

*Palaeobiology*

## Giant Ostrich in Dmanisi Fauna

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**ABSTRACT.** Dmanisi site and fauna of Upper Pliocene vertebrates is the widely known standard of late Neogene of the Caucasus. Materials on the rarest finds of skulls and mandibulae of the oldest (1,85 m) hominids in Eurasia in Dmanisi, as well of remains of multiform fauna of vertebrates have been repeatedly published in various scientific editions. Excavations of fauna of Upper Pliocene vertebrates of widely known Dmanisi site has been continued successfully. The list of fauna is enlarged with new elements yearly. Dmanisi faunistic complex contains representatives of about 40 species of six orders Mammalia: Lagomorpha, Rodentia, Carnivora, Proboscidea, Perissodactyla, Artiodactyla. There are also single finds of remains of Reptilia and Aves. The birds are most poorly presented in diverse fauna of Dmanisi. We have found only three bones of birds until recently. At the beginning of excavations of the site in 1983, a large femur of ostrich was discovered, then, in 2001 and 2006, the head of arm of Gallus and shin of Strix were found. And finally, in 2012, we succeeded in finding one more femur of ostrich, the description of which this article is dedicated to. Presence of remains of ostrich in old deposits unmistakably points to the predominance in the region of favorable conditions of climate. It is known that ostriches inhabit in open, snowless regions, preferring deserted, semi-deserted and steppe landscapes. Presence of remains of huge ostriches in the second half of the Pliocene on the territory of the South Caucasus is vivid evidence of the prevalence of continental arid stations in this region. © 2013 Bull. Georg. Natl. Acad. Sci.

**Key words:** *fauna, Upper Pliocene, birds, ostrich, Dmanisi, Georgia.*

Dmanisi site and fauna of Upper Pliocene vertebrates is a widely known standard of late Neogene of the Caucasus. Materials on the rarest finds of skulls and mandibulae of the oldest (1.85 m) hominids in Eurasia in Dmanisi, as well of remains of multiform fauna of vertebrates were repeatedly published in scientific editions [1-5]. Nevertheless, I think, it is not out of place to get specialists acquainted with the newest paleontological finds. Excavations in Dmanisi intensively continue and give us a palaeontological surprise every year enlarging the list of fauna with new elements. The Dmanisi faunistic com-

plex contains representatives of about 40 species of six orders of Mammalia: Lagomorpha, Rodentia, Carnivora, Proboscidea, Perissodactyla, Artiodactyla. There are also single finds of remains of Reptilia and Aves.

Birds are most poorly represented. Until recently only three bones of birds were discovered in Dmanisi. At the beginning of excavations on Dmanisi site in 1983, a relatively well-preserved femur of ostrich (*Struthio*) was found among the bones of ungulates and Proboscidea [1]. A little later Burtchak-Abramovich and Vekua published a detailed descrip-



Fig.1. *Struthio dmanisensis* Burtchak-Abramovich et Vekua, Femur (right)

tion of femur, identifying a new species of ostrich of rather huge dimensions - *Struthio dmanisensis* Burtchak et Vek. [6].

In 2001 new remains of the bird appeared. This is the proximal part of humerus and upper half of tibiotarsus with a proximal articulate epiphysis. Bendukidze and Burtchak identified a new species, *Gallus dmanisensis* [7] and *Strix gigas* Bend et Burch [8] as the result of investigation of a humeral head and a shin of a huge owl.

Presence of some huge ostrich in fossil fauna of the Caucasus was first established in 1952. Burtchak-Abramovich [9] found fragments of egg-shells of a rather large size in Western Azerbaijan in Upper Apsheron deposits. Remains of ostrich eggs on the territory of Georgia were found and established in Upper Akchagil deposits of Kotsakhuri; and a little earlier, nearly a whole pelvis of a huge ostrich was found in the Akchagil deposits of Kvabebi, well known in literature, which served as a basis for identification of a new species of Upper Tertiary *Struthio transcaucasicus* Burtchak-Abramovich et Vekua [10]. In the authors' opinion remains of egg-shells, found in Azerbaijan and Georgia, most likely belong to

*Struthio transcaucasicus*.

The present article is dedicated to the description of a new find – left femur, found in bone-bearing deposits of Dmanisi, nearly on the same geological level, as the first femur (D70) *Struthio*.

Order *Struthioformes* (Latham)

Family *Struthionidae* Vigors, 1925

Genus *Struthio* L., 1750

*Struthio dmanisensis* Burtchak-Abramovich et Vekua, 1990

Holotype: Femur dex., ad., D70., collection of the Institute of Paleobiology of the National Museum of Georgia.

Location: Dmanisi, East Georgia, Upper Parts of Middle Villefranche, MN17.

**Material:** two complete femurs D70 and D5768.

The femurs do not differ from each other according to their sizes, forms and location of morphological features, and obviously belong to one individual, though they are found in a burial place at some distance from each other, but on the same stratigraphic level. Regularity of selective burial of remains of separate animal parts is not observed. Disorderly pile of different bones of skeleton, absence of any certain orientation of bones in the burial place, rather frequent finds of skulls, mandibulae, as well as separate parts of skeleton in anatomical articulation indicate that bones were moved to the place of burial from a close distance.

The right femur D70 (femurs, dex. ad.) was found in Dmanisi in 1983. It seems that the femur had been damaged before being buried: all the three condyles on the distal end, especially medial aspect trochlea medialis, were bitten by predator; lateral proximal angle of the bone is also damaged on the proximal end in just the same way, as the result of which the crest of trochanter major is missed. The surface of bone is of rosy-yellow colour.

The left femur D5768 (femurs sin. ad.) was found in 2012 and differs from the first find by being preserved better, though insignificant damage is observed on this femur too. Some part of trochanter



Fig. 2. *Struthio dmanisensis* Burtchak-Abramovich et Vekua Femur (left)

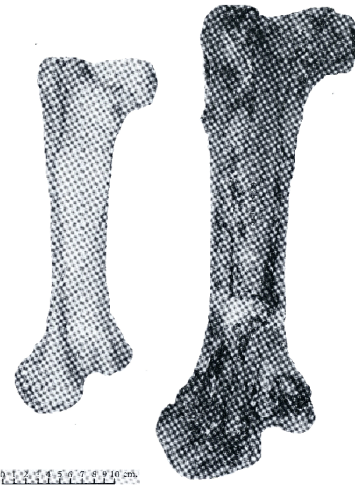


Fig.3. *Struthio* modern Femur (left) *Struthio oldowayi* Femur (right)

major on the proximal end of femur is broken off, as a result of which the anterior-lateral part of crest is absent. The upper end is bitten in the distal part of femur condylus lateralis.

**Diagnosis.** The femur is of very huge dimensions (the greatest length of bone is 380-385 mm), exceptionally massive (index of massiveness 20). Fovea patellaris gradually widens, when in other forms of the genus *Struthio* it narrows downward. Trochanter major is elevated noticeably above the level of the tip of caput femoris at a larger degree than in the other species of *Struthio*. Slopes of fovea patellaris are relatively gently sloping. Trochanter minor wholly lies on linea aspera (in *S. camelus* - only the lower part). Trochlea patellaris lateralis, lowering gradually, passes into linea anterior proximally (in *S. camelus* trochlea patellaris lateralis forms a steep ledge towards linea anterior).

**Description and Comparison.** Femurs of *S. dmanisensis* are of rather huge dimensions. The greatest length of a bone through trochanter major of D70 is 380 mm, and of D5768 is 385 mm. Consequently, *Struthio dmanisensis* is slightly inferior *S. oldowayi* from Tanganyika by the length of femur. The greatest length of femur of the latter is ca. 400 mm. It should be noted that femur of *S. dmanisensis* is rather massive and by this feature surpasses not only *S. oldowayi*, but all fossil and recent repre-

sentatives of genus *Struthio*. Index of correlation of the least width of femur with the greatest length of femur through trochanter major of Dmanisi ostrich is 20, and the same index of *S. oldowayi* is ca. 16. Generally this index has never been more than 17 in all the fossil and recent representatives of the genus *Struthio*. Because of such proportions of the bone, general forms of the femur of *S. dmanisensis* and *S. oldowayi* are considerably different. The femurs of both ostriches are very long, but that of Dmanisi is more massive, clumsy, bulky, and *S. oldowayi* femur is noticeably well-proportioned, graceful and lighter. The impression is gained that *S. oldowayi* was fast runner, agile, and Dmanisi ostrich was more clumsy and sluggish.

Dmanisi ostrich differs from Kvabebi ostrich *S. transcaucasicus* by slightly smaller size. In our work [6], it is erroneously pointed out that Dmanisi ostrich differs from *S. transcaucasicus* by somewhat bigger dimensions. In reality everything is on the contrary - Kvabebi ostrich *S. transcaucasicus* is slightly larger than that of Dmanisi one. We judge about it by the discrepancy between diameter of acetabular depression (70 mm) of *S. transcaucasicus* and the greatest diameter of a caput femori (anterior-posterior) of Dmanisi ostrich (63; 66).

Most of the species of fossil ostriches of the genus *Struthio* (*Struthio* sp. from Odessa caves,

*S. karateodoris*, *S. brachydactylis*, *S. orlovi*) differ from the described Dmanisi ostrich by noticeably smaller dimensions and older geological age.

Judging by the dimensions and massiveness of the first phalange of main finger of leg, *Struthio pannonicus* was a rather huge ostrich [11], which was probably not inferior to Dmanisi ostrich by its dimensions.

Caput femori of Dmanisi ostrich has the shape of hemisphere. Fovea capitis femoris occupies nearly half of the upper surface of the head. Fovea is of an oval form with a long medio-lateral axis. Its dimensions are (on the femur of D70 – 30/23 mm, on the femur of D5768 – 25/23 mm). The posterior wall of fovea is higher in comparison with the anterior one. Medial slope of fovea is gently sloping and laterally passes directly onto the surface of the head.

Collum femoris is comparatively narrow (antero-posteriorly). The collum of recent *S. camelus* is relatively wider. The index of comparative width of collum in relation to the antero-posterior width of the caput femori is 85.3 for the Dmanisi ostrich, 86.6 - for the recent *S. camellus* and 103.6 – for Nandu.

Caput femori is considerably elevated above the level of Trochanter major. The index of elevation of caput femori of Dmanisi ostrich is about 4, of African *S. camellus* – 2.8 and concerning Nandu both points – tips of head and trochanter – are nearly on the same level.

Arch-wise part of linea aspera of Dmanisi ostrich is weakly expressed, nearly imperceptible and does not form a ledge. Fossa trochanterica is on the rough surface. Its dimensions in Dmanisi ostrich are insignificant.

*Fossa patellaris* of Dmanisi ostrich is considerably wider, than that of *S. camellus*. Index of relative width of fossa patellaris is bigger (44.7) in Dmanisi ostrich than in *S. camellus* (30.5), but fossa patellaris in nandu is bigger (53) than in both others.

Comparing the femur of Dmanisi ostrich with the femur of *S. oldowayi* we use the photography of the right femur of Olduvai ostrich placed in the book

“Olduvai Gorge” [12]. While comparing these femurs, obvious shapeliness of the femur of Olduvai ostrich in comparison with the one from Dmanisi is striking. We have already noted, that index of relative width (medio-laterally) of the bone of Dmanisi ostrich with the greatest length of femur (through trochanter major) is equal to 20, the index of Olduvai ostrich femur is about 16. Thus, it should be emphasized that femur of Dmanisi ostrich is considerably more massive than all femurs of recent and fossil representatives of the genus *Struthio*. Besides, the femur of *S. dmanisensis* is larger than those of other ostriches and is only slightly (15-20 mm) inferior to the length of Oldoway femur. In connection with such proportions of bone, general shapes of femurs of Dmanisi and Olduvai ostriches essentially differ.

Caput femori of Dmanisi ostrich has the shape of hemisphere, positioned steeply and inclined to the longitudinal axis of the bone. Nearly half of the upper part of the head surface is occupied by an oval-shaped fovea capitis femoris with a long axis. The posterior wall of the fossa is higher than the anterior and practically vertical. The medial slope of fossa is almost gently sloping. Measurements of the fossa are 30/23 mm.

Collum femoris of Dmanisi ostrich is relatively narrow (antero-posteriorly). But the collum femoris of recent *S. camellus* is relatively wide.

Caput femori is considerably elevated (15 mm) above the level of trochanter major. Elevation of femur of *S. camellus* is less (8 mm), caput femori of Australian emu lies on the lower level, and in American nandu both points are almost on the same level. The femur of Dmanisi ostrich differs from the one of recent *S. camellus* by the structure of linea aspera. It is weakly expressed on the femur of Dmanisi bird, when it curves arch-wise and forms visible ledge on the femur of *S. camellus*.

Identification of a new species of ostrich *Struthio dmanisensis* Burtchak-Abramovich, Vekua, [13] was grounded by huge dimensions of femur and peculiarity of morphological features. First of all, these are

Table. Measurements of the femur of *struthio dmanisensis*

##	Measurements of Femur, mm	<i>Struthio dmanisensis</i> D70 Dmanisi Burtch.-Abr., Vekua, 1900	D5768 Dmanisi	<i>S. camelus</i> (recent) collect. Moscow, Baku	St. oldowaji gorge, 1967 (photo)
1	Length over trochanter major	ca. 380	385	304-325	ca. 400
2	Length over caput femoris	ca. 360	335	260-310	—
3	Small width of the diaphysis	76	76	42-51	ca.65
4	Small thickness anteroposterior	54	54	33-47	—
5	Width of the upper epiphysis	ca. 120	144	103-121	ca.135
6	Width of the lower epiphysis	ca. 125	129.5	95-112	135
7	Anteroposterior diameter of condylus lateralis	120	126.5	105-118	—
8	Anteroposterior diameter caput femoris	63	66	45-52	—
9	Vertical diameter of caput femoris	62	60.6	43-51	—
10	Fuveja ligament capitis length (mediolateralis)	25 23	41 13.8	23-38 14-18	—
11	Anteroposterior width of the neck	53	52.5	39-46	—
12	Upper surface of the trochlear major	ca. 105	—	65-90	—
13	Length of the anterior edge of the trochanter major	112	138.8	75-97	—
14	Width of the fossa patellaris	34	37.2	18-25	—

huge dimensions of femur, rather noticeable massiveness of diophysis of femur, high position of caput femori above Trochanter major, shape, dimensions and structure of linea aspera etc.

In one work dedicated to Dmanisi ostrich [13], we erroneously noted that in the process of accumulation of fossil material on Dmanisi ostrich, this species can turn out to be a synonym of *S. panonicus*. It is more natural to seek the relations between Dmanisi ostrich and Middle Akchagil *Struthio transcaucasicus* Burt. et Vek., [10], to which Dmanisi ostrich is drawn not only by the territory (Georgia) and the time of existence (the end of the Pliocene), but rather huge dimensions as well.

Transcaucasian fossil ostrich (*S. transcaucasicus*), existing in the Upper Pliocene in Eastern Georgia and Western Azerbaijan, is a well-expressed independent species, which can not be identified with other spe-

cies of ostriches, described earlier. In terms of location Dmanisi ostrich is the closest of all to it (100 cm). Insignificant geological difference, similarly huge dimensions justify their identification in future after new finds of remains in Dmanisi and Kvabebi.

The presence of remains of ostrich in old deposits unmistakably points to the predominance in the region of favorable conditions of climate. It is known that ostriches inhabit open snowless regions, preferring desert, semidesert and steppe landscapes. The presence of remains of huge ostriches in the second half of the Pliocene on the territory of the South Caucasus is vivid evidence of the prevalence of continental arid stations in this region. Apparently, the ostriches became extinct by the beginning of the Quaternary period in the South Caucasus, which was connected with sharp worsening of the climatic conditions.

## პალეობიოლოგია

# გიგანტური სირაქლემა დმანისის ფაუნაში

## ა.ვეკუა

აკადემიის წევრი, პალეობიოლოგიის ინსტიტუტი, საქართველოს ეროვნული მუზეუმი, თბილისი

დმანისში პალეონტოლოგიური გათხრები ინტენსიურად გრძელდება. ყოველი ახალი საექსპედიციო პერიოდის შემდეგ არსებითად იზრდება დმანისის ფაუნის სია. დღეისათვის დმანისში ხერხემლიანთა ფაუნის 40-მდე წარმომადგენელია დადგენილი. მათ შორის ჭარბობენ ძუძუმწოვრები: მღრღნელები, მტაცებლები, ხორთუმიანები, ჩლიქოსნები. ბოლო დრომდე იშვიათი იყო მხოლოდ ფრინველების წარმომადგენლები. ჯერ კიდევ დმანისის გათხრების დასაწყისში აღმოჩნდა ფრინველის ერთადერთი ძვალი - გიგანტური სირაქლემის კარგად შემონახული მარჯვენა ბარძაყის ძვალი. ბურჩაკ-აბრამოვიჩმა და ვეკუამ ახალი მონაპოვარი მიაკუთვნეს გიგანტური სირაქლემის ახალ სახეს - *Struthio dmanisensis* Burt. et Vek. შედარებით გვიან, 2001 და 2006 წწ. დმანისში აღმოჩნდა ფრინველის მხრის ძვლის ზედა ბოლო და წვივის ძვალი, რომლებიც ბენდუქიძემ და ბურჩაკმა გარეულ ქათამსა (*Gallus*) და ბუს (*Strix*) მიაკუთვნეს. სულ ახლახან დმანისში ჩვენ მიერ ნაპოვნია გიგანტური სირაქლემის მარჯვენა ბარძაყი, რომელიც უდავოდ იმავე ინდივიდს ეკუთვნის, რომელსაც პირველად ნაპოვნია ბარძაყის ძვალი. წინამდებარე სტატია სირაქლემის ძვლის ახალ აღმოჩენას, სირაქლემების საქართველოს ტერიტორიაზე გავრცელებასა და მათი ცხოვრების ნირის გაშუქებას ეძღვნება.

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