

Palaeobiology

The History of Vertebrate Fauna in Eastern Georgia

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ABSTRACT. At the end of the Middle Miocene the Caucasus represented a land forepart, the geographic position of which induced the development of peculiar flora and fauna in Eastern Georgia.

On the territory of Eastern Georgia several reference fossil vertebrate sites are discovered, among them its worth mentioning Udabno (Maeotian), Dzedzvtakhevi (Maeotian), Iaghludja (Sarmatian-Maeotian), Kvabebi (Akchagilian) and others. In the Pliocene an interesting association of vertebrate fauna was developed, the early *Homo* becoming the most remarkable representative. © 2008 Bull. Georg. Natl. Acad. Sci.

Key words: fossil mammals, Georgia, Mio-Pliocene, Akchagilian, locality, *Hipparion* fauna.

At the end of the Middle Miocene (appr. 14 mln. y. ago) the Mediterranean area, which borders the Russian Lowland in the south and reaches the Aral Sea in the east, subsided somewhat. In the second part of the Miocene it got colder and at the end of this epoch the fall of temperature intensified. As a result in the area of the Black and Caspian seas the aridity became stronger and the semi-closed Sarmatian basin decreased. The new continental areas (the Caucasus and Asia Minor, the Crimea and Southern Ukraine) caused a new dispersal of vertebrate fauna.

These developments played their part in the forming of the Late Cainozoic faunal province in the Black and Caspian areas..

The rise of the Caucasus continued, which led to the disappearance of the existing Transcaucasian strait by the Middle Sarmatian (*ca* 10 mln. years) and the origin of a fairly vast Transcaucasian land. The palynologic data at this time point to the predominance of open space land and the formation of *Hipparion* fauna, the flourishing of which is connected with the Maeotian Epoch [1].

At the end of the Miocene the Transcaucasus already represents an outpost of Asia Minor, bounded by the Black Sea basin in the west and the Caspian in the east. To the North the Transcaucasus is conterminous

with the Greater Caucasus. Today's Iori highland included the eastern and partially central part of this outpost.

The mentioned land is basically characterized by the predominance of highland landscape, which was greatly broken by gorges. The paleontological data [1] point to the fact that in the second part of the Sarmatian this land was inhabited by rich and diverse vertebrate fauna mainly forest animals.

Palynology also confirms the existence of forest tracts in the Middle Sarmatian. The climate must have been fairly, warm and humid, not ruling out the existence of open areas with respective flora close by the forests. Therefore, in the later faunistic complex of the Iori Highland steppe and savana forms are found more often: ostrich, gazella, oioceros, antelope, rodents, reptiles. In the Plio-Pleistocene the xerophytisation of the Iori Highland increased. There was expansion of open area plants, hence a change of the vertebrate fauna, especially mammals, is observed. Ultimately, a temperate humid and warm climate set in, and the new climatic conditions here favoured the penetration of the first Hominids from Africa.

On the territory of Kakheti the main sites of vertebrate fauna are concentrated in the Iori Highland. We

have to begin the history of this fauna by considering the Hipparionian fauna of the Miocene, which is well presented in the Upper Sarmatian deposits of the Transcaucasus. Regrettably, the first stage of evolution of the Hipparionian fauna, i.e. the Middle Sarmatian vertebrate fauna, is not found.

Upper Sarmatian sites are identified in Armenia, Azerbaijan and on the territory of Kakheti - East Georgia.

For almost 10 mln. y. Hipparionian fauna dominated in Eurasia, Africa, and North America. Therefore, it is clear that paleontologists attach great importance to a complex study of this fauna. - not only for a comparison of biostratigraphy and continental suites, but also for shedding light on theoretical questions of the evolution of the organic world.

It should be noted here that Caucasian, namely Transcaucasian Hipparionian fauna, is given special importance because its formation occurred on the crossroads of Eurasia and Africa. This crossroads was the route of migration of the Hipparionian faunistic complex to Africa and vice versa, The available paleontological material allows us to try to ascertain not only the directions from Africa to Eurasia of the paths of migration, but also the rate of distribution of mammals, and the peculiarities of their adaptation to and mastery of new areas.

We start examination of the distribution of Hipparionian fauna by the Eldari site. Today the Eldari site is within the Azerbaijanian territory. But this fauna is closely associated with the Kakhetian Miocene. The age of the Eldari fauna is confirmed by marine mollusks, and vertebrate fauna.

Eldari: *Testudo* sp., *Struthio* sp., *Phoca procaspica*, *Ychtitherium hipparionum*, *Crocuta eldarica*, *Deinotherium giganteum*, *Choerolophodon pentelici*, *Hipparion eldaricum*, *Hipparion* sp., *Eldarotherium burtchaki*, *Aceratherium transcausicum*, *Rhinoceros*

pachygnathus, *Achtiaria borissiaki*, *Palaeotragus* sp., *Gazella leilae*, *Eotragus martinianus*, *Microstonyx major*, *Cervavitus* sp. [1, 2].

The Eldari Hipparionian fauna is not attested by representatives of one common biocenosis. It is an aggregate of different ecological groups. Nevertheless, the main body existed in the humid climatic conditions. It should be noted also that the Hipparion from the Eldari morphologically is closer to the Asiatic Hipparion and essentially differs from the Sarmatian Hipparion of Europe [1].

In the environs of the mountain Iaghludja (20 km from Tbilisi) a rich site of the Hipparionian fauna was discovered. The site was named by G. Meladze as Hipparionian fauna of Rustavi [3]. The excavations are not finished yet, but the collected material permits to characterize its entire fauna. The following has been identified: *Testudo* sp., *Rustaviornis georgicus*, *Promephitis* ex. gr. *maeotica*, *Ychtitherium* sp., *Crocuta eximia*, *Choerolophodon pentelici*, *Hipparion* cf. *eldaricum*, *Dicerorhinus* sp., *Aceratherium* sp., *Microstonyx* sp., *Procacpreolus* sp., *Oioceros* aff. *atropatenes*, *Gazella* sp., *Paraoioceros improvisus*, *Tragocerus* sp., *Palaeotragus* sp.

An analysis of the fauna indicates that we are dealing with the Upper Sarmatian complex which has much in common with the fauna of the same age from Eldari, especially with the fauna of the Hipparion of these complexes [1,3].

The representatives of the Rustavi fauna are mainly the inhabitants of the forest and steppe, further emphasizing their similarity. During the Maeotian time the Transcaucasus was densely settled by Vertebrate fauna. This fauna too is known as Hipparionian, but the typical forms of the Miocene become rare. Maeotian fauna of mammals is most completely represented at the site of Udabno: *Testudo* sp., *Udabnopithecus garedziensis*, *Hystrix* sp., *Hyaena* sp., *Deinotherium* sp.,



Fig. 1. Udabno (Georgia). *Udabnopithecus garedziensis* Burt. et Gabashvili. P⁴ and M¹ (dex.).

Hipparion garedzicum, *Aceratherium* sp., *Cervus* sp., *Achtiaria* sp., *Tragocerus* sp., *Gazella* sp., [4,5]. The most interesting element of the cited fauna is two molars of a Primate [6]. In general the fauna is rich in forms typical of humid climate. Apparently at this time the climate in Eastern Georgia was warm and temperate forest zones were widespread.

Several years ago the Moscow geologist V. Trubikhin, during his palaeomagnetic studies on the right bank of the river Iori, discovered a paleontological site, Dzedzvtakhevi, with rich fauna. The fauna is of definite significance for dating the Neogene layers in the Transcaucasus and for resolving the questions of distribution of the fauna.

Only a few excavations yielded good results, Dzedzvtakhevi presents: *Gomphotherium* sp., *Crocota* (*Percrocota*) *eximia*, *Felis attica*, *Dicerorhinus* sp., *Hipparion* ex gr. *elegans*, *Microstonyx* aff. *erimantius*, *Gazella* cf. *deperdita*, *tragocerus* sp., *Tragelaphinae* gen. *Karsimatherium* aff. *bazaleticum*, *Cervidae* gen [7].

The mentioned fauna and layers are dated as Maeotian. The same is confirmed by palaeomagnetic study of the bones. The Vertebrate fauna from Arkneti, in Kartli, is also dated as the Upper Maeotian: *Simocion* sp., *Suidae* gen ?, *Dicrocerus salomeae*, *Sivatheriinae* gen ?, *Gazella incerta*, *Mirabiloceros brevicornis*, *Phronetragus arcnethensis*.

Typical *Hipparionian* fauna is indisputably determined in Arkneti. The *Hipparions* in Udabno and Arkneti are very much alike [1,3].

In Georgia the Pliocene layers have yielded rich paleontological fauna. We have to pay particular attention to the Pliocene sites of Bazaleti, Kvabebi and Dmanisi. In some researchers' opinion the Pliocene starts with Pontian layers that are continental suites and in Eastern Georgia are named as the Dushetian suite.

List of Bazaleti fauna: *Testudo* sp., *Promephitis brevirostris*, *Ychthitherium ibericum*, *Crocota miriani*, *Machairodontinae* gen ?, *Gomphotheriidae* gen ?, *Deinotherium* sp., *Hipparion garedzicum*, *Microstonyx* sp., *Palaeotragus* sp., *Karsimatherium bazaleticum*, *Gazella* ex gr. *incerta*, *G.* ex gr. *sinensis*, *Oioceros* sp., *Mirabiloceros maius*, *Phronetragus secundus* [3].

Some forms of this fauna are so far unstudied and their systematic position must be determined. In spite of this, it can be said positively that the Bazaleti fauna cannot be younger than the Pontian, as indicated by the presence of *Ychthitherium*, *Palaeotragus*, *Oioceros* and other typical Miocene forms in it, such as *Promephitis brevirostris*, *Karsimatherium*, *bazaleticum*, indicating that the fauna is comparatively younger than

that of Arkneti.

Ecological analysis shows that the majority of the fauna are mainly inhabitants of steppe landscape. But along with them there are also animals of the forest (*Melinae*, *Suidae*).

On the territory of Georgia the Late Pliocene is represented by Vertebrate fauna of Kvabebi - in the marine layers - and has been dated by mollusks as Akchagilian.

In the Kvabebi faunistic complex 21 representatives of mammals are identified. Besides, the gigantic ostrich and tortoise were found in Kvabebi. The fauna of Kvabebi: *Testudo aernovi transcaucasica*, *Struthio transcausicus*, *Ioriotis gabunia*, *Nyctereutes megamastoides*, *Canis* sp., *Ursus arvernensis*, *Therailurus* sp., *Lynx issiodorensis*, *Machairodus davitashvili*, *Hystrix* cf. *primigenia*, *Kvabebihyrax kachethicus*, *Anancus arvernensis*, *Hipparion crusafonti*, *Dicerorhinus megarhinus*, *Propotamochoerus provincialis*, *Eucladocerus* sp., *Pseudalces* sp., *Procapreolus* sp., *Ptotoryx heinrichi*, *Oryx* sp., *Gazella postmitilini*, *Parastrepsiceros sokolovi*, *Ioribos aceros*, *Eosyncerus ivericus* [8].

It is not difficult to understand that Kvabebi includes elements of Roussillion, Saber-toothed tiger, Mastodon of Overn, *Megarhinus-rhinoceros*, *Hipparion* and *Propotamochoerus* point to a close relationship between the layers of Kvabebi and Roussillion. At the same time the existence of the deer, *Nyctereutes* and some relatively progressive forms renders the Kvabebi somewhat younger. Hence we [9] consider the Kvabebi complex as a faunistic complex of the Transcaucasus and Asia Minor, crowning the Neogene history of the development of Pliocene Vertebrate fauna.

The analysis of Kvabebi fauna convinces us that we are dealing with both European and Asiatic forms. Nevertheless, Asian elements largely prevail: *Nyctereutes megamastoides*, *Lynx issiodorensis*, *Propotamochoerus provincialis* and some *Cavicornia*. The multiplicity of Asiatic forms in Kvabebi makes us think that the main part of them reached the Transcaucasus across the Near East. We assume that for some animals the great mountains of the Caucasus turned out to be an insurmountable barrier on the path to the West. This is indicated by the fact that a numerous group of Damans failed to spread to the West, for the same barrier must have prevented the spread of hippopotamus to the North early in the Neogene. The union of African and European vertebrates in the geological past causes no doubt. It is known that the main body of the present African savanna fauna is concordant with European *Hipparion* fauna and its migration probably took place in the sec-

ond part of the Neogene.

The discovery of the Akchagilian complex of Kvabebi shed much light on questions of faunistic interconnection between the faunas of Eurasia and Africa. Tragelaphinae, Buffalo, Kvabebihyrax, Ostrich and other forms in Kvabebi fauna indicate that the formation of the Southern African one took place in the period of Roussillion-Kvabebi fauna and at the expense of its migration to Africa, probably across the Levantine Corridor [10].

Explorers think that during the whole Oligocene there was no contact between Eurasia and Africa. In their opinion, contact between Africa and Europe was established only at the beginning of the Miocene, provoking migration from Eurasia to Africa, and vice versa. It should be noted that migration from Eurasia to Africa was more intensive; however, at the beginning of the Miocene some African savanna animals reached Eurasia through the continental bridge. This connection becomes more intensive at the beginning of the Pliocene and particularly in the second part of the Pliocene when the Roussillion-Kvabebi fauna flourished in the Eurasian Pliocene. The abundance of ancestors of African artiodactyls: Orix, Protorix, Parastrepsticerus, Eusincerus point to this situation. At the same time the spreading rate of these forms was so high that they at the end of the Pliocene almost occupied all African territory [10]. During the Pleistocene the dispersal of fauna between Europe and Africa continues, may be not so intensively as in the Pliocene, but just at that period various fauna of deer migrated to Africa. It should also be noted that migration was one-sided: from Europe to Africa. But the genus Giraffa in the Gomareti fauna indicates that by the end of the Pliocene some mammals managed to penetrate into Eurasia.

By the beginning of the Anthropogenic period (Apsheron) a change of the physical-geographic conditions is noticeable on the territory of Georgia. The comparatively warm and humid climate changes to a dry and hot one. Xerophytes spread, accordingly the composition of the vertebrate fauna changes. The earlier widespread Hipparion disappears and cabaloid horse takes its place instead, the Mastodon Elephant appears. The qualitative change of the fauna gave rise to the Quaternary fauna of mammals [11].

Rich paleontological material at our disposal allows us to trace the history of Anthropogenic fauna in Eastern Georgia. According to our data, this history is divisible into three stages: Early (Apsheronian), Middle (Pleistocene), Late (Holocene). Each stage contains two or several steps/ stages. characterized by a faunistic complex.

The early stage of Anthropogene (Eopleistocene) fully coincides with the Apsheronian time that is divided into two parts: the lower corresponds with the lower Apsheronian (Lower Eopleistocene) and Upper Apsheronian (Upper Eopleistocene). In Georgia this stage of Anthropogenic fauna is well represented at the sites: Kotsakhuri, Tsalka and Dmanisi.

The site of Kotsakhuri is situated in Dedoplistsqaro district, on the mountain ridge of Kotsakhuri in the Iori river valley. Here two types of sediments are found: Marine Akchagilian and sediments of the freshwater basin. The freshwater sediments are represented by the Damashkin Horizon, which is generally placed in the Lower Apsheronian. These sediments have yielded a lot of remains of vertebrate fauna: Testudo sp., Struthio transcaucasicus, Archidiskodon meridionalis taribanensis, Dicerorhinus cf. etruscus, Equus stononis, Protoryx sp., Camelus sp. [12]. The composition of the fauna points to Villafranchian fauna - very similar to the Lower Apsheronian fauna of Tsalka. It should be noted that the layers of Kotsakhuri are dated by the freshwater Unionids. In accordance with palaeomagnetic data, the layers with fossils follow after the Olduvai Subchron (1.67 – 1.83 mln. y.) The fauna of Tsalka and Kotsakhuri is peculiar, because the true elephant, Etruscan rhinoc-

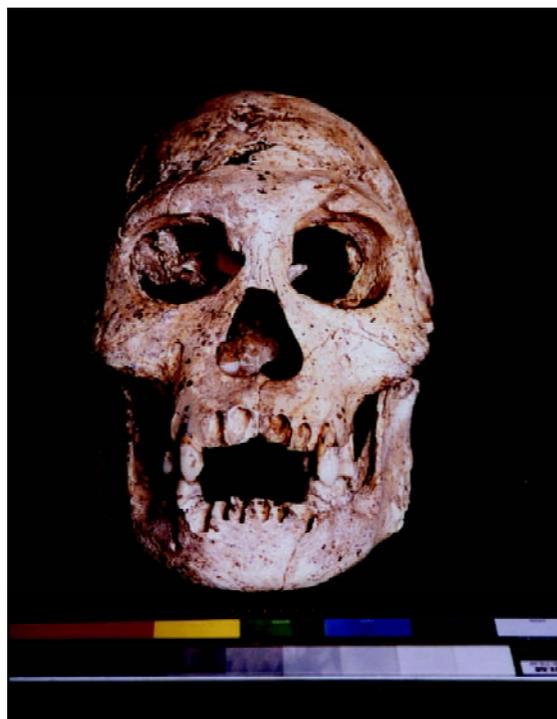


Fig. 2. Dmanisi, Homo ergaster. Cranium (D 2700) and mandible (D 2735). Frontal view.



Fig. 3. Dmanisi, *Homo ergaster*. Mandible D 211, *Homo georgicus*. Mandible D 2600.

eros, horse appear for the first time. The great mass of the fauna are inhabitants of the xerophyte landscape.

Dmanisi. A few years ago, at the site of the ancient town of Dmanisi, archaeologists discovered the bones of mammals under medieval cultural layers, in the alluvial fan deposits. The first excavations convinced us that we were dealing with a unique site with early stone artifacts, bones of animals and vegetation. The site covers rather a vast area.

Actually only a small area is excavated. But such a wealthy paleontological material enabled us to describe the site and fossils more or less in detail. The ascending geological profile of the Dmanisi site looks as follows: dark volcanic sandstone overlies dolerites. The mandible of rhinoceros and an isolated lower molar were discovered in this layer. Aleuritic sandstone and shingle beds overlie the volcanic sandstone. The thickness of the layer is 1.30m. This layer contains a lot of remains of fossils, vegetables and artifacts. The next layer is represented by stony aulerites, here and there including deposit lenses of vegetable origin. In the same layer rich faunistic material and stone instruments of early industry were discovered. Rich faunistic material and stone instruments were discovered in the same layer. White calcareous rocks overlie the described profile, its thickness being 10-15 cm. The Calcareous crust is very poor in organic remains, occasionally containing fragments of bones.

In the ascending profile the carbonate crust is overlaid by Calcareous clay, containing small volcanic detrital rocks. This layer contains remains of mammal bones and artifacts, bone remains are often found in this layer. The remains of bones represents the leftover of the primitive man. Then comes light brown cemented loam, which contains bones of medieval and Stone Age mammals. The profile ends with a thick medieval cultural layer.

At the site of Dmanisi crania of animals are found often, but seldom with the mandible, the postcranial elements are in the natural connection. It is clear that remains of fauna are brought to the basin by abundant streams. From a short distance accumulation of bones is largely of natural character; here animal bones of different groups of mammals are mixed. The Dmanisi fauna contains: *Miomys ostramosensis*, *Parameriones obeidiensis*, *Ochotona* sp., *Cricetus* sp., *Canis etruscus*, *Ursus etruscus*, *Pachyrocute* cf. *perrieri*, *Megantereon cultridens*, *Homotherium crenatidens*, *Cervus perrieri*, *Dama nesti*, *Dmanisibos georgicus*, *Lacerta* sp., *Testudo* sp., *Struthio dmanisiensis* [13, 14].

Cows and horses are of great importance for the dating of the layers of the Dmanisi vertebrate fauna and bone containing layers of Proboscidiens. The mentioned groups of animals are more or less well represented in the Dmanisi fauna. The South elephant, the cow of Dmanisi and Stenonian horse undoubtedly confirm the Villafranchian age of this fauna. But it is more difficult to determine to which fragment the Dmanisi fauna belongs to: Lower, Middle or Upper. The presence of the Etruscan wolf, bear and rhinoceros perhaps points to the Upper Villafranchian. If the existence of the deer of Perrier, hyaena of Perrier, and particularly *Palaeotragus*, is taken into consideration, this fauna could have been formed in the second part of the Middle Villafranchian. In describing the section of the Dmanisi site we noted that the bone-containing layers lie directly over a stream of dolerite lavas. A paleomagnetic study, conducted by G. Maisuradze and D. Sologhashvili [15], showed that Dmanisi dolerites correspond to the Olduvai episode in terms of parameters and character of magnetization. It should be noted that, according to the studies of German and American specialists Schmincke and Bogaard [16, 17], the radiological age (Swisher III) of Dmanisi dolerites is 1.8 ± 0.1 million years.

The fact should be noted that well-preserved remains of ancient man (4 skulls, 4 mandibles, isolated teeth, parts of skeleton) were at the depth of ca 2m 10cm of Dmanisi site [18].

The Dmanisi man belongs to the *Homo erectus* group. Thus, the Dmanisi *Homo erectus* is the oldest in Eurasia, and it may be indicative of the initial period of man's migration from Africa to Eurasia. The Vertebrate fauna of Dmanisi presents both forest (deer, bear) and savanna (open area) animals (horse, rhinoceros, camel). All the animals are heat-loving. Palynology indicates that in the second part of Villafranchian the savanna landscape prevails here and there, with small forest zones (15). Thus, warm and moderately humid climate could

dominate in the Dmanisi region., not excluding the presence of dry steppe zones [20].

Tsalka. At the junction of the Tertiary and Quaternary systems the South Georgia Highland was an area of intensive volcanic activity. There are numerous young effusives of dolerite lava. Determination of the geological age is difficult because of the absence of organic remains. Sometimes in lacustrine or deluvial-proluvial deposits remains of fossil animals occur, enabling us to make conjectures about the geological age of the layers and volcanic formations. Therefore every new paleontological find is of great stratigraphical importance.

The volcanic formation in Tsalka is known under the name of the Tsalka Suite. This suite is represented by lava dolerites with lacustrine layers between them. On the left side of the Tbilisi-Tsalka highway G. Zaridze and N. Tatrishvili found fossil bones of animals in the lacustrine-alluvial deposits [21]. N. Burchak-Abramovich determined them as an elephant and Stenonian horse. This paleontological find dates the Tsalka Suite to the Upper Pliocene. Later sufficient material was collected to determine its fauna.

The fauna of Tsalka: *Archidiskodon meridionalis*, *Equus stenorhinus*, *Eucladoceros* sp., *Dama aff. nesti*, *Dmanisibos georgicus*, *Cervus* sp., *Canis aff. etruscus*, *Homotherium* sp. Because of the fragmentariness of the material the determination of the species is difficult. Despite this fact, the Tsalka fauna is concordant with the Upper Willafranchian fauna [22]. In Georgia the Middle Pleistocene is represented by Vertebrate fauna, basically related to the Stone Age Man. There are a lot of

Paleolithic caves in Western Georgia where Acheulian and Mousterian cultural layers with stone artifacts and remains of bones are attested.

Unfortunately, in Eastern Georgia sites of the same age are rare. Tsopi is a Stone Age site [23] and those of the fauna are *Kvemo Kedi*, *Acha*, *Algeti*.

In the Middle Pleistocene the Cabaloid horse already dominates, rhinoceros of *Morcki* is not rare, *Trogontherium*, wild cow, gigantic deer are widespread. European elements dominate in this fauna.

In the Upper Pleistocene the fauna in the Kakheti region (East Georgia) is almost the same, as in the Middle Pleistocene but considerably impoverished. The role of the wild pig increases. The faunistic complex of the Holocene and modern fauna are very much alike, only some relicts are present. In the Holocene the physico-geographical conditions on the territory of Eastern Georgia change in the direction of xerophytisation. The areas covered with forests decrease. The steppe and semi-steppe landscapes increase, the fauna changing accordingly: *Hyaena hyaena*, gazelle, camel appear. In the opinion of O. Bendukidze [24], in Eastern Georgia arid region thermophile forms spread widely from the Near East: hedgehog, gerbil, wild sheep, *Capra*.

In the second half of the Holocene, under anthropogenic influence, the number of vertebrate fauna markedly decreased. The wild sheep, gazelle, hyena became extinct. The environment appreciably changed. The forest tracts decreased [25] and the landscape assumed the modern appearance.

პალეობიოლოგია

ადმოსავლეთ საქართველოს ხერხემლიანთა ფაუნის ისტორია

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სტატია ეძღვნება ადმოსავლეთ საქართველოს გვიან-ნეოგენურ ხერხემლიანთა ფაუნის ისტორიას. განხილულია რეგიონის მიოცენური და პლიოცენური ადგილსაპოვებლების ფაუნები, მათი გეოლოგიური ასაკი და სტრატეგრაფიული მნიშვნელობა. დეტალურადაა გაშუქებული უკანასკნელ წლებში აღმოჩენილი

ადგილსაპოვებლები და მათი ფაუნა, კერძოდ დმანისისა და კონაზურის ადგილსაპოვებლები, რომელთა გეოლოგიური ასაკი ზუსტადაა დადგენილი არა მარტო ბიო- და მაგნიტოსტრატოგრაფიული მეთოდებით, არამედ რადიოლოგიური მონაცემებითაც.

სტატიაში მოცემულია აღმოსავლეთ საქართველოს მიოცენური და პლიოცენური ფაუნების პალეონტოლოგიური დახასიათება. აღნიშნულია, რომ აღმოსავლეთ საქართველოში მიოცენიდან მოყოლებული ძლიერდება არიდიზაციის პროცესი, რამაც არსებითად შეცვალა ბუნებრივად ფაუნის შემადგენლობა.

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