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Institute of Systematics and Evolution of Animals
Polish Academy of Sciences
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ALEKSANDRU LUNGU † and BARBARA RZEBIK-KOWALSKA

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Excavations in Kalfa, 1967 (photograph from A. LUNGU collection)

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Professor Aleksandru Nikolae LUNGU (1936-2011)

Aleksandru Nikolae LUNGU (1.9.1936-30.7.2011) was a world class paleontologist that dedicated his life to science and teaching. He was born in Prodăneşti Vechi village (Soroca county, Floreşti district of contemporary Republic of Moldova). After finishing secondary school, A. N. LUNGU studied in Taras Shevchenko State Pedagogic Institute in Tiraspol at the Department of Geography where he majored in teaching geography and biology. He continued his postgraduate studies at the Paleontological Institute of the Academy of Sciences USSR (between 1963-1966) and received the degree of Candidate of Sciences for a thesis entitled "Hipparion fauna of the middle Sarmatian of Moldova" written under the scientific supervision of the well-known paleontologist, professor K. K. FLEROV. In the years 1966-1967 A. N. LUNGU worked in the division of Paleontology and Stratigraphy of the Academy of Sciences of MSSR, and subsequently returned to his pedagogical occupation. He received his doctorate in 1990 for the work: "Early developmental stages of the hipparion fauna of the continental edge of the Parathethys Sea". Georgian paleontologist L. K. GABUNIA was a consultant of this thesis.

Aleksandru N. LUNGU commenced his scientific and didactic work already at the Tiraspol State Pedagogical Institute in the Department of Geography, where he worked until he received a professorship in 1992. For over 20 years he was Chair of General Geography and put much effort into its development. The separation of the unrecognized Pridnestrovian Moldavian Republic (with a capital in Tiraspol) from the Republic of Moldova, accompanied by armed conflict, resulted in obligatory change for the Pedagogical Insti-

tute: in 1992 the Institute's employees were forced to immediately move the Institute to Kishinëv (Chişinău) without the possibility of taking the scientific collection with them. In Kishinëv everything had to be started from the beginning.

Professor A. N. LUNGU has authored more than 130 scientific papers, including original works, revisions and monographs. Many of these papers, especially concerning the Hipparion fauna of Moldova's Middle Sarmatian are widely known and cited to this day. Professor A. N. LUNGU also participated in many paleontological expeditions and collaborated with various well-known European paleontologists, substantially contributing to the systematics and morphology of the fossil mammal fauna, paleogeography, and paleoecology of the upper Miocene of Eastern Europe.

Apart from his scientific endeavors, A. N. LUNGU spent much of his time training younger generations of scientists by giving lectures and practical exercises, mostly in paleogeography and geology. He also contributed to academic textbooks, atlases and other references for students and pupils. He supervised many B. Sc. and M. Sc. theses and two Ph. D. theses.

The scientific and pedagogical achievements of Aleksandru N. LUNGU have been repeatedly acknowledged as attested by numerous diplomas and awards at both the university and national levels. In 1996 he was given the "Gloria Muncii" order, while in 2010 the President of the Republic of Moldova gave him the title of "Om Emerit" (Person of Merit).

Igor NICOARA

We mourn and remember, with especial respect.

His disciples

1. INTRODUCTION

Numerous outcrops of Late Miocene deposits exist across large areas of the Republic of Moldova (Fig.1). They represent mainly shallow marine, deltaic, fluvial, and lacustrine environments. Rich *Hipparion* faunas of the Vallesian-type were found in different stratigraphical levels of the Late Miocene Bessarabian and Khersonian beds (LUNGU 1971, 1990; LUNGU and BILINKIS 1979) (Fig. 2). Assemblages of small terrestrial vertebrates

Fig. 1. Late Miocene localities of the *Hipparion* fauna in the Republic of Moldova. ***Volynian***: 1 – Severinovka; ***Bessarabian***: 2 – Yaloven, 3 – Poshta Veke, 4 – Mikeūts, 5 – Petrikan, 6 – Vistemichen, 7 – Prūnkūl, 8 – Gidigich, 9 – Kalfa, 10 – Otovaska I-II, 11 – Breila, 12 – Malye Mileshty, 13 – Girovo, 14 – Būzhor I-II, 15 – Lepūshna, 16 – Varnitsa, 17 – Isakovo, 18 – Veveritsa I, 19 – Sirets, 20 – Nisporen; ***Khersonian***: 21 – Keĭnar, 22 – Tiraspol, 23 – Pitūshka, 24 – Pokshesht, 25 – Dragushany, 26 – Respopen, 27 – Pripichen-Rezesh; ***Maeotian***: 28 – Chiobrūchiū, 29 – Tarakliya, 30 – Chimishliya, 31 – Gūra-Galbene, 32 – Tūdora; ***Pontian***: 33 – Leordoaya.

Stratigraphic scale								Localities containing terrestrial vertebrates:
A				B				
Epoch	Regional Subdivision	Substages	Horizon	Epoch	Regional Subdivision	Zones MN		
Late Miocene	Pontian		Late	Katalonian	Turolian	13		Leordoaya
			Early					
	Maeotian		Late			12		Tūdora Chimishliya, Gūra-Galbene Tarakliya
			Early			11		Chiobrūchiū
	Sarmatian	Khersonian (Late Sarmatian)	Late		Vallesian	10		Respopen, Pripichen-Rezesh Pitūshka, Dragushany Keīnar, Tiraspol, Pokshesht
			Early					
		Bessarabian (Middle Sarmatian)	Late			9		Varnitsa, Isakovo, Būzhor-II, Veveritsa-I, Sirets, Nisporen Kalfa, Otovaska I-II, Breila, Malye Mileshty, Girovo, Būzhor-I, Lepūshna Gidigich, Prūnkūl, Visternichen, Mikeūts Poshta Veke, Yaloven
			Middle					
			Early					
		Volynian (Early Sarmatian)	Late		Astaracian	8		Severinovka
			Early		Aragonian			

A – stratigraphy of the marine beds
B – stratigraphy of the continental beds

Fig. 2. Stratigraphic position of the Late Miocene localities with terrestrial vertebrate fauna from the Republic of Moldova (by NICOARA).

with *Hipparion* fauna from the Early Turolian (Maeotian beds) of Eastern Europe were found in localities Tarakliya, Chimishliya, and Chiobrūchiū. Recently, in the central part of the Kodrinsk Upland, several new unknown Pontian localities with terrestrial vertebrates were also discovered. They provide insight into the final stage of evolution of the *Hipparion* fauna in the Eastern Paratethys territory in the Turolian (LUNGU 1998; NICOARĂ and LUNGU 2008). We address several controversial questions concerning the evolution of the theriofauna, as well as the biostratigraphy and palaeogeography of the Eastern Paratethys, by presenting the geology of the most important localities.

The specimens listed below are housed in the collection of the Tiraspol State University (TSU) in Kishinëv, the Republic of Moldova.

The Authors are deeply indebted to Dr. Igor NICOARA for illustrations and for his assistance in corrections of this book.

2. *HIPPARION* FAUNA LOCALITIES IN BEDS OF THE BESSARABIAN SUBSTAGE

The Bessarabian deposits (Middle Sarmatian) extend throughout the entire territory of the Moldovan platform and consist of three stratigraphic units: lower – Novomoskovskii, middle – Vasilevskii and upper – Dnepropetrovskii (ROSHKA and KHUBKA 1986). The remains of terrestrial vertebrates are present in all three units.

2.1. Localities of the Novomoskovskii unit (Early Bessarabian) in the Urban Kishinëv Region

Localities: Prūnkūl, Gidigich, Mikeūts, Poshta Veke, Visternichen, Yaloven (Fig. 1)

The Byk and Ishnovets river valleys cut the reef limestone upland of the Kishinëv Region. Limestone composed of algae, bryozoans, foraminifers (genus *Nubucularia*), and mollusks (bivalves and snails) appears in the form of domes and bioherms (their heights range from 1.4 to 1.8 m and widths from 0.6 to 0.8 m).

Bioherms are cut by large vertical fissures. Depressions between bioherms (Fig. 3) are filled with detritus of numerous shells of bivalves and snails (*Mactra fabreana* D'ORBIGNY, 1844, *M. vitaliana* D'ORBIGNY, 1844, *Obsoletiforma beaumonti* D'ORBIGNY, 1844,

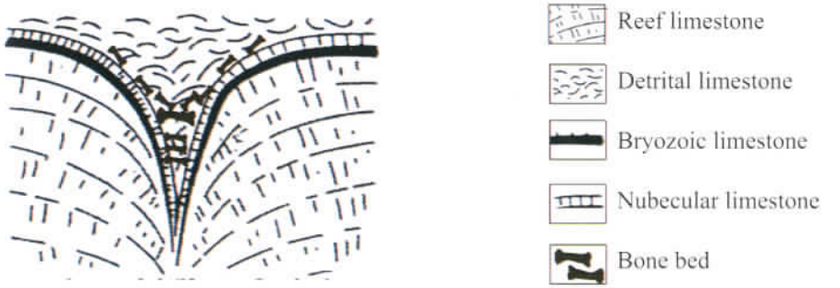

Fig. 3. Exposure of reef limestone near Visternichen (after SAULEA 1995, changed by NICOARA).

O. kishinewensis KOLESNIKOV, 1929, *Gibbula podolica* (DUBOIS, 1831), *Sinzowia elatior* (D'ORBIGNY, 1844), *Kishinewia besarabica* (D'ORBIGNY, 1844), *Cerithium comperei* D'ORBIGNY, 1844 etc.), bryozoans and foraminifers as well as concentrations of marine and terrestrial vertebrate remains (NORDMANN 1858-1860, 1861; SINZOV 1900; PAVLOV 1908; SIMIONESCU 1925; MACAROVICI and OESCU 1941; KIRPITSCHNIKOV 1953; KUROTCHKIN and GANEA 1972; LUNGU 1971, 2008a; LUNGU and CHEMYRTAN 1986). Bone remains of marine fauna and terrestrial vertebrates found in the localities of Poshta Veke, Visternichen, Prūnkūl, Gidigich, Mikeūts and Yaloven are brown in colour and are characterized by a high degree of washing and mineralization.

It is difficult to explain the presence of marine and terrestrial vertebrate remains in limestone fissures. Most probably bioherms, forming barriers, sometimes emerged and formed chains of islands used by seals as lairs. Evidently seals took rest and bred there. The presence of remains of young individuals in the material confirms this idea. After death and decomposition, the bones of seals were washed out by waves and accumulated in depressions between biohermes. This idea is corroborated by gaps in the marine sedimentation (SUKHOV 1955). Later, as a result of tectonic movements, islands joined with the continent and transformed into peninsulas penetrated by some terrestrial vertebrates.

It is also possible that bone remains of terrestrial vertebrates were brought from the coastal area to the biohermal zone by marine flows. The presence of leaf imprints and petrified remains of wood in the reef limestone may also be associated with these flows.

The following marine and terrestrial vertebrates are present in the localities Prūnkūl, Gidigich, Mikeūts, Poshta Veke, Visternichen and Yaloven of the limestone reef area in the Urban Kishinëv region:

AVES: *Phalacrocorax lautus* KUROTCHKIN and GANEA, 1972, *Probalearica moldavica* KUROTCHKIN and GANEA, 1972, *Ancerobranta tarabukini* KUROTCHKIN and GANEA, 1972, *Ardeagrandis arborea* KUROTCHKIN and GANEA, 1972, Anatinae gen. et sp. indet.;

MAMMALIA

Carnivora: *Limnonyx pontica* (NORDMANN, 1860), *Thalassictis robustua* NORDMANN, 1858, *T. sarmaticum* (PAVLOV, 1908);

Perissodactyla: *Hippotherium* sp., *Aceratherium* sp., *Alicornops* cf. *simorrensis orientalis* LUNGU, 1984;

Artiodactyla: *Korynochoerus* cf. *palaeochoerus* (KAUP, 1833), *Lagomeryx* sp.;

Proboscidea: *Deinotherium* sp.;

Cetacea: *Cetotherium priscum* EICHWALD, 1853, *Archaeocetus nordmanni* (BRANDT, 1873), *A. fockii* BRANDT, 1873, *Sarmatodelphis moldavicus* SIMIONESCU, 1923;

Sirenia: ?*Halitherium maeoticus* (NORDMANN, 1858);

Pinnipedia: *Phoca* (*Pusa*) *pontica* (EICHWALD, 1850), *Phoca bessarabica* SIMIONESCU, 1925, *Praepusa pannonica* KRETZOI, 1941, *Pontophoca simionescui* KRETZOI, 1941, *Monotherium maeoticum* (NORDMANN, 1858).

New species described from the reef limestone by NORDMANN (1858-1860) as *Equus pygmaeus* and *Palaeomeryx minor* are here referred to as *Hippotherium* sp. and *Lagomeryx* sp. Reptilia are represented by turtles.

The faunal assemblages from the limestone reef are known as the faunistic complex "Petrikanskii". It is characterized by the first appearance of the genus *Hipparion* DE CHRISTOL, 1832 in the area of the Eastern Paratethys. The "Petrikanskii" complex of deposits originated at the end of the Early Bessarabian. The geological age of localities situated in the reef area is considered to be Early Vallesian (early biozone MN9, see: Fig. 2).

2.2. Localities of the Vasilevskii unit (Middle Bessarabian)

Locality: Otovaska I – Kishinëv (Chişinău). Situated southeast of Kishinëv (Fig. 1), on the left bank of the Byk river valley. Strata in the clay pit (60 m a.s.l.), from the bottom to the top of the exposure, appear as follows (Fig. 4).

In the lower part of the outcrop organogenous and detrital limestones occur (layer 1, thickness 2 m). Grey mudstone and clay cover the limestone (layer 2, thickness 1.5 m). The next layer 3 (thickness 1.7 m) is built of green-grey clay and fine-grained sands with brown patches containing shells of mollusks: marine – *Mactra podolica* EICHWALD, 1853, *M. fabreana*, *Plicatiforma fittoni* (D'ORBIGNY, 1844), *Obsoletiforma desperata* (KOLESNIKOV, 1929) etc., and freshwater – *Congeria neumayri* ANDRUSOV, 1897, *Theodoxus* cf. *crenulatus* (KLEIN, 1853), *Planorbarius* sp., *Hydrobia elongata* EICHWALD, 1853, *Acteocina lajonkaireana* (BASTEROT, 1825). Inside layer 3, intercalations of gravelly sands and small clayey pebbles occur occasionally in its upper part. Fragments of hollow bones and teeth of *Hippotherium* VON MEYER, 1829, *Aceratherium* KAUP, 1832, and *Procapreolus* SCHLOSSER, 1924 are present, strongly mineralized and dark brown in colour. Layer 4 (thickness 1.5 m) consists of medium-grained grey quartzy sands characterized by weakly expressed diagonally undulated stratification. Layer 5 (thickness 1.5 m) is composed of fine-bedded, green-grey sandy-clays. Next comes layer 6 (thickness 8 m) built of fine- and medium-grained grey quartzy sands, slightly clayey with brown patches alternating with intercalations of laminated aleurite and clay. Concentrations of shells of marine – *Mactra podolica*, *Plicatiforma fittoni*, *Obsoletiforma ingrata* (KOLESNIKOV, 1929), *Solen subfragilis* EICHWALD, 1853, *Gibbula moldavica* (SIMIONESCU and BARBU, 1940), *G. subblainvillei* (SINZOV, 1897), *Potamides disjunctum* (SOWERBY, 1832), *Cerithium comperei* and freshwater – *Hydrobia* cf. *elongata* mollusks appear in the sands of layer 6. Layer 7 (thickness 8 m) is characterized by fine-grained and slightly diagonally undulated grey quartzy sands with clay intercalations. Sand concretions and clay galls (diameter up to 10 cm) are present inside of these sand beds. Sands are intercalated with green and blue sandy-clays and small clay balls. Shells of freshwater mollusks and bone concentrations of terrestrial vertebrates are present in sands and clays.

Subsequent beds continue in the outcrop of Otovaska II (Fig. 4). Layer 8 (thickness 17 m) is built of grey, clayey and diagonally bedded fine-grained sands, inside of which occur lenses of fine gravel and clay balls. Sands alternate with fine-bedded blue sandy-clays containing shells of marine mollusks – *Mactra podolica*, *Obsoletiforma ingrata*, *Solen subfragilis*, *Musculus* cf. *naviculoides* (KOLESNIKOV, 1935). Layer 9 (thickness 28-30 m) is built of grey, fine-grained and clayey sands with brown patches, diagonally or horizontally bedded with intercalations of green sandy and clumpy clays.

The described section of outcrop demonstrates that organogenous limestones appeared in the Otovaska pit (situated 60 m a.s.l.), and are associated with the lower part of the middle beds of the Bessarabian substage. On the eroded limestone surface (between layer 1 and layer 2) lies a pack of sandy-clayey layers (thickness about 70 m) heterogenous in ori-

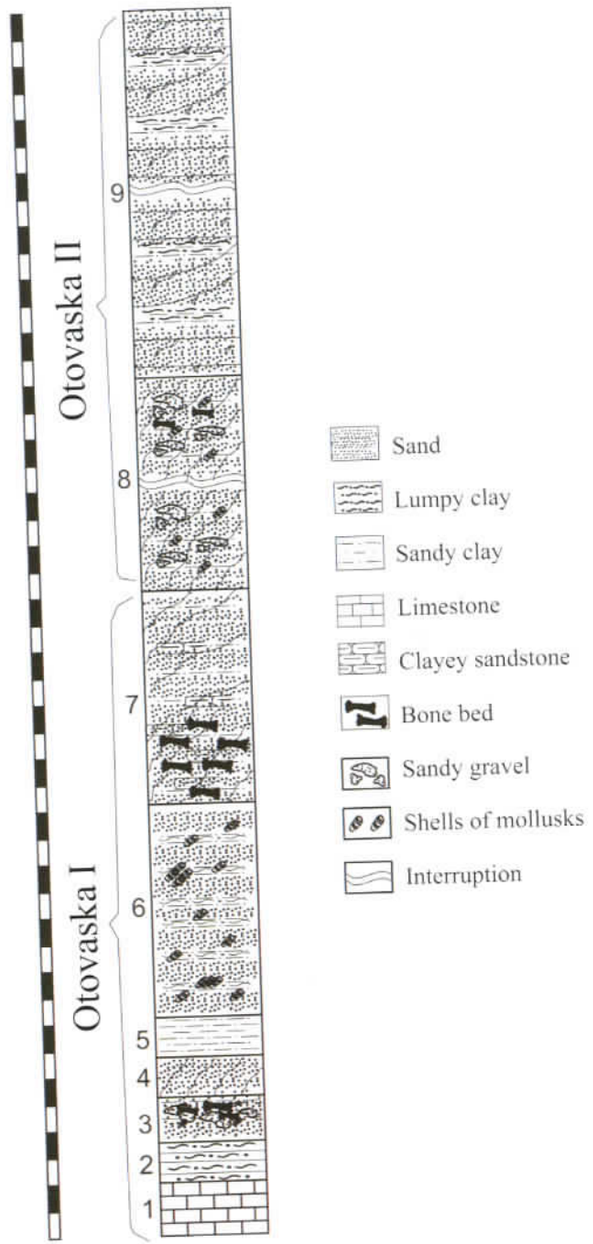

Fig. 4. Geological cross-section of the localities Otovaska I and II (by NICOARA).

gin and age. The lower part of the pack (layers 2-7, thickness 14 m) consists of grey, fine-grained sands and clays containing shells of marine and freshwater mollusks, as well as bones of terrestrial vertebrates, and presents a pro-delta facies. According to ROSHKA (1973), in the Kishinëv region of the Moldova territory these deposits correspond to the regressive phase of the second stage in the development of the Middle Sarmatian basin.

The middle part of this geological section (layer 8, thickness 17 m), composed of fine-grained sands alternated with green and fine-bedded blue sandy-clays, contains a typical Middle Sarmatian fauna of mollusks (*Mactra podolica*, *Obsoletiforma ingrata*, *Solen subfragilis*, *Musculus naviculoides*). In the upper part of this pack lenses of gravelly sands and clayey pebbles and also fragments of bones of terrestrial vertebrates occur. They were certainly deposited as underwater cones formed by temporary flowing streams. A part of this exposure containing a fauna of marine mollusks represents the littoral-marine facies of the upper beds of the Bessarabian substage.

The upper part of the described section (layer 9, thickness about 30 m), consisting of diagonally-bedded clayey sands with alternated grey-green diagonally-bedded sandy-clays, contains shells of freshwater mollusks (*Lymnaea* sp., *Planorbarius* sp.). These lacustrine-fluvial facies represent the upper part of upper beds of the Bessarabian substage.

The remains of terrestrial vertebrates are rare in pro-delta deposits. Large accumulations are present in the deltaic facies, where a bone lense of length 20-25 m and thickness of 1.0-1.5 meter is present. In the lower part of this bone lense, limbs, skulls and mandibles of *Hippotherium* sp., rhinoceros, mastodont and hyena predominate. Fragments of distal parts of limb bones and fragments of skulls and mandibles of *Hippotherium* sp., rhinoceros, lagomericids (Cervidae) and varanids (lizards) were also found. There was no special orientation in the position of bone axes. They present mass (ridge-like) and chaotic accumulations which alternated with fragments of rock without animal remains.

In the upper part of the lense (in the form of breccia) occur bone remains and isolated teeth of lagomericids, young teeth of *Hippotherium sp.*, and washed fragments of hollow bones of large mammals. The bones are strongly mineralized and are brown in colour. There are old and young individuals in the collected material.

Certainly, the area of burial represents an arm of the delta of a large river (waterway). The presence of concentrations of limbs, vertebrae, and skulls with articulated mandibles in the bone lense shows that whole animal bodies or their parts were buried before they decomposed.

The strong mineralization of bones indicates that they were not exposed to the process of weathering in sub-aerial conditions but were buried very quickly. When the speed of stream flow decreased, smaller bone remains appeared in the area of burial. The simultaneous presence of unwashed bones and strongly washed fragments of bones and isolated teeth shows that transport of animal remains took place both from distant areas as well as from the vicinity of the deposition site. Periodical heavy rainfall and floods which caused the death of the weakest part of populations – old and young individuals – were surely the reason of their demise. Their remains prevail in the sediments.

According to LUNGU and CHEMYRTAN 1989b, LUNGU 1990, LUNGU and OBADĂ 2007 the following taxa occur in Otovaska I:

REPTILIA: *Protestudo chisinauensis* REDKOZUBOV, 2007, *Varanus lungui* ZEROVA and CHKHIKVADZE, 1989;

MAMMALIA

Lagomorpha: *Proochotona kalfense* LUNGU, 1981;

Rodentia: *Chalicomys jaegeri* KAUP, 1832;

Carnivora: *Thalassictis* sp., *Percrocuta robusta* LUNGU, 1978, *Indarctos vireti* VILLALTA and CRUSAFONT PAIRO, 1943 (= *Indarctos sarmaticum* LUNGU and CHEMYRTAN, 1996), Machairodontinae gen. et sp. indet.;

Perissodactyla: *Hippotherium sarmaticum* LUNGU, 1973, *Aceratherium incisivum* KAUP, 1832, *Alicornops simorrensis orientalis*;

Artiodactyla: Suidae gen. et sp. indet., *Lagomeryx flerovi* LUNGU, 1972, *Procapreolus* sp., *Miotragocerus pannoniae* KRETZOI, 1941;

Proboscidea: *Choerolophodon* cf. *pentelici* (GAUDRY and LARTET, 1856), *Tetralophodon longirostris* (KAUP, 1832).

The remains of fish, amphibians and coprolites were also found.

Locality Otovaska I is considered to lie in the middle beds of the Bessarabian substage. Its age can be correlated with the Early Vallesian (MN9, Fig. 2). Concerning the fauna, this assemblage is identical with the assemblage of Kalfa.

Localities: Breila and **Malye Mileshty**. These localities are situated in the Ishnovets river valley, in the Yalovenskii region (15 km south of Kishinëv, Fig. 1).

Bone remains of terrestrial vertebrates are found in the marine beds of the Middle Bessarabian substage. In limestone and chalky clays they form beds similar to lense accumulations (thickness up to 1 meter) with shells of *Mactra fabreana*, *M. podolica*, *Plicatiforma fittoni*, *Cerithium* sp., etc. The bone layer is covered by the Middle Sarmatian limestone and sandstone with shells of *Plicatiforma fittoni*, *Mactra podolica*, *Solen subfragilis*.

The bone remains are strongly mineralized and the whole skulls and articulated limb bones of *Hipparion* are only exceptionally found. Shells of terrestrial and freshwater mollusks (*Unio* sp., *Congeria* sp., *Theodoxus* sp., *Helix* sp.) are also present.

The character of bone accumulations in the form of a lense, the presence of shells of freshwater mollusks and lithological features of the deposits indicate fast accumulation and burial of terrestrial vertebrates by ephemeral freshwater streams, the rapidity of which, as suggested by the predominance of large bones, was significant. The remains of terrestrial vertebrates were certainly buried during flooding of the pro-delta of the paleo-river valley.

The following taxa are present in the above mentioned localities:

REPTILIA: *Protestudo* sp., *Trionyx moldaviensis* KHOZATZKY, 1986;

MAMMALIA

Perissodactyla: *Hippotherium sarmaticum*, *Aceratherium* aff. *incisivum*, *Dicerorhinus* sp.;

Artiodactyla: *Microstonyx antiquus* (KAUP, 1833);

Proboscidea: *Deinotherium* aff. *gigantisimum* ŞTEFĂNESCU, 1892;

Pinnipedia: *Phoca* sp.

The remains of *Hippotherium* sp. predominate. The geological age of these localities is the Early Vallesian (MN9, Fig. 2).

Locality: Kalfa. This locality is situated near Kalfa village, in the Anenii Noi region (southeast of Kishinëv, Fig. 1). It is one of the most important localities with *Hippotherium* fauna of Bessarabian (Middle Sarmatian) age in Eastern Europe. A large outcrop rich in fossils (layers 6 to 15 are numbered from top to bottom) is located on the southern escarpment of the Byk river valley (northwest of Kalfa).

On the top of the outcrop lie Quaternary beds (layers 1-5 on Fig. 5). Layer 6 (thickness 1.7 m) is built of green-grey lumpy clay. Its lower part is sandier and contains pebbles of limestone, mudstone and sandstone, with shells of *Mactra* sp. and *Helix* sp. In this layer, fragments of bones of small vertebrates are occasionally found (fauna I). Layer 7 (thickness 0.7 m) is below the erosional surface. This layer is built of fragments of limestone and contains numerous shells of *Cerithium* sp., *Paphia* sp., and *Plicatiforma fittoni*, as well as terrestrial vertebrates (fauna II). The following section down to layer 8 (0.2 m thick), is composed of grey oolite limestone with rust patches containing shells of *Mactra podolica* and *Solen subfragilis*. The calcareous sandy-clay of layer 9 (thickness 0.3-1.2 m) is situated below and contains *Musculus naviculoides* and *Modiolus* sp. In layer 10 (thickness 1.3 m), fragments of limestone with carbonate clay and oolite limestone with small grey oncoids were found. Remains of Bryozoa (evidently redeposited) and shells of marine (*Mactra fabreana*, *Plicatiforma fittoni*, *Solen subfragilis*, *Gibbula* sp., *Paphia* sp., and *Cerithium comperei)*, freshwater (*Lymnaea* sp. and *Planorbis* sp.) and terrestrial (*Helix* sp.) mollusks were found. The shells of large mollusks are rounded. This layer also contains remains of terrestrial vertebrates (fauna III). Layer 11 (thickness 0.2-0.3 m), situated below layer 10, is built of carbonate clay with few shells of *Mactra* sp. and *Plicatiforma fittoni*. Layer 12 (thickness 0.5-0.6 m) consists of yellow-grey and cracked banded limestone and contains pebbles of oolite limestone and mudstone. In this layer shells of *Mactra podolica*, *Paphia vitaliana* D'ORBIGNY, 1844, *Solen subfragilis*, *Cerithium comperei*, and freshwater mollusks, as well as concentrations of vertebrae of terrestrial taxa, are also present (fauna IV). Layer 13 (thickness of 0.2 m) is built of yellow-grey oolite limestone with small shells of *Solen subfragilis* and *Mactra* sp. Underneath, layer 14 (thickness 0.6-0.7 m) consists of carbonate clay with pebbles and fragments of oolithic limestone. This layer contains large shells of marine (*Mactra fabreana, Cerithium comperei, Plicatiforma fittoni, Solen subfragilis*), terrestrial, and freshwater mollusks, as well as ridge-like concentrations of terrestrial vertebrates (fauna V). Small spherical oncoids can be found in the lower part of this layer. Layer 15 (thickness over 5.4 m) is situated on the bottom of the outcrop. It is built of grey oolite limestone with rare shells of *Mactra* sp., *Paphia* sp., *Solen subfragilis*, *Modiolus incrassatus* (D'ORBIGNY, 1844), and *Mactra podolica*. This layer contains an intercalation (0.18-0.15 m) of carbonate clays.

The remains of small vertebrates were found in laminated beds: 7, 10, 12, and 14 (Fig. 5). The layers with bones are ca 60-70 m in length, 2-3 m in width and 0.2-1.0 m thick (the total thickness of the bone beds reaches 2.5-3.5 m). The orientation of the bone axes is from the north to the south or from the northwest to the southeast. The Kalfa beds were apparently deposited in a short time and belong to the second group in the classification of EFREMOV (1950). The small extent and thickness of the bone layers suggest the activity of periodical streams. The paleo-environment of the terrestrial vertebrate deposition area was the pro-delta zone of the Sarmatian river. The migration of the delta was caused not only by changes of erosion basis, but also by an increase or reduction of freshwater flow. Such a

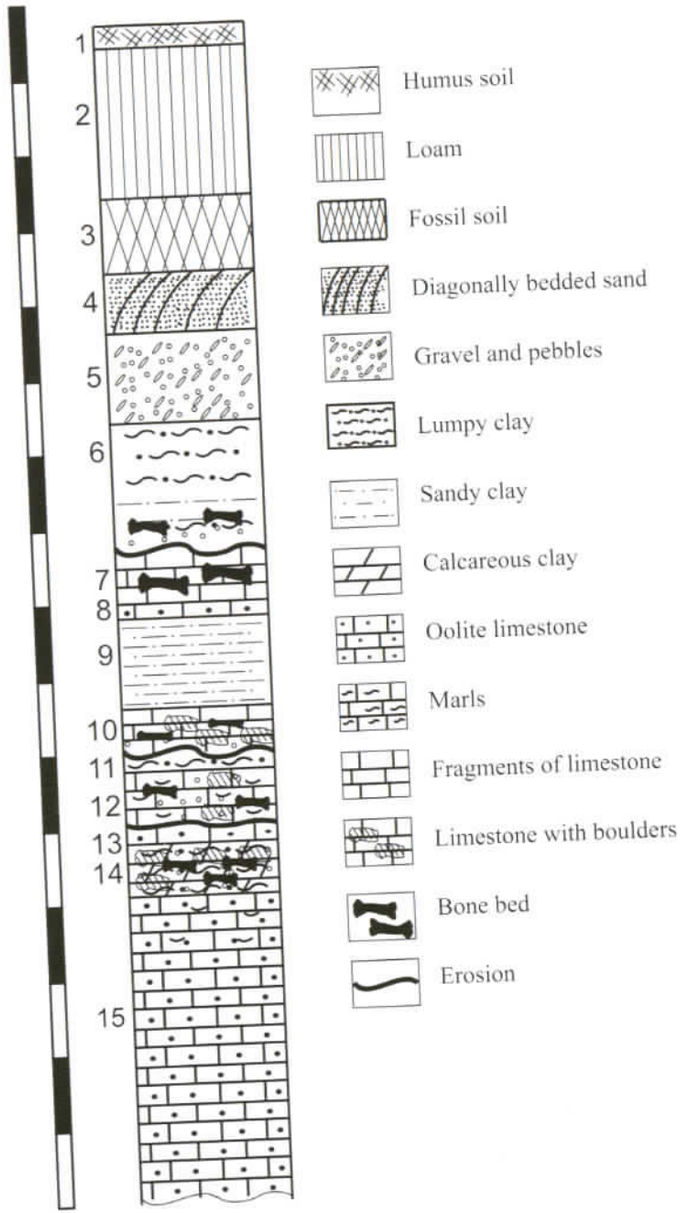

Fig. 5. Geological cross-section of the locality Kalfa (by NICOARA).

phenomenon is known usually as pseudo-transgression (NALIVKIN 1956). It is often associated with the unequal distribution of precipitation following dry and wet periods. Evidently, during dry periods (when freshwater was scarce or completely absent), oolite limestone, carbonate-clays, small oncoids and salt-water mollusks were deposited in brackish conditions. The pro-delta was formed during wet periods, when the supply of freshwater was high. In these periods the activity of rivers was greater and the remains of terrestrial vertebrates were deposited and covered with sediments. During this time rivers eroded, washed and deposited fragments of the oolite limestone and oncoid layers.

According to the segregation of the bone remains in beds, the Kalfa locality is considered to be of the mixed type (EFREMOV 1950). In horizons I and III bones are accumulated in masses, but in horizons II and IV bones occur in thin intercalations. Poor bone segregation may reflect changes in stream systems. When the speed of stream flow was greater, only large bones were deposited. Small bones were transported and deposited beyond the area. In this case the bones were buried rapidly, as confirmed by their diagonal sedimentation in beds. When the speed of stream flow decreased, only small bones were deposited in the deposition zone. In quiet hydrodynamic conditions, bone concentrations are found only in separate intercalations. Bones were broken and rounded during rapid stream transportation. The presence of long bones, parts of limbs, vertebrae, skulls, mandibles, together with strongly rounded and fragmented remains of animals, suggest that transport took place both from distant areas as well as from the vicinity of the deposition site.

The differences in fossilization and preservation of bones from various layers show that sometimes the animals were deposited shortly after death, perhaps before decomposition of their soft tissues. The bones of herbivorous animals with traces of carnivore gnawing marks and also the presence of a crevice net on the surface of particular bones indicate that in some circumstances the remains of animals were left on the soil surface for a long time. The weathering differences are expressed in the degree of preservation of the bone remains, and also in the colour of bones in particular beds. After burial, in the diagenesis of porous rocks, the bone remains were subjected to destruction. Numerous fractures, flatnesses and dilatations of the bones resulted.

LASKAREV (1911) and PAVLOV (1914) listed from Kalfa *Oreopithecus* sp., *Choerolophodon pentelici*, *Hipparion* sp., *Hipparion gracile* (KAUP, 1833), and *Aceratherium* aff. *incisivum*. A more complete list assembled by LUNGU (1978, 1981, 1984, 1990) and used in the present paper follows:

REPTILIA: *Protestudo csakvarensis* (SZALAI, 1934), *Sarmatemys lungui* CHKHIKVADZE, 1983, *Trionyx brunhuberi* AMON, 1911, *Ophisaurus* aff. *novorossicus* ALEXEJEW, 1912, *Vipera sarmatica* CHKHIKVADZE and LUNGU, 1989;

AVES: Anserinae gen. et sp. indet.;

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Soricomorpha: *Crusafontina* cf. *endemica* GIBERT, 1975, *Hemisorex suchovi* LUNGU, 1981;

Lagomorpha: *Eurolagus fontannesi* (DEPERET, 1887), *Proochotona kalfense*;

Rodentia: *Spermophilinus bredai* (VON MEYER, 1848), *S. turolensis* DE BRUIJN and MEIN, 1968, *Palaeomys* sp., *Neocricetodon* (*Kowalskia*) *moldavicum* LUNGU, 1981;

Carnivora: *Eomellivora piveteaui* OZANSOY, 1965, *Promeles* sp., *Protictitherium crassum* (DEPERET, 1892), *Miohyaena montadai vallesiensis* (CRUSAFONT PAIRO and PETTER, 1969), *Percrocuta robusta*, *Sansanosmilus piveteaui* (OZANSOY, 1965), *Machairodus lascarevi* LUNGU, 1978, *Pseudaelurus turnauensis* (HÖERNES, 1882), *P.* cf. *pamiri* (OZANSOY, 1965);

Perissodactyla: *Hippotherium sarmaticum*, *Hippotherium* sp., *Alicornops simorrensis orientalis*, *Aceratherium incisivum*;

Artiodactyla: *Schizochoerus vallesiensis* CRUSAFONT PAIRO and LAVOCAT, 1954, *Lagomeryx flerovi*, *Euprox* cf. *furcatus* (HENSEL, 1859), *Miotragocerus pannoniae*;

Proboscidea: *Deinotherium gigantisimum*, *Prodeinotherium bavaricum* (VON MEYER, 1931);

Pinnipedia: *Phoca* (*Pusa*) *pontica*.

The dominant remains in the fossil assemblage of Kalfa represent genera *Proochotona* KHOMENKO, 1914, *Eomellivora* ZDANSKY, 1924, *Protictitherium* KRETZOI, 1938, *Hippotherium* sp., *Aceratherium* sp., *Alicornops* (GINSBURG and GUERIN, 1979), *Lagomeryx* ROGER, 1904, and *Miotragocerus* STROMER, 1928. Rare fossils include *Hemisorex* BAUDELOT, 1967, *Eurolagus* LOPEZ MARTINEZ, 1988, *Sansanosmilus* KRETZOI, 1926, *Aceratherium incisivum*, and *Euprox* STEHLIN, 1928.

Both juvenile and old individuals are represented in the fossil assemblages of the Kalfa fauna. This suggests that their structure reflects the pattern of mortality in the population. The age of the fauna from the Kalfa locality is considered as Early Vallesian (MN9, Fig. 2).

Remains of terrestrial vertebrates found in localities situated eastwards of the reef region of Kishinëv are present in the limestone in the form of lense accumulations.

Locality: Girovo (Bessariabian middle beds situated northwest of Kishinëv, Fig. 1). This locality is situated in the northeastern part of the village of Girovo, in the Kelerash region. In the outcrop (high ca 80 m), the sandy-clayey deposits can be found (Fig. 6), containing the typical fauna of Bessarabian marine and terrestrial mollusks: *Helicella* sp., *Cepaea* sp., *Clausilia* sp., *Mactra urupica* DONOV, 1926, *M. fabreana*, *M. podolica*, *Cerastoderma vassoewitschi* KOLESNIKOV, 1935, *C. michailovi* TOULA, 1892, *Plicatiforma fittoni*, *Potamides disjunctum*, *Terebralia menestrieri* (D'ORBIGNY, 1844), *Barbotella grassocostata* (RADONOVIC and PAVLOVIC, 1893), *Helix* sp., *Calliostoma* sp. On the top of the outcrop, sandy-clayey deposits are intercalated with gravelly sand and coquina limestone with terrestrial vertebrates (LUNGU and OBADĂ 2001; RZEBIK-KOWALSKA and LUNGU 2009):

REPTILIA: *Protestudo* sp., *Ophisaurus* sp.;

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Soricomorpha: *Crusafontina* cf. *endemica*;

Rodentia: *Muscardinus hispanicus* (DE BRUIJN, 1966), *Anomalomys* cf. *gaillardi* VIRET and SCHAUB, 1947, *Neocricetodon* (*Kowalskia*) *moldavicum*, *Neocricetodon* sp.;

Perissodactyla: *Hippotherium* cf. *primigenium* (VON MEYER, 1829), *Aceratherium incisivum*;

Artiodactyla: *Lagomeryx flerovi*;

Proboscidea: *Amelobelodon* sp.;

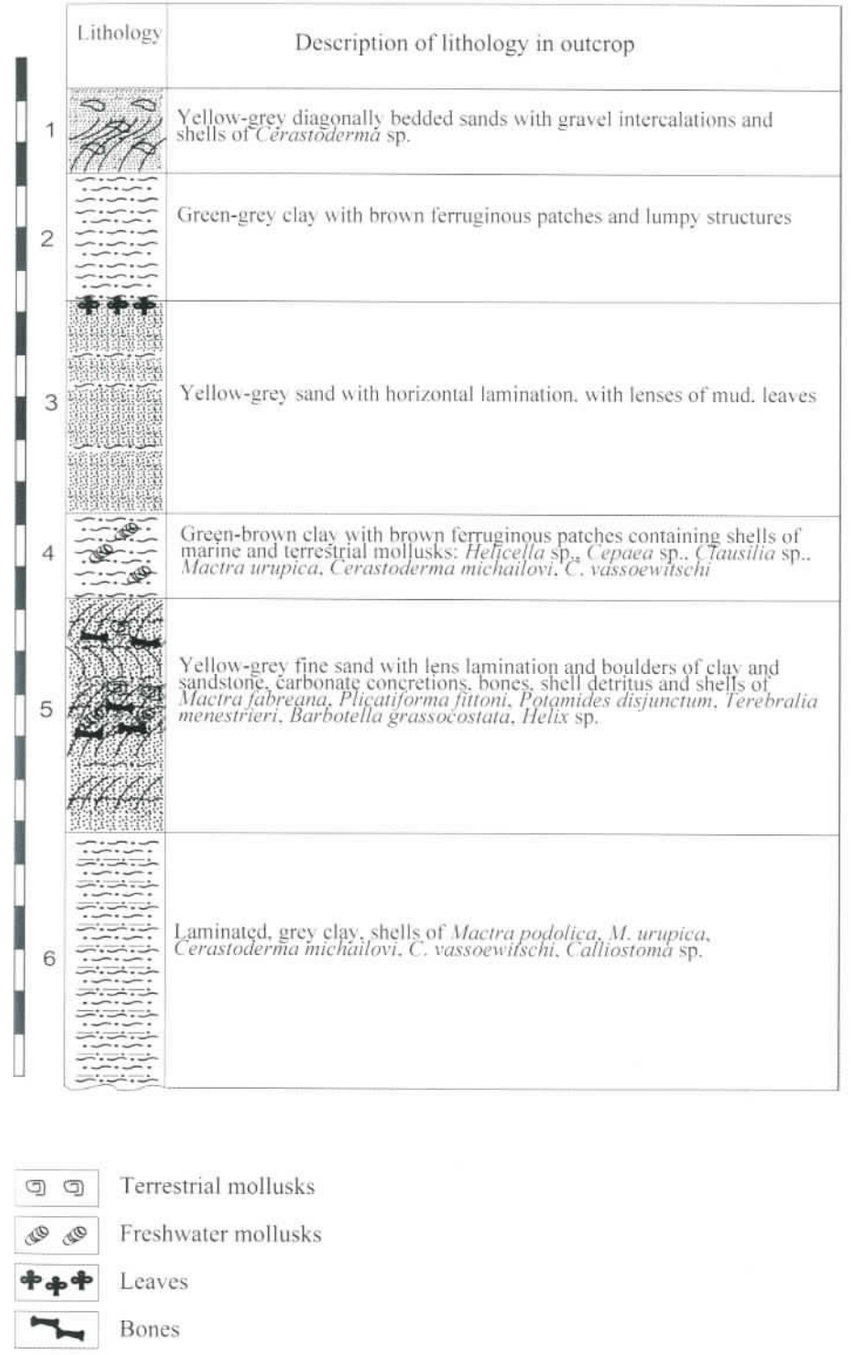

Fig. 6. Geological cross-section of the locality Girovo (by NICOARA).

The presence of clay, shells of freshwater and marine mollusks and fine-bedded deposits containing the remains of terrestrial vertebrates indicate that deposition took place in temporary streams of a pro-delta zone. Well preserved bone remains (brown and black in colour), are dispersed in the rocks. Isolated bones, teeth and fragments of jaws, often strongly rounded, attest to their long transportation. Archaic taxa in the fauna of Girovo such as *Lagomeryx* sp., *Amelobelodon* BARBOUR, 1927, *Muscardinus* KAUP, 1829 and *Anomalomys* GAILLARD, 1900 indicate that these deposits can be correlated with the Early Vallesian (MN9, Fig. 2).

Locality: Būzhor I. This locality is situated in the southeastern part of Būzhor village, in the Khynchesht region (west of Kishinëv, Fig. 1). Sandy-clayey deposits, known as the "*Congeria* beds" (thickness up to 20-25 m), were described by EBERZIN (1951). A rich assemblage of the terrestrial fauna and flora was found in these layers (LUNGU 1971, 1981, 2000). The outcrop on an escarpment (Fig. 7), with a section of the "*Congeria* beds" of the Bessarabian beds exposes the following strata (from bottom to top).

In the lower part of the outcrop (layer 1, thickness ca 3.0 m) occur fine-grained, micaceous and diagonally bedded sands with rusty patches and shells of *Congeria sarmatica* KOJUMDIEVA, 1968, *Unio* sp., *Anodonta* sp., and *Planorbis* sp. The sands are intercalated with microconglomerate and gravel (thickness of beds 0.15-0.20 m) with numerous remains of terrestrial vertebrates, fragments of petrified tree trunks and carbonized remains of wood and graminaceous plants. Higher, grey clayey sand can be found (layer 2, thickness 7.0 m), with brown patches and rare shells of *Congeria elongata* JEANRENAUD, 1963, *Unio* sp., *Limnoscapha* sp., *Plicatiforma fittoni*, *Mactra* sp., and *Solen subfragilis*. The next layer 3 (thickness 5.0 m), consists of laminated sandy-clay with blisters containing *Congeria neumayri*, *Congeria vasluiensis* JEANRENAUD, 1963, *Unio* sp., *Limnoscapha* sp., *Mactra podolica*, and *Plicatiforma fittoni*. The relatively thin layer 4 (thickness 0.15-0.25 m) is situated on top of layer 3 and consists of conglomerate with small pebbles of limestone, sandy and clayey rocks and large shells of *Plicatiforma fittoni* and *Mactra fabreana*. This layer contains numerous bones of terrestrial and marine vertebrates. On the top of the outcrop lies layer 5 (thickness 1.2 m) built of coquina limestone with *Mactra fabreana*, *M. podolica*, *Musculus naviculoides*, *Plicatiforma fittoni*, *Cerithium* sp., and *Solen subfragilis*.

The lithological composition, character of sedimentation, presence of freshwater and terrestrial mollusks, remains of plants and terrestrial vertebrates show that the lower part of the outcrop (layer 1) represents a fluvial facies, while the higher part (layers 2-4) corresponds to a deltaic facies covered by a marine facies (layer 5). The remains of terrestrial vertebrates were found in layers 1 and 4, the former representing the river facies (lower part of the "*Congeria* beds"), the latter the top part of the deltaic facies. Numerous bone remains and isolated teeth of fish, reptiles, birds, and mammals are known from the lower level. Remains of small mammals predominate.

Localities such as Būzhor I represent the mixed type of EFREMOV (1950). They would have originated under conditions of strong land erosion, powerful streams and fast sedimentation. Fine pebbles and gravelly sands containing terrestrial vertebrates constitute the river-bed facies, formed mostly during floods. The remains of terrestrial vertebrates could have been deposited as a result of erosion/washing of alluvial cones containing the bone

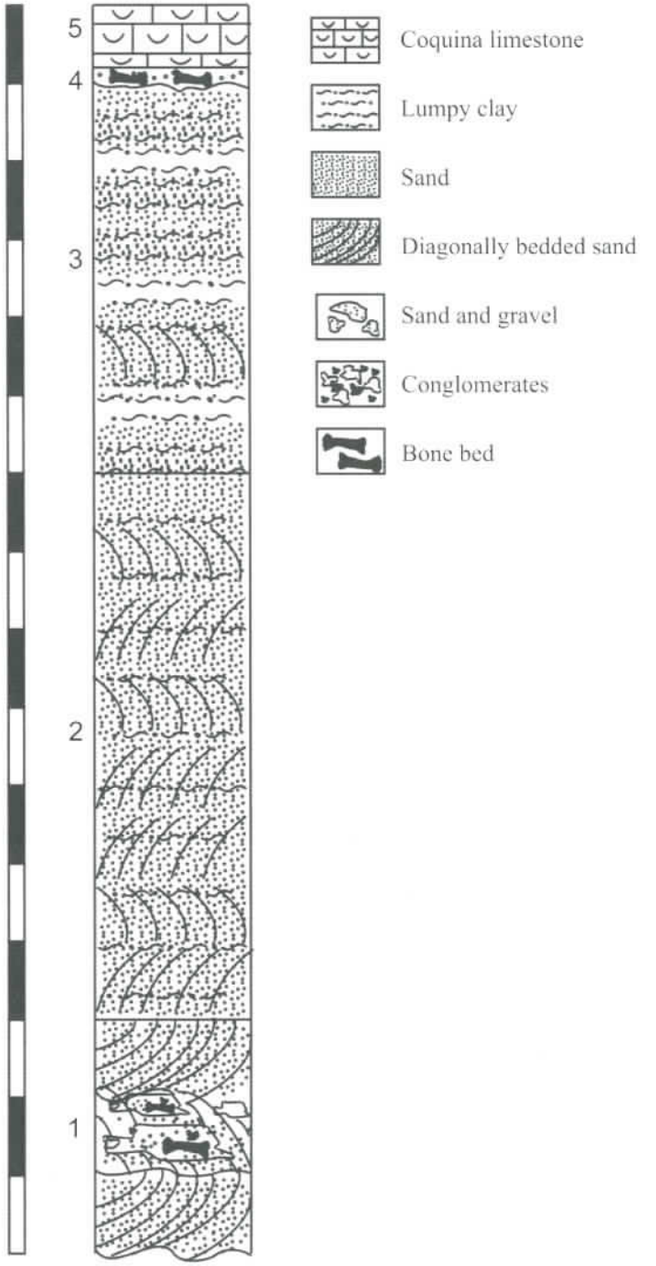

Fig. 7. Geological cross-section of the locality Būzhor I (after LUNGU 1981, changed by NICOARA).

fragments. Of course, the remains of woody plants (trunks and branches) were carried by water as the result of washing. Evidently, the bones were transported to the deposition area from various distances because they are in different stages of washing and fossilization. In the beds with vertebrate remains, algae, seeds, petrified and carbonized remains of wood and grass were also found. Trees such as *Salix* sp., *Populus* sp., and *Taxodium* sp. were identified.

The lower bone level (in layer 1) contains remains of:

PISCES: *Tinca* sp., *Parasilurus* sp., *Barbus* sp., *Carasicus* sp., *Perca* sp., *Rutilus* sp.;

AMPHIBIA: *Mioproteus* sp., *Anuria* sp., *Bufo* sp., *Rana* sp.;

REPTILIA: *Chelydropsis murchisoni* (BELL, 1939), *Trionyx moldaviensis, Melanochelys moldavica* CHKHIKVADZE, 1988, *Sarmatemys lungui*, *Protestudo csakvarensis*, *Anguis* sp., *Ophisaurus* sp., *Natrix* sp., *Coluber* sp., *Vipera sarmatica*;

AVES: *Promilio incertus* KUROTCHKIN and GANEA, 1972, *Tertiariaporphyrula lungui* KUROTCHKIN and GANEA, 1972;

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Erinaceomorpha: *Schizogalerix sarmaticum* (LUNGU, 1981), Galericinae gen. et sp. indet., Erinaceinae gen. et sp. indet.;

Soricomorpha: *Desmanella* sp., *Proscapanus metastylidus* RZEBIK-KOWALSKA and LUNGU, 2009, *P.* cf. *austriacus* ZIEGLER, 2006, *Crusafontina* cf. *endemica*, *?Amblycoptus* sp., *Dinosorex grycivensis* RZEBIK-KOWALSKA and TOPACHEVSKY, 1997;

Lagomorpha: *Eurolagus fontannesi*, *Proochotona kalfense*;

Rodentia: *Spermophilinus bredai*, *S. turolensis*, *Steneofiber* aff. *depereti* (MAYET, 1908), *Chalicomys jaegeri*, *Trogontherium* (*Euroxenomys*) *minutum minutum* (VON MEYER, 1838), *Miodyromys* aff. *hamardas* (MAJOR, 1899), *Ramys multicrestatus* (DE BRUIJN, 1966), *Keramidomys* sp., *Eomyops* aff. *catalaunicum* (HARTENBERGER, 1967), *Sarmatosminthus gabuniai* LUNGU, 1981, *Anomalomys gaillardi*, *?Progonomys cathalai* SCHAUB, 1938, *Byzantinia orientalis* (LUNGU, 1981), *Democricetodon* sp., *Neocricetodon* (*Kowalskia*) *moldavicum*;

Carnivora: *Plesiogulo* aff. *brachygnathus* (SCHLOSSER, 1903), *Proputorius* sp., *Eomellivora* sp., *Protictitherium* sp., *Percrocuta* sp., *Pseudaelurus* sp.;

Perissodactyla: *Hippotherium* aff. *sarmaticum*, *Aceratherium* sp.;

Artiodactyla: Suidae gen. et sp. indet., *Lagomeryx flerovi*, *Euprox* sp., *Protragocerus* sp.

Layer 4 yielded only incomplete remains of *Protestudo* sp., *Ophisaurus* sp., *Varanus lungui*, *Chalicomys jaegeri*, *Proochotona* sp., *Hippotherium* sp., *Aceratherium* sp., and *Lagomeryx flerovi*.

The bone remains, dark-brown in colour, are dispersed in the rocks and strongly abraded. Evidently, their burial took place in the pro-delta zone. There seems to be no differences in the composition of the terrestrial vertebrate fauna present in the lower and upper levels of the "*Congeria* beds". The remains of the terrestrial vertebrates from the "*Congeria* beds" belong to animals inhabiting different environments, including: fluvial, fluvio-swamps, moist flood forests, coastal plains as well as open areas of the savanna type. The age of the fauna is early Valesian (MN9, Fig. 2).

Locality: Lepūshna. This locality is situated in the southwestern part of Lepūshna village, in the Khynchesht region (west of Kishinëv, Fig. 1). Diagonally bedded sands intercalated with grey-green sandy clays known as the "*Congeria* beds" (thickness 4-5 m) contain shells of marine mollusks (*Plicatiforma fittoni*, *Obsoletiforma desperata*, *Mactra vitaliana*, *M. podolica*, *Musculus naviculoides*, *Solen subfragilis*. The succession of strata in the exposure of Bessarabian beds at Lepūshna village shows gradual changes: from a freshwater river delta, through gulf to open sea environments (NEVESSKAJA 1967). In the "*Congeria* beds" of Lepūshna *Hipparion* sp. and *Aceratherium* sp. bone remains were found (EBERZIN 1950).

In the "*Congeria* beds" of the Lepūshna locality, above sandy-clayey layers containing terrestrial, freshwater and marine mollusks, intercalations (thickness 0.5-0.7 m) of small pebble conglomerates also occurred, with fragments of strongly abraded bone remains and teeth of the following forms:

REPTILIA: *Protestudo* sp.;

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Lagomorpha: *Proochotona* sp.;

Perissodactyla: *Hippotherium* aff. *sarmaticum*, *Alicornops* cf. *simorrensis orietalis*;

Artiodactyla: *Lagomeryx* cf. *flerovi*, *Achtiaria* sp.

According to the lithological composition of rocks and presence of freshwater and marine mollusks, the accumulations of the vertebrate remains took place in pro-delta conditions, but bones passed a long transportation.

In localities situated west of the zone of the Kishinëv reef the remains of terrestrial vertebrates present in the sandy-clayey sediments do not form accumulations but they are scattered in the rocks.

Faunal assemblages from this locality and localities of the Vasilevskii level (Middle Bessarabian) form a faunistic complex named "Kalfinskii" (LUNGU 1966, 1968, 2008a).

2.3. Localities of the Dnepropetrovskii unit (Late Bessarabian)

Locality: Varnitsa. This locality is situated 12 km north of Bendery (Anenii Noii region), in the northern part of Varnitsa village, on the west bank of the Dniester River valley (east of Kishinëv, Fig. 1).

Below Quaternary deposits (thickness 6.0 m) of the Dniester terrace, five layers numbered from top to bottom, are present (Fig. 8).

Layer 1 (thickness 0.2-0.3 m) is built of medium-grained sand with lenses of carbonate clays and small shells of *Plicatiforma* sp., *Mactra* sp., unionids (Unionidae, Bivalvia) as well as accumulations of bones of terrestrial vertebrates. Pebbles and gravel of clayey-carbonate rocks with an accumulation of bones of terrestrial vertebrates form layer 2 (thickness 0.4-0.5 m). Layer 3 (thickness 2.0-2.5 m) consists of diagonally bedded sand with traces of washed bones. Layer 4 (thickness 1.0 m) is built of green-grey clay. Layer 5 (thickness 1.0-1.5 m) consists of compact coquina limestone with numerous moulds of *Mactra podolica*.

The main mass of bone remains is situated in a pebble bed (layer 2). Bones are rare in sands situated below and above the pebbles. Remains of terrestrial vertebrates form lense-

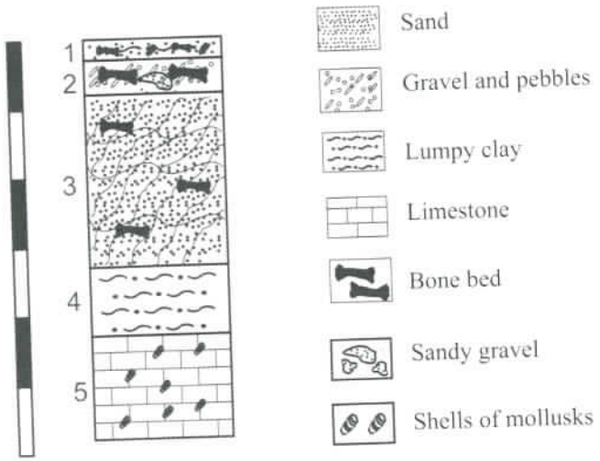

Fig. 8. Geological cross-section of the locality Varnitsa (after LUNGU 1978, changed by NICOARA).

like beds (thickness 1.0 m, width 1.5- 2.0 m). Inside the lenses, bone beds consist of compact accumulations in the form of nests alternating with rock devoid of bones. They are often inclined and broken, especially in pebbles, and are situated in disorder. Mostly bones and fragments of large animals (hipparions, mastodonts, *Chilotherium*) are present.

The lithological composition and bedding pattern show that sediments with terrestrial vertebrates represent fluvial and lacustrine facies. The small width and thickness of the bone lense, its wedge-like shape and character of sediments indicate that bone remains were transported by periodical and rapid streams. For the most part they transported large bone fragments, whereas smaller bones were carried farther from the burial zone. The fast deposition is also testified to by chaotic bone accumulation and oblique positions in the sediments. It is evident that they were carried away to the zone of deposition from various distances because strongly abraded fragments together with only slightly abraded and articulated parts of skeletons, especially vertebras, can be found. The deposition area represents a lake or shallow lagoon. The poor quality of preservation of the bone remains was certainly caused by weathering in subaerial conditions before burial.

According to LUNGU (1971, 1990), the following remains of vertebrates are present at Varnitsa:

REPTILIA: *Protestudo darevskii moldavica* CHKHIKVADZE and LUNGU, 1979, *Varanus tyrasiensis* ZEROVA and CHKHIKVADZE, 1989;

AVES: *Struthio orlovi* KUROTCHKIN and LUNGU, 1970;

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Lagomorpha: *Proochotona* sp.;

Rodentia: *Chalicomys* cf. *jaegeri*;

Carnivora: *Dinocrocuta gigantea* (SCHLOSSER, 1903), *?Ictitherium* sp.;

Perissodactyla: *Hipparion* aff. *verae* GABUNIA, 1979, *Acerorhinus zernovi* (BORISSIAK, 1915), *Aceratherium* sp.;

Artiodactyla: *Lagomeryx flerovi*, *Achtiaria expectans* BORISSIAK, 1915, *Tragoportax leskewitschi* (BORISSIAK, 1914), *Moldoredunca amalthea* LUNGU, 1984, Hippotraginae gen. et sp. indet.;

Proboscidea: *Choerolophodon pentelici*.

Taking into consideration the systematic assemblage of fauna from Varnitsa, its geological age is the MN9 (Fig. 2) or Early Vallesian (LUNGU 1984).

Locality: Otovaska II – Kishinëv (situated as Otovaska I, (Fig. 1 and Fig. 4).

In the outcrop (ca 75-100 m high), above fine-grained clayey sands intercalated with blue fine-bedded clays containing shells of *Mactra podolica*, *Obsoletiforma ingrata*, *Solen subfragilis*, a sandy-clayey patch (thickness 20-25 m) occurs, containing rare shells of terrestrial and freshwater mollusks (*Planorbarius* sp., *Lymnaea* ex gr. *palustris* MÜLLER, 1774). These deposits represent a lacustrine-fluvial origin.

On the bottom of the exposure in lenses of coarse-grained sands and small pebbles with rare shells of terrestrial and freshwater mollusks the remains of terrestrial vertebrates: *Proochotona* sp., *Chalicomys jaegeri*, *Neocricetodon* (*Kowalskia*) aff. *moldavicum*, *Hipparion* sp., Proboscidea gen. et sp. indet., as well as petrified remains of wood, were found. According to ROSHKA (1973) these vertebrate-containing deposits can be correlated with the Bessarabian substage of the Dnepropetrovskii level which in the Kishinëv Region appears between 70 and 130 m a.s.l. Apparently the remains of giraffes (*Palaeotragus* sp., KORSAKOV collection) from the Kishinëv area come from deposits of this level (GODINA 1964).

Locality: Sirets. This locality is situated in the Streshen area (north of Kishinëv), in the "Kazak" quarry (east of Sirets village). Below Quaternary deposits occur grey compact sandstones intercalated with clayey, diagonally bedded sand containing pebbles and fragments of shells of freshwater mollusks (thickness about 15 m). There are numerous leaf imprints of woody and gramineous plants in the sandstone. They attest to the presence of a rich and varied flora of the Moldova Plain of the Bessarabian beds (YAKUBOVSKAYA 1955). The remains of *Hipparion* sp. and *Aceratherium* sp. are also present in this locality (GROMOVA 1952).

The distribution of the plant remains in the rock in the form of fine layers as well as the lithological character of the deposits show that the remains of flora and fauna were transported to the deposition area by temperate streams and buried under placid hydrodynamic conditions. Apparently the deposition zone took place in a delta area.

The locality Sirets is considered to be of Late Bessarabian, the same as Otovaska II.

Locality: Būzhor II (situated as Būzhor I, west of Kishinëv, Fig. 1). Above the "*Congeria* beds" the following strata occur (from bottom to top) (Fig. 9).

In the lower part of the outcrop oolite limestones (layer 1, thickness 0.3 m) with *Mactra* sp. and *Plicatiforma* sp. are present. Layer 2 (thickness 1.5 m) is built of sandy clays with shells of *Plicatiforma* sp. The following section (layer 3, thickness 6 m) is composed of clayey sands with shells of *Mactra podolica*, *Plicatiforma fittoni* and *Solen subfragilis*. In greenish clays with brown patches (layer 4, thickness 2 m), scattered shells of *Mactra* sp.

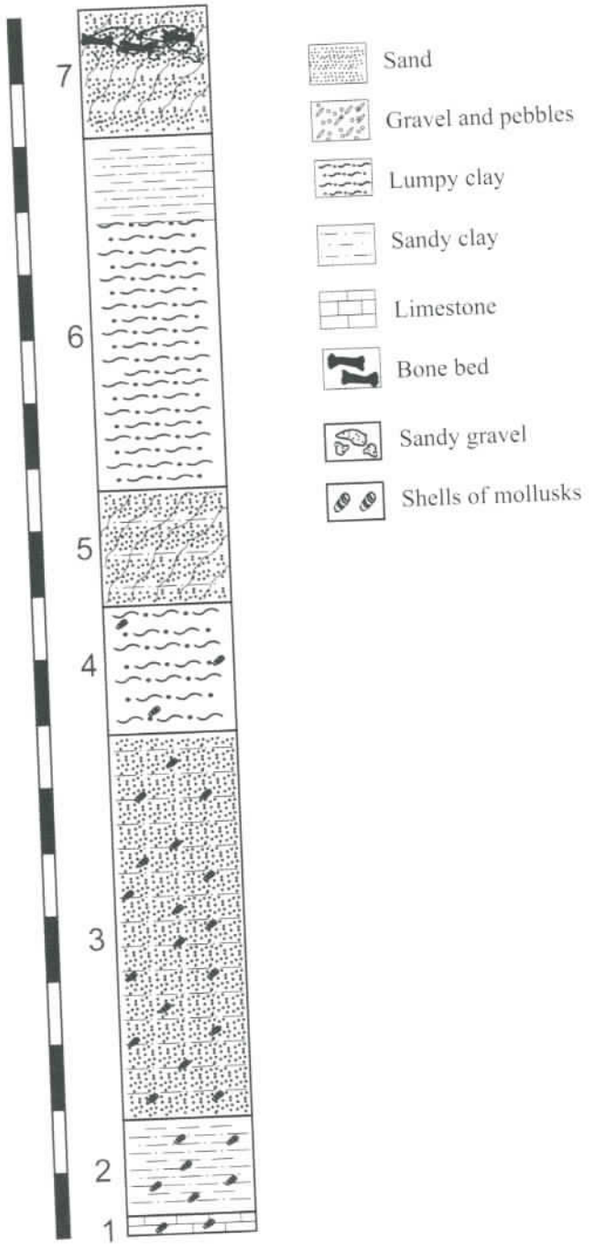

Fig. 9. Geological cross-section of the locality Būzhor II (by NICOARA).

and *Plicatiforma* sp. were found. Layer 5 (thickness 1.8 m) is built of fine-grained clayey and diagonally bedded sands. Higher up, layer 6 (thickness 5.5 m) consists of clays greenish in colour, sandy in their upper part with small shells of freshwater mollusks. Layer 7 (thickness 2.0 m) is situated on top. It consists of grey, diagonally bedded sands with brown patches and rare shells of freshwater mollusks. In the upper part of layer 7, lenses of carbonate and marly pebbles and gravelly sand (thickness of 0.2-0.3 m) are present. Sand passes into lumpy clays. In the upper part of this layer, in gravelly sands and pebbles, concentrations of bone remains of terrestrial vertebrates occur. Further up, grey-green lumpy clays occur, covered by Pleistocene deposits.

MAMMALIA

Carnivora: *Dinocrocuta gigantea*;

Perissodactyla: *Hipparion* sp., *Acerorhinus* cf. *zernovi*, *Alicornops* cf. *simorrensis orientalis*;

Artiodactyla: *Achtiaria* cf. *expectans*, Cervidae gen. et sp. indet., Antilopidae gen. et sp. indet.;

Proboscidea: *Choerolophodon pentelici*.

Coprolites and large shells of terrestrial mollusks are also present in the bone layers. The remains of terrestrial vertebrates were submitted to long transportation and weathering under sub-aerial conditions. Their state of preservation is poor. In terms of stratigraphy and faunal assemblage, Būzhor II resembles Varnitsa.

In the sandy clayey deposits of the Upper Bessarabian beds situated ca 3 km east of Būzhor village (Bogichen region), single bone remains of *Hippotherium* sp., *Zygolophodon turicensis* (SCHINZ, 1824) and *Procapreolus* sp. were found. They are referred to the Būzhor I assemblage.

Locality: Veveritsa I. This locality is situated in the northeastern part of Veveritsa village, in the Ungen region (northwest of Kishinëv, Fig. 1). In the outcrop (ca 340 m high), below the beds of the "Stolnichensk series" a patch of sandy clayey deposits (thickness 14-15 m) is present. Clayey diagonally bedded sands alternate with gray-green and blue bedded clays with bone remains of terrestrial vertebrates.

According to the lithological composition and occurrence of deposits with bone remains, this locality has a lacustrine-alluvial genesis. Bones do not form accumulations but are dispersed at different levels. They were found in lenses of gravelly sands. Apparently the accumulation and burial of remains of terrestrial animals were not associated with a change in the hydrological system of streams and deposition. The accumulation took place over a long period of time as the result of intense land erosion caused by streams.

According to LUNGU (1990) the following terrestrial vertebrates are present in Veveritsa I:

MAMMALIA

Erinaceomorpha: *Schizogalerix* sp.;

Lagomorpha: *Proochotona* sp.;

Rodentia: *Spermophilinus* cf. *bredai*, *Progonomys* cf. *cathalai*, *Anomalospalax* sp., *Neocricetodon* (*K.*) *moldavicum*, *Muscardinus* sp.;

Perissodactyla: *Hipparion* sp., ?*Aceratherium* sp.;

Artiodactyla: *Lagomeryx* cf. *flerovi*;

Proboscidea: *Tetralophodon* sp.

The composition of the fauna from Veveritsa I suggests an Early Vallesian time frame (end of MN9, Fig. 2).

Locality: Isakovo. Situated in the northern part of Isakovo village, 15 km west of the town of Orkheĭ (north of Kishinëv, Fig. 1). A description of the succession of strata in the exposure was given by KONKOVA (1957). In comparison to Varnitsa, the remains of terrestrial vertebrates are also situated in lenses of pebbles consisting of limestone and carbonate rocks of fluvial or deltaic origin. Diagonal stratifications of deposits and the presence of shells of freshwater mollusks attest to this. Bones are not found in the conglomerate but are scattered in the layers. They are fragmented but in a good state of preservation and mineralization.

According to LUNGU (1971) the following mammal remains were present at Isakovo:

MAMMALIA

Perissodactyla: *Hipparion* sp.;

Artiodactyla: *Lagomeryx* cf. *flerovi*, *Tragoportax leskewitschi*;

Proboscidea: *Deinotherium* sp.

The presence of *Lagomeryx* and *T. leskewitschi* indicates the Early Vallesian age (end of MN9) of this locality (Fig. 2).

Locality: Nisporen. Deposits of the Dnepropetrovskii level (Bessarabian substage) situated in the vicinity of the town of Nisporen (west of Kishinëv, Fig. 1), consist of carbonate clays, sandstones and sands and contain shells of marine (*Mactra podolica*, *Plicatiforma* sp., *Solen subfragilis*) as well as freshwater and terrestrial mollusks, leaf prints of woody plants and bone remains of *Aceratherium* sp. and *Zygolophodon turicensis* (LUNGU 1971, 1990).

Apart from localities described above, the remains of terrestrial vertebrates were also found in the vicinity of Kobeesht village, (Kelerash region), Selishte, Geuren and Shishkan villages (Nisporen region), Ignatseĭ (Rezina region), and Red-Tsereshnovets village (Soroka region). They are represented by *Hipparion* sp., *Aceratherium* sp., *Achtiaria* sp., and *Phoca* sp. (LUNGU 1971). The fauna and flora remains of localities mentioned above were collected from coastal and deltaic facies of Bessarabian beds, found at elevations 280-340 m above sea level.

The faunal assemblages of the Dnepropetrovskii level (Late Bessarabian substage) are also known as fauna from the Varnitskii complex (LUNGU 1968, 2008b). Assemblages from Peun (Romania) and Sevastopol (Ukraine) should also be included into this complex (BORISSIAK 1914; MACAROVICI 1958). The Varnitskii faunal complex existed in Eastern Europe at the end of the Bessarabian and it had a large range, from the eastern Carpathians to the northern Caucasus.

3. *HIPPARION* FAUNA LOCALITIES IN KHERSONIAN BEDS

The terrigene deposits of the Khersonian substage on the Moldovian platform are divided into two units: early (lower) – Katerlezskii and late (upper) – Mitridatski (ROSHKA and KHUBKA 1986). The Katerlezkii level consists of sandy clayey deposits o

deltaic origin with shells of marine (*Mactra caspia* EICHWALD, 1853, *M. bulgarica* TOULA, 1892) and freshwater (*Unio subpartschi* LASCAREV, 1909, *Lymnaea* sp., *Planorbarius* sp. etc) mollusks. The Mitridatskii level is built of lacustrine-alluvial deposits of the "Baltsk series".

Locality: Keĭnar (Katerlezskii level in deposits of the Keĭnar complex). This locality is situated on the right slope of the Botna river valley, 2 km northeast of the town of Keĭnar, in the Keushen region (south of Kishinëv, Fig. 1). The succession of strata in the exposure (Fig. 10) is as follows (described from top to bottom):

Layer 1 (thickness 0.2 m) is humus soil. Loam/loess-like deposits make up layer 2 (thickness 1.5 m). Below, layer 3 (thickness 2.0-2.5 m) consists of grey clayey-sand and gravel in its lower part, with lenses of fine pebbles and carbonate concretions. Layer 4 (thickness 2.0 m) is built of dark-grey sandy-clay, dark-green in the upper part. A grey clayey-sand with brown smuts comprises layer 5 (thickness 2-2.5 m). Further down, layer 6 (thickness up to 3.5 m), consists of coarse sand with lenses of coquina limestone, pebbles of clay and limestone with numerous marine (*Mactra caspia*, *Mactra bulgarica*), freshwater (*Unio* sp.) and terrestrial (*Planorbis* sp., *Helix* sp.) shells of mollusks. Further below lies layer 7 (thickness 2.0 m) built of coquina limestone with numerous shells of marine and terrestrial mollusks, or green clay. In layer 8 (thickness 4.0 m) fine sand and clay can be found, with fine pebbles in its lowest part. Small shells of *Mactra caspia* and *M. bulgarica* are also present. Layer 9 (thickness 3.0 m) is built of grey fine-grained sand with small shells of *Mactra* LINNAEUS, 1767. Layer 10 (thickness 0.4 m) consists of gravelly diagonally bedded sand with lenses of small pebbles of limestone and claystone, containing shells of marine (*Mactra caspia*), freshwater (*Viviparus novorossicus* SINZOV, 1897, *Helicella* sp.) and terrestrial (*Helix* sp.) mollusks, as well as terrestrial vertebrates. Layer 11 (thickness 3.5 m) consists of clayey sand with shells of *Unio* sp., *Planorbis* sp., *Lymnaea* sp., and *Helix* sp. in the upper part and coarse sand with lenses of limonitized pebbles in its lower part. Yellow clay passing into sand forms layer 12 (thickness 0.3-2.0 m). Further down, layer 13 (thickness 2.2 m) is built of fine-grained sand with dark-grey spots, and gravel with lenses (0.10-0.15m) of small pebbles. It contains numerous remains of terrestrial vertebrates and large shells of terrestrial mollusks in its lower part. The following levels are found below layer 13: layer 14 (thickness 3.0 m) built of sandy-clays with dark-grey spots; layer 15 (thickness 1.5 m) consisting of grey-green sandy-clays and layer 16 (thickness 1.0 m) built of fine-grained diagonally bedded sand. Layer 17 (thickness 2-2.5 m) is characterized by grey, diagonally bedded sand, and in its lower part consists of muds with lenses of small pebbles, concretions of sandstone and pockets of limonite. In the upper part of layer 17, fine-grained sand with limonite is also present. Thin layer 18 (thickness 0.15-0.20 m) consists of mudstone pebbles with fragments of bones of terrestrial vertebrates and shells of freshwater mollusks. Further below, layer 19 (thickness 3.5-4.5 m) is built of yellow sandy-clays, passing upwards into grey-green clumpy clays. Layer 20 (thickness 2.0 m) consists of grey, diagonally bedded sand. Its bottom section contains lenses of fine pebbles with shells of freshwater mollusks and fragments of bones of terrestrial vertebrates. Washed and rounded shells are present in its upper section. On the bottom of the outcrop lies layer 21 (thickness 4.0-27.0 m) built of grey-green clay with numerous shells of freshwater gastropods.

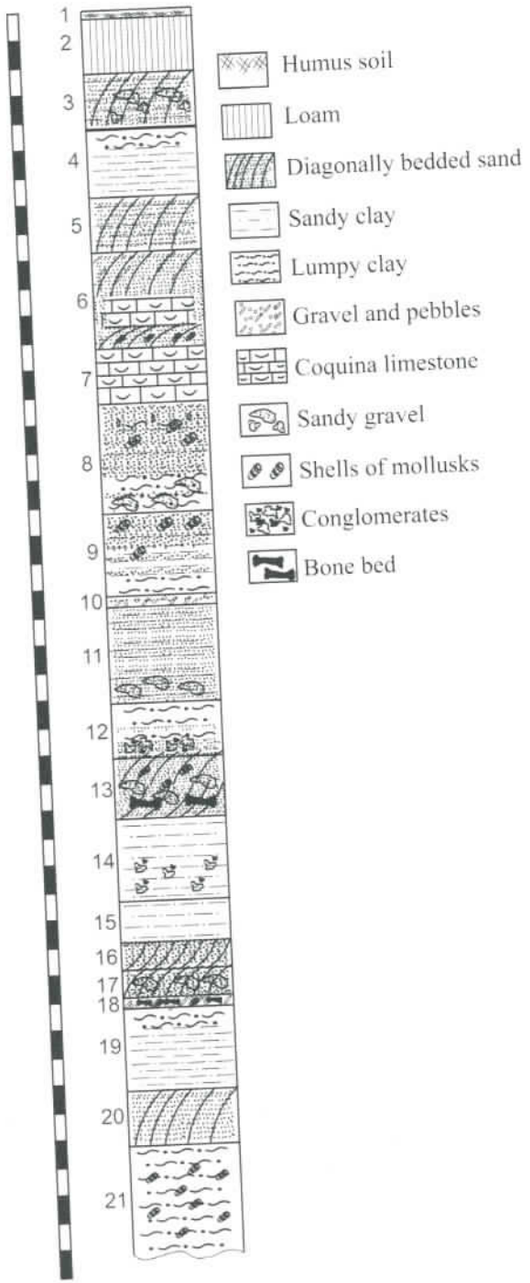

Fig. 10. Geological cross-section of the locality Keĭnar (by NICOARA).

The lower part of the outcrop (layers 11-21, thickness ca 20-23 m) shows periodical alluvial sedimentation with 3-4 cycles of deposition. Each cycle starts with lenses of gravels and pebbles, which change upwards into medium and fine grained sand and afterwards into clayey-sand or clay. Remains of small terrestrial vertebrates were found at the base of each cycle (in the gravelly sand and fine pebbles). The remains of *Chelotriton* sp., *Miodyromys* sp., *Neocricetodon* (*Kowalskia*) sp., and Lagomericidae gen. et sp. indet. are present in the lower part of the succession (layer 17). The middle and the top of the lower part of the outcrop (layer 13) contain remains of small terrestrial vertebrates (LUNGU 1980). In the middle part of the outcrop (layers 6-10, thickness ca 16 m), the lithology, structure of sediments, presence of shells of marine, freshwater and terrestrial mollusks show that deposition took place in pro-delta conditions. The presence of *Mactra caspia* shells indicates a Late Sarmatian age of these layers and favorable conditions for marine fauna. Presumably ingression took place during the submergence of the mouth of the river valley into the sea as the result of slow, periodic subsidence forming narrow lagoons in which brackish fauna developed. However, this is countered by the presence of clay layers and coquina limestone with marine fauna in pro-delta and delta beds of numerous outcrops of the late Sarmatian deposits in the region of Keushen, Khynchesht and Chimishliya in the Republic of Moldova. The upper part of the exposure (layers 3-4, thickness ca 7 m) is part of a delta environment.

Evidently, during dry periods a marine fauna was temporarily installed due to a deficit of freshwater in tributaries near mouths of rivers. Similar phenomena take place today in some east African and South American rivers. However, during moist periods the inflow of freshwater increased and the marine biocoenosis in delta and pro-delta areas changed into a freshwater biocoenosis.

In the Keĭnar locality remains of terrestrial vertebrates were found in the gravel layers. These layers contain fragments of bones, isolated teeth, and rarely fragments of upper or lower jaws. The fossils are strongly abraded as a result of long transportation. Apparently, the accumulation of bones took place during floods. The bone remains were transported from various distances and buried in low energy environments in pro-delta areas. The following remains are known from Keĭnar:

AMPHIBIA: *Latonia* cf. *seufreied* VON MEYER, 1843, *Chelotriton* sp., *Mioproteus* cf. *caucasicus* ESTES and DAREVSKI, 1977, *Pelobates* sp., *Andrias* sp.;

REPTILIA: *Trionyx* sp., *Melanochelys* sp., *Protestudo* sp., *Vipera* sp., *Natrix* sp., Colubridae (2 species), *Ophisaurus* sp., *Lacerta* sp.;

AVES: *Anas* sp.;

MAMMALIA

Erinaceomorpha: *Parasorex socialis* VON MEYER, 1865;

Soricomorpha: *Crusafontina* cf. *endemica*, Anourosoricini gen. et sp. indet., *Petenyia* cf. *dubia* BACHMAYER and WILSON, 1970, ?*Asoriculus* sp.;

Lagomorpha: *Proochotona* sp., *Alilepus* sp.;

Rodentia: *Spermophilinus bredai*, *Monosaulax cainarensis* (LUNGU, 1980), *Trogontherium* (*E.*) cf. *minutum rhenanum* FRANZEN and STORCH, 1975, *Ramys multicrestatus*, *Myomimus dehmi* (DE BRUIJN, 1966), *Progonomys woelferi* BACHMAYER and WILSON, 1970, *Parapodemus lugdunensis* (SCHAUB, 1938), ?*Anomalospalax* sp., *Neocricetodon* (*K.*) cf. *schaubi* KRETZOI, 1930, *Sarmatosminthus* sp.;

Carnivora: Carnivora gen. et sp. indet.;
Perissodactyla: *Hipparion* sp.;
Artiodactyla: Cervidae gen. et sp. indet.

Apart from the taxa cited above, numerous remains of freshwater fish, algae, and carbonized seeds of plants were found.

The fauna from the Keĭnar locality reflects various environments (biocoenoses): swamps (amphibians, reptiles such as *Trionyx* GEOFFROY, 1809, *Melanochelys* GRAY, 1869), coastal and moist forests (*Parasorex* VON MEYER, 1865, *Crusafontina* GIBERT, 1975, *Ramys* MORENO and LOPEZ MARTINEZ, 1986, *Myomimus* OGNEV, 1924, *Progonomys* SCHAUB, 1938, *Parapodemus* SCHAUB, 1938) and open areas of the savanna type (*Protestudo* CHKHIKVADZE, 1970, *Ophisaurus* DAUDIN, 1803, *Alilepus* DICE, 1931, *Proochotona* sp., *Sarmatosminthus* LUNGU, 1981, *Neocricetodon* SCHAUB, 1934, *Spermophilinus* DE BRUIJN and MEIN, 1968, *Hipparion* sp.). The locality is dated to the Late Valesian age (MN10, Fig. 2).

Locality: Tiraspol – Kalkotova Balka (Katerlezskii level in deposits of the Keĭnar complex).

The locality is situated in the vicinity of Tiraspol (southeast of Kishinëv, Fig. 1). It was discovered by LASKAREV in 1911. According to this work the remains of terrestrial vertebrates were found on the bottom of Kalkotova Balka outcrop in the sandy deposits above grey-green clumpy clays containing small shells of *Mactra caspia* and *M. bulgarica*. They were covered by alluvial deposits of the Quaternary Dniester terrace V.

The stratigraphical position and fauna of the Tiraspol locality have not been studied. LASKAREV (1911) and ALEXEJEW (1915) dated this locality to the Early Maeotian.

Lately the intense exploration of gravelly deposits of Kalkotova Balka discovered the socle of terrace V. Below the alluvial deposits of the terrace V lie clayey diagonally bedded sands containing rare small shells of *Mactra caspia* and fragments of shells of freshwater and terrestrial mollusks (thickness 2.5 m). On the bottom of this layer bone remains of terrestrial vertebrates were found. The lower part consists of grey-green bedded clays with *Mactra caspia* and *M. bulgarica*. In these clays, on the grounds of leaf imprints YAKUBOVSKAYA (1955) identified the following fossil plants: *Populus latior* BRAUN, 1852, *Salix angust* GOEPPERT, 1855, *S. varians* UNGER, 1852, *Alnus kefersteini* UNGER, 1845 and *Carpinus grandis* UNGER, 1845. Flora remains indicate the presence of humid (moist) coastal and valley forests.

According to ALEXEJEW (1915) the following vertebrate remains are known from the Tiraspol locality:

AVES: *Urmiornis* sp., *Gallus aesculapi* GAUDRY, 1862;
MAMMALIA
Tubulidentata: *Orycteropus* sp.;
Carnivora: *Adcrocuta eximia* (ROTH and WAGNER, 1854), *Paramachairodus* sp.;
Perissodactyla: *Hipparion* sp. (*H. gracile*), *Aceratherium incisivum*;
Artiodactyla: *Microstonyx major* (GERVAIS, 1848);
Proboscidea: *Choerolophodon pentelici*.

The lithological composition of sediments suggests that burying of the remains of terrestrial vertebrates took place in the deltaic zone of a paleoriver. The remains represent animals inhabiting coastal, fluvial and forest-steppe biotopes. In general, however, the fauna of this locality is poorly known and needs further study. The age of the locality is considered to be of Late Vallesian (MN10, Fig. 2).

The faunal assemblage of the Early Khersonian level is also known as the Kaĭnarskii complex.

Locality: Pitūshka (Mitridatskii level in Poleshetskii complex). This locality is situated at an elevation of 190-200 m a.s.l. at the northwest of Kishinëv (Fig. 1). In the outcrop (Fig. 11) alluvial and lake deposits, locally named the "Baltsk series", are exposed (LUNGU and CHEMYRTAN 1989a).

From top to bottom. Layer 1 (thickness 0.2 m), built of the humus soil, covers layer 2 (thickness 2.5 m), built of loess-like/loam deposits. Below, in layer 3 (thickness 3-3.5 m) grey-green clays occur. Further down is layer 4 (thickness 2.0 m), consisting of grey, ferruginous, fine-grained and diagonally bedded sands. On the bottom of the outcrop lies layer 5 (thickness 2.5 m). It is built of medium- and coarse-grained sands, diagonally bedded with gravels in its lower part. In this part of the outcrop (layer 5) there are intercalations of gravel with remains of small and large terrestrial vertebrates. The bones are very well preserved, but were strongly rounded due to transportation. Obviously they were

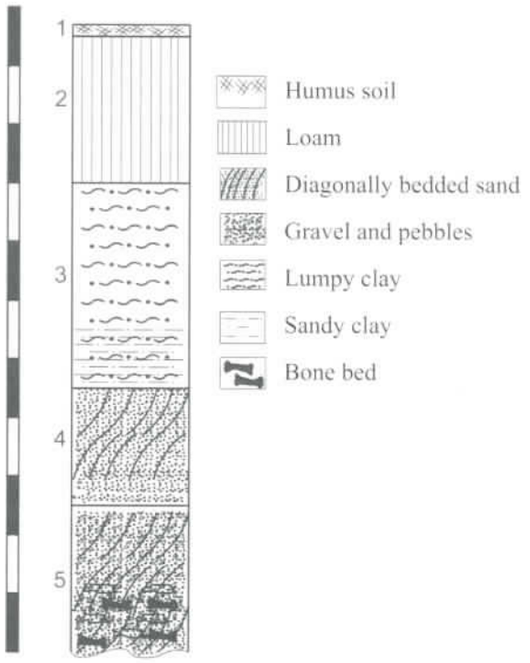

Fig. 11. Geological cross-section of the locality Pitūshka (by NICOARA).

transported by river water from various distances and buried in the Sarmatian river beds. From this locality the following remains of terrestrial vertebrates are known:

REPTILIA: *Protestudo* sp., *Trionyx* sp.;

MAMMALIA

Erinaceomorpha: *Schizogalerix* cf. *sarmaticum*;

Lagomorpha: *Prolagus* sp., *Alilepus* sp., *Proochotona* sp.;

Rodentia: *Neocricetodon* (*K.*) sp.;

Perissodactyla: *Hipparion* sp., *Chilotherium* sp.;

Artiodactyla: *Achtiaria* sp., *Gazella* cf. *schlosseri* PAVLOV, 1913;

Proboscidea: *Deinotherium gigantisimum*, *Choerolophodon pentelici*, *Zygolophodon turicensis*.

In the Pitūshka locality the remains of *Chilotherium* RINGSTRÖM, 1924, *Achtiaria* BORISSIAK, 1914, and *Gazella* cf. *schlosseri* show that these deposits are of Khersonian (Late Valesian, MN10) age (Fig. 2).

Locality: Pokshesht (Mitridatskii level in Poleshetskii complex). The locality is situated ca 200 m a.s.l. on the left slope of the Ikel river valley (catchment of the Raut River), in the Orkhei region (north of Kishinëv, Fig. 1). The outcrop is situated on a strongly eroded slope in the upper part of the hill creep. Here, above the marine deposits of the Besarabian substage, occur layers of sandy clayey sediments (thickness to 40 m) referred to the "Baltsk series". The succession of strata in the exposure (Fig. 12) is as follows (from top to bottom):

Layer 1 (thickness 0.3 m) consists of humus soil. Layer 2 (thickness 0.2-0.4 m) is built of loam, brown in colour. Lumpy non-bedded clays, grey in colour with carbonate concretions and carbonized plant remains, pass into sand representing layer 3 (thickness 1.8 m). Layer 4 (thickness 0.5 m) consists of grey sandy clays with carbonate concretions passing gradually into dark-green lumpy clays with bone fragments of terrestrial vertebrates. Layer 5 is built of non-bedded lumpy clays grey in colour containing carbonized remains of plants and separate fragments of bones of terrestrial animals. The thickness of the layer sharply changes (from 0.5 to 1.0 m). Grey sandy clays with sand concretions and clayey pebbles represent layer 6 (thickness 1.0-2.5 m). In its lower part, ridge-like concentrations of bones and skulls of terrestrial vertebrates are intercalated with empty rock. Layer 7 (thickness 0.5-2.5 m) consists of fine-grained and clayey, weakly diagonally bedded sand. Intercalations of gravel and small pebbles are present in its lower part. Layer 8 is made up of salty-sandy clays grey in colour, with rusty patches, lumpy in its upper part (thickness 1.5-2.0 m).

Layers 3-7 of the outcrop are referred to one alluvial cycle of deposition consisting of bottom sediments (layer 7), near bottom sediments (layer 6) and old floodplain facies (layers 3-5). They are situated on top of sandy and lumpy clays (layer 8), grey-green in colour with erosion discordance, and evidently represent the upper part of the previous alluvial cycle.

Remains of terrestrial vertebrates deposited in sandy and lumpy clays form concentrations of lenses (thickness from 0.3 to 0.7 m, length 200-250 m). Concentrations of large parts of skeletons, skulls, mandibles and bones of limbs of *Hippotherium*, *Chilotheri*

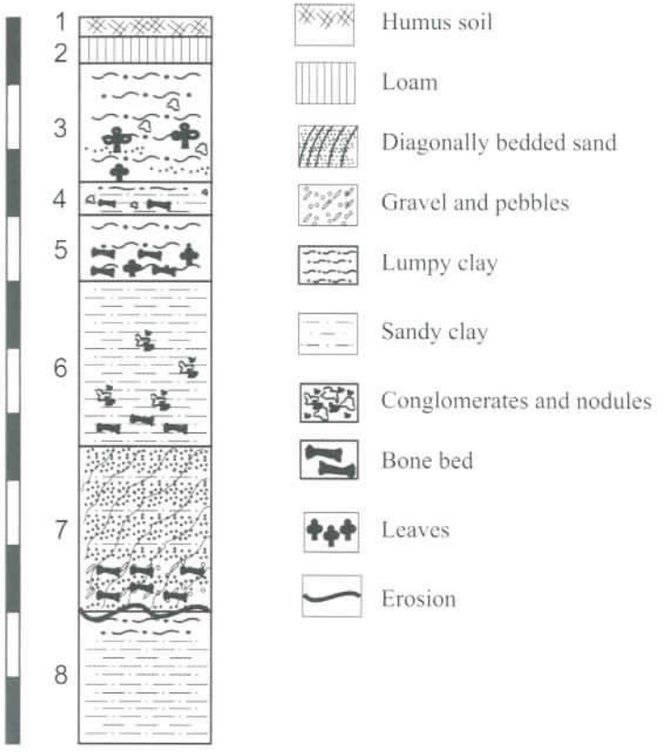

Fig. 12. Geological cross-section of the locality Pokshesht (by NICOARA).

and *Tetralophodon* FALCONER, 1857 are present in the lower part of this layer. Poor bone segregation indicates that they were accumulated over a short time. They are disorderly dispersed in the rock and have accumulated in masses intercalated with empty rock. Complete skeletons are rare. Concentrations of whole skulls of *Chilotherium*, *Hippotherium*, gazelles, often with articulated mandibles, and also post-cranial skeletons and distal parts of limbs with articulations, are present in the lower part of the bone layer. Their presence indicates that the majority of the material was transported to the place of deposition as non-decomposed cadavers.

In the upper part of the bone layer isolated teeth, bones of limbs and fragments of poorly abraded bones are present. Most probably, bone transport took place from short distances. The remains of animals were deposited as the result of powerful streams that arose after driving rain following long periods of drought. The presence of small clayey pebbles and oblique bone deposition testifies to the rapid accumulation of animal remains and strong erosion of periodical streams. The deposition area represents an old flood channel with swamp (marshy) plants. Apparently, this basin was not deep and dried up from time to time. In this situation, bone remains were periodically exposed to the influence of weather-

ing. Evidently, poor mineralization and, to a certain degree, bad preservation of remains attests to this. Before burial, the bodies of some animals spent some time in sub-aerial conditions and had partly decayed. Bones endure strong deformation (fractures, flatness, extension, etc.) during the process of sediment diagenesis.

It is necessary to notice that in the area of deposition there is relatively large number of remains of young and old individuals. Most probably, death took place in autumn. Perhaps this was caused by a lack of water and forage during long periods of drought. It caused the demise of the weakest part of the population.

According to LUNGU (1990) remains of the following terrestrial vertebrates are present in this locality:

AMPHIBIA: *Hyla* sp., *Bombina* sp.;
REPTILIA: *Protestudo* sp.;
AVES: *Struthio* sp.;
MAMMALIA
Lagomorpha: *Proochotona* sp.;
Rodentia: *Neocricetodon* (*K.*) cf. *schaubi*, *Collimys* sp.;
Carnivora: Parataxidea gen. et sp. indet., *Protictitherium* sp., *Dinocrocuta* aff. *gigantea*, *Metailurus* sp., *Machairodus* sp., [large form cf. *M. giganteus* (WAGNER, 1848)];
Perissodactyla: *Hippotherium giganteum* (GROMOVA, 1952), *Hipparion* aff. *verae*, *Acerorhinus* cf. *zernovi*, *Chilotherium* aff. *kowalewskii* (PAVLOV, 1913);
Artiodactyla: Suidae gen. et sp. indet., *Achtiaria* aff. *moldavica* GODINA, 1979, *Tragoportax leskewitschi*, *Tragoportax* sp. (large form), *Gazella* (*Miogazella*) cf. *schlosseri*, *Gazella* cf. *deperdita* (GERVAIS, 1847);
Proboscidea: *Tetralophodon longirostris*.

The presence of many gazelles and *Chilotherium* counted in dozens of individuals i striking and speaks for a high population density of these animals in the Pokshesht locality

In the region of Kodryanka, Donich, Peresechina villages situated 3-4 km from Pokshesh in sediments of the "Baltsk series" (190-200 m a.s.l.), bone remains of *Deinotherium g gantisimum*, *Chilotherium* sp., *Hipparion* sp., similar to fauna assemblage from Pokshesh were also found (LUNGU and BILINKIS 1979).

Locality: Dragushany (Mitridatskii level, Poleshetskii complex in Streshen region This locality is situated west of Kishinëv (Fig. 1) 190 m a.s.l. in the northwestern part Dragushany village. In sediments of the "Baltsk series", built of gravelly sands with pe bles and covered by sandy clays, bone remains of *Dinocrocuta* cf. *gigantea*, *Hipparion* sp *Tragoportax* sp., *Tetralophodon longirostris*, *Deinotherium gigantisimum* were foun This fauna resembles that of Pokshesht and is dated to the Late Sarmatian (Late Vallesia MN10).

Locality: Respopen (Mitridatskii level, Poleshetskii complex in Rezina region). Th locality is situated north of Kishinëv (Fig. 1) ca 220 m a.s.l. in the eastern part of the villa of Respopen (KONKOVA 1957).

On the bottom of the outcrop carbonate and sandy bedded clays with a typical fauna marine mollusks (*Mactra podolica*, *M. fabreana*, *Plicatiforma fittoni*, *Tapes* sp., *Donax* sp

characteristic for sediments of the Bessarabian substage, are present. They are covered by a sandy-clayey layer of lacustrine-alluvial origin referred to as the "Baltsk series" of rhythmical structure (thickness 50-60 m). In the upper part of the "Baltsk series", at the base of the alluvial cycle consisting of gravels and small pebbles of calcareous and carbonate rocks (thickness 0.2-0.4 m) and fine-grained clayey sands (thickness 1.5 m), a bone lense with concentrations of fossil remains of terrestrial vertebrates appears. The bone layer is covered by green-grey clays (thickness to 3 m). The structure of the sediments and taphonomy is similar to the Pokshesht locality.

According to TROFIMOV 1954, GODINA 1967, 1979, and DMITRIEVA 1970 the following terrestrial vertebrata are present in this locality:

REPTILIA: *Protestudo* sp.;
MAMMALIA
Lagomorpha: *Proochotona* sp.;
Perissodactyla: *Chilotherium* cf. *kowalewskii*, *Dicerorhinus* sp.;
Artiodactyla: *Microstonyx major*, *Cervavitus* sp., *Achtiaria moldavica*, *Gazella deperdita*;
Proboscidea: *Deinotherium gigantisimum*;

This assemblage is similar to the *Hipparion* fauna of the Pokshesht and Grebiniki localities. *Chilotherium* also predominates with a total of 20 skulls found there. The locality is dated to MN10, Late Vallesian (Fig. 2).

Locality: Pripichen-Rezesh (Mitridatskii level, Poleshetskii complex in Rezina region). The locality is situated on the right slope of the Kogylnik river valley (western tributary of the Reut river), ca 0.5 km south of the village (north of Kishinëv, Fig. 1). Above the Bessarabian deposits, a sandy-clayey layer referred to as the "Baltsk series" contains fossils of terrestrial vertebrates. A complete skeleton of *D. gigantisimum* and bone fragments of *Hippotherium* sp., *Aceratherium* sp., and *Testudo* sp. found there were described by TARABUKIN (1968a, b). The stratigraphy and taphonomic conditions of this locality are similar to the localities Respopen and Pokshesht. The vertebrate remains should be referred to the Respopen faunal complex.

Hipparion fauna named "Poksheshtskii". It existed in the second half of the Khersonian (LUNGU 2008b). Because of the predominance of rhinoceros of the genus *Chilotherium* in this assemblage, it can also be termed the "Khiloterievoi" complex.

4. *HIPPARION* FAUNA LOCALITIES IN MAEOTIAN BEDS

According to ROSHKA and KHUBKA (1986) continental Maeotian beds (up to 290 m thick), representing continental lumpy clays with intercalations of aleurites and fine-grained sands, are isolated as the "Kagulsk series". *Hipparion* fauna localities of the "Kagulsk series" are situated in Chiobrūchiū, Tudora, Tarakliya, Chimishliya and Gūra-Galbene villages.

Locality: Chiobrūchiū. This locality is situated on the western slope of the Dniester river valley, west of the village Chiobrūchiū, in the Shtefan-Vode region (southeast of Kishinëv, Fig. 1).