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# UPPER TUROLIAN SCIUROIDEA (RODENTIA, MAMMALIA) FROM THE REPUBLIC OF MOLDOVA

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**Abstract.** This paper focuses on Sciuroidea teeth originating from the continental deposits of the Stolniceni Formation found in localities from the central area of Codru Rand (Leordoaia, Veverița-2, and Bălăneşti). Five genera were recorded: *Csakvaromys* (=*Spermophilinus*)*, Miopetaurista, Hylopetes, Pliopetaurista*, and *Blackia.* The assemblage was assigned to the Early Pontian (MN 13) or to the "Pontian Level" according to the regional scale of Eastern Parathetys.

**Keywords**: *Sciuroidea*, Late Miocene, Stolniceni Formation, Republic of Moldova.

## INTRODUCTION

Upper Miocene deposits in the Republic of Moldova are mainly marine and belong to the Bessarabian, Kersonian, Meotian and Pontian. This time span corresponds to the European Land Mammal mega-zones Valesian and Turolian, or to Mein's units MN9-13. The fossil representatives of the Superfamily *Sciuroidea* yield rich and useful data for the stratigraphy of continental deposits, for paleogeography and environmental reconstructions.

## GEOLOGICAL SETTING

In the central part of Codru Rand (360–390 meters above sea Level, m a.s.l.), on the erosion surface of the Baltian sequence, rhythmical bedded continental deposits are present; they were defined as "the Stolnicenian sequence". The Stolnicenian sequence differs from the Baltian sequence because it contains Carpathian jaspers and fragments of silica rocks (5 %). The Stolnicenian sequence from Leordoaia, Veverița, Bahmut and Bălăneşti (Fig 1) is rich in remains of terrestrial vertebrates. These remains can be considered as being the latest phases of evolution of the *Hipparion* fauna in the Turolian (Barbot de Marny, 1866; Bukatchiuk & at., 1968; Nicoara & Lungu, 2008).

**Leordoaia**. The locality is situated in Călăraşi district (Fig. 2). On the erosion surface (360–380 m a.s.l.) of the Baltian sequence made up of gray quartz, and fine-grained laminated sands, the beds of "Stolnicenian series" were formed (Fig. 3).

In the lower part of the Stolnicenian sequence (layer 5), horizontal bedded fine- and medium-grained sands intercalated with coarse-grained sands, a matrix containing clay, yellow and red grains of Carpathian jaspers, as well as grains of silica rock, can be found. The top of this series consists of cemented sands, gravels and pebbles. On their top, layer 4 consists of green-gray conglomerates with gray sands containing grains of Carpathian jaspers, fragments of sandstone and concretions of carbonates. The bones of terrestrial vertebrates were found in this layer. Over these conglomerates, beds of horizontal or diagonally bedded medium- and coarse grained sands (layer 3) with gravels, small flat pebbles of Carpathian jaspers and sandstones, intercalations and lenses of gravel and pebble (clay, sandstone) can also be seen. On the top of the outcrop (on the eroded surface) fine-grained clayey-sands, diagonally bedded, partly showing iron oxidation (limonite), roots and worm traces form layer 2. It is covered by humus soil (layer 1). Layers 2 – 5 (of the Stolnicenian sequence) containing grains of Carpathian jaspers, as well as grains of silica rocks, comprise the alluvial plain facies.

**Taphonomy**. The remains of terrestrial vertebrates are found in the conglomerates, medium- and coarse grained sands (layers 3 - 5) which comprise the alluvial facies. The bones are scattered within the beds (no concentrations were noticed) and they show a different degree of washing. Apparently, they were transported by streams from various distances and then buried in the beds of the Pontian river. Bones of the large terrestrial vertebrates were found in the conglomerate. The remains of the small terrestrial vertebrates are present in the lenses of gravels and coarse-grained sands. The locality was probably formed over a long period of time as the result of intensive surface erosion.

Baltian and Stolnicenian (Barbot de Marny, 1866; Bukatchiuk & at., 1968) sequences are of special interest for the Upper Miocene biota. In these vertebrate assemblages, Sciuroidea is a still poorly studied group of small mammals. Terrestrial squirrels are represented in our area of interest by two genera, *Csakvaromys* and *Tamias* (Lungu, 1981; Delinschi, 2008). Family *Petauristidae* is known from deposits within the Stolnicenian sequences of the Central Codru Highland (Shushpanov & Lungu, 1993; Nicoara & Lungu, 2008). The site near Leordoaia village (Călăraşi District) recently yielded interesting fossils documenting three *Petauristidae* genera: *Miopetaurista*, *Pliopetaurista* and *Hylopetes*. Bălăneşti (Nisporeni District) is another outstanding locality, where remains of *Blackia*, similar to *B. wölfersheimensis* were unveiled. A characteristic peculiarity for the distribution of squirrel fossils of this group is a quite seldom occurrence in the sites of tereofauna (Fig. 2), fact explained by the specific adaptive radiation of this mammal group. This feature is also characteristic for the Upper Miocene sites of tereofauna in the Republic of Moldova.

The presence of squirrels was recorded only in a few Upper Miocene localities from the Republic of Moldova. Squirrels of the genus *Csakvaromys* were reported from Calfa, Bujor-1, Veverița-1, Căinari, and Ciobruciu (Lungu, 1981, 1990). Genus *Tamias* was mentioned to be found in Cimişlia (Delinschi, 2008). Flying squirrels were reported from Bălăneşti, Tătăreşti, and Moscovei (Shushpanov & Lungu, 1993; Baranova & Konikova, 1974) (Fig. 1).

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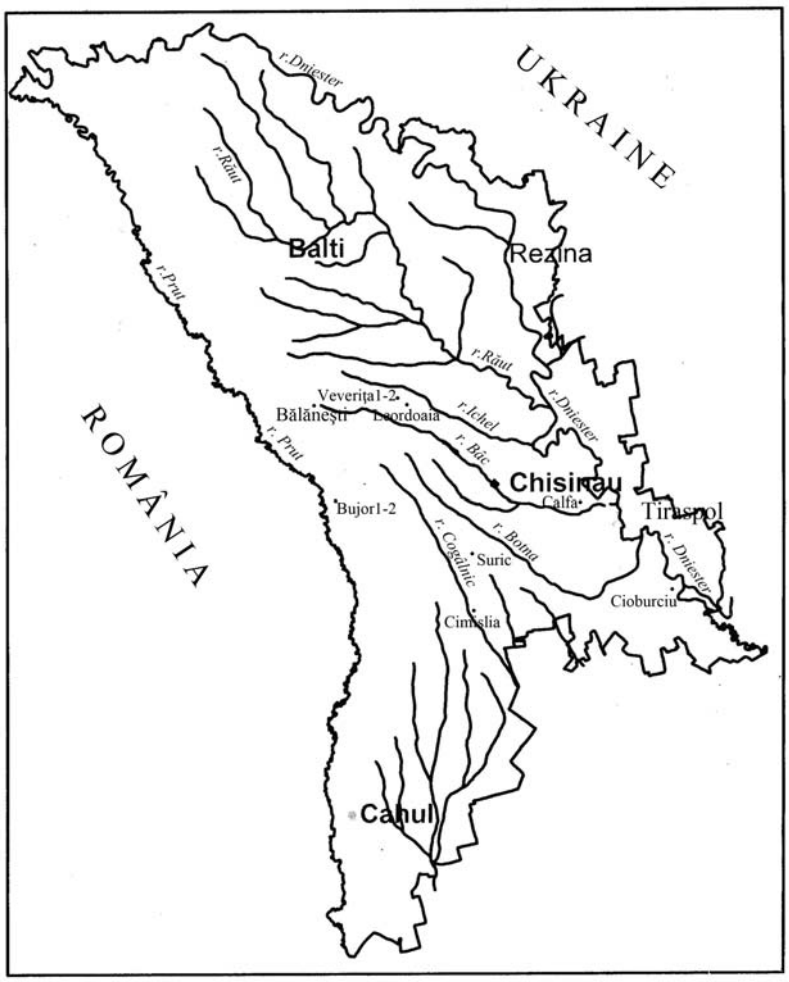



Fig. 1 - The Late Miocene localities with *Hipparion* fauna in the Republic of Moldova where squirrels were reported.

## MATERIALS AND METHODS

The samples used in this study originate from Leordoaia, Verevița-2, and Bălăneşti (Stolnicenian sequence exposed in the central part of Codru Rand). They were collected by A. N. Lungu during 1985-1988, and by myself, during the 2007-2009 field campaigns. The fossils are stored in the collections of the Tiraspol State University (Chişinău; abbreviated UST): UST PL-3 (1-14, 21-27), PV 2-3 (1-7), PB-3(1-2, 11). The nomenclature of tooth morphology for *Sciuridae* is adapted from Sean D. Bell (2004).

## SYSTEMATICAL DESCRIPTION

Order **RODENTIA**

Superfamily **SCIUROIDEA** GILL, 1872

Family **SCIURIDAE** GRAY, 1821

Genus ***Csakvaromys* (=*Spermophilinus*)** KRETZOI, 1951

*Csakvaromys (=Spermophilinus) turolensis* DE BRUIJN & MEIN, 1968. (Plate I. figs. 1-12)

**Material:** 1 D4, 2 P4, 5 M1-2, 2 M3, 6 d4, 3 m1-2, 2 m3. (measurements in Table 1)

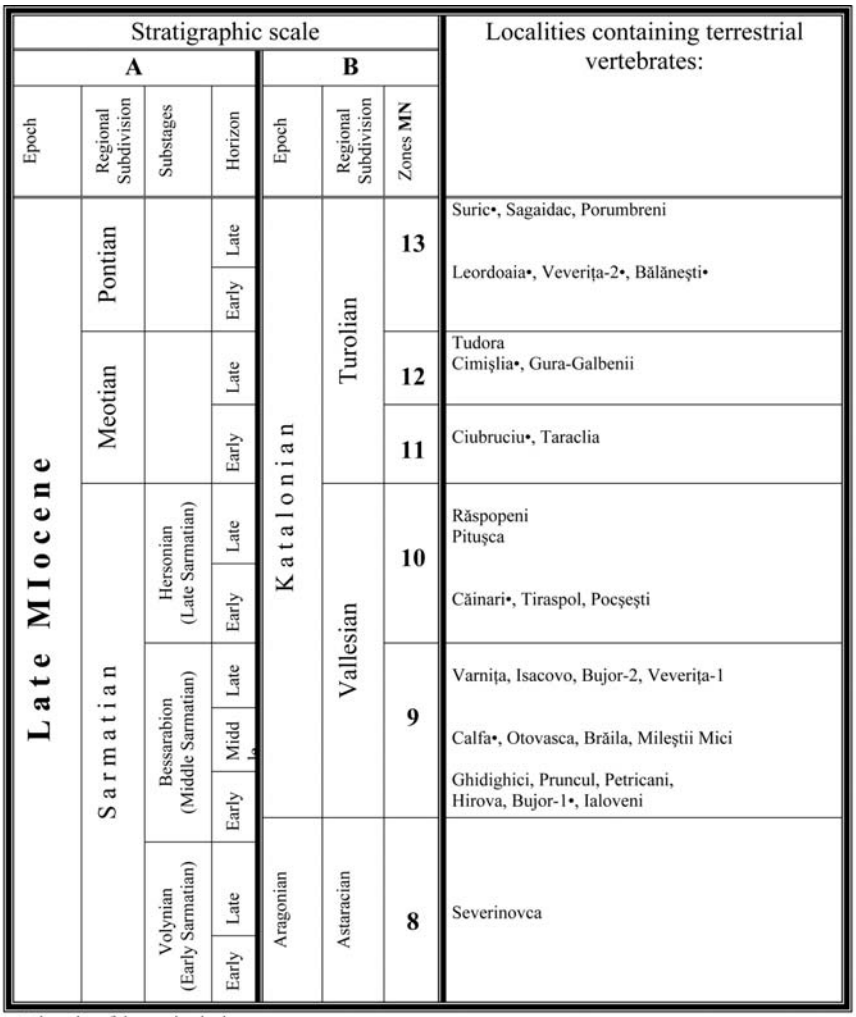
**Locality and Geological Age**: Leordoaia (Călăraşi District), Verevița-2 (Ungheni District), Bălăneşti (Nisporeni District), Late Miocene, Pontian (MN13).

**Species Definition**: (according to De Bruijn & Mein, 1968).

**Description**:

**Upper teeth**

**D4** – The tooth crown in occlusal view is triangle-shaped and somewhat smaller than P4. The protoloph and the metaloph are clearly separated, forming together a protocone. The size of the parastyle reaches 2/5 of the tooth's breadth, as well as the size of the anterior cingulum. The central depression is well-expressed and ranges from the protocone to the outer side of the tooth crown, trended at an angle of 30° relative to the anteroposterior longitudinal axis of the tooth crown. The mesostyle is weak. The height of the posterior cingulum decreases from protocone to outer edge. The paracone and the metacone are somewhat higher than the protocone. The tooth crown is worn.




A – stratigraphy of the marine beds
B – stratigraphy of the continental beds
• - localities with remains of squirrels mammals

Fig. 2 - Stratigraphic position of the Late Miocene localities with terrestrial vertebrates fauna from Moldova (Ržebik-Kowalska & Lungu, 2009).

| | *C. turolensis* Leordoaia, Verevița-2, Bălănești MN13 (Republic of Moldova) | | | *C.* cf. *turolensis* Calfa, Bujor MN9 (Republic of Moldova) | | | *C. bredai* Calfa, Bujor MN9 (Republic of Moldova) | | | *C. bredai* Can Missert MN7-8 (Spain) | | | *C. turolensis* Los Mansuetos MN (Spain) | | | *C. turolensis* Maramena MN13/14 (Greece) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length Range/Mean | N | Breadth Range/Mean | Length Range/Mean | N | Breadth Range/Mean | Length Range/Mean | N | Breadth Range/Mean | Length Range/Mean | N | Breadth Range/Mean | Length Range/Mean | N | Breadth Range/Mean | Length Range/Mean | N | Breadth Range/Mean |
| D4 | 1,6 | 1 | 1,5 | - | | - | | | | 1,56-1,69 1,62 | 2 | 1,84-1,98 1,91 | 1,71-1,77 1,74 | 3 | 1,61-1,91 1,76 | 1,72-1,89 1,81 | 2/1 | 1,92 |
| P4 | 1,7-2,0 1,83 | 2 | 1,7-1,8 1,77 | - | | - | 1,7 | | 1,75 | 1,47 | 1 | 1,86 | 1,86-2,04 1,96 | 3 | 2,23-2,38 2,29 | - | | - |
| M1-2 | 1,8-2,0 1,89 | 5/6 | 2,0-2,45 2,3 | - | | - | 1,8-2,0 | | 1,6-1,8 | 1,6-1,88 1,75 | 14 | 1,93-2,28 2,14 | 1,97-2,11 2,06 | 3 | 2,53-2,66 2,58 | 1,88-2,33 2,06 | 11/12 | 2,25-2,67 2,47 |
| M3 | - | 0/2 | 2,5 | - | | - | | | | 2,09 | 1 | 1,8 | 2,6 | 2/1 | 2,48 | 2,53-2,56 2,55 | 3 | 2,38-2,45 2,42 |
| d4 | 1,5-1,8 1,68 | 6 | 1,3-1,6 1,44 | - | | - | | | | 1,57 | 1 | 1,18 | 1,69-1,98 1,82 | 2 | 1,28-1,58 1,39 | | | |
| p4 | - | | - | - | | - | 1,2-1,3 | | 1,2-1,23 | 1,77 | 1 | 1,56 | - | - | - | 1,86-2,09 1,98 | 6 | 1,72-1,98 1,83 |
| m1-2 | 1,8-1,9 1,86 | 5 | 2,0-2,15 2,07 | 1,7-1,8 1,75 | 2 | 2,0-2,5 2,25 | | | | | | | 2,33 | 1 | 2,5 | 1,95-2,27 2,09 | 4 | 2,22-2,66 2,46 |
| m1 | | | | | | | 1,5-2,2 | | 1,5-1,9 | 1,7-2,01 1,81 | 7 | 1,75-2,25 1,88 | | | | | | |
| m2 | | | | | | | 2,0 | | 2,3 | 1,77-2,04 1,92 | 4 | 1,77-2,15 2,03 | | | | | | |
| m3 | 2,7 | 1/2 | 2,2 | 3 | 2/0 | 2 | 2,5 | | 1,75 | 2,21-2,38 2,3 | 2 | 1,82-1,95 1,88 | 2,57-2,72 2,65 | 2 | 2,2-2,4 2,3 | 2,38-2,95 2,63 | 7 | 2,3-2,5 2,43 |

Table 1 - Dentition measurements of *Csakvaromys* (=*Spermophilinus*) Kretzoi, 1951.

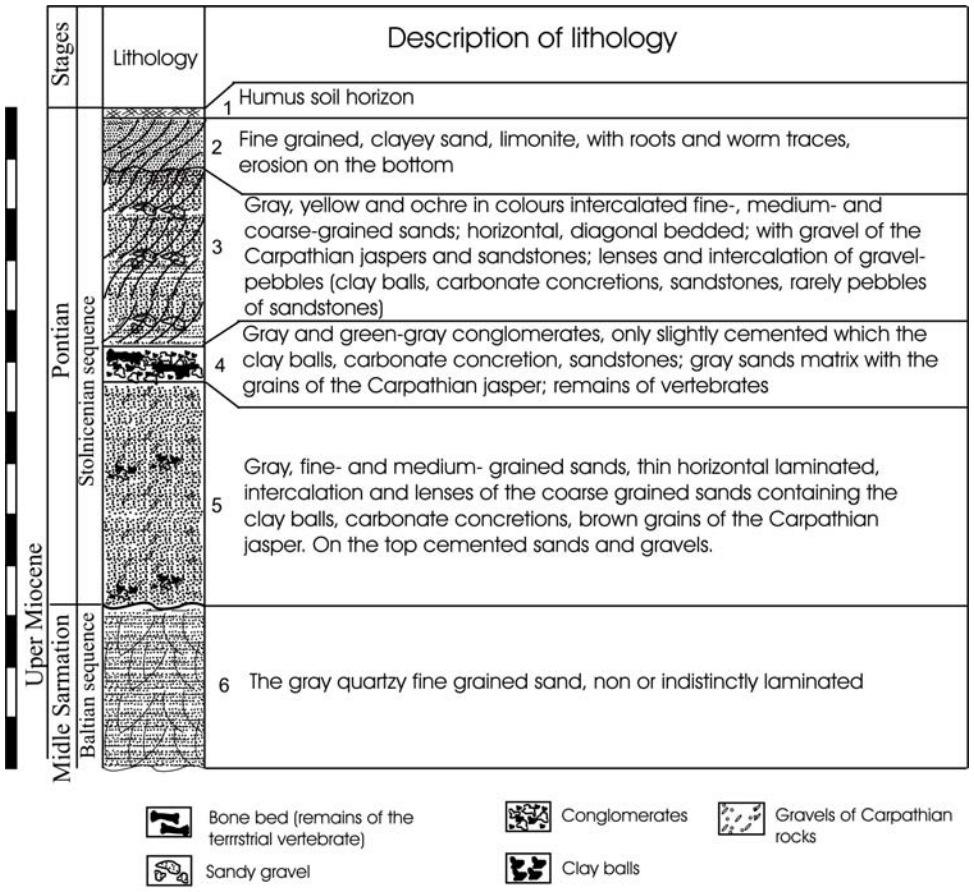



Fig. 3 -Geological cross-section of Leordoaia locality.

**P4** is larger than D4, also triangle-shaped. The metacone and paracone are high and clearly separated. The metaloph and the protoloph are connected with the protocone and together compose a “V”-shaped pattern, diagnostically meaningful. The metaloph gets thinner in the connection area with the protocone, but it is not interrupted. The mesostylid is weak. The anterocone is separated and does not reach the heights of the metacone and paracone. The posterior ridge gets lower ranging from the protocone to the external side.

**M1-2**. Both teeth crowns are trapezoidal, while the grinding surface is almost square-shaped. M1 and M2 differ only in size. Since the material is represented exclusively by isolated teeth, it is difficult to separate M1 from M2. The metacone and the paracone are high and well-distinguishable; the paracone is somewhat higher. The metaloph and the protoloph are connected with the protocone and together compose a “V”-shaped pattern. The hypocone is not visible. The metaloph becomes thinner at the junction with the protocone, but it is not interrupted. The mesostyle is weakly identified. Two of them were found in one sample, while in the other one, the mesostyle is absent. The posterior ridge gets weaker ranging from the protocone to the external side and forms the posterior wall of the tooth, as in D4 and P4.

**M3**. The posterior part of the tooth crown exposes a triangle-shaped depression. Its mesial part is similar to M1-2. The anterior and the posterior parts of the tooth are separated from each other by the protoloph. The protocone is distinct, being the highest cusp. The posterior part of the crown of the available specimen is damaged.

**Lower teeth**

**d4.** The wear surface is extended antero-posteriorly. The anterior part of the tooth crown is narrow and higher than the posterior one. The talonid depression is very narrow, in opposition to the trigonid one. The protoconid and the metaconid form the highest part of the crown. They are fused in some specimens, forming a continuous ridge. This ridge is a boundary between the talonid and trigonid depressions. The hypoconid is strong and connected to the posterolophid. The entoconid is not separated; it is included into the posterolophid, forming a rounded ridge that encircles the trigonid depression. The mesostylid is missing in all specimens, whilst the mesoconid is clearly separated in four specimens and is absent in the remaining ones.

**m1-2**. The wear surface is extended transversally. The metaconid consists the highest part of the crown. The protoconid and the hypoconid are at the same level as the posterolophid, which forms the rounded talonid wall from the posterior side and the major part of the inner one. The mesoconid is well-developed and connects the protoconid and the hypoconid. The

entoconid is not separated. The metalophulid II is strong, while the metalophulid I and anteroconid are not developed.

**m3**. The crown is elongated and triangle-shaped. The posterior part of the tooth is narrower than the anterior one. The metaconid is the highest cuspid of the tooth, similar to the one in m1-2. The labial wall of the tooth is similar to the one in m1-2. The protoconid and the hypoconid are well expressed, equal in height. They are fused with the mesoconid. The metalophulid II is relatively weak, if compared to the analogous structure in m1-2. The metalophulid I has a very low connection with the protoconid. The entoconid and the mesostylid are not separated. The posterolophid forms a lingual wall that expands to the metaconid.

**Geographical and geological distribution:** Late Miocene, Turolian**;** Leordoaia, Veverița-2, and Bălăneşti (Republic of Moldova), Maramena (Greece), Los Monsuentos (Spain).

**Comparison:** The morphology of the fossil *Sciuridae* from the Stolnicenian sequence is similar to *Csakvaromys* (=*Spermophilinus*) *turolensis* reported from Los Monsuentos (de Bruijn & Mein, 1968), Maramena (de Bruijn,1995), Calfa and Bujor-1 (Lungu, 1981). On one hand, the samples from Leordoaia, Veverița-2, and Bălăneşti are similar to the fossils found in Los Monsuentos and Maramena, especially concerning D4, P4 , and p4 . On the other hand, some morphological details and the crown length/breadth ratio correspond to the ones described for a *C. turolensis* sample originating from Moldova. It is noteworthy that the measurements of the teeth under study are close to those from Calfa and Bujor-1. This similarity may have phenotypic origins, as response to similar environmental factors. *C. bredai-turolensis* from Eichkogel (Austria) is of special interest to us, showing a mixture of characters found in *C. bredai* and *C. turolensis* (Daxner-Höck, 1970).

**Remarks**: The genus *Csakvaromys* (=*Spermophilinus*) originated in Europe in the Early Miocene (MN4) and continued until the Lower Pliocene (MN15). One can mention the increasing size tendency of the representatives of the genus in time. They possibly belong to a single phylogenetical lineage of family *Sciuridae* (de Bruijn & Mein, 1968; de Bruijn, 1995). The species *C. turolensis* was included by de Bruijn and Mein in 1968 in the new genus *Spermophilinus. Sciurus bredai* Herrmann and Meyer, 1848 was also included in *Spermophilinus*; however, somewhat earlier, Kretzoi (1951) described similar forms from Csakvar, as representatives of the genus *Csakvaromys* (Kretzoi & Fejfar, 2005). The presence of *C. bredai* and *C. turolensis* in the composition of the Upper Miocene faunal assemblages of Calfa and Bujor-1 (MN9) in Moldova is noteworthy. Apparently those species coexisted, but dwelled with different ecological niches. The morphology of *C. turolensis* suggests a more advanced ecological specialization, as compared to that of *C. bredai* (Lungu, 1981). Squirrel-like chipmunks from Leordoaia, Veverița-2, and Bălăneşti were small sized animals with low crowned teeth that inhabited well-lighted mixed forests interrupted by grassy areas (Lungu, 1981).

Family **PETAURISTIDAE** MILLER, **1912**
Genus ***Hylopetes*** THOMAS**, 1908**
(= *Pliopetes* Kretzoi, 1959)

*Hylopetes* cf. *macedoniensis* BOUWENS & DE BRUIJN**,** 1986 (Plate I. fig. 18)

**Definition**: according to Bouwens & de Bruijn, 1986.

**Material**: m3 (measurements in Table 2.)

**Locality and age**: Leordoaia (Călăraş District), Late Miocene, Pontian (MN13).

**Description**:

m3. The tooth crown is rhomb-shaped. The entoconid, metaconid, protoconid, and hypoconid are well expressed. There is a deep trigonid with a slightly wrinkled surface. The mesoconid and metastylid are well-distinguishable. The anteroconid is not developed. The entoconid is separated from the mesostylid by a clearly outlined depression and it is deeper than that separating the mesostylid from the mesoconid. A narrow metalophulid I emerges from the metaconid. The metalophulid I does not reach the protoconid. The metalophulid II is situated transversally to the longitudinal axis of the tooth crown and reaches ½ of the tooth crown's breadth.

**Geographical and geological distribution:** Late Miocene, Turolian**;**
Leordoaia (Republic of Moldova), Maramena (Greece).

**Remarks**: The **m3** from Leordoaia is relatively narrow if compared to the specimens from Maramena. One cannot exclude that the difference may result from the different measurement methods. Individual variability may be another explanation of this difference, since we have only a single specimen available from Leordoaia. *H. macedoniensis* is a tropical forest dweller and its presence in this fauna is indicative for a warm and dry climate (Bouwens & de Bruijn, 1986).

Genus ***Pliopetaurista*** KRETZOI, 1962
Type species *P. pliocaenica* (Deperet, 1897) – type locality: Perpignan (France) (MN15)

**Genus definition**: according to Mein, 1970.

***Pliopetaurista* sp.**
**(Plate I. figs. 13-15)**

**Material**: 2 - M1-2; 1 - m3 (Measurements in Table 3)

**Locality and age**: Leordoaia (Călăraşi District), Late Miocene, Pontian (MN13).

**Description**:

**M1-2**. The grinding surface is square-shaped; its breadth is slightly larger than its length. The paracone, the metacone, and the protocone are high and clearly separated from each other. The metaloph and the protoloph are connected with the protocone, forming a "V"-shaped pattern. The metaloph is weaker than the protocone. Posterior lophules are clearly expressed. The metaconulus is robust and clearly separated, but the metaloph is not interrupted. The parastyle is connected with the anterior cingulum and is extended towards the protocone forming a strong lingual wall. The protocone is very high. The metaconulus is connected to the posterior cingulum, reaching the protocone. The paracone is protruding, reaching the external edge. The posterior valley is weak and almost all its space is occupied by the metaconulus. The depressions on the internal side of the crown are strong.

**m3**. The grinding surface is almost triangle-shaped. The highest part of the tooth crown is represented by a

very strong metaconid. The metalophulid I extends towards the anteroconid and forms an angle at the level of the protoconid. The metalophulid II connects the metaconid with the protoconid, forming a crest that separates the trigonid from the talonid. The entoconid is promoted and is isolated by the depression of the metaconid. The metastylid is not separated. The protoconid and the hypoconid are well-developed. The mesoconid is weak. The ectolophulid connects the mesoconid and the hypoconid, forming an "M"-shaped crest.

**Geographical and geological distribution:** Late Miocene, Turolian**;** Leordoaia (Republic of Moldova), Vinogradovka (Ukraine), Podlesice (Poland).

**Remarks**: Some morphological characters and the size of m3 are similar to those of *P. bressana* specimen from Leordoaia. However, there are some differences as well: the less developed metaloph in M1-2, the strong posterior lophulus, as well as the strong pits on the internal side of the crown. *P. bressana* is an archaic specimen typical for MN10-11 units. The faunal assemblage of Leordoaia is indicative for the Late Turolian (MN13). *P. dehneli* from Maramena, Greece (De Bruijn, 1995) is clearly different from the form reported in Leordoaia. The material from Podlesice (Poland) is quite interesting. That site yielded *P. dehneli* in association with *Pliopetaurista* sp. (Black & Kowalski, 1974), with measurements of m1-2 close to those of the form from Leordoaia. *Pliopetaurista* sp. was also reported in Surik and has a similar geological age (Vangengeim & al., 1995). However, one can not draw a conclusion since the material from Surik is still unpublished. *Pliopetaurista* in association with *P. dehneli w*as also reported in Vinogravovka. It is possible that *Pliopetaurista* from Leordoaia, Surik, Podlesice, and Vinogradovka belongs to a new species that was coeval in Europe with *P. dehneli* and represented a transitional link between *P. bressana* and the smaller species *P. raui* and *P. meini.* However, additional fossils are needed to define this distinct species. Flying squirrels of the genus *Pliopetaurista* inhabited coniferous forests. The presence of this type of environment on the Moldavian Platform in the Early Pontian is supported by flora evidence (Negru, 1986; Medeanik, 2007).

| | Leordoaia (Republic of Moldova) MN13 | | | Maramena (Greece) MN13/14 | | |
|---|---|---|---|---|---|---|
| | Lenth | N | Breadth | Length | N | Breadth |
| m3 | 1,8 | 1 | 1,6 | 1,91-2,17<br>2,02 | 10/9 | 1,73-2,06<br>1,88 |

Table 2 - Measurements of lower third molar of *H. macedoniensis*.

| | Leordoaia (Republic of Moldova) *Pliopetaurista* sp. | | | Kohfidisch (Austria) *P. bressana* | | | Maramena (Greece) *P. dehneli* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Length Lim/M | N | Breadth Lim/M. | Length Lim/M | N | Breadth Lim/M. | Length Lim/M | N | Breadth Lim/M. |
| M1-2 | 1,8 | 2 | 2,0 | 1,65-1,95<br>1,8 | 11 | 2,0-2,15<br>2,06 | 2,05-2,55<br>2,4 | 37 | 2,33-2,74<br>2,54 |
| m3 | 2,4 | 1 | 2,0 | 2,25-2,35<br>2,3 | 3 | 1,9-1,95<br>1,92 | 2,92-3,37<br>3,07 | 15 | 2,17-2,51<br>2,33 |

Table 3 - Comparison of molar measurements (mm) of *Pliopetaurista.*

| | Leordoaia (Republic of Moldova) *Miopetaurista* sp. | | | Vaucluse (France) *Miopetaurista thaleri* (Mein,1970) | | |
|---|---|---|---|---|---|---|
| | Length Range/Mean | N | Breadth Range/Mean. | Length Range/Mean | N | Breadth Range/Mean. |
| P3 | 1,3 | 1 | 1,3 | | | |
| D4 | 3,7 | 1 | 3,6 | 4,0 | 1 | 3,85 |

Table 4 - Teeth measurements (mm) of *Miopetaurista.*

| | Bălăneşti (Republic of Moldova) *B.* cf. *wölfersheimensis* | | | La Grive (France) *B. miocaenica* | | | Wölfersheim (Germany) *B. wölfersheimensis* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Length Range/ Mean | N | Breadth Range/Mean. | Length Range/Mean | N | Breadth Range/Mean. | Length Range/Mean | N | Breadth Range/Mean. |
| m1-2 | 1,3 | 1 | 1,8 | 1,17-1,34 1,24 | 4 | 1,2 – 1,39<br>1,26 | 1,22 | | 1,37 |

Table 5 - Measurements (mm) of lower molars of *Blackia* Mein.

Genus ***Miopetaurista*** KRETZOI, 1962

**Genus definition**: according to Mein, 1970.

**Stratigraphic distribution**: Early Miocene–Pliocene

***Miopetaurista* sp.**

(=1993, *Cryptopterus* sp. Shushpanov & Lungu)

**(Plate I. figs. 16-17)**

**Material**: ?P3, D4 (measurements in Table 4)

**Locality and geological age**: Leordoaia (Călăraş District), Late Miocene, Pontian (MN13).

**Description**:

**P3**. The tooth crown is triangle-shaped, with two cusps.

**D4**. The tooth crown is rounded, triangle-shaped. The protocone is the highest cusp and it is slightly shifted towards the labial side. The metaloph and protoloph are almost parallel and are connected with the protocone. The hypocone is not separated and forms, together with the protocone, the lingual wall. The posteroloph is broad, lower than other lophs, and is connected with the metacone base. The mesostyle is small. The anterocone is strong and it is connected with the protoloph through the narrow anteroloph. The surface of the valleys is slightly granulated.

**Remarks**: The P3 from Leordoaia conventionally is ascribed to *Miopetarista* sp. However, one may not exclude the possibility that it belongs to another genus. The P3 to P4-D4 size ratio is the main argument that supports the *Miopetaurista* hypothesis. Nonetheless, the specimen does not show any specific diagnostic characters and may also belong to ?*Pliopetaurista*, which is also known to be found in Leordoaia. Then again, the relatively large size of P3 in the sample from Leordoaia constitutes a weak argument to describe this specimen as ?*Miopetaurista*. D4 of the sample from Leordoaia is of special interest. P4 was earlier described as belonging to *Cryptopterus* sp. (Shushpanov & Lungu, 1993). D4 is morphologically very close to the D4 of *Miopetaurista thaleri* (Mein, 1970) from Vaucluse (France), however some differences can be noticed: the mesostyle of the specimen in Leordoaia is weak and does not forms a loph connecting the protoloph and the anterior cingulum. This difference may be caused by the difference in the wearing stage, or it could be an individual variation. Flying squirrels of the genus *Miopetaurista* inhabited coniferous forests on the rocky slopes, based on paleogeographical data on Early Pontian in the Moldavian Platform (Negru, 1986; Medeanik, 2007). It is possible that the regression of the Eastern Paratethys exposed rocky ridges of previously formed Badenian-Sarmatian limestone.

Genus ***Blackia*** MEIN, 1970

**Genus definition**: according to De Bruijn, 1999

**Locality and age**: Bălăneşti (Nisporeni District), Late Miocene, Pontian (MN13).

*Blackia* cf. *wölfersheimensis* MEIN, 1970

(= 1993, *Blackia* sp. Shushpanov & Lungu)

**(Plate I. fig. 19)**

**Species Definition**: according to Mein, 1970.

**Description**:

**m1-2**. The wearing surface is rhomb-shaped. The crown's breadth is slightly larger than its length. The surface of the talonid is slightly granulated. The strong metaconid is the highest part of the crown. It is slightly sloped toward the labial side. The protoconid is relatively low and slightly shifted longitudinally. The mesoconid is absent. The entoconid and hypoconid are not expressed individually but fused into a posterolophid that borders the talonid. The posterior part of the tooth crown is more robust from the labial side than the anterior part. The mesoconid is not separated.

**Remarks**: The above mentioned characters of the lower molar (m1-2) suggest that the specimen belongs to genus *Blackia*. If compared to *B. miocaenica* from the Middle and Late Miocene of Western and Central Europe (Mein, 1970; Shushpanov & Lungu, 1993), *Blackia*'s teeth from Bălăneşti are of larger size, with reduction of the labial cingulum and the anterolophid, and more expressed separation of the protoconid and hypoconid. The enlisted differences characterize the fossil form from Bălăneşti as a more advanced one. The tooth dimensions, the reduction of the anterior cingulum, the development degree of the anterolophid, and the depressions on the trigonid are very similar to the ones of *B. wölfersheimensis* from the Miocene of Germany. *Blackia* from Moldova is characterized by the protoconid being separated deeper from the metaconid, the presence of the anterosinusid, and, opened from the labial side, the depression of the talonid. The morphological peculiarities of the Moldavian form suggest that this is a more archaic representative of the genus *Blackia* that is in accordance with its older age. However, one can not exclude that *Blackia* from Bălăneşti belongs to the same phylogenetical lineage as *B. wölfersheimensis*.

**Geographical and Geological Distribution:** Late Miocene, Turolian**;** Bălăneşti (Republic of Moldova), Stolnicenian sequence, Late Miocene (Early Pontian). Late Miocene of Western and Central Europe.

## CONCLUSIONS

The remnants of the described fossil squirrels from several sites within Stolniceni sequence located in the central part of Codru Rand allowed us to assign them to Late Turolian. They are indicative for the unit MN 13, i.e. the Pontian (Nicoara & Lungu, 2008) (fig. 2). The presence, in the same deposits, of several species of Sciuroidea that represent different ecotypes indicates the existence of various terrestrial environments in the Late Miocene of the Moldavian Platform as follows: *Csakvaromys* inhabited broad-leafed forests interrupted by large open areas (de Bruijn & Mein, 1968); *Pliopetaurista*, apparently dwelled within coniferous forests; flying squirrels of the genus *Miopetarista* inhabited coniferous forests of Mediterranean type, which were growing on rocky slopes; small-sized flying squirrels *Blackia* and *Hylopetes* apparently dwelled in broad-leafed lowland forests (Nicoara, 2009).

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## PLATE EXPLANATION

### PLATE I

Fig. 1-12 - *Csakvaromys turolensis* de BRUIJN & MEIN, 1970
1: D4; 2-3: P4; 4-5: M1-2; 6: M3; 7-8: p4; 9-10: m1-2; 11-12: m3.
Fig. 13-15 - *Pliopetaurista* sp.
13-14: M1-2; 15: m3.
Fig. 16-17 - *Miopetaurista* sp.
16: ?P3; 17:D4.
Fig. 18 - *Hylopetes* cf. *macedoniensis* BOUWENS & DE BRUIJN, 1986
18: m3.
Fig. 19 - *Blackia* cf. *wölfersheimensis* MEIN, 1970
19: m1-2.

**PLATE I**