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Palaeobiology

A New Site of the Neogene Vertebrate Fauna from Kaspi District

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ABSTRACT. Hipparion fauna is of major importance for dating the Neogene fossil-bearing sediments. There are a number of sites with Hipparion fauna in the Southern Caucasus. Out of them only two are dated as Upper Sarmatian: Eldari (Azerbaijan) and Iaghludja (Georgia). Fossil bearing Sarmatian sediments were recently found in Kaspi district, Georgia. Fossil fauna is not diverse, however, key taxa undoubtedly date this site as Late Sarmatian. *© 2012 Bull. Georg. Natl. Acad. Sci.*

Key words: *Neogene, vertebrate fauna, Sarmatian, Caucasus, Kavtiskhevi.*

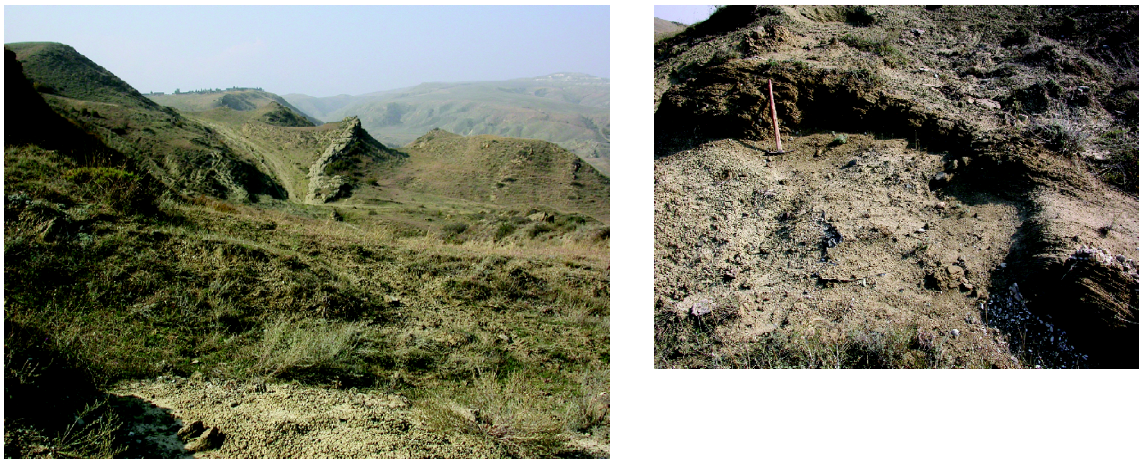
Several years ago the head of the Kaspi archeological expedition Dr. Z. Makharadze informed us that in the environs of Kavtiskhevi village in the sandstones he had seen fossil animal bones. We got interested in this information, a paleontological expedition: D. Lordkipanidze, A. Vekua, G. Megrelishvili, G. Bidzinashvili, Z. Meskhi, J. Agusti and O. Oms immediately went to Kavtiskhevi. The information provided by Makharadze was confirmed and we started explorations and fossil collection.

Geological setting of the region

The research area is located in the central part of Kartli intermontane depression, in the Kura basin, between the villages of Metekhi and Dzegvi. Strata building of the region encompasses almost all stratigraphic units starting with the Upper Cretaceous (Turonian-Santonian) up to the Quaternary sediments inclusively.

Neogene sediments are well represented in the area and have two major lithological facies. The lower facies is represented by a succession of sandstones and claystones and is known as Sakaraulo horizon [1]. Faunistically this horizon was described by G. Kharatishvili [2].

The upper facies is mainly represented by Maikopian clays (Kotsakhuri horizon) which are conformably followed by an almost complete Middle Miocene



a. b.

Fig. 1. General view of the Kavtiskhevi site (a) and fossil-bearing sediments (b).

stratigraphic section.

The scope of our interest lies in Late Neogene fossil-bearing sediments and our discussion will deal with them.

Geologists identify three different horizons in the Sarmatian sediments:

– Early Sarmatian – blue sandstone-mudstone layers, with frequent inclusion of dense greywacke carbonate sandstones with alteration of gravelite lenses. These sediments are exposed on the northern slopes of the Vakistavi mountain and to the North of the Sachite mountain.

– Middle Sarmatian – characterized by variegated facies and mainly found in the central part of Vakistavi-Sachite series. The Middle Sarmatian sediments in general are represented by alterations of sandstones and loam. Lamellar structure of clays is well observable. Sandstones are dense and characterized by carbonate cementation. Rhythmic alterations of shallow sea and continental facies are well observable on these sediments, which are reflected in the lithological diversity and variety of colours. Continental coloured clays and seashore sandstones with midlayers of microconglomerates follow one another in the section. According to geologists, the entire formation can be considered as an analogue of David-Garedji coloured formation which is dated as Sarmatian.

– Late Sarmatian in the region is represented by continental facies: mainly by thick layers of sandstones with middle layers of carbonate gravelites. Loams are brownish, without structure, weakly sandy. Upper Sarmatian sediments are distributed in the environs of Vakistavi-Sachite hills (North- East of the town of Kaspi, along the left bank of the Kura river).

Magnetostratigraphic sampling of the the Kavtiskhevi area took place at two locations. First, at the homonymous macromammals site, which is an isolated outcrop. Second, in a continuous section found at the trench of the road leading to Kaspi, to the north of the Kavtiskhevi village. The site can be easily tracked to the middle of the section, which accounts for some 160 meters of clays and sandstones. In the upper part of the section (135 m thick), a level with microfauna (KJ17 - KJ 18) is also found. Both section and macromammals site are found in strongly dipping strata.

The general paleomagnetic behavior displays a strong post-tilting remagnetization affecting most samples, but in some cases, a high temperature characteristic component can be recognized, being previous to tilting. Thus, in the lower part of the Kavtiskhevi section (including the macromammals site), basically reverse polarities are found. Towards the upper part of the section, some normal polarity

samples are found, including the micrommals site KJ17 - KJ 18. Regarding correlation to the standard polarity scale, the occurrence of lower Vallesian (MN-9), indicates that KJ17-18 is located within the normal chron of C5n (9.8 to 10.9 Ma), while the macromammals site would be in the younger part of C5r (lasting from 10.9 to 11.9 Ma).

Paleontological material

As was anticipated, Hipparion fauna was discovered in Kavtiskhevi. This faunal complex was widely distributed during Mio-Pliocene all over the world, except Australia and South America. Neogene faunas with open landscape animals and three digit horses (*hipparions*) are known as Hipparion faunas. Hipparions are the dominant faunal elements in these faunas.

The beginning of the Tertiary is marked by intensification of xerophytisation, which becomes especially remarkable starting with the Middle Miocene. Vegetation characteristic of savannas and steppes becomes dominant, forested areas diminish. This universal process unavoidably induced essential changes in faunal composition. Animals get adapted to and get used to coarse fodder, which is followed by corresponding changes in their bodies, especially tooth masticatory apparatus. Teeth become high crowned, enamel becomes more folded and thicker, accessory elements appear on teeth masticatory surface [3]. These transformations reinforce the stability of teeth against abrasion.

Hipparion faunas in Eastern Georgia are found at the sites: David-Garedji, Dzedzvtakhevi, Arkneti, Bazaleti and Kvabebi. Among them David-Garedji fauna is especially diverse.

It was not a difficult task to find fossil-bearing sediments in Kavtiskhevi. With the aid of archeologists we quickly founda fossil-bearing horizon. Unfortunately, we failed to find any significant accumulation. Very eroded fossils are found in lenses. Isolated teeth and limb bones of *Hipparion* represent the majority of fossils. Bones are found between coarse sandstones, rather cemented and are difficult to prepare. Fossil-bearing layer has latitudinal distribution and creates a positive relief against the background of claystone and sandstone layers.

Kavtiskhevi fauna is evidently Hipparion fauna and is represented by accompanying faunal elements. Despite the poor composition of Kavtiskhevi fauna (this shortcoming can be improved as a result of excavations), the already found material is very important for dating geological structures of Eastern Georgia as well as for reconstruction of Sarmatian geographic situation. The discovered fossils belong to the following animals:

Reptilia: *Testudo* sp.

Mammalia:

Giraffidae: *Achtiaria borissiaki* Alexeev

Bovidae: *Gazella* sp., *Tragocerus* aff. *leskovitschi* Borissiak

Cervidae: *Cervus* sp.

Suidae: *Microstonyx erimanthius* (Roth et Wagner)

Equidae: *Hipparion* aff. *eldaricum* Gabunia

Hyaenidae: *Crocuta* sp.

Proboscidea: *Choerolophodon pentelici* (Gaudry et Lartet)

It was noted above that in the Kavtiskhevi fossil material mainly *Hipparion* remains are found (mandibles, isolated teeth and limb bones). Fortunately, among these finds are almost comlete hipparion mandible (Kav. 5, Fig. 2, Tab. 2) and left hemimandible (Kav. 85). All the teeth are in place on the complete mandible including canines and incisors.

About 10 isolated moderately and strongly worn upper teeth of *Hipparion* were found. Morphological features are well preserved, which allows us to make taxonomic identification of the Kavtiskhevi *Hipparion*.

Kavtiskhevi *Hipparion* is of a moderate size. Upper teeth are of a moderate size, protocone index is moderate (P^4-19.7; M^1-M^2 – 27.4). Protocone is somewhat elongated and relatively low. Double loop

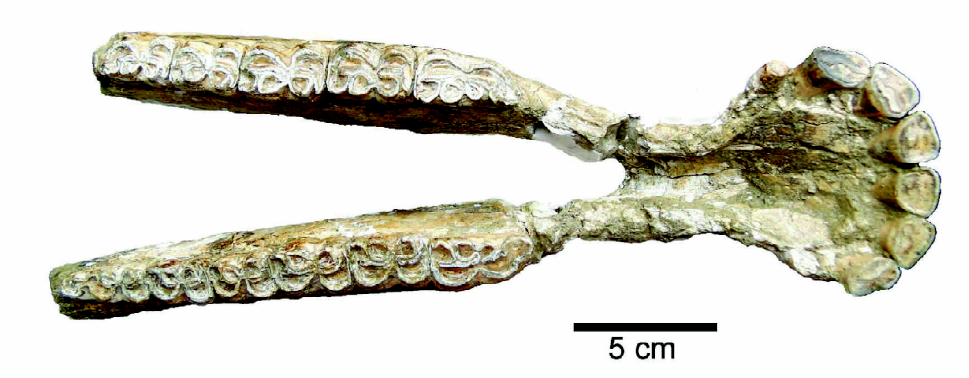


Fig. 2. *Hipparion* cf. *eldaricum* from Kavtiskhevi, mandible (Kav. 5), occlusal view.

of lower teeth has open wings and has a typical shape characteristic of hipparions. Outer bosom is rather deep, especially in molars.

The length of the horizontal ramus of the mandible from incisors to the ascending ramus is 247 mm; P2-M3 alveolar length is 142.5 mm; width of the mandible at the premolars is 75 mm; height in front of P2 is 45 mm. P1 is not present and has never been present. Diastema between canine and P2 is rather long (61 mm). This indicates that the muzzle of the Kavtiskhevi hipparion was of a moderate size. Incisors are well developed, with closed loops on the occlusal surface. Canine is small, cylindrical and is placed immediately next to the I3. Accessory elements are not observable. Molars are rather large (MP index on Kav. 5 - 93.5, and on Kav. 89 - 93.6). With this character Kavtiskhevi hipparion resembles *Hipparion elegans* found in the Chachuna steppe (Eastern Georgia).

Hipparion limb bones are few among the collected fossils. The only relatively complete metacarpal (Kav. 101, Fig 3) is strongly damaged, yet it is possible to measure it and to observe some morphological characteristics. Metacarpal is relatively long; its total length is 222 mm; transversal diameter of the proximal end is 90.7 mm, and of the distal end – 34.0 mm. Kavtiskhevi *Hipparion* is remarkably smaller than Eldari and David Gareji hipparions according to dimensions of metacarpal as well as of the teeth, but larger than Dzedzvtakhevi *Hipparion* (*H. elegans*) [4].

Dimensions and morphological features of dentition and metacarpal reveals some similarities with Eldari hipparion, however there is not a complete coincidence in morphological characteristics between these two forms. Yet, despite this fact, we still attribute Kavtiskhevi hipparion to the Eldari form and define it as *H.* aff. *eldaricum* Gabunia.

The presence of mastodon in the Kavtiskhevi fauna is of stratigraphic significance and dates the

Fig. 3. *Hipparion* aff. *eldaricum* from Kavtiskhevi, Mc (Kav. 101), dorsal view.

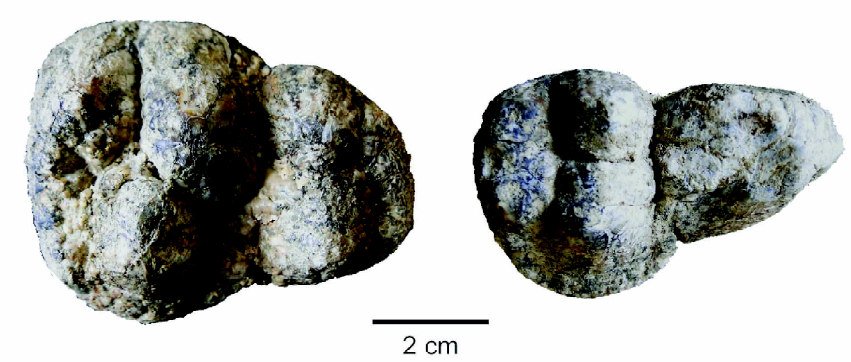


Fig. 4. *Choerolophodon pentelici* from Kavtiskhevi, DP2 (Kav.2, to the left) and dp2 (Kav.3, to the right), occlusal view.

fauna as Sarmatian-Maeotian. It should be noted that only two mastodon teeth are present in the collection – DP2 (Kav. 2) and dp2 (Kav. 3) (Fig.4). Nevertheless these teeth possess taxonomically important features which allows to attribute these fossils to *Choerolophodon pentellici*. *Choerolophodon pentellici* is present in Neogene sediments of the Caucasus, Moldova, Ukraine, Greece and other European localities and is considered to be a form characteristic of Sarmatian-Maeotian age.

The fossil suidae – *Microstonyx erimanthius* (Fig. 5) is another stratigraphically important element in Kavtiskhevi fauna. As a rule, this form is found in Sarmatian faunas, especially in the Caucasus. Presence of *Achtiaria*, *Tragocerus* and *Gazella* convincingly attest to the Upper Sarmatian age of Kavtiskhevi, but due to scarcity of material we will not dwell on their description and distribution.

The presence of *Cricetulodon* sp. in Kavtiskhevi, in a layer above a large fossil mammal site confidently dates the site as Late Sarmatian. In Spain *Cricetulodon* is a typical form from the early Vallesian, MN9, which is correlated with the early Tortonian (sites of Can Ponsic and Can Llobateres). *Cricetulodon* is present in a number of sites from western Turkey, such as Bayraktepe 1 (MN8) and Mahmutkoy (MN9).

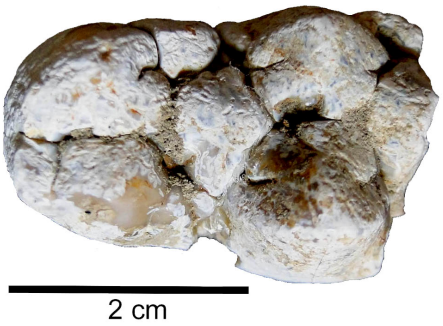


Fig. 5. *Microstonyx erimanthius* from Kavtiskhevi, M_3 (Kav.114), occlusal view.

In 1966 a group of geologists (L. Gabunia, K. Matskhonashvili, D. Chkheidze) found a rather rich fossil vertebrate site on the right bank of the river Kura. This site is known as Iaghluja site in the paleontological literature. Based on its faunal composition, they established the age of Iaghluja site as Upper Sarmatian and published a preliminary faunal list [5]. Relatively later this site was excavated and its fauna was studied by G. Meladze [6]. According to this author, the following taxa are present in Iaghluja:

Reptiles: *Testudo* sp.; Aves: *Rustaviornis georgicus*; Mammalia: Melinae sp., *Premophitis* ex gr. *maeotica*, *Adcrocuta eximia*, *Machairodontinae* gen.?, *Choerolophodon pentellici*, *Hipparion* cf. *eldaricum*, Chalicotheriinae gen.?, *Procapreolus* sp., *Oioceros* sp., *Dicerorhinus* sp., *Aceratherium* sp., *Microstonyx* sp., *Oioceross* aff. *atropatenes*, *Gazella* sp., *Paraoioceros improvisus*, *Tragocerus* sp., *Palaeotragus* sp. [7]. It is evident from this faunal list that Iaghluja fauna has many elements in common with the Kavtiskhevi fauna. Geologically, they come from the same stratigraphic layers and represent one faunal complex.

Animals of different ecological niches are present in the Kavtiskhevi fauna, yet, open savanna and steppe animals predominate. This indicates that

Table 1. Measurements and comparison of the upper teeth of *Hipparion* aff. *eldaricum* from Kavtiskhevi.

	Hipparion aff. *eldaricum* Kavtiskhevi	*Hipparion eldaricum* Eldari Gadjiev, 1997	*Hipparion garedzicum* Garedzi Gabunia, 1951	*Hipparion elegans* Pavlodar Gromova,1952
DMD P^3	22.4	27.6	24	22.6
DVL P^3	23	24.7	22.8	22.8
L protocone	5.4	–	–	–
H protocone	3.4	–	–	–
Protocone index	24.1	36.9	30.2	28.4
DMD M^1	27.9	26.1	21.2	19.4
DVL M^1	20.2	21.3	22.3	20.2
L protocone	5.5	–	–	–
H protocone	1.9	–	–	–
Protocone index	19.7	34.4	31.8	33.6
DMD M^2	28.1	–	–	–
DVL M^2	23.1	–	–	–
L protocone	7.7	–	–	–
H protocone	2.7	–	–	–
Protocone index	27.4	–	–	–
DMD M^3	24.5-26.3	22.5	–	19.8
DVL M^3	20-21.4	17.2	–	17.3
L protocone	6.1; 6.6	–	–	–
H protocone	2.7; 4.5	–	–	–
Protocone index	26.9; 25.2	–	–	35

Table 2. Measurements and comparison of the lower teeth of *Hipparion* aff. *eldaricum* from Kavtiskhevi site

	Hipparion aff. *eldaricum* Kavtiskhevi mandible Kav.5	*Hipparion* aff.*eldaricum* Kavtiskhevi mandible Kav. 85	*Hipparion eldaricum Eldari Gabunia,1959*	*Hipparion garedzicum Garedzi Gabunia, 1951*	*Hipparion elegans Pavlodar Gromova,1952*
L P_2-M_3	142.5	135.2	–	–	–
L P_2-P_4	73.8	70	–	–	–
L M_1-M_3	69	65.5	–	–	–
M/P index	93.5	93.6	–	–	–
DMD P_2	27	25	27.2	31.0	25.5
DVL P_2	16.3	15.5	15.1	15.7	13.5
DMD P_3	23.4	21.8	24.2	25.2	21.2
DVL P_3	15.1	15.5	16.2	16.7	15.3
DMD P_4	23.0	22.0	–	–	–
DVL P_4	14.4	14.8	–	–	–
DMD M_1	20.0	18.2	27.8	26.4	19.2
DVL M_1	15.9	14	14.8	15.3	12.5
DMD M_2	19.5	20.4	–		–
DVL M_2	13.7	15.2	–		–
DMD M_3	26.5	26.3	27.8		22.9
DVL M_3	11.7	16.7	13.1		10.7

relatively open landscape developed in this region at the end of the Sarmatian and beginning of Maeotian. Climate most probably was relatively warm and humid.

Paleontological excavations in Kavtiskhevi continue. It is very probable that many interesting fossils will be unearthed.

პალეობიოლოგია

ნეოგენურ ხერხემლიანთა ახალი ადგილსაპოვებელი კასპის რაიონში

ა. ვეკუა[*], დ. ლორთქიფანიძე[**], ჯ. აგუსტი[#], ო. ომსი[£], მ. ბუხსიანიძე[§], გ. მაისურაძე[¶]

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ჰიპარიონულ ფაუნას დიდი მნიშვნელობა აქვს ნეოგენური ფაუნის შემცველი ნალექების დათარიღებისათვის. სამხრეთ კავკასიაში ჰიპარიონული ფაუნის ადგილსაპოვებელი რამდენიმეა, მაგრამ მათგან ზედა სარმატული მხოლოდ ორია – ელდარი (აზერბაიჯანი) და იაღლუჯა (საქართველო). ახლახან კასპის რაიონში აღმოჩნდა ზედა სარმატული ფაუნის შემცველი ნალექები. ფაუნა არაა მრავალფეროვანი, მაგრამ დამახასიათებელი ფორმები ზუსტად ათარიღებენ მას ზედა სარმატულად.

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