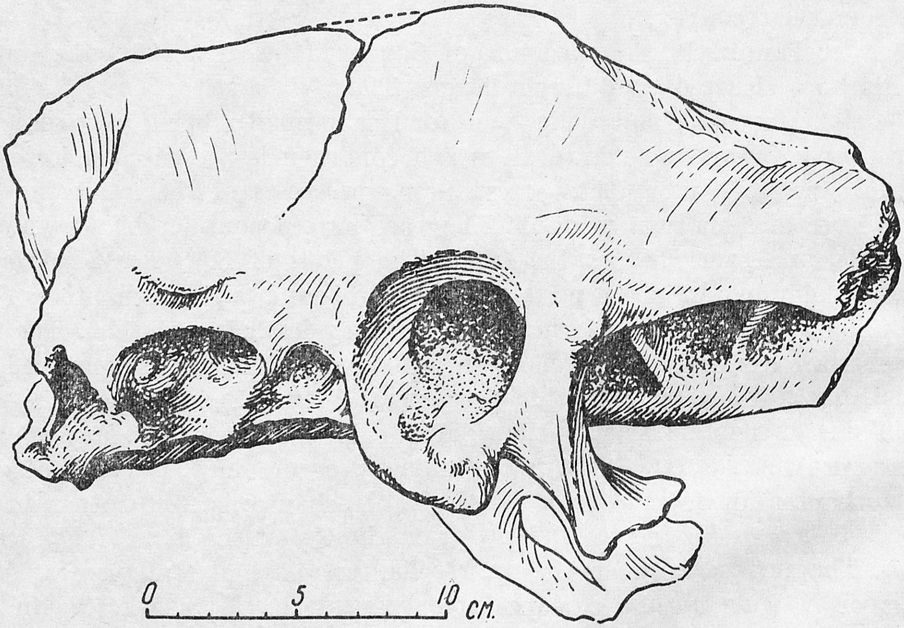

Fig. 1. Transcaucasian fossil ostrich *Struthio transcaucasicus* sp. n. View of the left lateral surface of the pelvis. About 2/5 natural size

pelvis of *S. transcaucasicus* forms a right angle with the lower edge of the lateral area of the renal part. This angle is also right in the pelvis of *S. transcaucasicus*, but here the lower edge of the lateral area of the renal part falls more steeply backwards towards the antitrochanter. The antitrochanter of *S. transcaucasicus* is shorter than that of *S. camelus*. In the pelvis of *S. transcaucasicus* the length of the right antitrochanter, measured along its anterior wall, is 56 mm, in the larger pelvis of *S. camelus* 61 mm, and in the smaller one 54 mm. Its dorsoventral width, measured along the upper crest, is, respectively, about 45, 47, and 41 mm. The lateral area of the renal part is relatively narrow (low) in *S. transcaucasicus*, in which its width is 66 mm, whereas in the larger pelvis of *S. camelus* it is 68 mm and in the smaller one about 51 mm. The antitrochanter of the pelvis of *S. transcaucasicus* is considerably stouter in appearance than those of the two pelves of *S. camelus* being compared with it; it is particularly strongly expanded transversely (mediolaterally). In both pelves of *S. camelus* the top of the antitrochanter develops a ridge, which extends dorsocranially. The transverse thickness of this ridge is about 10 mm in the upper half and about 20 mm in the lower. No such ridge exists in *S. transcaucasicus*, whose top of the antitrochanter presents a thickly rounded, hilly prominence. The incurvation of the external wall of the antitrochanter in the two pelves of *S. camelus* is sharp, with distinct upper and lower lateral marginal rims, this incurvation being weak and without marginal rims in *S. transcaucasicus*.

Acetabulum. In the pelvis of *S. transcaucasicus* the position of both acetabular sockets of the hip joints is normal. Apart from some damage done to the pelvis, both sockets for the head of the femur have the same form, i. e., they are somewhat extended along the longitudinal axis of the pelvis and pyriform, with an apparent narrowing in the anterior portion. The lower internal wall of the acetabulum lies at nearly the same level as the ventral surface of of the bodies of the vertebrae which adjoin it. According to the data given by Lowe (1931), in the pelvis of *S. wimani* the pubic peduncle is situated at an obtuse angle to the axis of the synsacrum, whereas in the pelvis of contemporary *S. camelus* it forms an almost right angle. In *S. transcaucasicus* this angle probably reached 45°. In the pelvis of this species the acetabulum is situated less steeply in relation to the long axis than it is in the two pelves of *S. camelus*. Thus, in the pelvis of *S. transcaucasicus* the angle formed by the long axis of the acetabulum with the ventral surface of the backbone (the portion of the synsacrum situated in front of the acetabulum) is about 168° on the right side and about 161° on the left side. In the larger pelvis of *S. camelus* it is 154° and in the smaller one 150°. The vertex of this angle points to the front. Measurements of these angles were taken with the help of a small goniometer and, therefore, they may be somewhat inexact, but they all express the general position of the acetabulum correctly, indicating the less steep orientation of its long axis in *S. transcaucasicus* than in contemporary *S. camelus*. The angle of inclination of the acetabulum and the orientation of its long axis in relation to the axis of the antitrochanter have an effect on the details concerning the attachment and function of the locomotive muscles. The greater inclination of the long axis of the acetabulum makes it possible for the hind limbs to gather momentum and, as a result, increases the bird's power of running. However, the interesting problem of the mechanism of movement of the hind limbs in the ostrich needs a separate study.

The incurvation of the external surface of the basal portion of the pubic bone, adjoining the cranioventral depression of the acetabulum is far more pronounced and abrupt in the pelvis of *S. transcaucasicus* than in the two pelves of *S. camelus*. In the former this incurvation is limited at the top and at the bottom by blunt ridges of the bone edges, whereas in both the latter pelves there are no ridges and the weak concavity of the pubis passes gradually into a convexity.

The cranioventral depression of the acetabulum in the pelvis of *S. transcaucasicus* is relatively narrow and deep, its craniocaudal width being 12 mm.

In this it approximates to the smaller pelvis of *S. camelus*, in the larger pelvis this depression is wider (about 17 mm), shallower, and has less steep slopes. The posterior wall of the acetabulum of *S. transcaucasicus* is oriented less steeply to the vertebral column than it is in the two pelves of *S. camelus* under comparison, i. e., in the former it more tilts up to the rear, forming an angle of about 50° with the dorsal surface of the backbone (the vertex of the angle points to the front), this angle being 70—80° in the two pelves of *S. camelus*. The acetabulum of *S. transcaucasicus* is relatively more elongated craniocaudally than that of *S. camelus*. The long axis of the left acetabulum of *S. transcaucasicus* is 81 mm, the short axis 58·5 mm, and the index of the ratio of the short axis to the long one is 72·2. In *S. camelus* these values are, respectively, 71 and 63 mm and the index is 90 in the large pelvis, and 61 and 56 mm, the index being 92, in the smaller one. The ring of the articulation facies of the acetabulum of *S. wimani* is interrupted cranioventrally by a narrow furrow, the smallest width of which is about 4 mm. The furrow comes out directly on to the wide depression in the lateral surface of the base of the pubic bone. In *S. transcaucasicus* the greatest width of the ring of the articular facies is about 37 mm cranioventrally, and about 31 mm caudoventrally, its smallest value, 17 mm, being found in the caudal sector. This ring is trough-shaped and its indentation is deepest in the dorsal and the ventral portion, whereas caudally its surface is flat.

Postacetabular part of the iliac bone. This part of the pelvis of *S. transcaucasicus* is characterized by its small height (cf. Table II.), which cannot be explained by deformation, since there are no signs of compression or crushing in the lateral area. In his description of the pelvis of *S. wimani* LOWE (1931) emphasizes the exceptionally great height of its preacetabular part, which in this specimen is 73 mm. In fossil *S. karatheodoris* this height is 72 mm, in 6 skeletons of *S. camelus* (after LOWE, 1931) it ranges from 48 to 59 mm, and only in one, from Nigeria, reaches 70 mm, which seemingly fills up the gap between the pelves of the two fossil species of the ostrich and the modern ones. In fossil *S. brachydactylus* this height is 64 mm, which brings it somewhat nearer to the two fossil species mentioned above than to the modern one. Consequently, allowing for the generally larger size of the pelvis in *S. transcaucasicus*, we must regard the height of its postacetabular part as relatively smaller than that in the other known contemporary and fossil ostriches of the genus *Struthio*. This character can be best illustrated by the indices of the ratio of the height in question to the measurements of other parts of the pelvis. For example, the index of the ratio of the greatest height of the renal part to the width of pelvis between both antitrochanters is 29·8 in *S. transcaucasicus*, 34·5 in *S. wimani* and 34·3—35·1 in contemporary *S. camelus*. The other indices are also significant (cf. Table II.) in their being the smallest for *S. transcaucasicus*.

As has already been mentioned, both dorsal areas of the renal parts of

S. transcaucasicus form a homogeneous bony surface, showing no boundaries with the synsacrum. LOWE (1931) mentions this very state in the pelves of *S. wimani* and *S. karatheodoris* in contradistinction to all the pelves of contemporary *S. camelus* examined by him (collection of the British Museum), in which the two dorsal areas were separated along the midline by a crest formed of fused spinous processes, there being a longitudinal fissure between the dorsal area of either side and this spinous crest. An analogous fissure is observed in the postacetabular portion of both halves of the pelvis also in fossil *S. brachydactylus*, which shows some signs of its still not entirely mature state (BURCHAK-ABRAMOVICH, 1953). The perfect coalescence of the dorsal areas into a uniform whole should be regarded as typical of quite mature, very probably even old, specimens, whereas the presence of the above-mentioned longitudinal fissures appears to be a distinctive character of youth. Writing about the complete coalescence of the two dorsal areas with the synsacrum, LOWE (1931) makes a remark that it is „a hyperostosis of the lumbo-sacral aponeurosis or fascia in old bird“ or that it is developmental in character and typical of old birds. The anterior iliac crest of the pelvis of *S. transcaucasicus* forms an obtuse angle of about 135—140° with the surface of the dorsal area of the renal part. In *S. camelus* this angle is about 160° in the larger of the pelves used for comparisons and about 175° in the smaller one, and, therefore, in this species the surfaces of these two parts of the pelvis lie nearly in the same plane.

C. Egg Shells

Egg shells of the fossil ostrich referred to the species *Struthio transcaucasicus* in the present paper were collected for the first time in fairly large numbers in Western Azerbaydzhan during the palaeontological expedition organized by the Museum of Natural History, Academy of Sciences of the Azerbaydzhan S. R. R. in 1952. In the following years such shells were found in the Bozdagy, west of Mingechaur, on the right-hand side of the River Kura. They are sometimes found in abundance in tali on the slopes of the Bozdagy, in original deposits of fragile sandstones, and in Lower-Apsheronian and probably Akchagilian continental deposits. The remains of shells are generally small, not exceeding 3 × 5 × 8 mm in measurements, with worn or sharp edges of the usually old breakage surfaces, which indicate that the egg had been broken still before its being buried. No whole eggs have been found so far, but the possibility of such finds cannot be excluded. Judging by their thickness, these shells belonged to a very large ostrich. The shell thickness ranges on the average from 2·9 to 3·3 mm, whereas somewhat thinner fragments (between 2·46 and 2·9 mm) are met with occasionally (BURCHAK-ABRAMOVICH, 1952, 1953). Thus, the thickness of egg shell places *Struthio transcaucasicus* among the largest fossil ostrich species of the genus *Struthio*. Out of the fossil ostriches whose egg shells exceed those of *S. transcaucasicus* in thickness, we must mention the following: *Struthio* sp. from Chadzhi-Abdul in Moldavia (egg shell thickness: 2·6—3·6) (BURCHAK-ABRAMOVICH and KONKOVA, 1967), *Struthio* sp. from the basin of the River Ili in Kazakhstan (egg shell thickness: 2·8—3·5 mm), and *Struthio chersonensis* from Semenovka in the Kuybyshev Province (egg shell thickness: 3·4—3·5 mm).

The macro- and microscopic studies of the egg shells will be published in a separate paper.

III. DISCUSSION

However few the finds of fossil ostriches are in the Caucasus Mts., they have already been reported from Transcaucasia, the Northern Caucasus, and from the regions neighbouring on the Caucasus. The site of the oldest find of a fossil ostrich (*Struthio* sp.), i. e. that from 1908, lies in Northern Iran (Southern Azerbaydzhan). Here, in the region of Lake Urmia and the town of Maragheh a big fossil ostrich (*Struthio* sp.) was found as a constituent of the Lower-Pliocene Hipparion fauna. It has been described by Mecquenem (1908, 1925) on the basis of one fragment of phalanx I of the third toe, which is kept in France. Gromov (1937, 1948) mentions the find of a tibiotarsus of *Struthio* sp. belonging to the so-called „Psekups fauna" of the Upper Pliocene from the River Psekups near the hamlet Levchenko south of Krasnodar. This bone has not been described and it was lost during the 2nd World War.

Burchak-Abramovich (1952) described egg shells of a very large ostrich (*Struthio* sp.) from the Lower-Apsheronian or Akchagilian continental deposites of Western Azerbaydzhan (southern part of the Palan-Tiukan Ridge). In the next years such shells were found in fairly large numbers in soft sandstones and sands of the Bozdagy, west of the town of Mingechaur. In the present paper the egg shells of fossil ostriches from the Upper-Pliocene deposits of Western Azerbaydzhan are referred to the new ostrich species *Struthio transcaucasicus* sp. nova. The basis of this determination is the same or nearly the same geological age and the nearness of the sites in which the pelvis (holotype) and egg shells were found (50—70 km, this distance lying within the area of usual wanderings of such a runner as the ostrich is). There is also a correspondence between the large size of the pelvis and the thickness of the egg shells. The ostrich egg shells from Western Azerbaydzhan are kept in Baku (Museum of Natural History, Academy of Sciences of the Azerbaydzhan S. S. R.), Tbilisi (Institute of Palaeontology, Academy of Sciences of the Georgian S. S. R.) and Kirovabad (Regional Museum).

Gadzhev (1958) describes a single egg shell fragment belonging to a relatively small fossil ostrich *Struthio* sp. from the Upper-Sarmatian Hipparion fauna of Eldar.

Yankova (1958) writes about a tibiotarsus of *Struthio* sp. found in a sand-pit near Livencovka in the region of Rostov-na-Donu together with a large number of bones of fossil mammals. The fauna of the Livencovka sand-pit corresponds to the „Psekups assemblage", which has been referred to the Upper

Pliocene and contains some fossil ostrich bones also (Gromov, 1937, 1948). Therefore, these two faunas are probably the same or nearly the same age. The bone in question is kept in the Regional Museum in Rostov-na-Donu.

The pelvis of a large fossil ostrich from the Akchagilian deposits of Kvabebi in Kachetia, described in this paper, is the latest find. It is the first sign of the presence of fossil ostriches in Georgia and the first find of bony remains of this bird in Transcaucasia, since up to the time of its finding only the egg shells of ostriches had been recorded from this territory (Western Azerbaydzhan).

Five pelves or their fragments of fossil ostriches of the genus *Struthio* had been known up to then, and thus pelvis of *Struthio transcaucasicus* under discussion is the sixth one. The first is the pelvis of *Struthio karatheodoris* found on Samos I. in 1894 and described by Martin (1903). It comes from the same place as the holotype of the species (femur) and is rather heavily damaged. It is in the possession of the Museum of the Viennese University. The second find is that of the pelvis belonging to *Struthio wimani*, collected in Shansi in China and used for the description of the species (Lowe, 1931). This pelvis is kept in the Uppsala Museum in Sweden. The third and largest pelvis, described by Lowe (1933) as that of *Struthio oldawayi*, was found in the Lower-Pleistocene deposits at Oldaway in Tanganyika (Central Africa). The fourth pelvis was used by Burchak-Abramovich (1953) as the holotype for the description of *Struthio brachydactylus*. This was a relatively small ostrich found in the Meotic Hipparion fauna of Grebeniki in the Odessa Province in the southern Ukraine. The state of preservation of this pelvis was better than that of the previous specimens. It was in the possession of the Museum of the Ukrainian Academy of Sciences in Kiev, but probably destroyed during World War II. The fifth find is the pelvis of *Struthio* sp. from the karst caves (so-called catacombs) in Odessa. The fragment described (Burchak-Abramovich, 1953) is the anterior part of the 1st vertebra of the synsacrum.

The Transcaucasian fossil ostrich, *Struthio transcaucasicus*, occurring in the Upper Pliocene of eastern Georgia and western Azerbaydzhan, is a distinct and independent species, which provides no grounds for its inclusion in any other ostrich species described before. Territorially, the Maragheh ostrich, *Struthio* sp., described by Mequenem (1908, 1925) from Northern Iran, stands nearest to it. However, the clear-cut differences in geological age (the Maragheh ostrich is from the Lower Pliocene) does not allow their identification with each other. Moreover, the remains of the Maragheh ostrich are too fragmentary, as there exists only one fragment of a phalanx of a toe. The Maragheh ostrich may rather be identified with *S. karatheodoris* from Samos, since they both go back to the same period, the Lower Pliocene, and the sites of their finds are not very distant from each other. There is still less reason to identify the Transcaucasian fossil ostrich with the South-Ukrainian, Moldavian, Upper-Sarmatian, Meotic and Lower-Pliocene ostriches, such as small *S. brachydactylus*, large *Paleostruthio sternatus* Burchak-Abramovich *Struthio novorossicus* Alexeyev, 1916, *Struthio* sp. from Novaya Emetovka near Odessa, and all other finds representing the same geological period. Relatively small Upper-Sarmatian *Struthio* sp. from Eldar, so far known only from a single egg shell fragment, apparently belongs to another, new species. Somewhat younger specimens of *Struthio* sp. from the River Psekups (GROMOV, 1937, 1948) and the Livencovka sand-pit (YANKOVA, 1958), from the very top of the Pliocene, stand near each other in respect of their geological age. They come from very distant sites (Northern Caucasus and Central Transcaucasia), which are separated by the then already existing main ridge of the Caucasus, an impassable barrier for ostriches. All these facts suggest that, most probably, these specimens were members of different ostrich species, the North-Caucasian ones, which approximated to the South-Ukrainian ostriches, and the Transcaucasian one, belonging to the ostrich group from Asia Minor.

The Middle-Pliocene *Struthio* sp. from the Odessa karst caves, the so-called Odessa catacombs, is a big ostrich, perhaps not inferior in size to the Transcaucasian ostrich from Kvabebi, but these two forms are too far removed from each other and too much differing in geological age, as they represent, respectively the Middle and the Upper Pliocene, to be counted in one species. The Odessa fossil ostrich will, in all probability, appear to be a new species.

The age of *Struthio chersonensis* (BRANDT, 1873) or *Struthiolitus chersonensis* BRANDT, described on the basis of a whole egg, has not been determined exactly, but it probably comes from the top of the Pliocene or the Lower Pleistocene. Therefore, it seems the right thing to place the egg of *Struthiolitus* side by side with the ostrich from the River Prekups and that from the sand outcrops of Livencovka, identical or nearly identical in respect of age and found at places not very distant from each other (Kherson Province in the south of the Ukraine and Northern Caucasus). In no circumstances can *S. chersonensis* be identified with the Middle-Pliocene specimen of *Struthio* sp. from Odessa or *S. transcaucasicus* from Transcaucasia (Akchagil).

BRODKORB (1963) mentions 6 species of ostriches in his catalogue of fossil birds: Lower-Pliocene *Struthio asiaticus* MILNE-EDWARDS 1871, Lower-Pliocene *Struthio chersonensis* (BRANDT 1873), Lower-Pliocene *Struthio wimani* LOWE 1931, Lower-Pleistocene *Struthio oldwayi* LOWE 1933 and Upper-Pleistocene *Struthio anderssoni* LOWE 1931. In the group designated by the name of *Struthio chersonensis* (BRANDT) he includes two genera, *Struthiolitus* and *Paleostruthio*, inclusive of 5 species: *Struthiolitus chersonensis* BRANDT 1873, *Struthio karatheodoris* FORSYTH MAJOR 1888, *Struthio novorossicus* ALEXEYEV 1916, *Struthio brachydactylus* BURCHAK-ABRAMOVICH 1939 and *Paleostruthio sternatus* BURCHAK-ABRAMOVICH 1953. We cannot agree with BRODKORB (1963), in whose system all the fossil ostriches from the southern Ukraine, Greece, Samos I., Asia Minor, Egipt and Kazakhstan are brought together in one species, *Struthio chersonensis* (BRANDT). This is unacceptable in view of the vast territory over which the sites of finds of their remains are scattered, the differences in the anatomic structure of the remains and their size, and the great ampliture of geological age of the particular finds: from the Upper and even Middle Sarmatian

(Moldavia) to the beginning of the Pleistocene. BRODKORB (1963) seems to have been led into error by his unacquaintance with the geological age of particular specimens, because he referred all of them to the Lower Pliocene (Pannonian) and in the footnote on page 197 remarked that „there are no grounds for the existence of more than one ostrich species in the Early Pliocene".

The data obtained from detailed macroscopic and, above all, microscopic examination of the egg shells, which are found more frequently than the remains of ostrich bones, will be of fundamental importance to the study of the fossil ostriches of the Caucasus, Asia Minor and Southern Ukraine, in particular, to the accurate definition of their systematic position, the erection of new species and the combination of the old ones. A large number of egg shells of *S. transcaucasicus*, *Struthio* sp. from the Odessa caves, *Struthio* sp. from Novaya Emetovka and numerous localities in the Southern Ukraine, as well as from Kazakhstan and other places have been collected in this country. This material, however, needs separate studies.

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STRESZCZENIE

Znaleziska kopalnych strusi z rodzaju *Struthio* na Kaukazie nie są częste. Jako pierwszy był znaleziony *Struthio* sp. w łożysku rzeki Psiekups (lewy dopływ Kubani), na południe od Krasnodaru, w miejscu znalezienia tzw. „psiekupskiej fauny ssaków", datowanej na sam szczyt pliocenu (GROMOV, 1937). Następnie BURCHAK-ABRAMOVICH (1952) opublikował makroskopowy opis skorup jaj bardzo dużego (sądząc z grubości skorupy) kopalnego *Struthio* sp., znalezionych przez niego w Zachodnim Azerbejdżanie. W następnych latach skorupy takie były znalezione w Bozdagach, na zachód od miasta Mingeczaur. W obecnym opracowaniu skorupy jaj wspomnianego wyżej, kopalnego strusia z górnoplioceńskich pokładów Zachodniego Azerbejdżanu, wiązane są z opisywanym, nowym gatunkiem *Struthio transcaucasicus* n. sp.

Opisywana w tej pracy miednica (holotyp) kopalnego strusia *Struthio transcaucasicus* sp. n., pochodzi z akczagiłskich warstw miejscowości Kwabebi, rejonu Signachskiego w Kachetii (Wschodnia Gruzja). Miednica ta jest uszkodzona. Synsacrum obłamane jest od tyłu między 2 i 3 kręgami ogonowymi. W pierwszym kręgu synsacrum uszkodzona jest górna część wyrostka ościstego. Z kości łonowych i kulszowych pozostały tylko części bazalne. Kości biodrowe zachowały się lepiej: u nich obłamane są peryferyjne części tylnej połowy i przednio-górne kraje. Miednica w całości jest do pewnego stopnia zdeformowana, co zostało uwzględnione przy opisie i ustalaniu proporcji.

Opis miednicy (holotypu) *Struthio transcaucasicus* sp. n.

Miednica jest bardzo dużych rozmiarów. Niektórymi wymiarami przewyższa wszystkie dotychczas znane miednice kopalnych strusi z rodzaju *Struthio*, a innymi, odwrotnie, ustępuje im (por. tabele I i II). Diapofizy pierwszego kręgu lędźwiowo-miednicowego położone są bardziej połogo niż u współczesnego *S. camelus* i *S. wimani* Lowe. Bruzdy, idącej u *S. camelus* wzdłuż dolnego kraja preacetabularnej części kości biodrowej, do przodu od 2. kręgu, brak. Wysokość processus spinosus 1. kręgu jest wyraźnie mniejsza niż u innych przedstawicieli rodzaju *Struthio*, gdy tymczasem szerokość miednicy na poziomie pierwszego kręgu jest znacznie większa niż u innych strusi. Na skutek tego preacetabularna część miednicy jest u niego stosunkowo niska i szeroka. Wysokość postacetabularnej części kości biodrowej jest mniejsza niż u wszystkich innych kopalnych i współczesnych gatunków rodzaju *Struthio*. Preacetabularna część synsacrum jest krótsza niż u *S. camelus*.

Skorupy jaj są grube, średnio 2·9—3·3 mm. Na poprzecznym przekroju widać 3 warstwy jak u jaj wszystkich innych przedstawicieli rodzaju *Struthio*, ale szczegóły ułożenia i forma małych otworków są inne.

РЕЗЮМЕ

Находки ископаемых страусов рода *Struthio* на Кавказе не часты. Впервые ископаемый страус (*Struthio* sp.) был найден в среднем течении реки Псекупса (левом притоке р. Кубани) к югу от г. Краснодара в местонахождении т. н. „псекупской фауны млекопитающих“, датируемой самыми верхами плиоцена. (В. И. Громов, 1937). В 1952 г. Н. И. Бурчак-Абрамович опубликовал макроскопическое описание скорлупы яиц весьма крупного ископаемого *Struthio* sp. (судя по толщине скорлупы), найденной им в Западном Азербайджане. В последующие годы такая же скорлупа была найдена в Боздагах к западу от г. Мингечаура. В настоящей статье скорлупа яиц ископаемого страуса из верхнеплиоценовых отложений Западного Азербайджана отнесена к описываемому новому виду ископаемых страусов — *Struthio transcaucasicus* sp. n. Описываемый в данной статье таз (голотип) нового вида ископаемого страуса — *Struthio transcaucasicus* sp. n. происходит из акчагыльских отложений местности Квабеби, Сигнахского района в Кахетии (Восточная Грузия). Таз в дефектном состоянии. Синсакрум обломан сзади между 2-м и 3-м хвостовыми позвонками. У 1-го синсакрального позвонка дефектная вершина остистого отростка. От лобковой и седалищной костей остались только их базальные основания. Подвздошные кости сохранились лучше, у них обломаны периферийные участки задней половины и верхнепередние края. Таз до некоторой степени деформирован, что учитывается при описании и установлении его пропорциональных отношений.

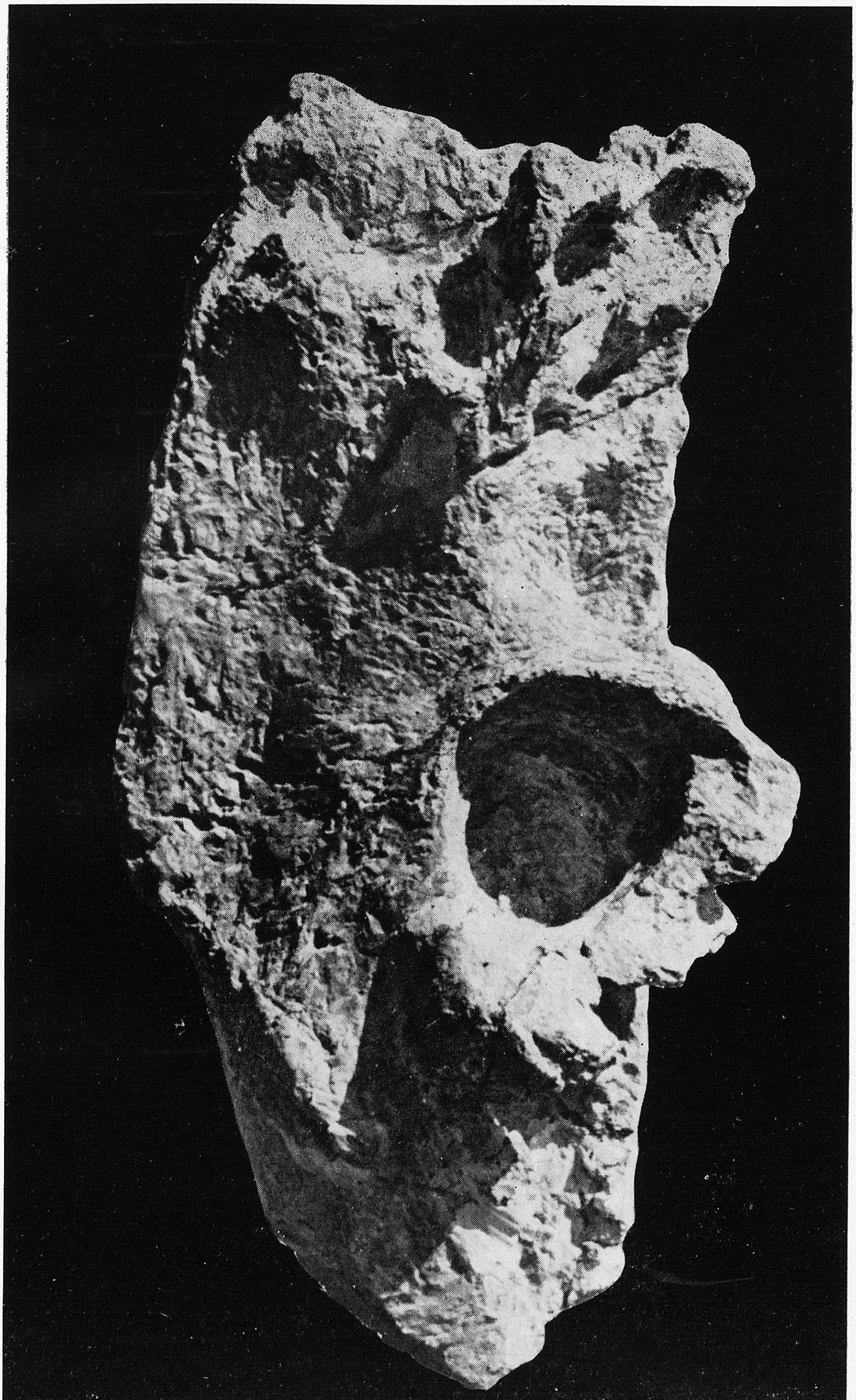
Диагноз таза (голотип) *Struthio transcaucasicus* sp. n. Таз весьма крупных размеров (по некоторым промерам превосходит все до сих пор известные тазы ископаемых страусов рода *Struthio*, по некоторым наоборот уступает им). Диапофизы первого позвонка (пояснично-тазового) поставлены более полого, чем у рецентного *S. camelus* и *S. wimani* Lowe. Борозда, идущая вдоль нижнего

края преацетабулярной части ossis ilii кпереди от 2-го позвонка отсутствует. Высота proc. spinosus 1-го позвонка значительно меньше, чем у других представителей рода, тогда как ширина таза на уровне 1-го позвонка значительно больше, чем у других видов рода *Struthio*. Вследствие этого преацетабулярная часть таза у него относительно низкая и широкая. Высота постацетабулярной части ossis ilii относительно ниже, чем у всех других ископаемых и рецентных видов рода *Struthio*. Преацетабулярная часть synsacrum относительно короче, чем у *S. camelus*. Длинная ось ацетабулюм лежит более полого, т. е. образует относительно более острый угол с осью synsacrum, чем у *S. camelus*. Скорлупа яиц толстая, в среднем 2,9—3,3 мм. В поперечном сечении состоит из 3-х слоев, как и у всех остальных представителей рода *Struthio*, но особенности расположения и форма мелких пор иная.

PLATES

Plate I

Phot. 1. The pelvis of the Transcaucasian fossil ostrich *Struthio transcaucasicus* sp. n. View of the right lateral surface. Somewhat larger than 1/2 natural size



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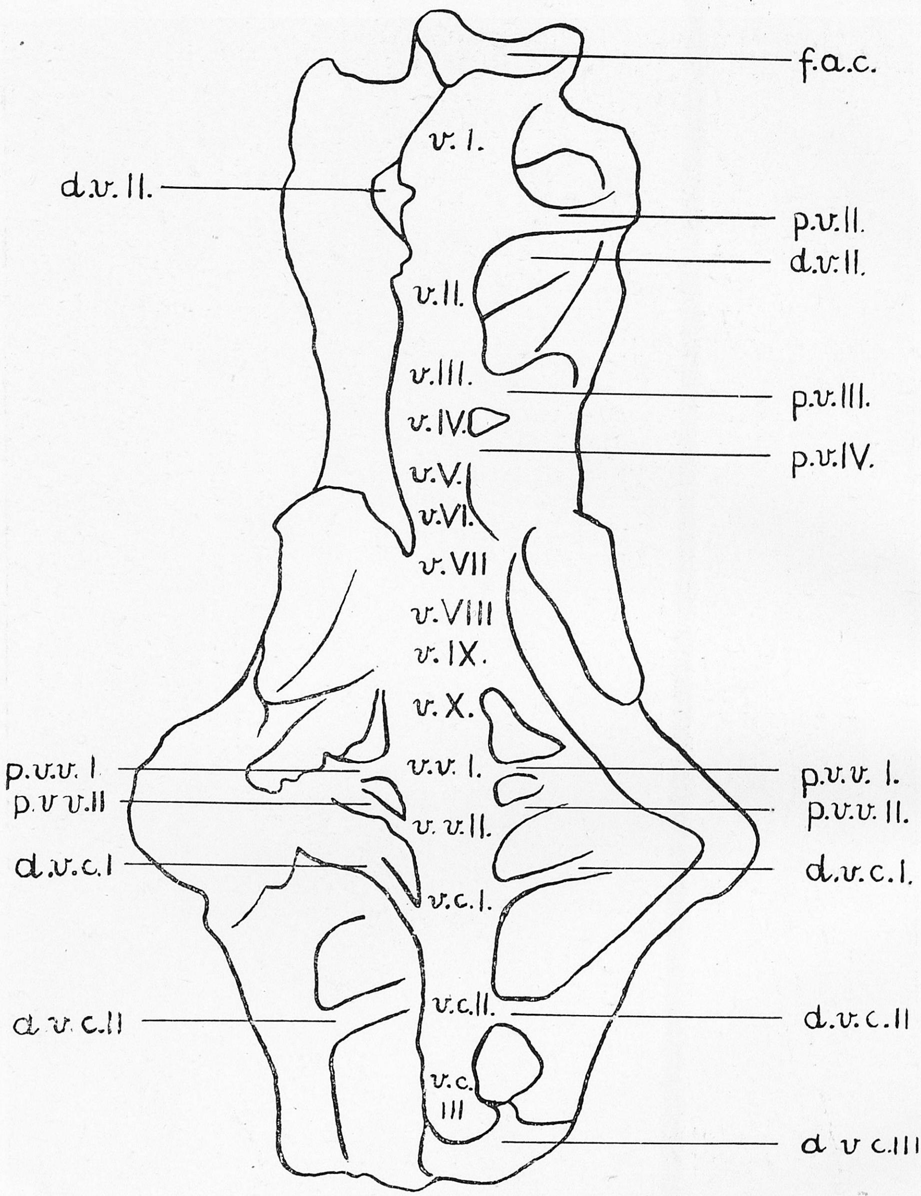
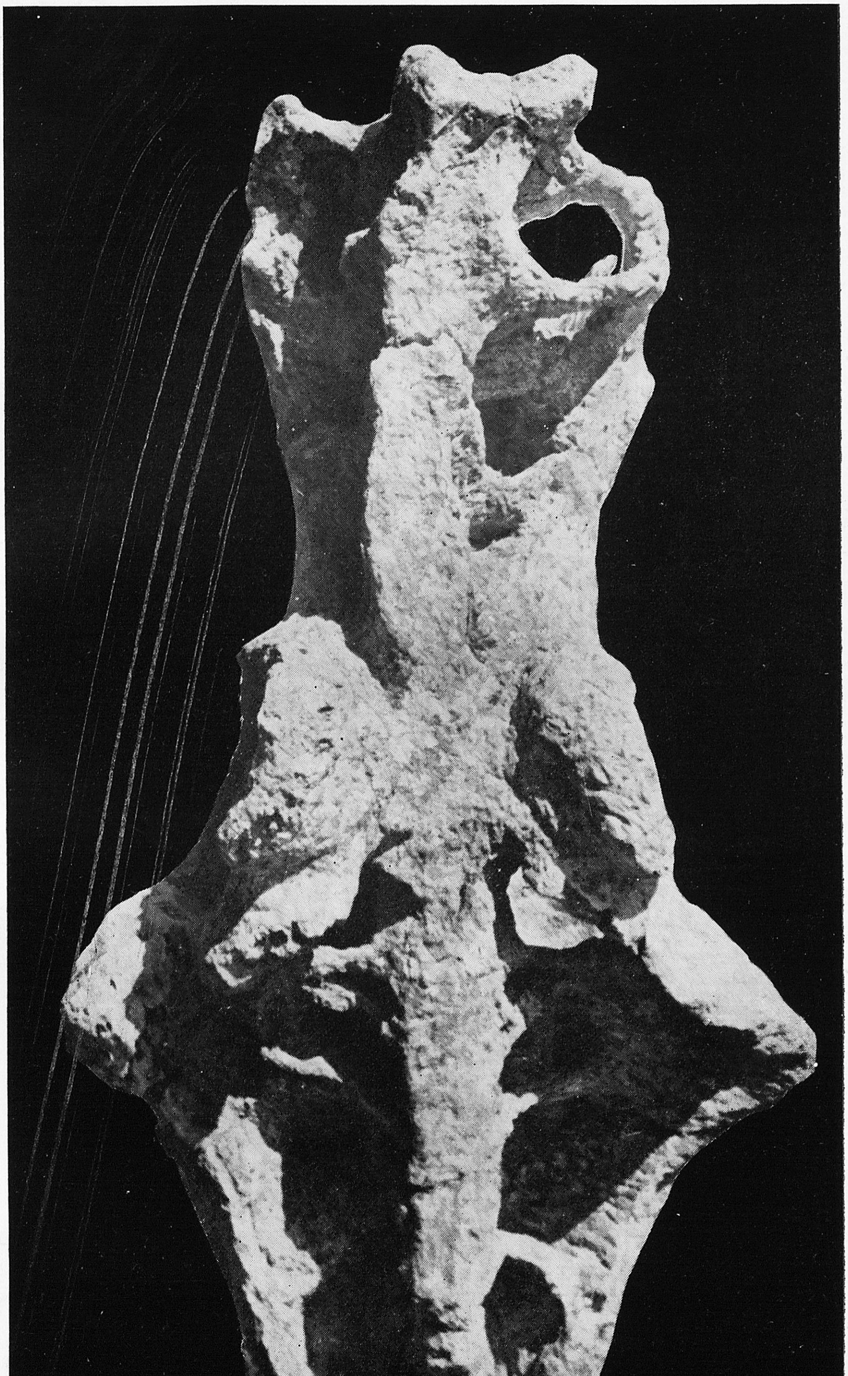


Plate II

Fig. 2. The pelvis of the Transcaucasian fossil ostrich *Struthio transcaucasicus* sp. n. View of the ventral surface. Somewhat larger than 1/2 natural size. The detailed explanations are given in the diagram above. v. I — v. X — synsacral vertebrae, v. v. I, v. v. II. — proper sacral vertebrae, v. c. I. — v. c. III. — caudal synsacral vertebrae, p. v. — parapophyses of synsacral vertebrae, p. v. v. — parapophyses of proper sacral vertebrae, d. v. — diapophyses of synsacral vertebrae, d. v. c. — diapophyses of caudal synsacral vertebrae, f. a. c. — cranial articulation surface of synsacral vertebra I (The explanation of Phot. 2.)



Phot. 2

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