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SOME ASPECTS CONCERNING THE QUATERNARY DEPOSITS IN SOUTH DOBROGEA

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Abstract. This paper presents data concerning the genetical types of Quaternary deposits in South Dobrogea. The greatest part of this territory is covered by loess, having eolian origin and different thicknesses depending on the subjacent paleorelief. The age of loess is considered Middle Pleistocene-Upper Pleistocene. Furthermore, there were more separated reddish clays (Lower Pleistocene), loessoid deposits (Upper Pleistocene-Holocene) as well as actual and subactual alluvia, lacustrine deposits, beach deposits (Holocene). Under the loess there are reddish clays that overlay unconformably the Lower Cretaceous, Upper Badenian, Sarmatian and Pliocene deposits. The loess and the loessoid deposits contain fossil remains of mammals and gastropods. Unlike the loess, the loessoid material was formed through a resedimentation process. The Holocene deposits occur on the valleys, in the lacustrine areas and along the Black Sea shore. These deposits contain species of molluscs.

Key words: South Dobrogea, Quaternary deposits, lithobiostratigraphy.

INTRODUCTION

Dobrogea is prevailingly covered by Quaternary deposits. The research carried out in South Dobrogea have led to the knowledge of several lithobiostratigraphical features concerning these deposits that are represented by the following lithological types: reddish clays (ascribed to the Lower Pleistocene), loess (Middle Pleistocene-Upper Pleistocene), loessoid deposits (Upper Pleistocene-Holocene), actual and subactual alluvia, lacustrine deposits, beach deposits (Holocene). These lithological types were separated by Ghenea & Ghenea in Ghenea et al. (1978, 1984 a, 1984 b) and in Pop et al. (1991). In our research, we have identified all these types whose main characteristics are described below.

LOWER PLEISTOCENE. REDDISH CLAYS

The first type includes red, reddish-yellowish and reddish-brownish clays, which presents variable extension and thickness. Depending on the amplitude of topographic area of Dobrogean paleorelief and the post-Lower Pleistocene erosion, the thickness of reddish clays is highly variable, going from 0.1 m (the Western bank of Oltina Lake) or 0.5 m (North Cernavodă) to 6 m (South-East Capidava, Seimenii Mari) or almost 8 m (the both banks of central part of Poarta Albă-Midia-Năvodari canal

Frequently, the reddish clays contain calcareous concretions and, seldom, more or less rounded polygenetic gravels. Noteworthy that in the both banks of Poarta Albă-Midia-Năvodari canal as well as in Constanța cliff, the clays contain gypsum concretions or concretionary aggregates. These aggregates have white, white-reddish or grey colour and amount to 0.4 m in length.

Granulometrically, the clay samples collected from East Oltina, North Cernavodă, West Ovidiu and South Constanța are prevailingly represented by silty sandy clays. Thus, the sample from East Oltina contains 54,5 % clay, 33,8 % silt and 11,7 % sand; at North Cernavodă, the sample contains 60,7 % clay, 20,1 % silt and 19,2 % sand; at West Ovidiu, the sample contains 72,2 % clay, 26,1 % silt and 1,7 % sand; at South Constanța, the sample contains 66,2 % clay, 31,4 % silt and 2,4 % sand. In case of clay, the grain size is smaller than 4 microns; silt corresponds to the 4-63 microns class; for sand, the grain size is bigger than 63 microns.

Genetically, the reddish clays represents residual-eluvial and alluvial deposits, considered like a paleosoil group, which it has generally formed in subairy environment, in warm and moist climate conditions.

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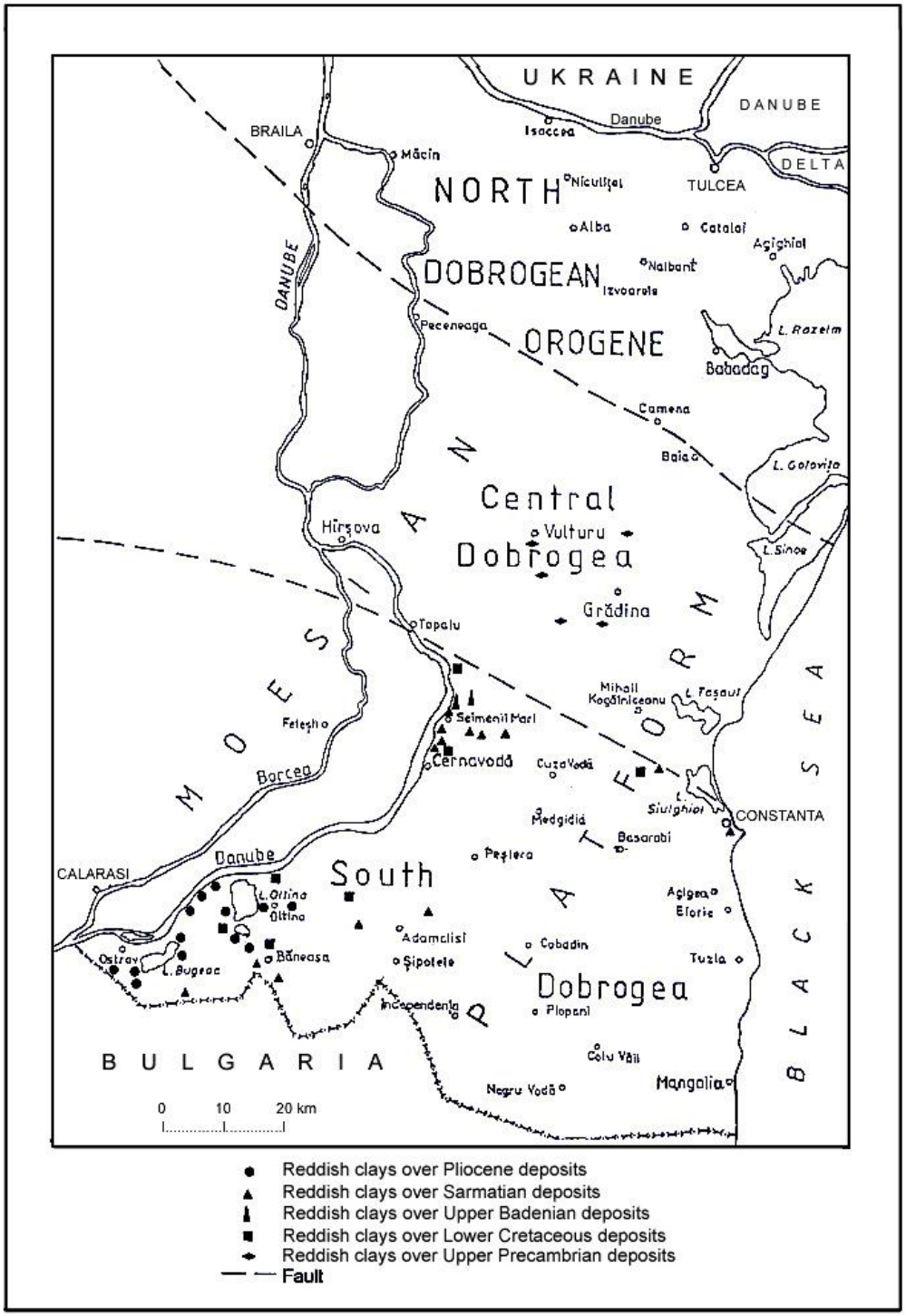

Fig. 1. Sketch showing the distribution of some outcrops with Lower Pleistocene reddish clays

Stratigraphically, in South Dobrogea, the reddish clays overlay unconformably the following pre-Quaternary chronostratigraphical divisions (Fig. 1): Lower Cretaceous (Oltina Lake area, Băneasa area, Cernavodă area etc.), Upper Badenian (Seimeni area), Sarmatian (Băneasa area, Cernavodă area, Constanța area etc.) and Pliocene (Bugeac Lake area, Oltina Lake area, Băneasa area). In Central Dobrogea, the clays overlay, in some

places, the Upper Precambrian green schists (Vulturu-Grădina area). In North Dobrogea, the reddish clays are visible only in boreholes; thus, in the southern part of Danube Delta, the clays overlay Triassic or Jurassic deposits, and northward overlay the Romanian ones.

As concerns the Lower Pleistocene age of reddish clays, it has observed their stratigraphical position, respectively under the Middle Pleistocene-Upper Pleistocene loess. The age of Dobrogean loess was established on the basis of paleontological, archaeological, paleopedological and geophysical methods (paleomagnetism and thermoluminescence).

The paleomagnetic data obtained from some loess sections located in Black Sea cliff and plateau of South Dobrogea indicated a normal magnetic polarity, assigned to the Brunhes Chron. According to the thermoluminescence method, the age of eolian primary loess accumulated in South Dobrogea is younger than 730,000 years. Based on these results as well as paleomagnetic data which emphasized the Lower Pleistocene age of reddish clays situated under loess in Moldova Republic (oral information offered by Mr Theodor Obadă, 2007), Hungary, former Yugoslavia and China (Ghenea in Avram et al., 1992), it considers the same age for the reddish clays in the Dobrogean territory.

MIDDLE PLEISTOCENE - UPPER PLEISTOCENE. LOESS

Broadly, the loesses from South Dobrogea are characterised by the yellowish colour, variable thickness (depending on the morphology of pre-Quaternary relief and the processes which affected primary eolian material), lack of bedding, high porosity and carbonates content. As a whole, the loess thickness does not exceed 40 m.

After granulometric composition, the typical loess has about 70 % silt and is especially found in South Dobrogea, while in Central and North Dobrogea, the loessoid deposits prevail. In the western part of South Dobrogea, the loess is coarser and becomes finer eastward, to the Black Sea coast.

In South Dobrogea, the granulometric analyses indicated the following composition: in Viile area, the loess sample contains 69,79 % silt, 22,70 % clay and 7,51 % sand; in Ion Corvin area, the loess sample contains 71,68 % silt, 20,70 % clay and 7,62 % sand.

Biostratigraphically, the loess fauna is represented by taxa of mammals and gastropods (Fig. 2). According to Macarovici (1968), Chiriac (1968 a, 1968 b), Conea (1970), Ionesi (1994) the mammals fauna comprises taxa corresponding to the cold phases - *Mammuthus primigenius* BLUMENBACH, *Coelodonta antiquitatis* BLUMENBACH, *Rangifer tarandus* LINNÉ, *Saiga tatarica* LINNÉ, *Bison priscus* BOJAN, *Vulpes corsac* LINNÉ, *Alopex lagopus* LINNÉ, *Equus przewalskii* POLIAKOF, *Equus scythicus* RĂDULESCU & SAMSON, *Equus germanicus* LINNÉ, and taxa corresponding to the mild phases - *Sus scrofa* LINNÉ, *Megaceros giganteus* BLUMENBACH, *Cervus elaphus* LINNÉ, *Bos primigenius* BOJAN, *Hydruntinus hydruntinus* (REG.). Furthermore, Terzea (1983) cites *Arvicola* sp., *Saiga* sp., *Allactaga* sp., *Lagurus* sp., *Eolagurus* sp., *Mesocricetus* sp.

Among the most characteristic and frequent molluscs, the following taxa are quoted: *Pupilla muscorum* LINNÉ, *Succinea oblonga* DRAPARNAUD, *Helicopsis striata* MÜLLER, *Chondrula tridens* (MÜLLER), *Zebrina detrita* MÜLLER, *Cepaea vindobonensis* PFEIFFER.

Locally, there were identified 2-5 yellowish loess levels, separated by brown-reddish fossil soil (paleosoil) intercalations. These loess-paleosoil alternances were founded in the Ciamur valley (from the Ostrov locality ca. 6 km south-south-eastward), the south-west shore of the Oltina Lake, the Urluia quarry (from the Adamclisi locality ca. 5 km west-north-westward) and the Black Sea shore from North Constanța. The lithological succesion from these locations are expressed in some sections (Fig. 3).

These sections suggest the following climatic variations concerning to the loess succesion in South Dobogea: a cold and dry climate favouring the loess forming process; a warm and moist climate corresponding to the forming of a fossil soil (paleosoil) levels. Accordingly, the fossil soil (paleosoil) levels represent pedogenetic formations resulted due to climatic oscillations.

The Ciamur valley section has been stratigraphically interpreted. Analysing the loess and paleosoils sequence, it observes the presence of three yellowish loess layers (L I, L II, L III) with two reddish paleosoil intercalations (Ps I, Ps II). The whole pile has about 15 m thickness.

The south-west shore of the Oltina Lake permitted the identification of three yellowish loess layers (L I, L II, L III), separated by two brown-reddish paleosoil levels (Ps I, Ps II). In the basal part of loess and paleosoils sequence, a bank of Lower Pleistocene reddish clay is separated. The outcrop thickness has about 23 m, out of which each loess layer has 6-6,5 m, and each paleosoil level has 0,8-1 m.

Lithology/ geochronology	Mammals	Molluscs	
		Bivalves	Gastropods
Actual and subactual alluvia/ Holocene		*Unio pictorum* *U. tumidus* *Anodonta sedakowi* *A. cygnaea*	
Beach deposits/ Holocene		*Mya arenaria* *Mytilus galloprovincialis* *Cardium edule* *Arca lactea* *Ostrea sublamellosa* *O. taurica* *Spisula subtruncata* *Gastrana fragilis* *Angulus fabulus* *Venus gallina* *Irus irus* *Corbula mediterranea*	*Rapa venosa* *Nassa neritea* *N. reticulata* *Cerithiopsis minima* *Rissoa splendida* *Gibbula divaricata* *Hydrobia ventrosa*
Loessoid deposits/ Holocene+ Upper Pleistocene	*Cervus elaphus* *Bos primigenius* *Mammuthus primigenius* *Coelodonta antiquitatis* *Sicista subtilis* *Lagurus lagurus* *L. lagurus thracicus* *Eolagurus luteus axshaenicus* *Apodemus sylvaticus* *Microtus* cf. *epiroticus*		*Pupilla muscorum* *Succinea oblonga* *Helicopsis striata* *Chondrula tridens* *Zebrina detrita* *Cepaea vindobonensis*
Loess/ Upper Pleistocene+ Middle Pleistocene	cold phases *Mammuthus primigenius* *Coelodonta antiquitatis* *Rangifer tarandus* *Saiga tatarica* *Bison priscus* *Vulpes corsac* *Alopex lagopus* *Equus przewalskii* *Equus scythicus* *Equus germanicus* mild phases *Sus scrofa* *Megaceros giganteus* *Cervus elaphus* *Bos primigenius* *Hydruntinus hydruntinus* *Allactaga* sp. *Arvicola* sp. *Lagurus* sp. *Eolagurus* sp. *Mesocricetus* sp.		*Pupilla muscorum* *Succinea oblonga* *Helicopsis striata* *Chondrula tridens* *Zebrina detrita* *Cepaea vindobonensis*

Fig. 2. Mammals and molluscs fauna identified in the Quaternary deposits from South Dobrogea (according to: Macarovici, 1968; Chiriac, 1968 a, 1968 b; Conea, 1970; Terzea, 1983; Ionesi, 1994; our research - only for alluvia and beach deposits)

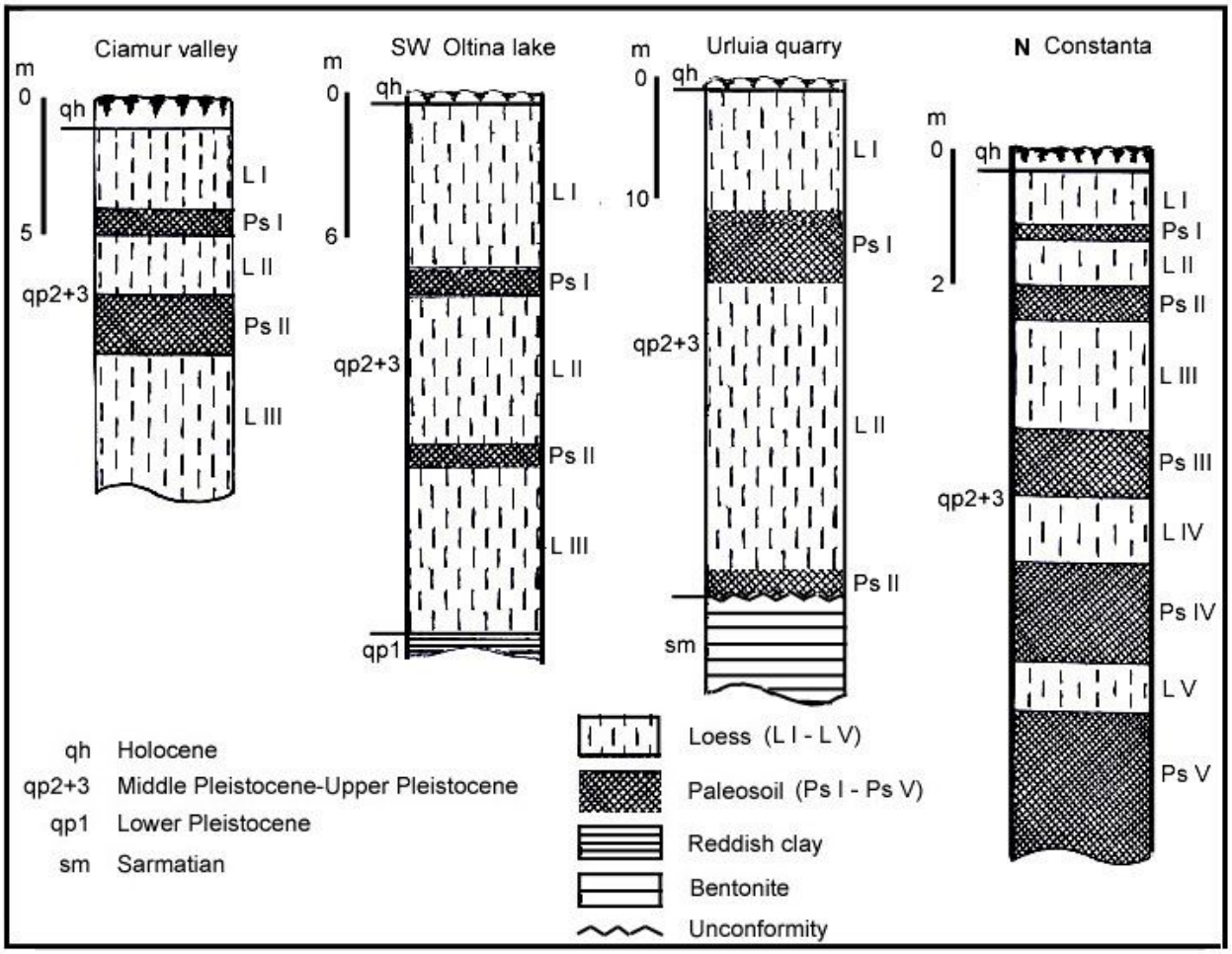

Fig. 3. Loess-paleosoil sections in South Dobrogea

In the Urluia quarry section (Fig. 4) there are a loess-paleosoil alternance represented by two loess levels (L I, L II) and two paleosoil levels (Ps I, Ps II). The first level of paleosoil (Ps I) overlays unconformably the Sarmatian bentonites.

In the Black Sea shore from North Constanța, five loess layers (L I – L V) were identified. The five loess layers are intercalated with five paleosoil levels (Ps I – Ps V).

These well developed alternances of loess-paleosoil allowed the identification of some climatic oscillations during the Pleistocene.

Magnetostratigraphically, the results of paleomagnetic investigations of the loess layers with paleosoil intercalations in South Dobrogea show their normal magnetization, corresponding to the Brunhes chron. We mention that the boundary between the Lower Pleistocene and the Middle Pleistocene coincides with the boundary between the normal polarity Brunhes chron and the reverse polarity Matuyama chrone.

Based on the paleontological, archaeological, paleopedological and paleomagnetic data, the loess with paleosoils intercalations is ascribed to a chronostratigraphical interval including the Middle Pleistocene and Upper Pleistocene. The oldest loess layer was ascribed to the Mindel stadial.

UPPER PLEISTOCENE - HOLOCENE. LOESSOID DEPOSITS

Unlike the loess, the loessoid deposits present some modifications of the sedimentological characteristics. These deposits are devoid of carbonates, contain

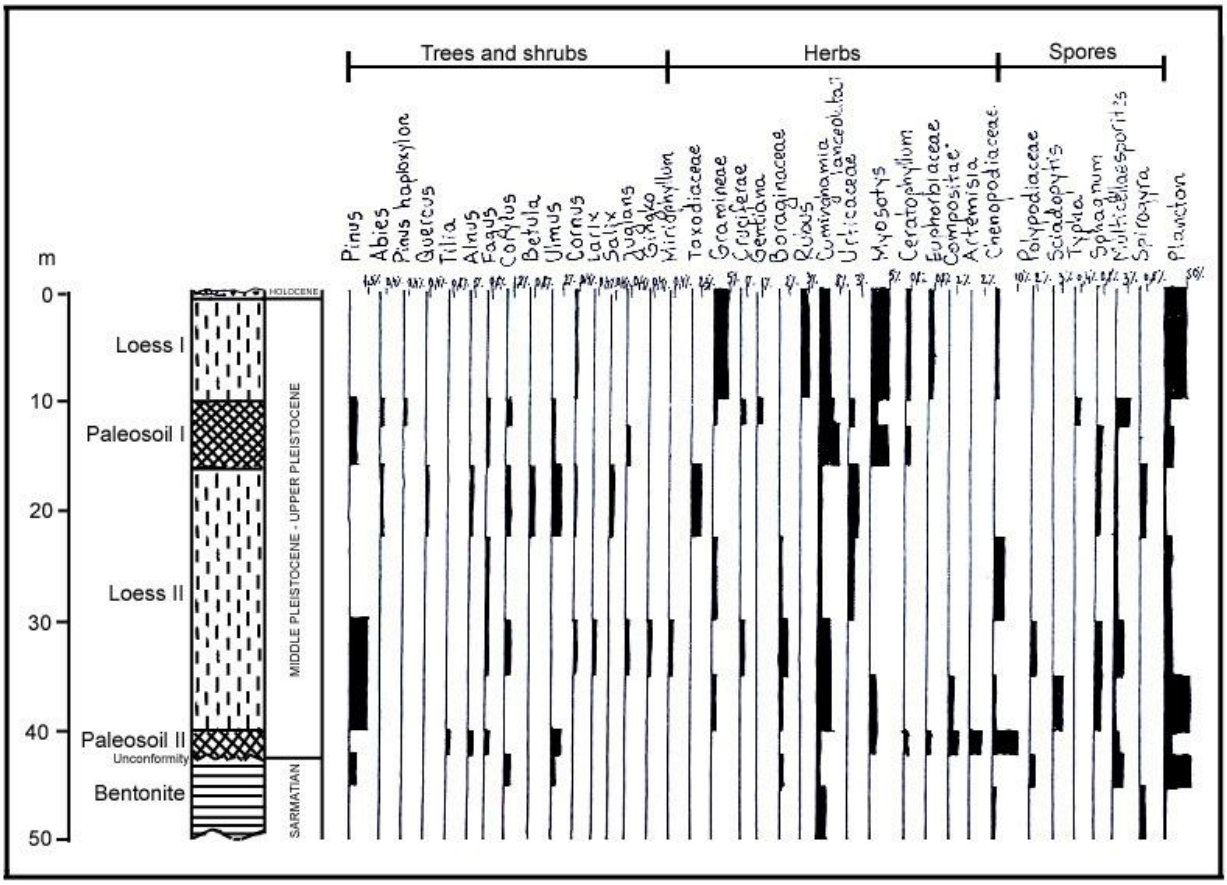

Fig. 4. Spore-pollen diagram of a loess profile in the Urluia quarry (Stoian in Avram et al., 1992)

coarser fragments in the sediment mass, and are stratified. In manny times, the separation between loess and loessoid deposits is rather difficult in the field.

Genetically, depending on the agent which determinated the forming of loessoid deposits, there are described the following types of these deposits: alluvial, deluvial, colluvial, colluvial-aluvial etc.

Granulometrically, the loessoid deposits are prevailingly siltic. The lithological constitution comprises argillaceous silts, argillaceous-sandy silts and sandy-argillaceous silts. In Ion Corvin area, the grain size analyses indicated the following composition: 78,99 % silt, 15,38 % clay and 5,63 % sand. In Brebeni area, the loessoid deposits are constituted of 63,39 % silt, 32,19 % clay and 4,42 % sands. In Negureni area, these deposits contain 68,03 % silt, 27,85 % clay and 4,12 % sand.

Biostratigraphically, the mammals fauna is represented by remains of *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Bos primigenius*, *Cervus elaphus*.

The gastropods content is characterized by the presence of species of *Pupilla muscorum*, *Succinea oblonga*, *Helicopsis striata*, *Chondrula tridens*, *Zebrina detrita*, *Cepaea vindobonensis*.

Chronostratigraphically, the loessoid deposits are considered as being formed in the Upper Pleistocene-Holocene interval.

It is worth remembered that Ştiucă & Ilinca (1995) have identified in the Movile Cave (located near the Mangalia town) remains pertaining to the following rodent species: *Sicista subtilis* (PALLAS), *Lagurus lagurus thracicus* RĂDULESCU & SAMSON, *Eolagurus luteus axshaenicus* RĂDULESCU & SAMSON, *Apodemus sylvaticus* LINNÉ, *Microtus* cf. *epiroticus* ONDRIAS. The first three species are characteristic to a dry open environment; the last two species are indicative of a land with herbs and shrubs. In addition to the cited species, the *Mustelidae* indet., fish and amphibian remains were more identified. The authors mention that Dr. T. Constantinescu has more found a mandible retaining the second and the third molars attributed to the

steppe lemming *Lagurus lagurus* (PALLAS). All fossil remains are ascribed to the last phase of the Würm glaciation. The Movile Cave was discovered in 1986 by C. Lascu, is dug in Sarmatian limestones and consists of two superposed gallery systems: the dry upper level (the Main Gallery) and the submerged lower level. The fossil remains of rodents, fishes and amphibians were found in alluvial loessoid deposits accumulated on the floor of the upper level, in a trench excavated to a depth of 38 cm.

HOLOCENE. ACTUAL AND SUBACTUAL ALLUVIA, LACUSTRINE DEPOSITS, BEACH DEPOSITS

On the valleys from South Dobrogea (e.g. Boasgic, Siliştea, Ţibrin, Nisipari, Cochirleni, Caramancea, Baciului, Adâncata, Goliţei, Ghiolpunar etc.), the alluvia are represented by clays, siltic clays, argillaceous silts, argillaceous-sandy silts, sandy-argillaceous silts, silts, sands, gravels, seldom boulders. On the sands and gravels in the right bank of Danube there are taxa of *Unio pictorum* LINNÉ, *U. tumidus* PHILIPSSON (in the Oltina and Seimenii Mari areas), *Anodonta cygnaea* LINNÉ and *A. sedakowi* SIEMASCHKO (in the Seimenii Mari area).

The lacustrine deposits consist of clays, siltic clays, argillaceous silts, silts, sands, sandy silts with organic material, and are found in the Bugeac, Oltina, Dunăreni-Aliman, Ramadan, Siutghiol areas etc.

The marine deposits on the Black Sea beach are constituted of fine sands with a lot of actual molluscs taxa, among which the most frequent are *Mya arenaria* LINNÉ, *Mytilus galloprovincialis* LAMARCK, *Cardium edule* LINNÉ, *Arca lactea* LINNÉ, *Ostrea sublamellosa* MILASCHEVICH, *O. taurica* KRYNICKI, *Spisula subtruncata* DA COSTA, *Gastrana fragilis* LINNÉ, *Angulus fabulus* GRONOVIUS, *Venus gallina* LINNÉ, *Irus irus* LINNÉ, *Corbula mediterranea* DA COSTA, *Rapa venosa* (VALENCIENSIS), *Nassa neritea* LINNÉ, *N. reticulata* LINNÉ, *Cerithiopsis minima* BRUSINA, *Rissoa splendida* EICHWALD, *Gibbula divaricata* LINNÉ, *Hydrobia ventrosa* MONTAGU.

INFERENCES

From climatic point of view, the Quaternary in Dobrogea is characterized by important climatic oscillations, when the cold intervals (glaciations, stadials) alternate with the warm ones (interglaciations, interstadials).

The reddish clays (ascribed to the Lower Pleistocene) represents residual-eluvial and alluvial deposits, considered like a paleosoil group, which it has generally formed in subairy environment, in warm and moist climate conditions.

Habitually, the loess succesions (Middle Pleistocene-Upper Pleistocene) suggest the following climatic variations: a cold and dry climate favouring the loess forming process; a warm and moist climate corresponding to the forming of a fossil soil (paleosoil) levels. Furthermore, the loess mammals fauna indicates a severe cooling of the climate, corresponding to the Mindel, Riss and Würm glaciations.

The loessoid deposits (Upper Pleistocene-Holocene) depend of the agents which determinated their forming, so that there are described the following types of these deposits: alluvial, deluvial, colluvial, colluvial-aluvial etc.

As regards the actual and subactual alluvia, lacustrine deposits, marine (beach) deposits, it is noteworthy that these formations are ascribed to the Holocene.

Finally, on the basis of the lithostratigraphical peculiarities it may draw the following conclusion with regarding to the grain size of the material from which the Dobrogean loess and loessoid deposits were formed.

Thus, in the neighbourhood of the Danube there is an area where the deposition of alluvial material transported by the fluve in the Quaternary, is obvious. This area has determinated the forming of a loess which presents a more sandy character.

In the neighbourhood of the Black Sea shore it may note the existence of another depositional area. The origin of the material is probably connected to marine deposits, taking into account during the Pleistocene cold periods the land of Dobrogea had extended eastwards in the area presently occupied by the Black Sea. Consequently, it noted a more argillaceous character of the loess.

REFERENCES

Avram, E., Andreescu, I., Bombiță, G., Drăgănescu, A., Ghenea, C., Pop, Gr., Stoian, L., Szasz, L., 1992. Harta geologică a României scara 1:50 000, foaia Adamclisi. Inst. Geol. al României, Bucureşti.

Chiriac, M., 1968 a. Harta geologică a României scara 1:200 000, foaia Constanța. Notă explicativă, 1-44, Bucureşti.

Chiriac, M., 1968 b. Harta geologică a României scara 1:200 000, foaia Mangalia. Notă explicativă, 1-21, Bucureşti.

Conea, A., 1970. Formațiuni cuaternare în Dobrogea. Edit. Acad. Române, 1-234, Bucureşti.

Ghenea, C., Avram, E., Szasz, L., Drăgănescu, A., Ghenea, A., Andreescu, I., 1984 a. Harta geologică a României scara 1:50 000, foaia Medgidia. Inst. Geol. al României, Bucureşti.

Ghenea, C., Avram, E., Szasz, L., Ghenea, A., Drăgănescu, A., Andreescu, I., 1984 b. Harta geologică a României scara 1:50 000, foaia Peştera. Inst. Geol. al României, Bucureşti.

Ghenea, C., Ghenea, A., Andreescu, I., 1978. Harta geologică a României scara 1:50 000, foaia Cotu Văii. Inst. Geol. al României, Bucureşti.

Ionesi, L., 1994. Geologia unităților de platformă şi a orogenului nord-dobrogean. Edit. tehn., 1-280, Bucureşti.

Macarovici, N., 1968. Geologia Cuaternarului. Edit. did. pedag., 1-234, Bucureşti.

Pop, Gr., Andreescu, I., Avram, E., Drăgănescu, A., Ghenea, C., Ghenea, A., Mihăilescu, N., 1991. Harta geologică a României scara 1:50 000, foaia Aliman. Inst. Geol. al României, Bucureşti.

Ştiucă, E., Ilinca, H., 1995. Pleistocene mammals (Rodentia) from Movile Cave (Romania). Theoretical and Applied Karstology, Inst. de Speol. „Emil Racoviță", Edit. Acad. Române, 8, 157-161, Bucureşti.

Terzea, E., 1983. Evoluția faunei terestre. Geografia României, I, Geografia fizică, Edit. Acad. Române, 444-450, Bucureşti.