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PALEONTOLOGY

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GEOGRAPHY

PALEONTOLOGY

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NEOGENE BALEEN WHALES (*CETACEA: MYSTICETI*) FROM TRANSYLVANIA AND OLTENIA

Vlad CODREA*

Abstract. Baleen whales are often recorded from the Middle Miocene formations of our country, mainly in Oltenia and rarer in Transylvania. Scattered vertebras frequently represent them whereas the limb bones are extremely rare and the skulls, completely unknown. Several forerunners assigned such fossils to *Cetotherium genus*, or even to *Cetotherium priscus* in spite of lack of enough arguments for appropriate assignations. This paper deals with several scattered vertebras found in various sites from the already mentioned regions. All can be related to undetermined Mysticeti originating from Sarmatian (Middle Miocene) formations.
Key words: baleen whales, Middle Miocene, Sarmatian, Romania.

Introduction

In our country fossil whales had been reported from various localities located both in inner or outer Carpathian areas. The majority of fossils are Sarmatian, the remaining ones being considerably rare. Such a peculiar stratigraphy has to be explained by trophic conditionings, but detailed researches on this topic are missing until now in Romania. In the last decades the attention focused on the Miocene cetaceans with a priority on the Odontocetes (Ionesi & Galan, 1988; Codrea, 1996; Kazar & Venczel, 2003; Kazar et al., 2004). The baleen whales (Mysticeti) are rarely reported, from scanty localities. A notorious such report for Transylvania belonged over hundred years ago to Koch (1899). He described from Cluj-Napoca two large-sized vertebras assigned to a new species „*Beriardopsis miocaenus*". Both vertebras had been found on the actual Bisericii Ortodoxe Street during the diggings done for a house footwall. Koch suggested that the rocks the vertebras originated from were Sarmatian. Curated in the collection of the Paleontology-Stratigraphy Museum of Cluj-Napoca Babeş-Bolyai University, only one of these two vertebras persisted until nowadays. In '70th, the late vertebrate paleontologist Leo Gabunia had a closer look to this fossil and presumed that it should belong rather to a Basilosauridae representative (Prof. Maria Şuraru, personal communication). In this context, the deposits where the fossils originated from should obviously be considerably older (Paleogene). Now, all the area is completely cover by buildings and subsurface data are not available in order to clarify the stratigraphy.

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Considering the rarity of fossil Mysticeti from the whole county area I appreciated as opportune to describe some of such fossils discovered in northern Oltenia as well as from the Miocene Basin of Transylvania.

Collections and abbreviations. Paleontology-Stratigraphy Museum, Faculty of Biology and Geology, Babeş-Bolyai University from Cluj-Napoca (PSMBBU); Paleontology Collection of the Mining Faculty, Petroşani University (PCPU).

PALEONTOLOGY

Class Mammalia
Order Cetacea Brisson, 1762 (= Cete Linné, 1758)
Suborder Mysticeti Flower, 1864

Mysticeti indet.

Localities

Oteşani, Valea Podoasei (Vâlcea district)

Pl. I, fig. 1; Pl. II, fig. 6

Two caudal vertebras from the posterior half of the tail (PSMBBU V-414 and V-413) are available for study. Both had been donated to the university museum by Prof. Elena Giurea (Horezu gymnasium).

The vertebras had been found reworked into the river alluvia. V-414 is damaged, broken on both lateral sides without the transverse apophysis and some centrum pieces. V-413 exposes obvious rolling marks indicating an appreciable long river stream transport after its extraction from the original rock matrix. According to the 1 : 200 000 geological map published by the Romanian Geological Institute (folio 34 Piteşti, L-35-XXV), in Oteşani area are exposed Middle Miocene deposits, belonging to Badenian and Sarmatian.

Ţaga (Cluj district)

Pl. II, fig. 3

Only a caudal vertebra is available from this site (PSMBBU V-415) donated by Prof. Ioan Mârza.

The bone had been found by the archaeologist Gheorghe Lazarovici during the diggings done for a construction in the lieu named Viglab. At Viglab there are exposed lower Sarmatian deposits (Volhynian) represented by yellowish sand with black and blue clay interbeddings, located hundred meters beneath the Giriş Tuff (Mârza, 2003). The Giriş Tuff is a lithologic marker in the Miocene Transylvanian Basin belonging to the terminal succession of the Early Sarmatian (Volhynian; Mârza & Mészáros, 1991). Usually in these rocks the vertebrate fossils are extremely rare, represented only by fish remains as otoliths and teeth. The vertebra is well preserved, without damages.

Glodeni (commune Bălăneşti; on Pietrosu Creek, confluent to Amaradia Creek, Gorj district; to be not confused with Amaradia Valley !).

Pl. I, fig. 2

A single whole large caudal vertebra is available (PSMBBU 21755) for study, but in the same collection it is also curate a large neural apophysis (antero-posterior diameter – 61 mm). The fossils had been found and donated to the museum by Marius Simionescu and Bebe Puşcaşu in 1984. There are not additional details concerning this finding, but both fossils are exposing rolling marks made by the river stream transport. On the 1: 200 000 geological map published by the Romanian Geological Institute (folio 33 Tg. Jiu, L-34-XXX), upstream of Glodeni there are exposed lower and middle Sarmatian deposits related to an anticlinal fold.

Gornicel-Vâjoaia (jud. Gorj)

Pl. I, fig. 5

The material consists on a single caudal vertebra (PCPU 534). There are not other details on this finding, but the bone probably originates from river alluvia, reworked from Sarmatian deposits. It was donated by Gheorghe Fekete.

Voiteşti, Gruiului Valley (Gorj district)

Pl. II, fig. 1,2,4,5

Four vertebras under a single inventory number (PSMBBU 1636): a thoracic damaged one (1636 a) and three caudal (1636 b-d).

In this case there are very old findings, the fossils originating from Prof. I. P. Voiteşti collection. On the labels there are not additional details concerning the findings but obviously they originate from similar contexts as the previous ones: Sarmatian fossils liberate from their matrix, carried subsequently by river streams. It worth to be mentioned that the same Sarmatian deposits cropping out at Glodeni are extending towards Voiteşti and Gruiu.

Unspecified site, called „Oltenia"

Pl. I, fig. 3, 4

A single caudal vertebra (PCPU 529) donated by Teodor Holovaci. The posterior articular side is slightly damaged.

Descriptions

Excepting the neural apophysis fragment from Glodeni and the thoracic vertebra from Voiteşti, all the remaining fossils concern only caudal vertebras. The thoracic vertebra is too damaged and preserves too few characters to be useful.

The vertebras from Valea Podoasei, Glodeni, Gornicel-Vâjoaia and the unspecified site from Oltenia, all can be located in the anterior side of the second half of the tail vertebras series, judging on the small extension of apophisys. The one from Valea Podoasei (PSMBBU V-414) has the widest dimensions.

All expose subcircular outline of articular facets of centrums, with neural arch devoid of tall apophysis, small transverse apophysis and well expressed haematic apophysis hosting between them the median caudal artery groove. On lateral view, one can observe the blood vessel grooves of the secondary blood vessels. These ones, either directly crossed the transverse apophysis or by-passed them on their posterior sides, as can be observed on the right side of PCPU 529. In this vertebra, the vascular grooves from the right side, under the transverse apophysis form a "Y"-shaped outline.

The different vertebras belonged to various individuals of different ages, if thinking to the coalescence degrees between epiphysis and centra. If the majority originates from mature individuals, the one from Valea Podoasei-Oteşani is obviously indicating a still young animal.

The other vertebras were located towards the end of tails. At these ones the neural arches disappeared, replaced by obsolete apophisys. The same tendency concerns the transverse or haematic apophisys. Towards the tail series apex, the vertebras were small and the centra were antero-posterior compressed (the most conspicuous example is PSMBBU 1636 d).

Measurements (mm)

	V-413	V-414	V-415	21755	1636 a	1636 b	1636 c	1636 d	534	529
Centrum length	32.0	60.5	62.0	75.0	44.5	75.5	67.0	48.0	65.0	50.0
Anterior height of centrum	24.0	67.5	55.5	74.5	-	64.0	64.0	56.0	70.0	60.0
Posterior height of centrum	24.0	66.0	54.0	76.0	48.0	61.0	61.0	55.0	65.0	60.0
Anterior breadth of centrum	24.0	-	48.5	76.0	-	70.0	68.0	52.5	75.0	65.0
Posterior breadth of centrum	23.0	-	48.6	72.0	-	67.5	65.0	53.0	65.0	65.0

Conclusion

Fossil baleen whales are probably enough current, mainly in the Sarmatian deposits from northern Oltenia. However, the most part of these fossils is not systematically collected and disappear every year into the alluvia of the rivers crossing the Miocene successions. Among the fossilized bones, the vertebras are the most common, prevalently the caudal ones due to the reduced or missing apophysis. This kind of vertebras can be easily rolled by water streams and carried on large distances from their origin. That explain why their stratigraphic value is commonly considerably reduced.

An impediment against clear systematic assignation of the Neogene whales from our country consists on their rare anatomical connections between the bones. Whole or partial preserved skeletons are for instance completely missing. This rule concerns usually all the fossil marine mammals, due to the peculiar environments where their carcasses decay and the skeletons are buried. Generally the carcasses decay into the water and the bones gradually fall and reach the bottom, being rolled by streams and waves before their burial. That explains why usually one has to deal only with isolated bones. However, in exceptional circumstances the skeletons or at lest parts of them could preserve in the same place, but this kind of situation had never been emphasized in Romania until now. Consequently, adequate comparative material originating from Miocene cetaceans is extremely scarce in our country.

During the previous decades, there were several attempts for generic and specific assignations, totally inappropriate, as long as determinant diagnostic characters were missing. Based exclusively on old references, a part of vertebras were related to *Cetotherium* BRANDT or even to a genus' species, *C. priscum* (EICHWALD, 1853; e.g. Nicolaescu, 1933; Macarovici & Zaharia, 1968). However, *Cetotherium genus* is nothing else but a waste basket into one can actually find a lot of assignations that obviously need revision.

For Romania, only additional and more relevant discoveries (mainly skulls or limb bones) could complete the knowledge status of these cetaceans. This aim continues to represent a challenge for the years to come.

Acknowledgements. I am deeply grateful to several colleagues: Prof. Ioan Mârza (Babeş-Bolyai University) and Elena Giurea (Horezu highschool) kindly accepted to donate some cetacean fossils to Cluj University collection; my former colleague and friend, Prof. Mircea Rebrişoreanu (Petroşani University) allowed me to study the cetacean vertebras from Petroşani University collection; I am also very grateful to Dr. Emese Kazár (Geological Institute Budapest) for our intercommunity on Miocene baleen whales.

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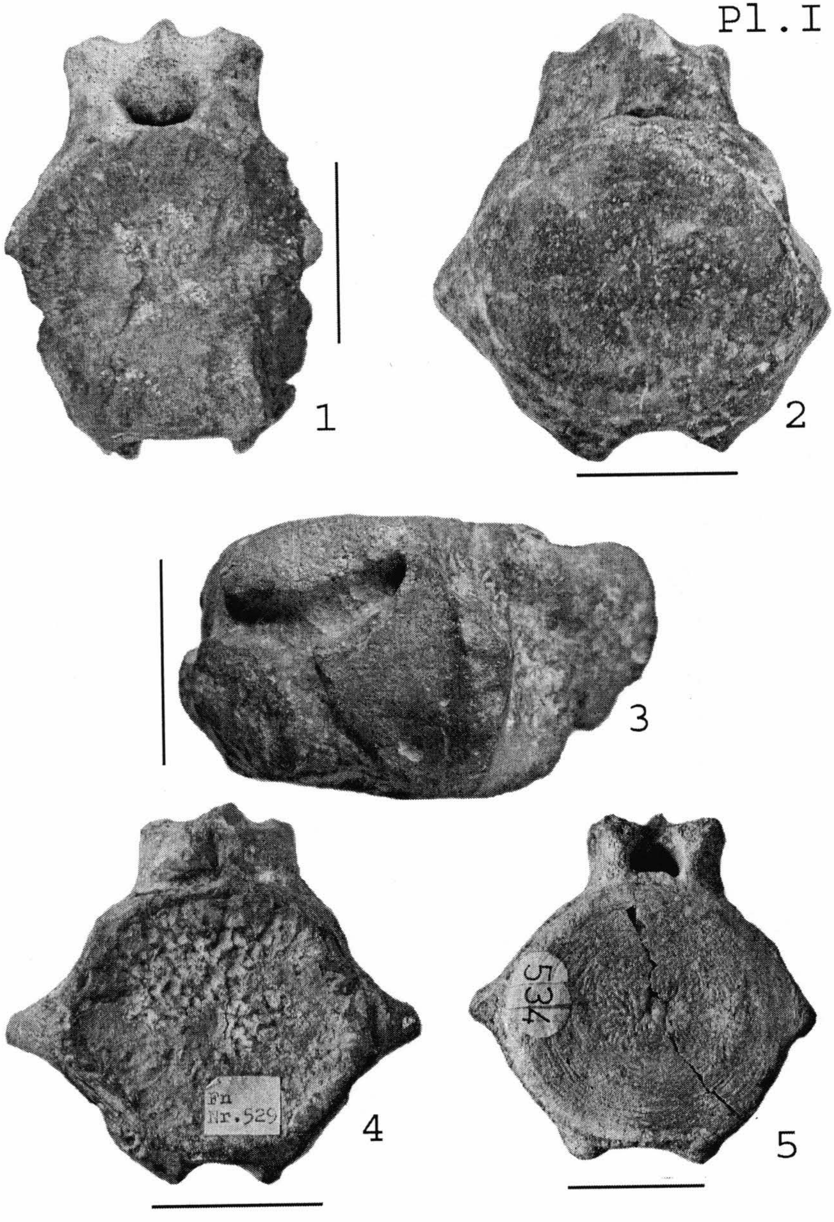
PLATE CAPTIONS

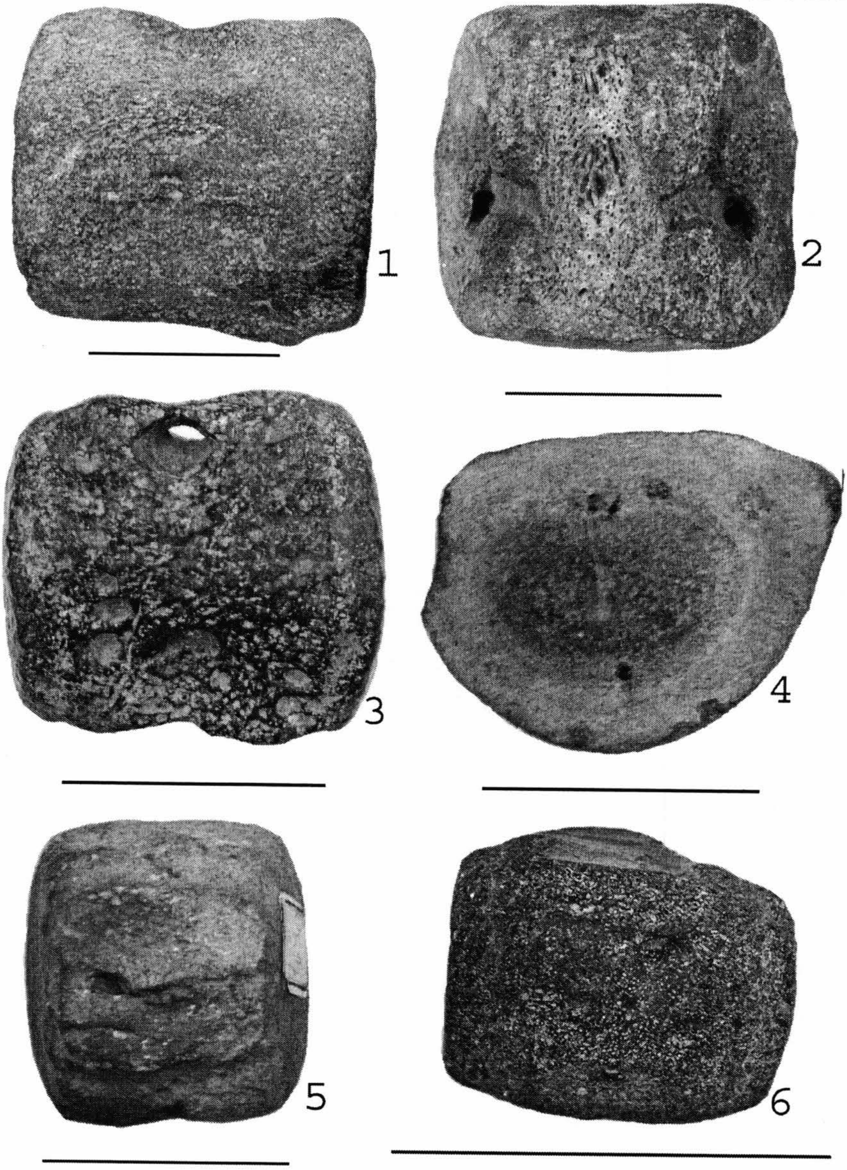
Pl. I – Mysticeti indet.:
Fig. 1 – caudal vertebra, front view, Oteşani, PSMBBU V-414
Fig. 2 – caudal vertebra, back view, Glodeni, PSMBBU 21755
Fig. 3 – caudal vertebra, lateral view, Oltenia – unspecified site, PCUP 529
Fig. 4 – idem, back view.
Fig. 5 – caudal vertebra, front view, Gornicel-Vâjoaia, PCUP 534
Scale bars: 50 mm

Pl. II – Mysticeti indet.:
Fig. 1 – caudal vertebra, dorsal view, Voiteşti, PSMBBU 1636 b
Fig. 2 – caudal vertebra, ventral view, Voiteşti, PSMBBU 1636 c
Fig. 3 – caudal vertebra, lateral view, Ţaga, PSMBBU V-415
Fig. 4 – centrum of thoracic vertebra, back view Voiteşti, PSMBBU 1636a
Fig. 5 – caudal vertebra, dorsal view, Voiteşti, PSMBBU 1636 d
Fig. 6 – caudal vertebra, ventral view, Oteşani, PSMBBU V-413
Scale bars: 50 mm

Pl. I



Pl.II



A MASTODON (*PROBOSCIDEA, MAMMALIA*) FINDING AT FIRITEAZ (ARAD DISTRICT)

Vlad CODREA*, George IUGA**

Abstract. In a small open pit once exploiting gravel near Firiteaz (Arad district), in 1988, some mastodon bones had been recovered. Among these bones, only two mandible fragments reached the Arad Museum Natural Sciences collection. Initially, they were assigned to *"Mastodon borsoni"*. A revision outlined that the mandible belonged to a bunodont mastodon, *Anancus arvernensis*. One can presume that the gravel deposits where the bones originated from could be moreover Pliocene than Late Miocene, related to the filling process of the Pannonian Basin after the retreat of the Pannonian Lake.
Key-words: Vertebrate paleontology, Proboscidea, bunodont mastodon, Pliocene, Pannonian Basin, Romania.

Introduction

On the eastern rim of the Pannonian Basin, *i.e.* the sector belonging to Romania, the mastodon findings are not very common. A synopsis of these discoveries belongs to Jurcsák (1973, 1983) and Codrea et al. (in press; Fig. 1).

Generally, the land vertebrates are rare there because the Miocene terrestrial deposits are less extended too: for long periods, wide superficies were covered in Middle and Late Miocene by the Central Paratethys seas, later by the Pannonian Lake (Steininger et al., 1985). This lake begun to confine towards the end of the Miocene, than this process advanced faster in Pliocene when large areas became dry. Concomitantly, a hydrographic system installed on the new emerged territories and fluvial deposits begun to accumulate. This evolutionary tendency is extremely obvious on the majority of oil and gas or geothermal well logs carried on the numerous boreholes drilled in this region. However, usually these deposits are less studied and their stratigraphy is poor known: there are very few data available, the majority of them in unpublished reports.

In spite of the scarcity of the fossils collected from this pile of sediments, sometimes this kind of evidence doesn't lack. It refers primary to vertebrates, mainly to large mammals.

In 1988, a fortuitous fossil vertebrate finding originated at Firiteaz, in one small open pit mining gravel, located 2 km NE from the village in a place named "Cap de Bou" ("Ox Head").

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Pl. I

View on “Cap de Bou” open pit at Firiteaz.

Pl. II

Detail on Firiteaz open pit; one can observe superposed channels filled with gravel; mastodon bones level, labeled F.

Pl. III

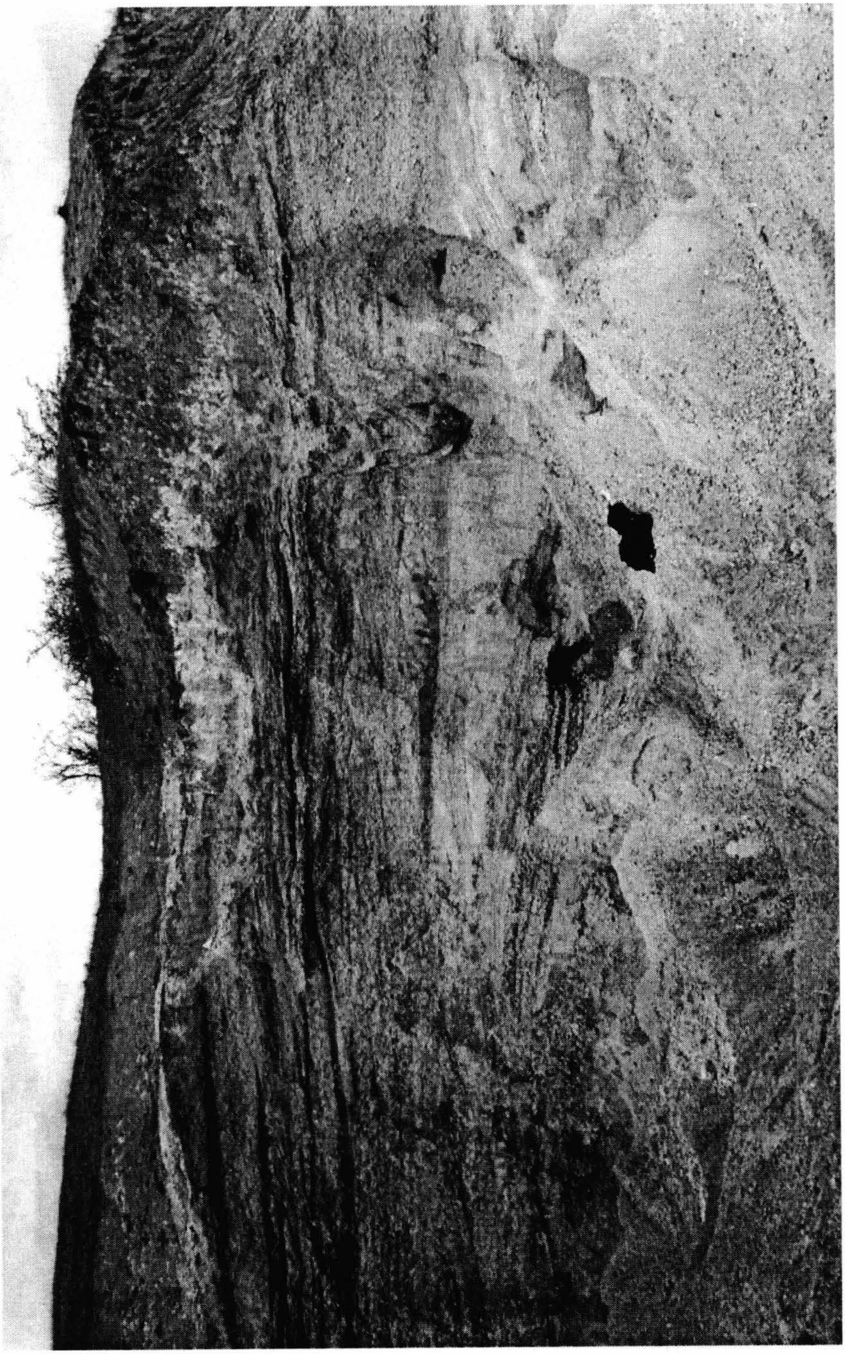
Anancus arvernensis from Firiteaz: upper view of mandible fragments.

Scale bar: 150 mm

Pl. IV

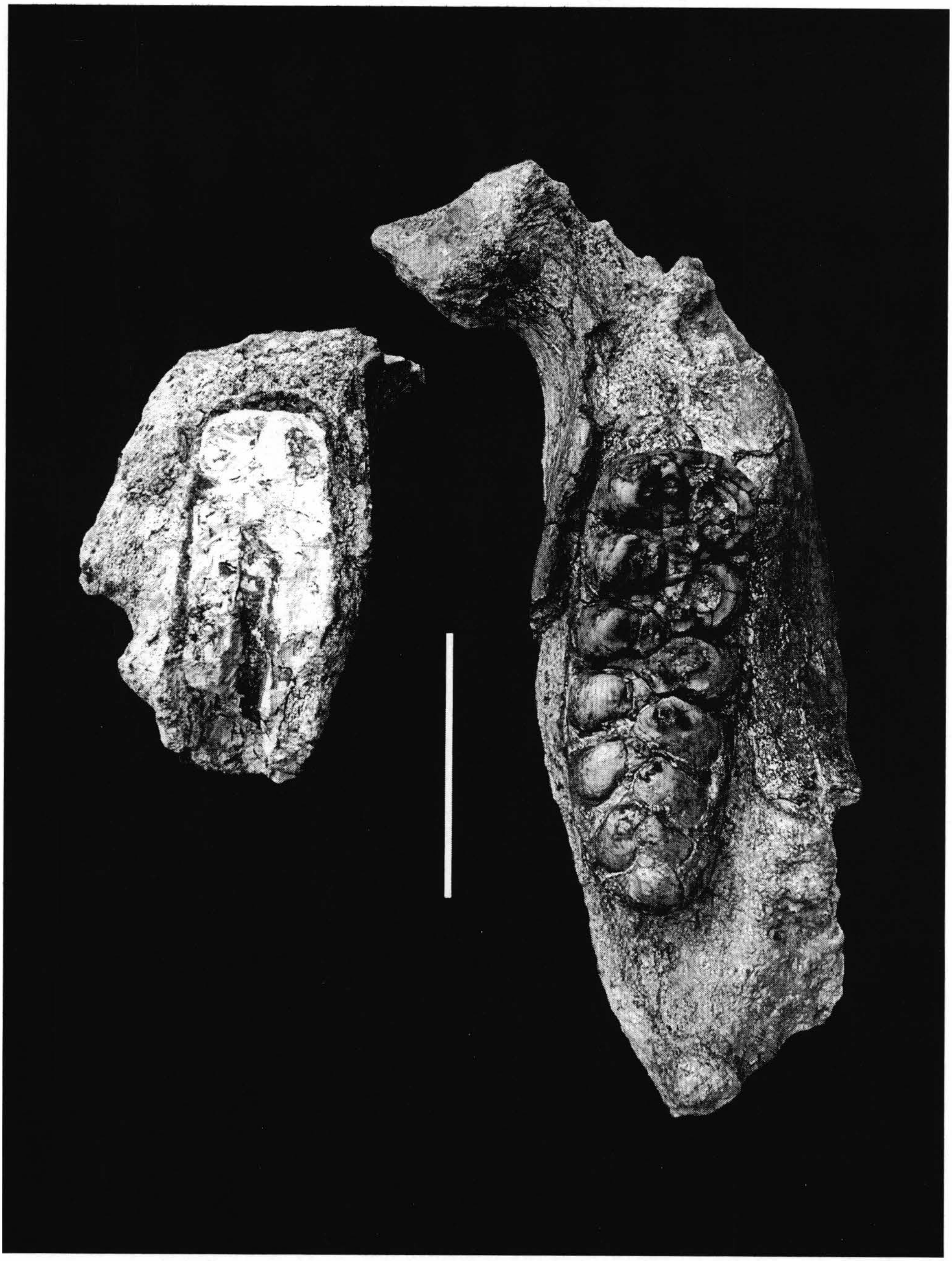
Anancus arvernensis from Firiteaz: m3, crown view.

Scale bar: 150 mm



Pl. 1.

Pl. 2.



Pl. 3.

Pl. 4.

A MAMMOTH (*PROBOSCIDEA, MAMMALIA*) DISCOVERY IN THE SIRET RIVERBED NEAR GALAŢI

Vlad CODREA*, Cornelia SUSTER**

Abstract. Löess and löess-like rocks are very common in SE Romania. However, in spite of their large exposures and thickness, the fossils are almost rare in these deposits. Several years ago, a mammoth *(Mammuthus primigenius)* skull fragment was recovered due to the drag works carried on in the Siret riverbed near Galaţi, from a löess-like rock. It belongs to a subadult or prime adult mammoth, as all the M1 ridge plates are abraded and the alveoli of the last milk teeth can still be distinguished. The mammoth is a cold climate marker, very frequent in Middle and Late Pleistocene löess deposits in Eurasia.
Keywords: Mammoth, Pleistocene, löess, Galaţi area, SE Romania.

Introduction

In the area where Siret River meets the Danube near Galaţi town, Late Quaternary rocks are wide exposed. In this manner, Siret riverbed cut löess deposits on several kilometers.

From geological viewpoint, Galaţi area belongs to the North Dobrogea Orogene Promontory, a tectonic structure plunging towards NW. That means that large parts of Măcin and Niculiţel nappes are buried, draped by Neogene molass deposits and thick Quaternary sedimentary cover. Due to borehole and geophysical data, the Peceneaga-Camena and Luncaviţa break-thrust fault alignments can be followed under the covering deposits, both trended NW-SE (Paraschiv et al., 1983).

The löess and löess-like deposits signify the last depositional episode happened in Middle and Late Pleistocene. These rocks are mainly exposed in the front of some terraces, covering the bedrocks belonging to older formations. In this area, the löess thickness is the highest of the whole Romanian territory, varying between 25-70 m. As in other locations in our country, here into the löess succession one can distinguish several reddish levels interpreted as advanced soil generating tendencies (Sficlea, 1980).

On August 2, 2003 due to drag activities related to the Siret riverbed recession, on the left river branch near Galaţi (international nautical mile 389 – Călăraşi), a mammoth skull

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fragment was recovered. It represents only the palate and maxilla with left and right M1 fixed into the alveoli, but this bone obviously belonged to a skull (either complete or anyhow, a larger fragment) broke by the bucket dredge. Neither the praemaxilla, nor the tusks could not been have recovered during the dragging works.

In the sinuses preserved on the broken sides of the bone, the bone rock matrix still exists, filling these goals. It is a löess-like rock yellow-red, extremely fine, dominate by quartz grains. The fossil is curate at Natural Sciences Museum in Galaţi.

PALAEONTOLOGY
Class Mammalia
Order Proboscidea ILLIGER 1811

Mammuthus primigenius (BLUMENBACH 1799)
Pl. I, II

The skull fragment belongs to a subadult or prime adult mammoth. The bone is broken as follow: before the back third of *crista interalveolaris*; along the interpalatal suture (probably this suture was not completely fused); immediately after the M1; above *margo alveolaris*.

Both M1 involve ten enamel plate ridges. A weak lamella foregoes the first plate ridge, another one succeed the last one. Excepting the lamellae, all ridge plates of both M1 are abraded (wear stages 1-4, according Musil, 1968; stage C according Beden, 1979). An exception is the left M1 heavy worn first ridge plate (l_1), as the mesial enamel wall can not be distinguished (wear stage D-1 according Beden, 1979). Excepting l_{10}, all others have both median and lateral columns very worn, as the wear surface of the ridge plate is united. Wear was less advanced in l_{10}, as the lateral columns appear isolated from the median ones, forming circular island-like enamel areas surrounded by cement. The cement is not excessive, the apical parts of the enamel ridge plates exceeding by far the apical cement level. The median sinus is weak, of complex pattern due to the numerous enamel folds. The grinding surface outline is distal pear-shaped (Musil, 1968): the mesial and distal edges are convex, the palatal one is attenuate convex, nearly straight and the labial one is convex. On sagittal view, the plate ridges are straight and parallel, excepting the last ones (l_6-l_{10}), with a distal diverging pitching tendency. On occlusal view, l_1-l_4 have waved outlined, keeping however a straight alignment, perpendicular on the mesio-distal tooth axis. At l_5-l_6, the plate ridges labial endings are backward curved. In this manner, these plates have a mesial convex shape. On the right side, the last milk tooth alveoli foregoing M1 are clearly distinguishable. These teeth had been ejected when the mammoth was still alive.

Table 1. Compared M1 measurements (mm)

	N	N_F	L	L_F	l	e	p	DLI	L/l
Galați Right M1 Left M1	 x10x x10x	 10_F 1/? 10_F	 130.8 132.0		 67.5 70.0	 1.6/2 1.6/2	 56/12 56/12	 7 7	 1.93 1.86
Oradea (1) M1	x14x	-	205.5	-	87.0		-	7	
Předmosti (2) M1	x10x/ x15x	-	100.0- 160.0	-	42.0- 83.0	1.0- 2.6	-	7.1- 12.5	2.8- 1.93
La Fage (3) M1 42335	x15x	6	180	55.0	72	134	-	8.1/ 8.7	2.5

N – number of enamel plate ridges; N_F – number of ridge-plates of the grinding surface; L – length of crown; L_F – length of grinding surface; l – breadth of the crown; e – enamel thickness; p – enamel folds; DLI – laminar frequency on 100 mm.
(1) – according Jurcsák & Moisi (1983); (2) – according Musil (1968); (3) – according Beden & Guérin (1975).

Discussion

Fossils are rare in the Pleistocene löess of our country. However, sometimes Pleistocene large mammals are mentioned from different localities. Such an example is the wooly rhino [*Coelodonta antiquitatis* (BLUMENBACH 1799); = *Rhinoceros lenensis* PALLAS 1773; = *Rhinoceros tichorhinus* FISCHER 1811] partial skeleton found in Galați, in Ţiglina ward (on the eastern slope of Ţiglina Hill) and Bărboşi (near the railroad station; Sficlea, 1960). Unfortunately, a detailed study on these fossils was never done and it seems that the majority of the material was lost.

Another well-known discovery concerns some fossils collected from Danube drags at mile 12. 3 – 7 m in depth, from the löess belonging to the Late Glacial (Würm, Weichsel) underlying the recent alluvia. The assemblage includes *Mammuthus primigenius, Coelodonta antiquitatis* and *Equus* sp. (Antipa, 1912). Similar findings are also mentioned at Poarta Albă and Cernavodă (Ionesi, 1994).

The mammoth skull findings in our country are scarce. That explains why the knowledge about the upper teeth series ontogenetic evolution based on fossils from Romania, is still poor. Commonly, the mammoth teeth found in Pleistocene deposits had been ejected already during the animal lifetime. Some are reworked usually by water streams before to be embedded into the sediments. The fossilization process of mammoth skulls was obstructed due to the peculiar taphonomy of these bones. After the death of the animal, the skull formed a prominence over the other bone of the skeleton. The skull was commonly embedded the last into the sediment. In the meantime, it was damaged by weathering, so the fossilization was either half way, or none. Such an example is the mammoth unearthed at Oradea (NW Romania), in löess-like deposits (Jurcsák & Moisi, 1983). There, the skull is represented only by some fragmented bones, crushed by the sediment overburdening. Or else, in Romania only very few mammoth skulls are known, like the one from Ceala, near Arad (Iuga, 1998). This skull was probably complete, but it was damaged during the excavation process related to drag activities in a gravel pit. Some other unpublished mammoth skull fragments originate from Jimbolia (a small town in Banat, near the border to Serbia).

In these circumstances, due to lack of refined stratigraphy, a lot of details concerning the Pleistocene large herbivores migrations remain still unknown for our country. Among the unsolved problems linked to the Pleistocene, the age of the löess remains a subject of debate. In SW Romania, one supposes ancient löess sequences, antecedent to the last glacial (Ionesi, 1994). However, evidence linked to vertebrate repertory is still missing for geological ages foregoing the Late Glacial. The Galaţi mammoth can not offer too many details useful for solving this dilemma. The teeth features (size, extremely weak median sinus) are diagnostic for *Mammuthus primigenius*. However, some other features (enamel thickness, laminar frequency) could suggest an earlier stage of this species, preserving inherited *trogontheri*-like features. They could indicate either an older age for the sediment that yielded the fossil, or a conservative individual. Such features are not missing in Würmian *M. primigenius* assemblages as the one from Pøedmosti (Musil, 1968). For instance, the scarcity of fossils from Galaţi obstructs a more clear answer.

The presence of the mammoth in the Pleistocene löess from SW Romania is not surprising, if thinking to the löess depositional cold environment. All the large herbivores accompanying the mammoth (wooly rhino, giant elk, bison and horse) reflect the same cold climatic tendency. Perhaps future approaches of the löess exposures from SW Romania will allow a better detailed image on its Pleistocene evolution.

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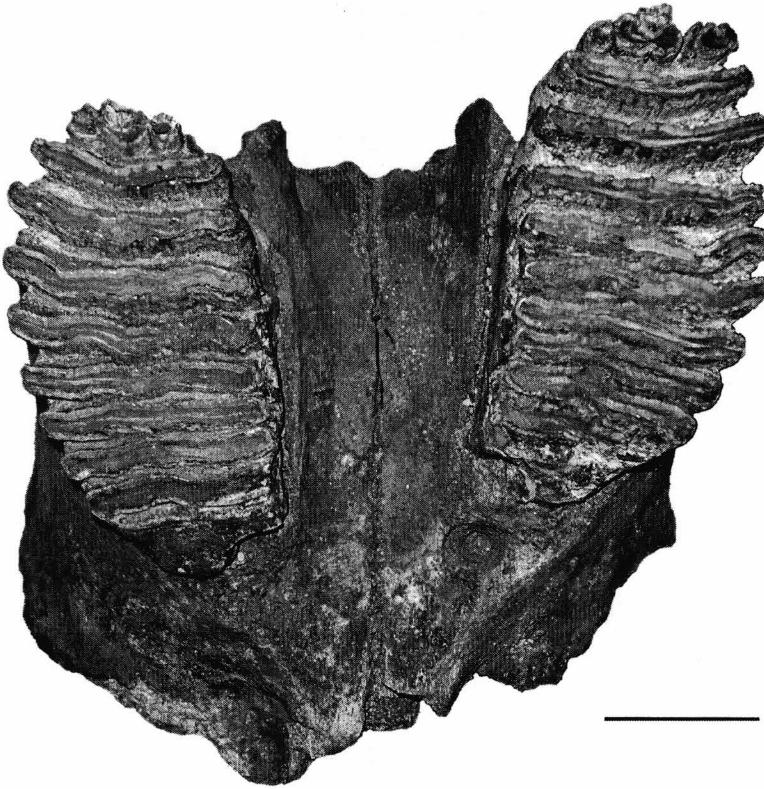
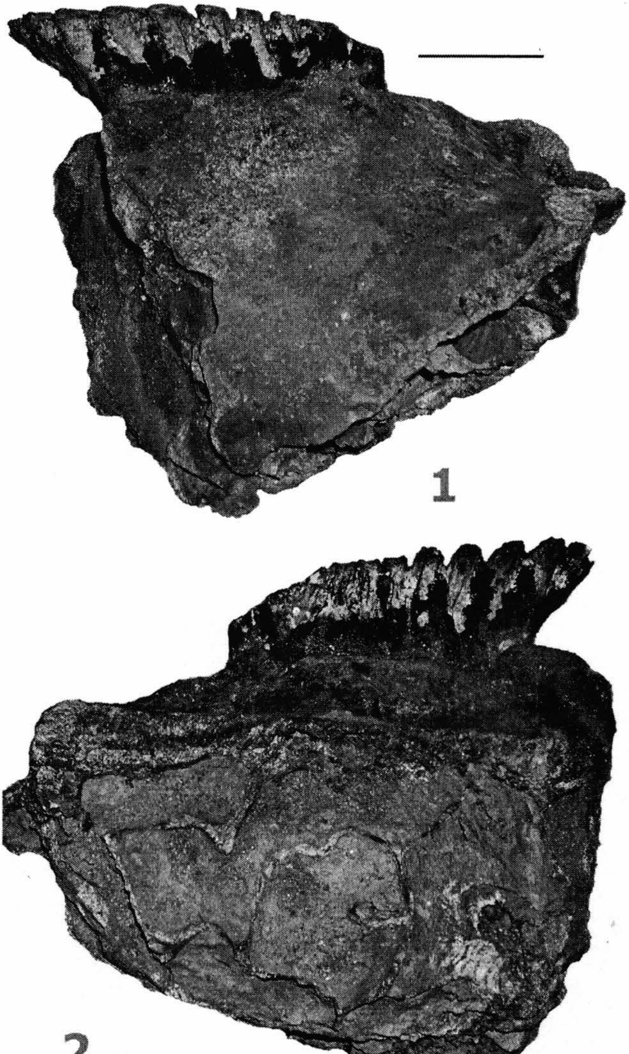
PLATE CAPTIONS

Pl. I – *Mammuthus primigenius,* Galaţi, palate with M1, crown view. Scale bar: 40 mm

Pl. II – *Mammuthus primigenius,* Galaţi, palate with M1. Fig. 1: outer view; Fig. 2: inner view. Scale bar: 40 mm



Pl. I.



Pl. II.

MINERALOGY

Studii şi cercetări, Geology-Geography 11, Bistriţa, p. 33-39

CRISTAUX IDIOMORPHES DE MÉLANOPHLOGITE DE GENÈSE HYDROTHERMALE ET SÉDIMENTAIRE DE ROUMANIE

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Résumé: Pour la première fois en Roumanie on signale l'apparition des cristaux idiomorphes, millimétriques, de mélanophlogite. Des cristaux de genèse hydrothermale sont présents dans l'aire d'apparition de la calcédoine bleue de Trestia (Maramureş). Des cristaux de genèse sédimentaire ont été trouvés, certains sur du bois opalisé à Rîmetea Oaşului (Satu-Mare) et d'autres sur du bois silicifié à Coaş (Maramureş).
Mots clés: mélanophlogite hydrothermal, Trestia (Maramureş), mélanophlogite sédimentaire, bois silicifiés d'âge Badenian et Pliocène.

Introduction

La mélanophlogite est considérée comme une variété polymorphe de silice de basse pression et température, cristallisée en système quadratique et dont la stabilité est due à des composants organiques qu'il contient en proportion de 1 à 12%. Dans la nature, la mélanophlogite apparaît rarement sous forme des cristaux idiomorphes de petite taille, de 1 à 4 mm. Elle a été signalée pour la première fois au monde en 1876 par Lassaulx, dans la mine de souffre de Giona (à côté de Girgenti, Racalmuto) en Sicile, Italie. Trouvée dans des gisements sédimentaires, la mélanophlogite est considérée d'origine syngénetique ou diagénetique et elle est associée à la cristobalite, au souffre, à la calcite et à la céléstine. Ultérieurement elle a été signalée dans d'autres localités d'Italie: Fortunillo, Livorno (en Toscane) et en Sardine.

D'autres signalements, dans d'autres pays, ainsi que des données sur la mélanophlogite ont été faites par plusieurs chercheurs. Bertrand E. (1880), Stoicovici E. (1938) et Frondel C. (1962) parlent de mélanophlogite trouvée dans les basaltes de Kilauea (Hawaii). Appelman D.E. (1965) et Kamb Brelay (1965) signalent la mélanophlogite aux Etats-Unis d'Amérique. Toujours aux Etats-Unis, Cooper J.F. et Danning G.E. (1972) décrivent la mélanophlogite de Santa Clara (le Mont Hamilton, Californie), trouvée sur les fissures de serpentinite métamorphosée d'origine épigénetique. Zak L. (1967,1968, 1972) décrit la mélanophlogite de Chevaletice (Bohème, Cekoslovakie), trouvée dans des filons de pyrite, rhodochrosite métamorphosés, associées à la cristobalite, dolomite, pyrite, marcassite, calcédoine. Elle est considérée d'origine hydrothermale.

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Zak L. (1972), Gies H. et Liebau F. (1981), donnent des nouvelles informations sur la composition et la structure réticulaire clatroidique (en grille) de la mélanophlogite. Cette structure présente des trous (vides) qui permettent son association à d'autres éléments, à des composants organiques ou anorganiques. Cette association intime fait que la composition de la mélanophlogite, prédominant siliceuse, varie d'un gisement à l'autre. Macroscopique, cette structure réticulaire clatroidique (en grille) se reflète dans l'aspect externe des cristaux idiomorphes, qui sont ornés des nombreuses trames décalées, spécifiques. On retrouve la figuration morphologique des cristaux de mélanophlogite dans l'Atlas cristallographique de Goldschmidt (1920-VII-).

La mélanophlogite a été signalée aussi en Roumanie à Trestia (Maramures). Sa présence a été détectée aux analyses Rœntgen (X) par Mârza I. (1972) et Ilinca Gh. (1989).

Caractéristiques minéralogiques de la mélanophlogite

D'après Lebrun P. (2000) la mélanophlogite n'est pas une variété polymorphe de la silice car il contient aussi des composants organiques. Il donne les caractéristiques minéralogiques: la mélanophlogite est cristallisée en système quadratique avec les constantes suivantes $P4_2/nbc$. Les dimensions du réseau sont: a=26,72 A° et c=13,395 A°, Z=4 (Z=128 pour le SiO_2). D'après ces données, le système de cristallisation est pseudo-cubique car a=2c. La mélanophlogite est caractérisée par une charpente pentagonododecaedrique de tétraèdres dont les vides (trous) sont stabilisés par des composants organiques et parfois du souffre.

La formule chimique de la mélanophlogite de Cekoslovakie (Chevaletice) décrite par Zak L. (1972) est la suivante: $Si_{46}O_{92}C_2H_{17}O_5$. La formule de la mélanophlogite du Mont Hamilton (Etats-Unis) est $46SiO_2C_2H_2,O_3.H_2O$. La mélanophlogite décrite par Gies et Liebau (1981), qu'ils considèrent cristallisée en système cubique, a la formule suivante: $46SiO_26CO_2N_2.2CH_4N_2$. On constate donc que la mélanophlogite a une composition chimique variable car les éléments organiques se trouvent dans des proportions variables dans les vides (trous) de la structure clatroidique (en grille) (des fois on trouve aussi du N ou du SO_3).

D'autres caractéristiques minéralogiques de la mélanophlogite: la dureté est de 6,5-7, la densité est de 2,005-2,052 g/cm^3, la polarisation et les indices de réfraction – izotrope, n_o= 1,423-4,467. Biréfringence faible. La mélanophlogite se présente (rarement) sous forme des cristaux pseudo-cubiques avec les côtés de 4mm maximum, plus souvent sous forme de croûte. La couleur peut être incolore, blanche, jaune ou brun-rouge. L'aspect est brillant, vitreux, transparent ou translucide. La couleur de la trace est blanche, le clivage absent, il est insoluble par les acides, fusibilité: il devient noirâtre au contact de la flamme.

La mélanophlogite est considérée comme synonyme du léucophlogite ou du sufuricin ou encore, d'après nous, synonyme du cubosilicite. Tous ces minéraux de silice ne sont pas reconnus.

En Roumanie, la mélanophlogite est associée à la calcédoine, au quartz et aux substances bitumineuses ou, plus rarement, on la retrouve dans certains bois silicifiés.

Localisation et conditions géologiques et génétiques d'apparition de la mélanophlogite en Roumanie

Les occurrences de mélanophlogite de genèse hydrothermale associées à la calcédoine sont situées dans le nord de la Roumanie dans la région minière Baia-Mare, à environ 10 km au sud de la renommée localité minière Cavnic, aux alentours de la localité Trestia-Plopiş.

Nous mentionnons par ailleurs que la calcédoine de Trestia, par sa couleur bleu-saphir (saphirine) intense a attiré l'attention des hommes dès l'ère paléolithique. Les minéralogistes s'intéressent depuis environs 300 ans aux cristaux cubiques que cette calcédoine présente parfois. Les grands musées du monde exposent des échantillons de cette calcédoine bleue de Trestia. Son périmètre d'apparition, d'une superficie de 16 km^2 est délimité par les localités Trestia au sud, Izvoarele (Bloaja) à l'est, Surdeşti à l'ouest et Plopiş au nord. Ce territoire est délimité par les rivières Bloaja à l'est et Cavnic à l'ouest.

La présence de la calcédoine de Trestia à laquelle est associée l'apparition de la mélanophlogite est liée à l'activité hydrothermale de l'appareil volcanique Măgura Focului, datant du Sarmatien (il y a 11 millions d'années). Les filons de petite taille sont localisés dans l'andésite microcristalline de Răchiţele. En paragénèse avec les minces filons de calcédoine (de 0,5 à 10 cm d'épaisseur) on peut trouver des petites accumulations de carbonates (ankerite, siderite, calcite) situés de part et d'autre du filon, rarement des sulfures (galène), barytine, dolomite, fluorine et plus rarement encore, des bitumes (substances bitumineuses) incluses dans la calcédoine. Une bonne partie de ces minéraux paragénétiques ont été substitués par la calcédoine ou ont disparu suite à des processus ultérieurs d'altération, de dissolution. Les moulages négatifs de leurs cristaux ont laissé l'empreinte dans la calcédoine gélatineuse déposée ultérieurement.

Suite aux processus intenses d'altération subis, la plupart des échantillons de calcédoine bleue avec des pseudomorphoses cubiques de fluorine (de 3 à 30 mm) ou les échantillons (encore plus rares) de mélanophlogite on les trouve remaniés dans les alluvions des petits ruisseaux, dans les colluvions de pantes et même dans les sols alentours. La fréquence d'apparition de fragments de petits filons de calcédoine-quartz (de 2 à 5cm_2) avec présence de mélanophlogite est de 1 à 300 échantillons. Ayant à la disposition une collection de plusieurs milliers d'échantillons de calcédoine bleue nous avons pu séparer les échantillons avec des cristaux de mélanophlogite. Sur le terrain on peut identifier la présence de la mélanophlogite à la loupe géologique.

En 1899, le professeur italien Luigi Bombicci identifie des agglomérations de cristaux cubiques millimétriques dans des géodes de bois silicifié crétacée, au Musée de Bologne. Les échantillons de bois (inventoriés sous les numéros 44161, etc.) provenaient des dépôts crétacés d'Olmo di Castellucio di Capugnamo des Apennins. Les cristaux ainsi identifiés, Bombicci les considérait identiques à ceux trouvés sur les échantillons de calcédoine bleue de Trestia (13 échantillons inventoriés dans le musée) et sur la base de ces analyses il crée une nouvelle variété de silice qu'il nomme "cubosilicite" (espèce non reconnue des nos jours).

Dans la région de Trestia, en Roumanie, la présence de la mélanophlogite a été signalée suite à des analyses Rœntgen dès 1972 par Mârza I. En 1989 Ilinca Gh. effectue une étude sur la calcédoine de Trestia. Il considère que certaines microstructures reliques qu'on peut voir sur les sections microscopiques de quelques échantillons présentent des remarquables similitudes et du même ordre de grandeur que les micro-zonalités présentés par les pellicules de matériel organique contenues dans les cristaux de mélanophlogite de Sicile.

Le spectre infra rouge met en évidence la présence de la calcédoine mais aussi celle de la mélanophlogite. Les analyses Rœntgen mettent en évidence la présence du quartz mais aussi des rares réflexes pour la mélanophlogite. Les analyses chimiques mettent en évidence la présence des substances organiques en proportion de 0,707%. Sur la base de ces résultats Ilinca (1989) attribue tous les aspects cubiques de la calcédoine de Trestia à des pseudomorphoses de mélanophlogite. Nous vous faisons remarquer que souvent la taille des pseudomorphoses cubiques (entre 2mm et 3,5cm) est supérieure à la taille normale, millimétrique, des cristaux de mélanophlogite. Souvent les pseudomorphoses ont une ornementation de type "parquet" et des macles qui sont spécifiques à la fluorine. Parmi les nombreux échantillons de calcédoine de Trestia nous avons pu mettre en évidence quelques rares pseudomorphoses cubiques d'après mélanophlogite avec leur ornementation spécifique qui est très différente de celle de la fluorine. Nous voulons aussi attirer l'attention sur le fait que certains fragments de filons de calcédoine présentent des petites géodes, complètement isolées de l'extérieur et remplies d'une substance organique déposée syngénétiquement (des échantillons cueillis dans une carrière d'andésites à Surdeşti, Maramureş).

I. La mélanophlogite de genèse hydrothermale

Les cristaux de mélanophlogite de Trestia, que nous avons étudié surtout sous l'aspect morphologique et de présentation nous les avons groupés dans quelques types principaux:

1. Cristaux pseudo cubiques sous-millimétriques ou millimétriques, de couleur blanche ou bleuâtre, entre-percés peu individualisés, translucides. Ils sont déposés sous forme de pellicule sur la calcédoine bleue ou sur les pseudomorphoses de fluorine. Les cristaux sont disposés les uns sur les autres de façon que seul un coin du pseudo cube est visible. Rarement on peut voir les faces latérales qui peuvent avoir la surface lisse ou présenter des trames de croissance décalées et superposées. (17 échantillons de dimensions maximums de 3,5 x 1,5 x 0,8 cm et minimums de 1 x 1 x 0,1cm)

2. Cristaux pseudo cubiques sous-millimétriques ou millimétriques, de couleur blanche ou bleuâtre, translucides, rarement mates, disposés soit sur les pseudomorphoses de fluorine, soit sur des petits filons de cristaux de quartz. Les cristaux de mélanophlogite présentent une face bien individualisée et les quatre faces latérales visibles sur une petite profondeur. Les surfaces sont lisses, elles présentent rarement des stries faiblement individualisées en parallèle avec les côtés. On peut observer des faibles déplacements des plans réticulaires. (5 échantillons de dimensions maximums de 5 x 3 x 1,5 cm et minimums de 2,5x1,5x0,3 cm)

3. Groupes de cristaux pseudo cubiques compactes, les uns à côté des autres, entre-percés de couleur blanche, bleuâtre, rarement rougeâtre développés sur des petits filons de quartz et à leur tour couverts d'un niveau de calcédoine bleue. Généralement, les cristaux

de 1-2 mm ont les quatre faces latérales du cube faiblement développées en profondeur. Les plans réticulaires sont fortement décalés et striés en parallèle avec les côtés. Parfois sur la face supérieure du cube sont développés de petites excroissances triangulaires.(3 échantillons de dimensions maximums de 2,5 x 1,8 x 0,4 cm et minimums de 1 x 1 x 0,8 cm)

4. Cristaux pseudo cubiques, translucides parfois solitaires parfois entre-percés compactes disposés sur une pellicule mamelonnaire de calcédoine ou d'opale qui à son tour habille les prismes des cristaux de quartz. Les cristaux ont de dimensions entre 0,5 et 1 mm et les quatre faces latérales bien développées, visibles sur toute la profondeur. Elles présentent des ornements sous forme des stries régulières sur lesquelles apparaissent parfois des substances organiques noirâtres. La surface supérieure des pseudo cubes de moins de 0,5mm ne présentent pas des stries mais des excroissances triangulaires désordonnées. (4 échantillons de dimensions maximum de 4 x 3 x 0,5 cm et minimums de 2x 1,5x0,3 cm)

5. Agglomérations compactes de cristaux pseudo cubiques typiques, translucides, bleuâtres, entre-percés ou solitaires bien individualisés de 1,5 à 2mm disposés sur un échantillon filonien de 4 x 3 x 1,4 cm. A la base du filon une couche de calcédoine bleue de 4 mm suivie d'une couche de cristaux de quartz de 8mm. Sur les pyramides des cristaux de quartz sont disposés des cristaux de mélanophlogite, souvent avec les quatre faces latérales bien individualisées et fortement striées. Les cristaux qui se trouvent sur les sommets de cristaux de quartz sont mieux développés (comme des petits mamelons). Un échantillon de dimensions de 3 x 3 x 1,2 cm (les cristaux sont semblables à ceux qui figurent dans l'atlas de Goldschmidt)

6. Les pseudomorphoses de calcédoine bleue d'après la mélanophlogite sont des exceptions et on les rencontre rarement Nous les avons partagés en deux catégories: les paramorphoses de calcédoine d'après la mélanophlogite et les perimorphoses par incrustation de calcédoine d'après la mélanophlogite.

– dans le cas des paramorphoses les cristaux de mélanophlogite substitués par la calcédoine bleue sont plus grands (jusqu'à 3 mm). Ils gardent, en grandes lignes, la forme et les caractéristiques d'ornementation des cristaux de mélanophlogite originaux. Ils se développent en général sur des petites plaques (surfaces) de calcédoine bleue, rarement sur du quartz. (5 échantillons de dimensions maximums de 2,5 x 1,5 x 1,2 cm et minimums de 2 x 1 x 0,7 cm)

– dans le cas des perimorphoses, les cristaux sont développés sur une petite couche de quartz translucide. Les cristaux pseudo cubiques de mélanophlogite sont bien individualisés (1 mm) avec une ornementation typique. Les cristaux sont couverts d'une pellicule sous millimétrique d'opale blanche. Le tout est incrusté des formes pseudocubiques entre percés, lisses, translucides de calcédoine bleue qui ne gardent plus de trace de l'ornementation très fine, typique des cristaux de mélanophlogite. Sur le même échantillon on peut donc voir des cristaux typiques de mélanophlogite ainsi que leurs perimorphoses résultés de leur recouvrement d'une couche d'opale et ensuite l'incrustation dans la calcédoine bleue. (1 échantillon de 2 x 1,5 x 0,3 cm)

II. Mélanophlogite de genèse sédimentaire

D'après nous, les formes de "cubosilicite» décrites par Bombicci (1889) et trouvées dans les échantillons de bois silicifié du Musée de Bologne, nous pouvons les attribuer a la mélanophlogite. Pour soutenir cette affirmation nous voulons mentionner que nous avons nous aussi trouvé, en Roumanie, des cristaux de mélanophlogite logés dans les fissures et les trous de deux échantillons de bois silicifié. Ces cristaux de dimensions millimétriques ou sous millimétriques ont une origine syngénétique.

– Un premier échantillon est un bois brun opalisé trouvé dans des formations quaternaires, dans le cimetière du village Remetea Oasului (Satu-Mare). Il a été remanié des dépôts pliocènes et présente des petites surfaces carbonisées. Cet échantillon de bois présente des trous avec des dépôts (de forme stalactitique) bruns, constitués d'une agglomération de cristaux cubiques (de 0,5 mm) dont une des faces est bien visible et une ou deux faces latérales sont visibles en partie et présentent, rarement, des trames de croissance.

– Un deuxième échantillon de bois intensément silicifié (constitué de calcédoine) a été trouvé à Coaş (la vallée de Chiţii). Il provient des dépôts badénians et à l'origine il appartenait à un conifère, il est partiellement carbonisé. Sur ses fissures fines il présent des cristaux blancs de forme cubique sous millimétriques (0,1 mm) mettant en évidence la surface supérieure et qui présente rarement des trames de croissance.

Dans les deux cas, la formation des cristaux de mélanophlogite a eu lieu en présence des substances organiques libérées par le bois lors des processus de transformation: carbonisation, silicification.

Conclusions

Nos recherches effectuées au binoculaire sur plusieurs milliers d'échantillons de calcédoine bleue-saphir (saphirin) de Trestia (Maramureş) qui présentent des pseudomorphoses d'après la fluorine (fait confirmé par la présence sporadique des cristaux de fluorine non substitués) mettent en évidence aussi la présence des cristaux idiomorphes de mélanophlogite, de fréquence plus rare, présence mise en évidence par des analyses roentgen antérieures. Les cristaux idiomorphes de mélanophlogite identifiés par nos recherches ont un habitus et une ornementation identiques à ceux figurés par Goldschmidt d'après les cristaux découverts par Lassaulx (1876) dans les dépôts de souffre de Sicile.

La localité Trestia de Transylvanie connue par la présence de cette calcédoine dont la couleur est invariablement bleue et qui a des qualités gémmologiques, qui présente des très belles pseudomorphoses d'après la fluorine, nous attire de nouveau l'attention par la récente découverte des cristaux idiomorphes de mélanophlogite, qui même s'ils ne sont pas fréquents sont très beaux.

Nous voulons mentionner que les intailles de la Grèce antique (des vrais œuvres d'art du V-IV siècle av. J.Ch.) ont été confectionnées dans une calcédoine similaire que celle de Trestia provenant de l'ancienne colonie grecque Kalchedon (aujourd'hui Kadikoi, Turquie), sur les rives est du Bosphore. Le nom de la calcédoine provient du nom de cette localité.

La calcédoine bleue de Turquie, de męme que celle de Dalan Turu (au sud de la Mongolie) et celle de Trestia en Roumanie, présentent toutes les trois des pseudomorphoses cubiques d'après la fluorine, plutôt une curiosité pour la calcédoine, ce qui montre qu'elles ont été générées par des processus hydrothermaux similaires.

Il est possible que dans l'avenir, la présence des cristaux idiomorphes de mélanophlogite liés à la calcédoine bleue soit mise en évidence aussi dans les occurrences de Turquie et de Mongolie.

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INTAILLES COUPEES EN CALCEDOINE BLEU PROVENANT DE LA GRECE ANTIQUE

Virgil GHIURCĂ*

Introduction

En feuilletant un album (NEVEROV,1976) sur les intailles antiques exposées dans le renommé musée Hérmitage de Saint-Petersburg, qui fête cette année 300 ans de sa création par Pierre le Grand, j'étais surpris par la couleur bleue saphirinique de ceux-ci. Les maîtres grecs dans l'art de la glyptique de l'antiquité préféraient confectionner leurs œuvres d'art dans une calcédoine d'une couleur bleu qui se rapproche beaucoup de celle de la calcédoine bleue de Trestia, en Roumanie.

Dans l'album, la provenante topographique de ces calcédoines n'étant pas spécifié, je me suis posé la question si la source n'était pas le gisement de Trestia (de l'ancien royaume Dacia). A l'époque, sur les bords de la Mer Noire autant en Dacia qu'en Ukraine existaient des nombreuses colonies grecques qui faisaient commerce (des échanges en produits) avec les habitants (LAYKRAT, GANINA,1984).

Partant de cette prémisse, pour confirmer (ou infirmer) mon hypothèse, j'avais besoin de savoir si des gisements de calcédoine bleue existent en Grèce. J'ai demandé donc a mes étudiants d'origine grecque, effectuant leurs études en géologie à l'Université de Cluj, en Roumanie leur collaboration. Sur une période de 30 ans j'ai doté plusieurs des mes étudiants avec des échantillons représentatifs de calcédoine bleue de Trestia pour chercher des similitudes de couleurs avec les calcédoines de Grèce. Il semblait à l'époque qu'une telle ressource était identifiée dans l'île Lesbos. Toutes ces recherches n'ont rien donné de concluant et le mystère sur la calcédoine bleu utilisée pour les intailles antiques restait à résoudre.

Historique, localisation, géologie et genèse de la calcédoine de Trestia

Pour effectuer une comparaison entre la calcédoine bleue de Trestia et la calcédoine qui a été utilisée pour confectionner les intailles grecques exposées au Musée de L'Hérmitage de Saint Petersburg, nous allons faire une présentation succincte de cette première.

La calcédoine de Trestia est connue sur le territoire de la Roumanie depuis l'ère Paléolithique. Nous l'avons trouvée parmi les vestiges archéologiques de la localité paléolithique de Boineşti-Oaş (département de Satu-Mare), sous forme d'un fragment calciné. Exposée à des fortes températures, la calcédoine devient blanche mais nous avons pu la reconnaître d'après les pseudomorphoses cubiques qu'elle présentait comme provenant de Trestia (ce sont des pseudomorphose des cristaux de fluorine, typiques pour la calcédoine bleue de

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Trestia).Trestia se trouve à 10 km sud de la renommée localité minière de Cavnic de la zone minière de Baia-Mare (département de Maramureş). L'aire d'apparition de la calcédoine bleue, d'une superficie de 16 km^2 est délimitée par les localités Trestia au sud, Izvoarele (Bloaja) à l'est, Plopiş à nord et Surdeşti à ouest; la rivière Cavnic à l'ouest et Bloaja à l'est.

Son apparition à cet endroit est une conséquence de l'activité hydrothermale de l'appareil volcanique Măgura Focului – Dărăbani qui a favorisé aussi la mise en place des andésites micro-cristalines de Răchiţele. La calcédoine apparaît dans la roche mère sous forme de filons ou des géodes de 1 à 20 cm. A côté de la calcédoine bleue sont présentes des minéraux paragénetiques constitués des carbonates (ankerit, siderit, calcite), des sulfures métalliques (galène), barytine, fluorine, plus rarement du melanophlogit. Pour la plupart ces minéraux sont substitués, dissous ou altérés. La majorité des échantillons se trouvent aujourd'hui remaniés dans les alluvions des petites rivières, dans les colluvions de pente ou carrément dans le sole de cette aire.

Données analytiques et gémmologiques

Les analyses chimiques effectuées sur la calcédoine de Trestia indiquent la composition suivante: SiO_2 entre 98,08 et 99,01%; CaO entre 0,50 et 1,11%; Fe_2O_3 entre 0,24 et 0,65%; et MgO entre 0,15 et 0,30%.(MOŢIU, GHIURCĂ, 1979)

Les analyses spectrales mettent en évidence la présence des éléments suivants, dispersés dans la calcédoine: Ca, K, Cl, B, Ni, Cu, Mg, Mn, Ti, Ge, Cd et Al.

La couleur de la calcédoine de Trestia est invariablement bleue avec des nuances plus foncées (saphirinique) ou plus claires (aqua-marine)

Pour la confection d'intailles sont utilisés les filons de texture homogène et d'un bleu translucide, qu'on nomme aussi la variété "noble". Ces pièces sont plus rares, d'une couleur bleu intense (saphirinique) et elles sont presque identiques aux celles utilisées par les maîtres grecques dans l'art glyptique de l'antiquité.

Pour la confection des camées les agates camaïeu de Trestia sont recommandées. Elles sont formées d'habitude dans des creux de forme triangulaire. Elles sont constituées des bandes de différentes nuances de bleu (plus claire ou plus foncé). On peut utiliser aussi la forme filonienne si elle est constituée de deux ou trois bandes de différentes nuances de bleu.

Quelques données sur les intailles grecques antiques

Conditions sociales et historiques. L'époque fleurissante de l'art glyptique grecque et spécialement celle des intailles, atteint l'apogée au $V_{ème}$ et $IV_{ème}$ siècle av.Ch.. Cette période est aussi appelée la période grecque classique. A cette époque, les Grecques étaient dispersés jusqu'aux cotes ouest de l'Asia Minor (Phocee, Clazomens, Teos, Milet, Khalkedon), les îles Lesbos, Samos, Chios, Naxos, ainsi que sur les cotes ouest de Peloponez (Eritree, Megare, Andros). Ce sont des localités nommées aussi "cités mères", point de départ des migrations vers la Mer Noire et la Mer Méditerranée où les Grecques ont formé une série de colonies. La période d'expansion coloniale des grecques est située au $VII_{ème}$ et au $IV_{ème}$ siècle av.Ch.

Vers l'est de l'Asia Minor se trouvait l'empire persan, dans les Balkans et l'Europe centrale vivait les tracs (d'après Homer c'était le peuple le plus nombreux après les indiens) et dans les steppes de la Mer Noire vivaient les scits.

Les colonies doriennes et ioniennes créées au VIIème et au Vème siècle av.Ch. par les commerçants faisant des échanges avec les populations locales, étaient emplacées sur les cotes actuelles de la Mer Noire en Bulgarie (Dionisopolis, Odessus, Mesembria), en Roumanie (Callatis – Mangalia, Tomis – Constanta, Histria, Argamum), en Ukraine (Tyras – Belogorod, Olbia – Nikolaev, Kersonesos – Sevastopol, Feodosia, Panticapeum – Kerci, Adana – Gorgippia, Tanais – Rostov), localités situées près de la presqu'île de Crimée et de la Mer d'Azov. Quelques localités situées vers Caucaz et la Turquie. Sur les cotes de la Mer Méditerranée on peut mentionner Massalia – Marseille au sud de la France.

La plus grande partie des intailles confectionnées en calcédoine bleue ont été trouvés dans les nécropoles grecques et sciites (qui pratiquaient les échanges) situées près de l'embouchure des rivières Nistre, Nipre, Bug et Don dans la Mer Noire, mais aussi dans la zone de Crimée. Probablement un certain nombre d'intailles ont été découvertes dans des nécropoles similaires de Bulgarie, Roumanie et Turquie mais alors elles ont du se perdre dans des collections privées n'ayant pas apparus dans les collections des musées de ces pays.

Les intailles en calcédoine bleue au Musée de l'Hérmitage

La plus riche collection d'intailles du monde se trouve au Musée de l'Hérmitage. Nous avons remarqué la présence d'approximatif 30 intailles confectionnées en différant variétés de silice cryptocristaline de nuances bleues parmis lesquelles 19 ont une nuance bleue saphirine. Deux provient de la collection du Duc d'Orléans (du IVème siècle av.Ch. et du 1er siècle) d'une couleur bleu blanchâtre qui ne s'encadre pas dans la catégorie des calcédoines de type Trestia (bleue saphirin translucide). Dans le même type de calcédoine bleue, avec des nuances plus claires ou plus foncées nous pouvons inclure 8 autres intailles (les numéros: 3, 21, 28, 35, 37, 38, 43 et 46, sur les planches de l'album). Parmi les 17 intailles restantes, 9 seulement ont le même type de coloration que la calcédoine de Trestia. Parmi les 9 intailles que nous allons présenter succinctement, 7 proviennes des nécropoles antiques de Panticapeum (Kerci de nos jours), une provient des nécropoles de la Presqu'île de Taman et 2 des collections privées russes sans précision de leur lieu de provenance. Elles ont été trouvées suite à des fouilles archéologiques entre 1836 et 1907. Nous devons mentionner que pour aucune de ces intailles la provenance de la matière première, en occurrence la calcédoine brute, n'est précisée. Les 9 intailles sont datées entre le Vème et le IVème siècle av.Ch. correspondant à l'apogée de l'art glyptique grecque, connue aussi sur la période hellénistique classique. Quelques caractéristiques de cette période sont la liberté et la perfection de la composition, une parfaite qualité de la pierre, des lignes précises, une approche humaniste. Elles étaient portées comme pendentifs au poignet ou à la ceinture. Sur les planches de l'album elles portent les numéros: 16, 20, 36, 40, 45, 47, 48 et 49. Voici une succincte présentation:

1. (n° 16) Intaille de 2,9/2,3 cm en calcédoine bleue saphirin translucide représentant la Médusa Gorgona sur fond marin. Cette œuvre est attribuée au maître Galène, elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du Vème siècle av.Ch.

2. (n° 20) Intaille de 1,8/1,3 cm en calcédoine bleue saphirin translucide représentant un Héron en vol sur le fond bleu du ciel. Cette œuvre est attribuée au maître

Dexamenos de Kios (comme 8 autres intailles de la collection de l'Ermitage), elle est signée par son auteur, fait plutôt rare. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du $V_{ème}$ siècle av.Ch..

3. (n° 36) Intaille de 2,6/2,0 cm en calcédoine bleue saphirin translucide représentant une Femme blottie dans la baignoire. Elle est fixée sur une agrafe pivotante en or. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du $IV_{ème}$ siècle av.Ch.

4. (n° 39) Intaille de 2,2/1,7 cm, même type de calcédoine, représentant la déesse Artemis. Elle était fixée sur une agrafe en or. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du $IV_{ème}$ siècle av.Ch.

5. (n° 40) Intaille de 2,5/2 cm, même type de calcédoine bleue, représentant un Guerrier persan et attribuée au maître Pergamos. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du I_{er} siècle.

6. (n° 45) Intaille de 2,9/2,2 cm en calcédoine bleue saphirin translucide représentant un Guerrier avec bouclier et lance, montée sur une agrafe en or. Elle appartient à une collection privée, datée du $IV_{ème}$ siècle av.Ch. et sans précision du lieu de provenance.

7. (n° 47) Intaille de 2,2/1,7 cm, même type de calcédoine représentant un Ours et montée sur une agrafe pivotante en or. Elle a été trouvée dans une nécropole de la Presqu'île Taman et datée du $IV_{ème}$ siècle av.Ch.

8. (n° 48) Intaille de 2,3/1,9 cm, représentant un Cerf. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du $IV_{ème}$ siècle av.Ch.

9. (n° 49) Intaille de 3,0/2,4 cm en calcédoine bleue saphirin translucide représentant un Sphinx achaemenid. Elle a été trouvée dans la nécropole de la Panticapeum (Kerci) et datée du $IV_{ème}$ siècle av.Ch..

Au Musée de Kiev, en Ukraine, existent une série des bijoux, des objets de culte appartenant à une prêtresse du I_{er} et du $II_{ème}$ siècle, confectionnés dans le même type de calcédoine bleue. Ces objets ont été trouvés dans une nécropole funéraire (sarmate?) à Sokolovaia Movila près de Nikolaev (ancienne colonie grecque, Oblia).

Nous mentionnons aussi un collier confectionné en carneol, ambre, verre, agate, calcaire rosé à rayures blanches et 20 pièces de calcédoine bleue saphirin de type Trestia. Dans le texte qui accompagne la collection de Kiev est spécifié que ces pièces de bijouterie ont été confectionnées dans la région du Bosphore. La plus grande partie des trésors de bijoux ont été récoltés dans les imposantes nécropoles funéraires scyite-sarmates ou grecques durant le $XIX_{ème}$ siècle. Ainsi, les informations concernant les intailles et les bijoux confectionnés en calcédoine bleue saphirin de type Trestia que nous avons pu trouver dans les différentes documentations s'arrêtent là.

Comme nous avons mentionné en introduction, les recherches faites par nos étudiants grecques à notre demande, se sont soldés avec un échec.

Nous avons ensuite contacté un grand collectionneur de minéraux d'Athènes, Nicholas Barbis, qui nous a indiqué comme source dę calcédoine bleue l'Ile Lesbos. Ainsi en 2001 il nous a acheté un échantillon de cette calcédoine (provenant des environs de la ville de Myttilini) dans un magasin de spécialité (à 50$). Pour notre grande surprise, nous avons découvert qu'il s'agissait d'un échantillon de bois silicifié avec une grande géode de calcédoine blanchâtre, légèrement bleuâtre, mais sans aucune ressemblance avec la calcédoine utilisée pour confectionner les intailles.

Enfin, en 2002, par la bienveillance de M. Mătieş Paul (géologue roumain), nous avons acquisitioné un petit échantillon (2,0/1,5/0,4cm) de calcédoine de la même couleur bleue saphirin translucide des intailles et de la calcédoine de Trestia. Le lieu de provenance de cet échantillon est la localité qui a donné le nom à ce minéral, Khalkedon par son nom antique (Kadyköi de nos jours) située sur les côtes ouest de la Turquie dans la zone du Bosphore.

Malgré les dimensions réduites de l'échantillon étudié, nous avons pu mettre en évidence dans sa base (lit) un moulage négatif d'après un minéral carbonatique, et a son sommet des pséudomorphoses de fluorine (cubiques, de dimensions millimétriques) exactement comme les échantillons de calcédoine de Trestia (Roumanie). Ceci montre que les deux gisements (en Turquie et en Roumanie) ont eu la même origine (genèse) hydrothermale filonienne. Une autre occurrence du même type de calcédoine d'origine (genèse) hydrothermale filonienne qui présente des pséudomorphoses cubiques de fluorine se trouve au sud du désert Gobi aux alentours de la localité Dalan-Turu.

Nous voulons mentionner que dans l'antiquité une partie de la population grecque était installée sur les côtes ouest de l'Asia Minor et qu'une colonie dorienne était située sur l'emplacement de la localité Khalkedon (Kadyköi aujourd'hui). Nous pouvons nous imaginer, qu'attirés par la beauté et la pureté de cette calcédoine bleue saphirin translucide, les habitants de l'époque ont ramassé les fragments les plus beaux pour les envoyer dans les ateliers de glyptique situés dans les zones insulaires Kios, Lesbos, Melos et dans les localités continentales du Peloponez. L'abrasive à base de corindon utilisé dans la confection des intailles provenait de l'île Naxos. L'atelier du maître Dexamenos était situé sur l'île Kios, mais il n'a pas été le seul maître d'ans l'art de la ' glyptique à l'époque, nous avons déjà mentionné Pergamos et Galène. Après leur fabrication, les intailles ont constitué une monnaye d'échange avec les peuples des colonies grecques de l'époque situées sur les côtes de la Mer Noire tracs (dacs et gets) ainsi que les peuples scyites et sarmates.

Conclusions

Après des longues recherches nous sommes arrivés à préciser la provenance topographique de la calcédoine bleue saphirin utilisée dans la confection des intailles antiques de la collection du Musé de l'Hérmitage à Petersburg. Le gisement de calcédoine hydrothermale filonienne se trouvant près de la localité turque Kadyköi (Khalkedon en antiquité) représente la source utilisée pour les intailles antiques de couleur bleue saphirinique translucide. Cette localité représente l'occurrence classique de la calcédoine et qui à donnée son nom au minéral (Khalkedon). Il semblerai que l'idée qui nous avions eu au départ de cette étude, c'est à dire que la calcédoine de Trestia, Roumanie, aurait pu être la ressource des intailles bleues de L'Hérmitage, n'est plus fondée, malgré la similitude de couleur, homogénéité et genèse.

Pour appuyer notre affirmation concernant la provenance (Kadyköi, Turquie) de la calcédoine utilisée dans la confection des intailles de l'Hérmitage des analyses par méthodes non destructives (analyse spectroscopique, analyse avec la microsonde électronique) devraient être effectuées. Ainsi, une similitude de composition en éléments rares et disperses entre la calcédoine employée pour la confection des intailles et le gisement de calcédoine de la localité Khalkedon (Kadyköi, Turquie), serai sans appel.

A ce jour, nous ne connaissons pas les réserves en calcédoine bleue de Kadyköi (Turquie) mais nous pouvons affirmer que les réserves de calcédoine similaire de Trestia (Roumanie), de qualité gemmologique utilisable pour la confection des intailles ou gemmes, sont encore intéressantes.

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MINERALOGICAL STUDIES ON ROMAN CERAMICS FROM STUPINI (BISTRIŢA-NĂSĂUD COUNTY)

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Abstract. The paper presents the archaeological and mineralogical (structural-textural and compositional) characteristics of Roman ceramics identified in the Dacian-Roman settlement from Stupini (Bistriţa-Năsăud county). Based on the mineralogical transformations reflected by the optical and X-ray structural analyses, the technological process used for Roman ceramics, i.e. the forming method used and the maximum temperatures reached during firing could be established. According to the mineralogical and petrographical composition of the ceramic body (crystalloclasts, lithoclasts, and ceramoclasts), potential source areas could be defined for the specific raw materials.

Introduction

The ceramics under study was collected from the archaeological site from Stupini, located in the southern part of Bistriţa-Năsăud county, north-eastern Transylvanian Plain. The exact location of the site is north from Stupini locality, between Stupini and Brăteni, on the left side of the Brătenilor brook; the site covers an area of several hectares, on both sides of Bânda Valley, on the terraces and smooth slopes delimited by brooks and lower wet, marshy areas.

Archaeological features

The Dacian-Roman settlement from Stupini (Bistriţa-Năsăud county) was discovered in 1995. Its southern exposure provided optimal conditions for periodical inhabitation, starting with the Bronze Age until the VIIIth-IXth centuries A.D.

The chronological assignment of the various levels within the settlement was done based on ceramic rests, showing a wide range of shapes, and on the metallic artefacts: two knife blades, one iron sickle, a bronze needle, as well as several small iron knives; among the weapons, a javelin and a spear end. Besides one fibula showing a clearly shaped outline, at the top of the G9 pit a bronze fibula with facetted body and the arch decorated with the flying bird motive was identified and dated as middle of the IIIrd century A.D. (Gaiu, 1999).

The investigated ceramics was recovered from the Roman cultural level of the Stupini site („Fânaţele Archiudului") and it was registered as museum samples in the collection of the

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Bistriţa-Năsăud Museum Complex. No previous research has been carried out on this ceramics. The ceramic samples have been provided for study by archaeologist dr. Corneliu Gaiu.

Geological framework

The deposits cropping out in the proximity of the Stupini archaeological site are represented by sedimentary rocks (Miocene and Quaternary in age): carbonatic clays, sands, tuffs, and sandstones (Geological Map of Romania, Sheet 11, Bistriţa, 1967). The sedimentary formations were deposited on a metamorphic basement consisting of rocks affected by several tectonic stages that outline of the current structural framework.

Samples and methods

The mineralogical investigations were performed on 15 samples (S1 to S15). The macroscopical and microscopical characteristics (ceramics' physiography and phase composition) of the samples have been defined. The methods used are transmission polarized microscopy and X-ray diffraction – the latter for an accurate identification of the doubtful minerals according to optical microscopy, and thus for defining the firing temperature. The equipment consisted in a Nikon Eclipse E200 microscope, a Jenapol transmission polarizing microscope, and a Dron3 diffractometer with Cu anticathode and Ni filter, using a $ë_{K\alpha}$=1.54051Å monochromatic beam.

Macroscopic characterization of the ceramic samples

Variously coloured fragments (splinters) consisting of fine, semifine or coarse materials represent the Roman ceramics from Stupini. The thickness of the ceramic walls ranges from 3.5 mm (S15) to 12.5 mm (S1).

The fine ceramics (type I) is heterogeneous, and chromatically it varies from grey (fig. 1) to yellowish-reddish. This group consists of two grey samples (S11 and S13) and one light brick-coloured (S9). The ceramic matrix is compact, homogeneous, slightly porous and smooth, traces of the potter's wheel being noticeable in samples S9 and S13 (where, in the break, a series of elongated pores could be observed).

The semifine ceramics (type II) shows a homogeneous, compact, well-blended and slightly porous ceramic matrix. The ceramic body has a heterogeneous colour, varying from reddish – brick-like to yellowish-reddish and to grey. Five of the studied samples are coloured brick-like, while one sample is grey. Lithoclasts below 2 mm in size (excepting samples S5 and S10), and ceramoclasts – in general below 2 mm in diameter (in samples S1, S2, and S5) can be noticed in the break. Striations, usually with a parallel display, are visible on the ceramics' walls as a result of processing on the potter's wheel, as well as brownish-reddish coloured slip traces (only in sample S3, fig. 2). In sample S1 the internal part of the ceramic break shows a grey colour, as a result of firing.

The coarse ceramics, processed by wheel *(type IIIa)* or by hand *(type IIIb)* presents a yellowish-brick-like or grey to black coloured, porous and heterogeneous ceramic matrix, with elongated pores in samples S7 and S14 (fig. 4). By naked eye, lithoclasts usually up to 3 mm in diameter, and ceramoclasts can be identified in almost all the samples (for example, S7). Traces of processing by potter's wheel are noticeable in samples S4, S15, and S12 (fig. 3).

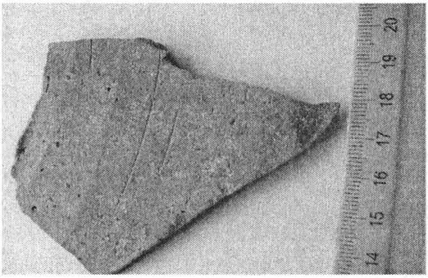

Fig. 1. Sample S13

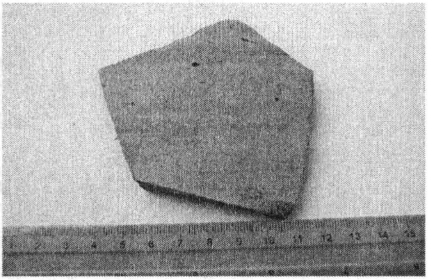

Fig. 2. Sample S3

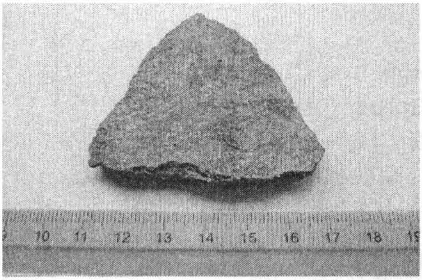

Fig. 3. Sample S12

Fig. 4. Sample S14

Ceramic's grain size analysis

By plotting the measured data (obtained by planimetry) in the ternary A(renite)-L(utite)-S(ilt) diagram (fig. 5), the Roman ceramics from Stupini can be defined as fine (samples S9, S11, and S13), semifine (samples S1, S2, S3, S5, S6, and S10), and coarse (samples S4, S7, S8, S12, S14, and S15). This classification is based on the ratio between the main components: matrix, crystalloclasts, lithoclasts, bioclasts, and ceramoclasts. About 20% of the total samples are represented by fine ceramics, the semifine and the coarse ones being present in equal amounts (about 40%).

In all the investigated samples, lutite is the dominant size fraction (about 58%). Most of the samples represent the mixed, lutitic-siltic, sometimes arenitic-type, being accordingly assigned to fine, semifine, or coarse ceramics (the „coarse" appearance is mainly due to the presence of ceramoclasts used as filler).

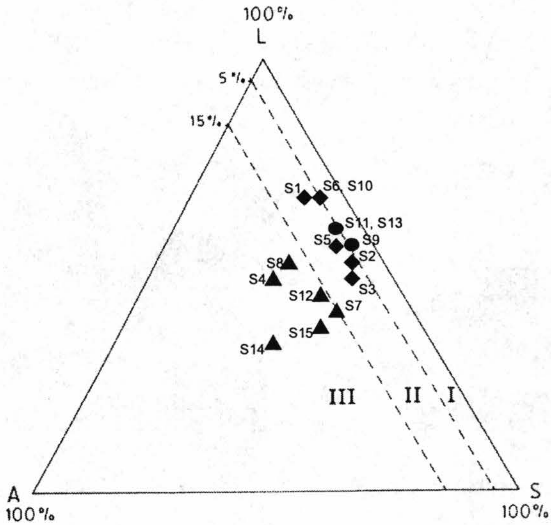

Fig. 5. The grain size distribution of the Roman ceramics from Stupini archeological site as defined by the ternary A-L-S diagram
(I – fine ceramics; II – semifine ceramics; III – coarse ceramics).

Petrography and mineralogy of the ceramics from Stupini

The presentation follows the three types defined according to the grain size distribution: fine, semifine and coarse ceramics.

Type I – fine ceramics

The matrix is amorphous-microcrystalline and consists of a vitreous phase and clay minerals transformed into amorphous mass. An oriented texture is noticeable along the whole ceramic body, except in sample S13 where the internal part shows a chaotic texture followed by an area with outwards oriented lamellae, trend that is more obvious on the external surface. The porosity is relatively low.

The matrix embedded crystalloclasts (quartz, plagioclase and orthoclase feldspars, microcline only in sample S13, relatively large amounts of muscovite in samples S11 and S13, and subordinate amounts biotite, titanite, apatite, and opaque minerals), lithoclasts (table 1) in all the samples (heteroblastic quartzite, quartzitic sandstones with "limonitic" or carbonatic cement, slightly thermally transformed micritic limestone, or "limonite"-rich soil concretions). The ceramoclasts were noticed only incidentally in sample S9, while bioclasts (microfossils with carbonatic tests, slightly affected by the thermal treatment) were noticed only in sample S13 (figs. 6, 7).

The firing temperature, interpreted based on mineralogical features (Ghergari et al., 1999a, b) was between 850-900° C.

Table 1. Structural characteristics of the fine ceramics (type I) from Stupini and data on the filler

Sample	Grain size fractions					Filler			
	Arenite	Silt	Lutite	Maximum Φ (mm)	Structure	Litho-clasts	Calci-clasts	Bio-clasts	Ceramo-clasts
S9	4	36	60	< 0.3	Lutitic-siltic	+	+		+
S11	5	35	60	< 1	Lutitic-siltic	+			
S13	5	35	60	< 0.9	Lutitic-siltic	+	+	+	

Type II – semifine ceramics

The semifine ceramics is very similar to the fine ceramics, because the arenite content is only 1-2% over than the formal limit between the two ceramic classes (table 2).

Table 2. Structural characteristics of the semifine ceramics (type II) from Stupini and data on the filler

Sample	Grain size fractions					Filler			
	Arenite	Silt	Lutite	Maximum Φ (mm)	Structure	Litho-clasts	Calci-clasts	Bio-clasts	Ceramo-clasts
S1	6	30	64	< 1	Lutitic-siltic	+			+
S2	6	35	59	< 1	Lutitic-siltic	+	+	+	+
S3	7	35	58	< 1.75	Lutitic-siltic	+	+		
S5	6	34	60	< 1.25	Lutitic-siltic	+	+	+	+
S6	5	30	65	< 1.5	Lutitic-siltic	+			+
S10	5	30	65	< 0.6	Lutitic-siltic	+	+		+

The amorphous-microcrystalline ceramic matrix (figs. 8, 9) consists of an amorphous mass produced by the collapse of the clay minerals at high temperatures and the formation of glass via the reaction between the amorphous phase and calcium oxide resulted by calcite decomposition. Most of the samples show an oriented texture along the full width of the ceramic body, which is an argument for forming by wheel. Some samples display a circular orientation of the clasts in the central part of the ceramic wall that, towards the margin, gradually passes into a parallel orientation to the wall surface (samples S1, and S6). It is possible that clay rolls have been also used for shaping the ceramic bowls. The porosity is low. The voids within the ceramics show irregular shapes, they are usually elongated (primary pores), but also form rings around lithoclasts that underwent volume decrease by firing. Crystalloclasts of quartz, plagioclases, and rarely microcline and orthoclase (S1), muscovite, Fe-depleted biotite, and calcite strongly affected by thermal treatment (excepting samples S1 and S6 where calcite was fully decomposed by firing), subordinately garnets (S2, S3), anatase (S2), pyroxenes and brown hornblende (S10) are present in the ceramic matrix. The lithoclasts (table 2) are represented by the following rock types: microblastic quartzite, gneiss, quartz-muscovite schist, granite, microgranite, granodiorite, andesite with pilotaxitic groundmass (S3), clayey sandstone, sandstone with carbonate-clayey cement transformed into gehlenitic glass, micritic limestone strongly thermally affected, vitroclastic tuff, and "limonite" aggregates (probably of pedogenic origin, in samples S5, S6, and S10). Ceramoclasts are rare (1-2%) in almost all the samples, except S1 where the amount is about 5%, and S3, which is lacking ceramoclasts. Bioclasts such as nannoplankton and some microfossils were noticed in samples S2 and S5.

The firing temperatures for the semifine ceramics fall within the 850-950° C interval.

Type IIIa – Coarse ceramics processed by wheel

This ceramics type presents an amorphous-microcrystalline matrix with a mineralogical composition dominated by kaolinite, and subordinate illite. The texture is slightly porous, with elongated pores resulted by fast drying. The mica lamellae, as well as some fine drying cracks show a parallel display to the ceramic wall, pleading for processing by potter's wheel (figs. 10, and 11).

Table 3. Structural characteristics of the coarse ceramics processed by wheel (type IIIa) from Stupini and data on the filler

Sample	Grain size fractions					Filler		
	Arenite	Silt	Lutite	Maximum Φ (mm)	Structure	Litho-clasts	Calci-clasts	Ceramo-clasts
S4	22	20	58	< 1.2	Lutitic-arenitic- siltic	+		+
S12	16	28	56	< 2	Lutitic-siltic-arenitic	+	+	
S15	17	30	53	< 0.8	Lutitic-siltic-arenitic	+		

In samples S4 and S15 the ceramic matrix contains crystalloclasts of volcanic origin: twinned plagioclases ± glass inclusions, sometimes zoned, pyroxenes, brown hornblende, biotite, opaque minerals, and additionally quartz and muscovite, while in sample S12 quartz, plagioclase, orthoclase, muscovite, Fe-depleted biotite, garnets and titanite have been identified. The lithoclasts (table 3) consist of basaltic andesites with intergranular or intersertal groundmass, andesites with pyroxenes and pilotaxitic groundmass, andesites with brown hornblende and microcrystalline groundmass, besides which granites, microblastic gneisses, microblastic quartzites, quartzitic schists, and biotitic hornfels (samples S4 and S15) have been also identified. Sample S12 contains lithoclasts of heteroblastic quartzites, gneisses with garnets, rhyolite with microcrystalline, trachitic, or altered intersertal groundmass, micritic limestone thermally affected, and siltite transformed into hornfels. The ceramoclasts are rare and were noticed only in sample S4.

The firing temperature was around 900° C.

Type IIIb – Coarse ceramics processed by hand

The structure of the ceramics is amorphous-microcrystalline, the brownish matrix consisting of sintered clay with noticeable birefringence, besides isotrope aggregates of clay minerals transformed into amorphous mass (collapsed structures). The ceramics has a brecciated texture due to the frequent ceramoclasts that were mixed with the clay as filler, and is slightly porous, showing numerous elongated pores resulted by the fast water removal.

Crystalloclasts (quartz, plagioclases of volcanic origin, fine muscovite lamellae, rare biotite, zoisite, anatase, and opaque minerals; in particular, pyroxenes, brown and green hornblende in sample S8, and calcite in samples S7 and S14) are present in the matrix. The lithoclasts consists of andesites with pyroxenes, basaltic andesites with intersertal groundmass, or pilotaxitic with devitrified glass, silicified rocks, and heteroblastic quartzites (in sample S8, figs. 12, and 13). In sample S7 andesites, dacites and quartz aggregates were identified, while the lithoclasts in sample S14 have a different origin, consisting of: marble, micritic limestone slightly thermally affected, zeolitized tuff, volcanic glass, micaschist, and heteroblastic quartzite. All the samples contain variable amounts of pedogenetic "limonite" concretions. Also ceramoclasts (table 4) were noticed in all the studied samples.

The firing temperature is considered to have been lower than 850°C.

Table 4. Structural characteristics of the coarse ceramics processed by hand (type IIIb) from Stupini and data on the filler

Grain size fractions					I	
nite	Silt	Lutite	Maximum Φ (mm)	Structure	Litho-clasts	Cal clas
	30	55	<2	Lutitic-siltic-arenitic	+	+
	25	59	<2.6	Lutitic-siltic-arenitic	+	
	25	45	<2	Lutitic-arenitic-siltic	+	+

X-ray diffraction (XRD) analyses

Concerning *type I – fine ceramics,* the diffractograms obtained on the three samples (fig. 14) evidence the following minerals that did not undergo thermal transformations: quartz (complete pattern), feldspars (indicated by the most intense peaks) and micas only in samples S11 and S13 (the most intense peaks), calcite (with the most intense peak, at 3.03 Å and only in samples S11 and S13). The absence of the micas in the pattern of sample S9 is a consequence of their reduced amount. The clay minerals were thermally transformed, the only remaining peak (corresponding to 020) being that at d=4.50 Å. The intensity of this peak increases from sample S9 to S13, pointing to a decrease of the firing temperature. We assume a firing temperature of about 900°C in the case of sample S9, and of about 850°C for the other two samples.

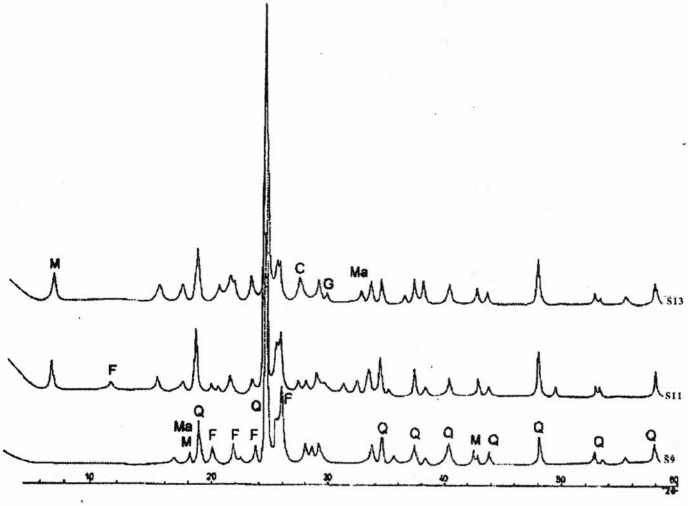

Fig. 14. Diffractograms of the samples of fine ceramics from Stupini.
Q – quartz; F – feldspars; M – micas; Ma – clay minerals; C – calcite; G – gehlenite.

The diffraction patterns of the semifine ceramics – type II samples (Fig. 15), are similar concerning the presence of the main minerals, not affected by the thermal treatment, i.e. they show the complete pattern for quartz and a small number of peaks corresponding to feldspars. The largest amount of feldspars was evidenced in samples S3 and S10, and the lowest amount in samples S1 and S6. Micas were noticed only in four samples (S1, S2, S5, and S6), even if microscopically they were present in all the studied samples (as a consequence of the reduced sensitivity of the XRD method for phases present in small amounts). Neoformed minerals, such as hematite (samples S1, S2, and S5), and gehlenite (ubiquitous in all the samples in various – but in general low – amounts), and calcite, present in very small concentrations in samples S1 and S6 (but not evidenced in thin sections) were identified in the XRD patterns. The only peak we could assign to the clay minerals, which underwent structural collapse under firing, was the line at d=4.5 Å that becomes extinct in the 800-900° C temperature interval. The XRD data suggest that the firing temperature was above 800° C but did not go over 900-950° C.

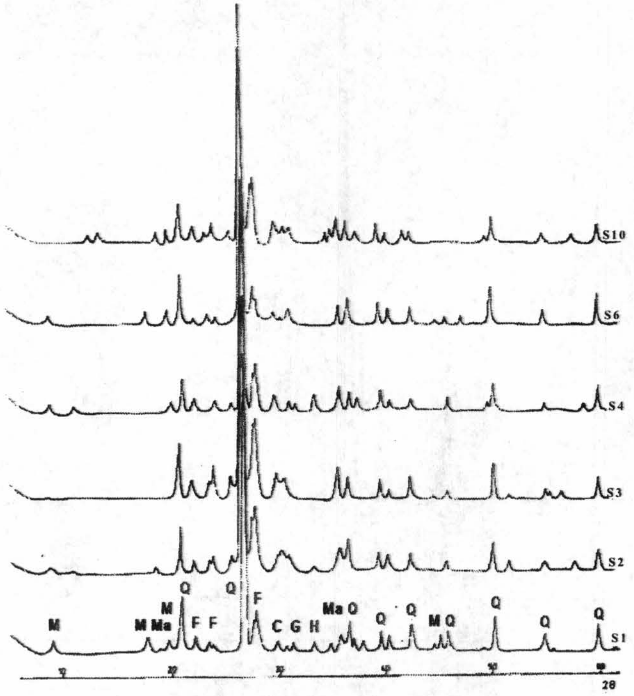

Fig. 15. Diffractograms of the semifine ceramics samples from Stupini. Q – quartz; F – feldspars; M – micas; Ma – clay minerals; C – calcite; H – hematite; G – gehlenite.

The diffraction patterns obtained on the samples of coarse ceramics processed by wheel (type IIIa) (fig. 16) show the presence of quartz (complete pattern) and of feldspars (indicated by the most intense lines). The main peaks of the micas (at d=10 Å, and respectively 5 Å) are present only in the pattern of sample S15, even if micas were noticed, in relatively smaller amounts, in all the other samples. The main peak of calcite (at d=3.03 Å) occurs only in the pattern of sample S15. Microscopically, calcite as a lithoclast consisting of strongly thermally affected micritic limestone was identified also in sample S12. Hematite and gehlenite represent the neoformed minerals identified by XRD via their most intense peaks (samples S12 and S15). Concerning the clay minerals, only the 020 peak (d=4.50 Å), typical for the phyllosilicates, is visible, the rest of the structure missing due to the effect of the thermal treatment. One can assume a firing temperature interval of 800-900° C in the case of all the samples.

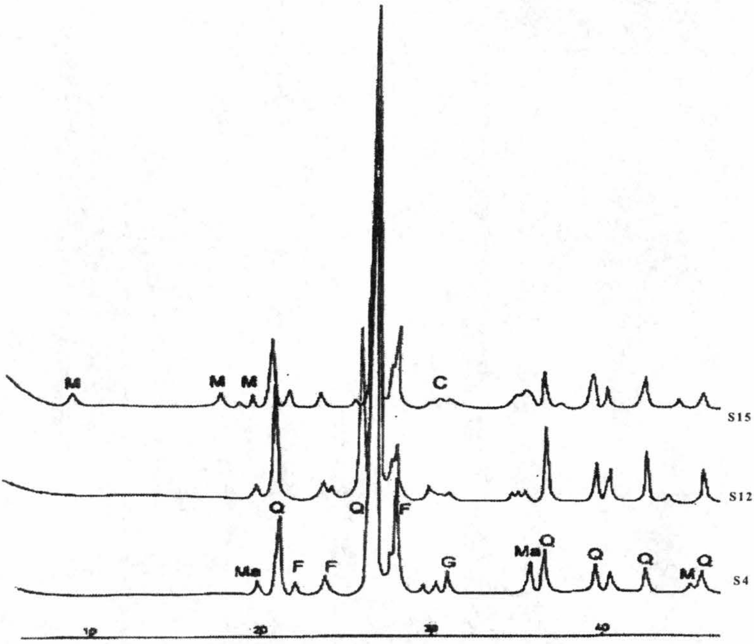

Fig. 16. Diffractograms of coarse ceramics processed by wheel from Stupini. Q – quartz; F – feldspars; M – micas; Ma – clay minerals; C – calcite; G – gehlenite.

Similar diffraction patterns were obtained on the samples of coarse ceramics processed by hand – type IIIb (fig. 17). Among the minerals that did not undergo thermal transformations one can mention: quartz (complete pattern), as well as feldspars and micas (indicated by their most intense lines). The most intense peak (d=3.03 Å) of calcite is present in samples S8 and S14. The neoformed minerals are represented by hematite (in samples S7 and S8) and gehlenite – the latter in all the samples. The basal lines of clay minerals are missing, only the common phyllosilicates line at d=4.50 Å being present. Accordingly, one can assume a firing temperature of about 800-850° C in the case of sample S14, and respectively of 850-900° C for the rest of the samples (S7, S8).

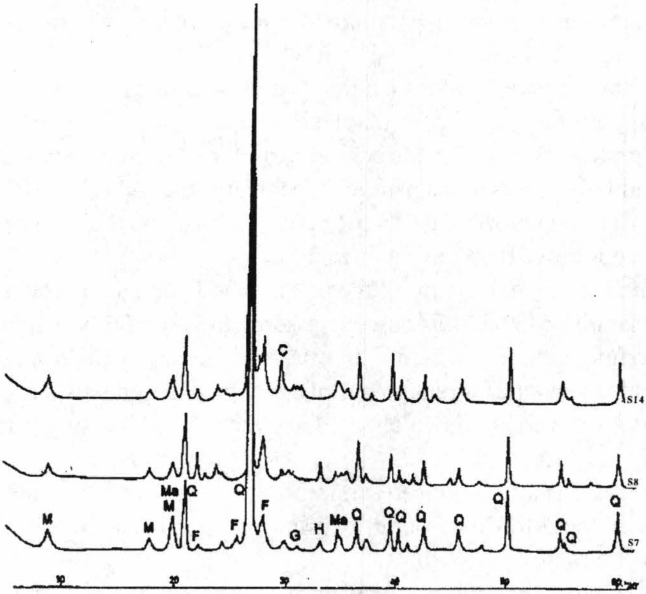

Fig. 17. Diffractograms of coarse ceramics processed by hand samples from Stupini.
Q – quartz; F – feldspars; M – micas; Ma – clay minerals; C – calcite; H – hematite; G – gehlenite.

Conclusions

The fragments of Roman ceramics under study, collected from the archaeological site from Stupini are lacking ornamentation, except of one single sample (S3) that shows brownish-reddish slip traces. In most of the cases, except for samples S7, S8 and S14, the internal ceramic wall presents parallel striations pointing to possible processing by using potter's wheel. Microscopically, the ceramic body consists of a sintered clayey matrix, sometimes slightly vitrified, which embedded crystalloclasts, lithoclasts (fragments of magmatic, metamorphic, and sedimentary rocks), and ceramoclasts used as filler, bioclasts (microfossils with carbonate tests in sample S11, nannoplankton and microfossils in samples S2 and S5). The ceramic matrix, consisting of kaolinite and illite has an amorphous-microcrystalline structure in all the investigated samples.

Based on the ratios between the lutite-silt-arenite grain size fractions, the Roman ceramics from Stupini can be classified as fine, semifine and coarse. The crystalloclasts, lithoclasts and ceramoclasts from the matrix range between 0.3 and 3 mm in diameter.

When studied in transversal section, perpendicular to the ceramic wall, the ceramics shows oriented, semi-oriented or unoriented (chaotic) textures. According to the orientation of the lamellar minerals (micas and clay minerals) inside the ceramic body, the samples can be grouped as follows:

a. a good orientation parallel to the ceramic wall (in samples S2, S3, S4, S5, S9, S10, S11, S12, and S15) points to ceramics' processing by potter's wheel.

b. in some samples (S1, and S6), the central part of the ceramic body shows a circular orientation that gradually passes into a parallel one towards the ceramic wall. It may be that the corresponding fragments originate from the curved part of the ceramic vessel, less affected by the circular movement during forming.

c. an unoriented area in the centre of the ceramic body and an oriented area towards the external wall (sample S13). In this case we assume the possibility that clay rolls were attached to the ceramic wall, for changing the shape of the vessel (its neck or its base).

d. the unoriented (chaotic) arrangement of the lamellar minerals suggests that clay boulders of various sizes were used, which were shaped by hand pressing (samples S7, S8, and S14).

The thermal transformations noticed at microscopic scale in the ceramic matrix and in the clasts, as well as the XRD data point to firing regimes between 800-950°C for the Roman ceramics under study.

The correlation of the mineralogical-petrographical features of the litho- and crystalloclasts identified in the ceramic samples with the lithological framework of the Stupini area points to the usage of local raw materials (clay and filler), represented by Sarmatian and Quaternary deposits.

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Rezumat. În articol este prezentat un material ceramic descoperit în aşezarea daco-romană de la Stupini (judeţul Bistriţa-Năsăud) şi anume caracteristici arheologice şi mineralogice (structural-texturale şi compoziţionale) ale acestuia. Pe baza modificărilor mineralogice reflectate de caracteristicile optice şi roentgen-structurale, s-au putut stabili condiţiile tehnologice de obţinere a ceramicii romane, respectiv tipul de modelare şi

temperaturile maxime atinse în timpul tratamentului termic. În funcţie de compoziţia mineralogică şi petrografică a ciobului ceramic (cristaloclaste, litoclaste, ceramoclaste) pot fi conturate zone din care este posibil să provină materiile prime utilizate.

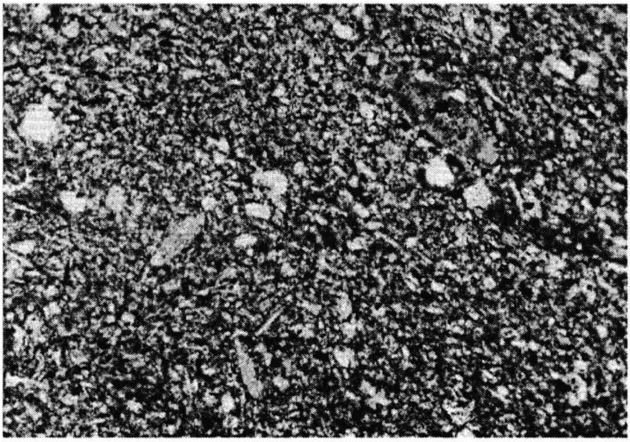

Fig. 6. Grey fine ceramics from Stupini (Sample S13). Amorphous-microcrystalline structure and oriented texture. Calcitic bioclasts, partly affected by thermal transformations, are also visible. 1N; 100 X.

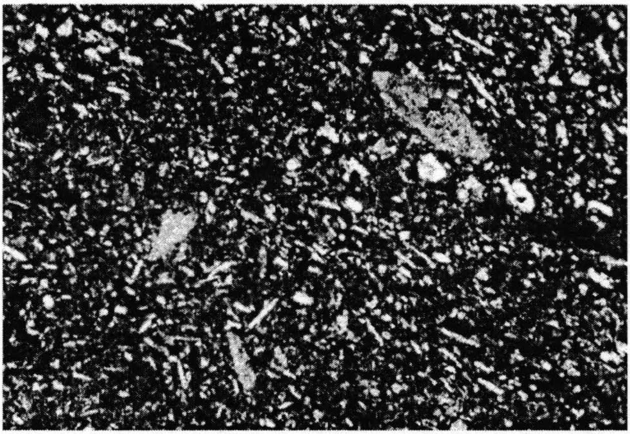

Fig. 7. Idem Fig. 6, N+, 100 X.

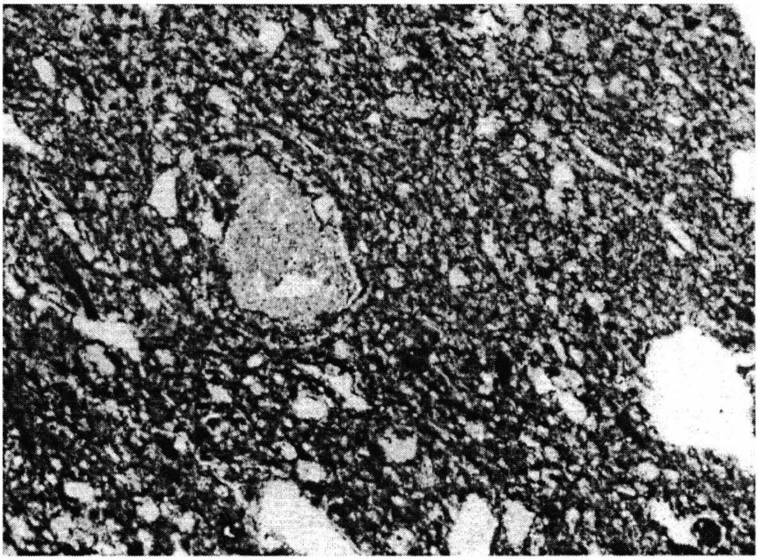

Fig. 8. Yellowish-brick-like coloured semifine ceramics from Stupini (Sample S3). Amorphous-microcrystalline structure and oriented texture. A lithoclast consisting of slightly thermally affected micritic limestone is visible. 1N; 40 X.

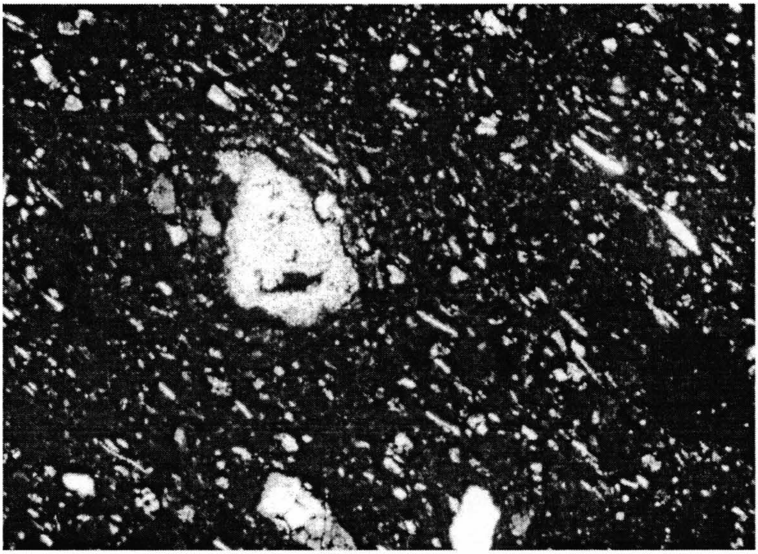

Fig. 9. Idem Fig. 8, N+, 40 X.

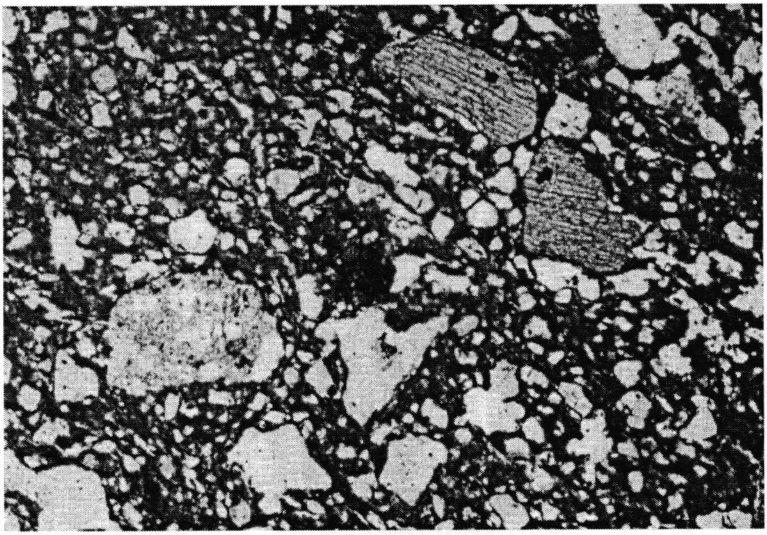

Fig. 10. Grey coarse ceramics processed by wheel from Stupini (Sample S4). Amorphous-microcrys-talline structure, with numerous embedded lithoclasts and crystallo-clasts, and relatively oriented texture. In the upper right corner, two pyroxene crystalloclasts are visible. 1N; 40 X.

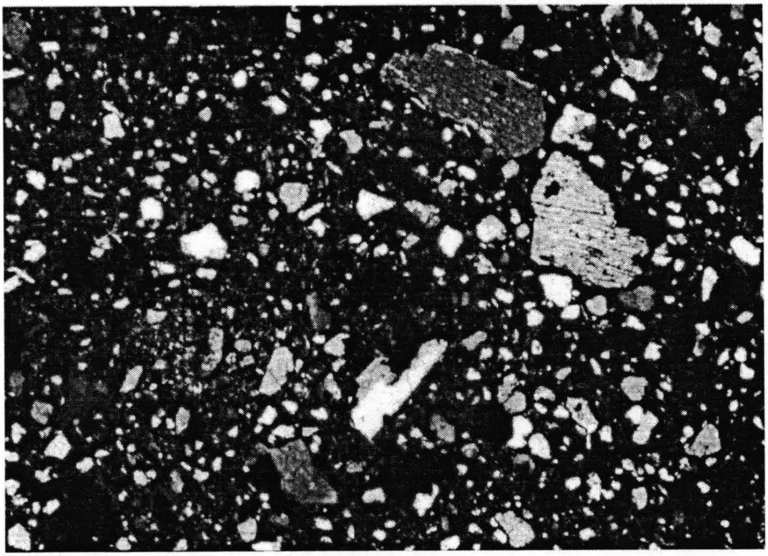

Fig. 11. Idem Fig. 10, N+, 40 X.

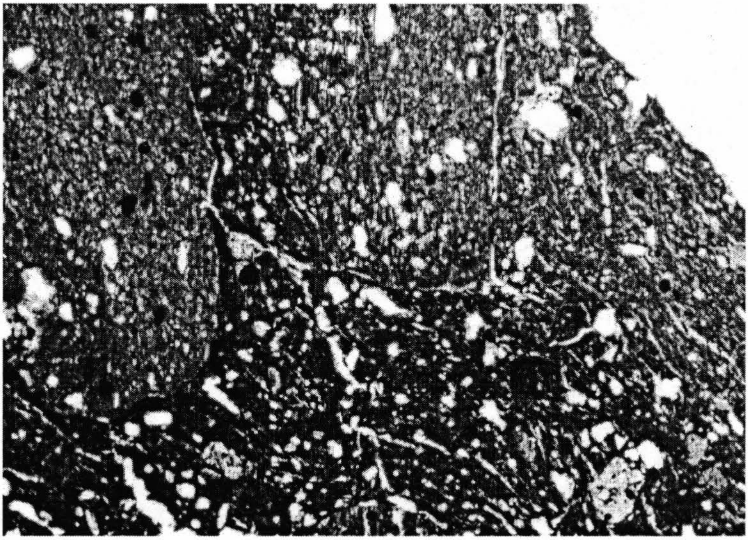

Fig. 12. Yellowish-brick-like coloured coarse ceramics processed by hand from Stupini (Sample S8). Amorphous-microcrystalline structure with frequent ceramoclasts and lithoclasts (upper right corner: heteroblastic quartzite). Non-oriented (chaotic) texture. 1N; 40 X.

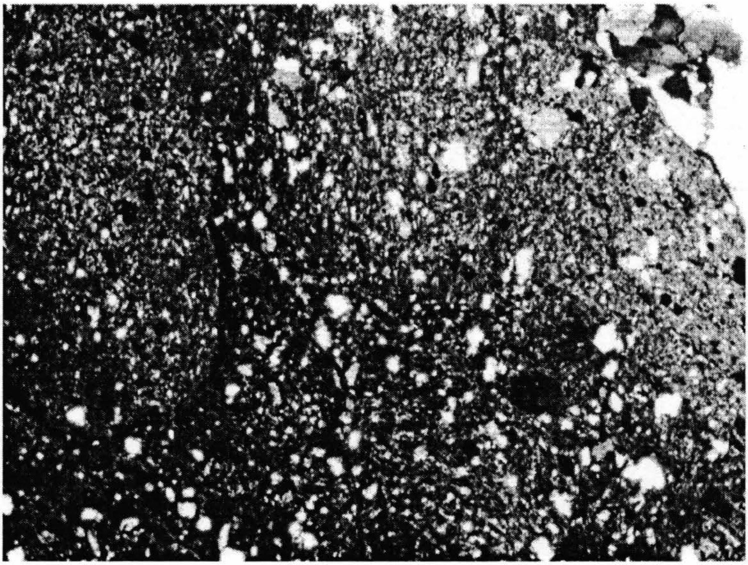

Fig. 13. Idem Fig. 12, N+, 40 X.

ETNOPETROGRAPHY, GEOLOGY ENVIRONMENTAL, LITHOSTRATIGRAPHY

Studii şi cercetări, Geology-Geography 11, Bistriţa, p. 65-69

MENHIRS EN ROUMANIE

Ioan CHINTĂUAN*

L'utilisation des roches dans la production artisanale des objets utilitaires et symboliques, en Roumanie et ailleurs, a été un des sujets que nous avons traité dans nos ouvrages antérieurs (Chintăuan, 2000, 2002, 2003, 2005).

Dans «L'Ethnopétrographie. Culture populaire et religion en pierre» (2005), nous avons proposé un nouveau concept, une nouvelle discipline: l'Ethnopétrographie. Nous avons fait ça, tout en précisant les directions de cette nouvelle voie, sans définir ses limites entre deux sciences déjà consacrées: l'Ethnographie et la Pétrographie.

Cette nouvelle discipline – l'Ethnopétrographie – de l'objet artisanal fait traditionnellement et celle de la roche utilisée pour sa création, a reçu ainsi un nom et une position. L'apparition des objets d'étude de cette science – outils, armes, objets de culte et utilitaires – a débuté à l'aube de l'époque des Hominidae et continue aujourd'hui. L'intérêt de l'étude de ces objets en pierre est soutenu aussi par leur large distribution: européenne, voir mondiale.

Une place privilégiée parmi les créations humaines en pierre ont «les monuments et les constructions mégalithiques». Avec une origine, age et significations troublées par l'incertitude, ces créations sont dispersées au niveau mondial. Parmi elles, les «menhirs» – menhir, mot d'origine celte issu du duo «men» (pierre) et «hir» (long) – sont les plus répandus et /ou les mieux aperçus, ayant une remarquable longévité parsemée par des formes matérielles différentes avec une symbolisation proche. Ces formations, dans leur forme d'origine ou modifiés, dominent le spectre de quatre types principaux de «mégalithes»: menhirs, dolmens, cromlechs et alignements. Leur distribution en Europe, les caractéristiques des sites «à menhirs», sont détaillés dans nombreux ouvrages (voir Chintăuan 2000, 2002, 2003, 2005). Les communautés fondatrices de cet «art vertical» en pierre, comme le processus de la création et de mise en place de ces «pierres étranges» ou «pierres soulevées» ont une évolution temporo-spatiale trouble, contestée. Les roches utilisées dans la création des menhirs présentent une diversité retrouvée dans les formes comme dans les dimensions de ceux derniers. En règle générale, la forme allongée est prédominante pour les menhirs. Peux modifiés dans leur périmètre européen, les menhirs sont parfois «particularisés» (France, Italie, Grande Bretagne): 1) par le rajout des croix ou des symboles

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de Jésus Christ crucifié ou 2) par leur transformation en croix ou en statues du Jésus Christ crucifié. En France, les premiers sont dénommés «menhirs christianisés» et les seconds, «menhirs chrétiens» (MARC, 1999).

En Roumanie, les menhirs sont peux nombreux. Leur origine, but et classification parmi les autres «pierres soulevées», que nous avons décrits antérieurement de notre pays (CHINTĂUAN, 2000), sont troubles pour l'instant.

Nous avons identifiés deux menhirs dans la Plaine de Transylvanie, à Bidiu et à Archiud (Bistrita-Năsăud). Ces menhirs sont des roches gréseuses allongées, positionnées verticalement:

1) dans le petit jardin situé en bas du cimetière avec des concrétions gréseuses en guise de pierres funéraires et avec une église en bois (aujourd'hui effondrée), à Bidiu, et 2) au carrefour des deux routes qui délimitent la cour de l'école a Archiud. «Quand et pourquoi ont été soulevés ces menhirs?» sont des questions qui nous intriguent et nous stimulent à continuer nos «fouilles». Ces questions restent ouvertes autant pour nous comme pour notre lecteur.

Nous pourrions supposer que leur «géniteur» est la première communauté stable dans cette région (MARINESCU, 2003 – Époque de Bronze). Etouffée par les caprices de la nature, cette communauté aurait eut elle besoin d'un symbole protecteur ou d'un messager auprès du Protecteur avec une durabilité que seulement la pierre pourrait lui conférer? C'est fort possible.

Dans la Plaine de Transylvanie où ils habitaient, ces gens ont trouvé, dans les couches sarmatiennes, la roche appropriée a leur but, la seule ayant un aspect symbolique possiblement sacré: le grès comme concrétions gréseuses. D'autres roches de la plaine, comme le toufe volcanique, la marne, l'argile etc. étaient utilisée dans le bâtiment, mais pas dans le «sacré».

Nous pensons que les menhirs ont eut une distribution couvrant pas seulement la Transylvanie, mais toute la Roumanie. Leur distribution européenne a due être continue comme celle des croix votives en pierre – un autre composant oublié de l'identité des peuples qui nous incite à continuer nos recherches...

Les menhirs sont présents ainsi dans la région de Petrosani (Hunedoara) sous la forme des «dalles soulevées» dans les espaces libres qui entourent les églises de la ville. Nous pensons que les premiers ont apparus dans la court de l'église du cartier Lunca, proche de l'hôpital municipal, et la suivante (chaulée comme beaucoup d'autre pierres soulevées), près de l'église de Dărăneşti, connue aussi comme «l'église du triage», située a 1 km nord de la gare. Madame Maria (Mura) Mitrofan de Bucarest, connaisseuse de la région, a eu la gentillesse de me transmettre des informations concernant les menhirs de cette région. Je n'ai pas eu le plaisir de la connaître personnellement, mais je profite de cette occasion pour la remercier pour son aide valeureux et pour la patience de m'avoir lu. Elle m'a apri que, il y a approximativement trente ans près de l'église de Dărăneşti, elle a vu un group de plusieurs (5-6) «dalles soulevées», avec une hauteur dépassant parfois les deux mètres. Ces objets ont attiré son attention sur la coutume des «momârlani» (les paysans de la région) de placer des «dalles soulevées» sur les tombeaux. A présent, ces dalles n'existent plus, mais la coutume persiste. Dans les régions de montagne et hautes collines de Roumanie, comme Hunedoara, les populations locales ont toujours l'habitude d'enterrer les morts dans le jardin de leur maison et de placer des «dalles soulevées» sur les tombeaux. Sont donc ces formations des pierres funéraires? Mais, dans ce cas, n'auraient elles pas du avoir des inscriptions ou des croix, du moins celles plus récentes? L'absence des inscriptions explicatives (avec une connotation chrétienne?), leur poids, l'hauteur, sont des arguments en faveur de l'encadrement des ces «dalles soulevées» comme menhirs. Intéressant est le fait que, dans la région de Hunedoara (Petroşani, Jieţ, Baru Marc etc.) et de Tara Haţegului, à coté des menhirs «classiques», existent des «menhirs christianisés». Ceux-ci sont des bloques rocheux allongés, positionnés verticalement, finissant par des éléments en bois qui définissent une «troiţă» (croix votive roumaine). Leur origine est placée dans les siècles XVIII-XIX.

Des «menhirs christianisés» ou des croix votives existent dans presque toutes les régions de la Roumanie et ont constitué ou définiront les sujets des autres ouvrages d'etnopétrographie. La signalisation des menhirs de la Plaine de Transylvanie, représentés par des concrétions gréseuses, et des ceux de Hunedoara et Ţara Haţegului, composés de roches cristallines, représente une première sélective dans l'étude des menhirs en Roumanie.

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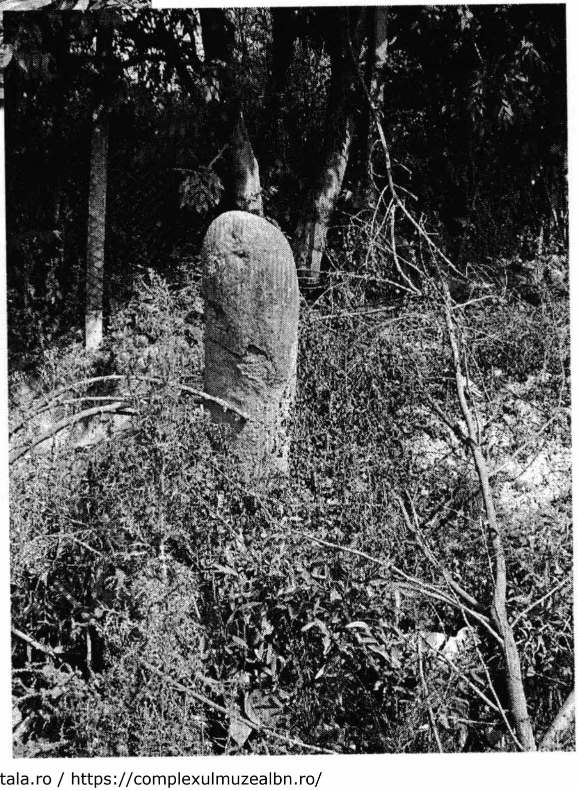
Le menhir de Bidiu (Bistriţa-Năsăud)



Le menhir de Archiud (Bistriţa-Năsăud)

«Menhir christianisé» à Petroşani (Hunedoara)

ENVIRONMENT CHANGES INDUCED BY THE PLIOCENE COAL MINING AT LUPOAIA OPEN PIT (GORJ DISTRICT)

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Abstract. The Lupoaia open pit – located NW from the Motru town (Gorj district) – cross a terrigenous sequence belonging to the Jiu-Motru Formation (Late Dacian – Middle Romanian), including several interbedded lignite layers too. The coal mining in this quarry involves very complex activities with negative impact upon the environment (soil, surface and underground waters, air, flora, fauna and human settlements).
Key-words: Pliocene, coal, mining, Lupoaia open pit, Oltenia, SW Romania.

Introduction

By their combustion qualities as well as by the large supply, the Neogene lignites from Oltenia mean an important resource for the electricity production in power thermal plants. In order to be economically profitable, the lignite exploitation is now performed in several open pits located both in the oriental and occidental Oltenia. Among them, one of the most important is Lupoaia (Gorj district), situated North-West of the Motru town (Fig. 1).

The Lupoaia quarry opens a terrigenous sequence belonging to the Jiu-Motru Formation (Pliocene, *i.e.* Late Dacian – Middle Romanian), including several lignite layers, labelled VI – XIII. The Dacian/Romanian boundary, as well as the Siensian/Pelendavian (*i.e.* Lower/Middle Romanian) one in the Lupoaia quarry had been much disputed (for details, see Petrescu et al., 1989). In the most modern approaches, the Dacian/Romanian boundary was set between the lignite layers VII and VIII and the Siensian/Pelendavian boundary between the lignite layers XI and XII.

The fossil assemblages supporting the above mentioned ages refer to plants, mollusc and some vertebrates. The molluscs (Pană et al., 1981) are especially interesting for stratigraphy. However, the mollusc assemblages are marked by a lot of endemic features which darkens sometimes the stratigraphic correlations. But at Lupoaia, additional valuable data had already been offered by some micromammals collected at the bottom of the VIII lignite layer (Rădulescu et al., 1989).

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The palynology allowed to estimates for the Early Romanian a warm-temperate climate with annual averages of 13-14°C and rainfall averages of 1000-1100 mm (Petrescu et al., 1989).

Such an evolutional context of this region explains the accumulation of exploitable coal supplies between Late Miocene and Pliocene. These deposits had been and still are intensely exploited in the quarries of Oltenia.

Environmental impact of mining activities

The lignite open pit exploitation implies a bulk of very complex activities with direct harmful impact on the environment (flora, fauna, soil and underground rocks, surface and underground waters, air, but also upon the human settlements).

1. The impact on soil and underground rocks

This kind of impact is both local and regional in surface and volume, on long term, and refers to disturbing the physical-chemical balance of the geological environment as a whole. The destruction of soil and underground rocks is the following: the soil layer is retrieved from the agricultural lands, but it is impossible to recover from the deforested lands, and consequently it is destroyed, the rock layers are displaced, excavated, transported and stored on sites located tens and even hundreds meters away; the resulting mining masses, wastes and useful materials, acquire geotechnical features different from those of the initial bedrock. The stored tailings create new slumping and stability effects within the new emplacements. The physical-chemical disequilibrium of the subsoil produced by excavations and dumping extends also in areas next to the mining site, soil degradation and decrease of its fertility class on large surfaces, by changing the initial purpose of agricultural or forest lands and organizing the activities associated to the exploitation.

The quality of soils in the mining and dumping perimeters is entirely modified by direct and related activities of lignite exploitation. The same situation concerns the underground, where the exploitation activity actually destroys the geological initial environment.

The potential environmental impact on soil and underground is related to the accident or catastrophes risks, referring more exactly to the risk of some environmental accidents resulting in the ignition of the coal deposits; accidents or catastrophes which can lead to major disturbances of the geological environment; aquiferous interferences, infiltration of pollutants coming from the surface. Implementation of some managing measures and exploitation technologies which do not limit the effective *„in situ"* action to the necessary level and which are not adapted to the peculiarity of the local geological structure, can generate the development and variation of the complexity of coal exploiting/mining activity on soil and underground.

The impact induced by coal exploitation activities in the Lupoaia open pit on the geomorphology and landscape is a regional one, both surface and volume, long lasting and refers to: adjustment of the relief due to the excavation and dumping activities, thus creating some cases of anthropic relief reversal; natural relief modification into "lunar"-type industrial landscape.

The reserves of the coal deposit are limited in time. An uncontrolled activity, within a short period of time can lead to a rapid depletion of the coal deposit, as much as the coal is not a natural regenerating fuel.

The exploitation requirements, meaning the selection of the exploitation method, the optimal machines operation, quality, physical state, performances and peculiarity of the exploitation facilities according to the deposit conditions are the control factors that can positively or negatively influence the equilibrium environmental conditions of the deposit.

We also mention that exploitation of this deposit had been and will be performed in compliance with the licences of the competent authorities (at present, the ANRM – National Agency of Mineral Resources).

2. The impact on the surface and underground waters

The impact produced by the coal mining activities within the Lupoaia quarry upon waters is local but also regional, temporary as well as a long term one, and refer to:

– **the surface waters**, in which case there are observed changes of the natural valleys, of rivers and creeks; disappearance of some creeks trough mining and dumping actions; remodelling of the permanent or torrential water courses by floods control, sewage, embankments, consolidations, course deviations, changes of the surface waters quantitative regime – by the increase of the Lupoiţa river flow, determined by the output of waters in the quarry, the increase of the dilution degree of surface waters as a consequence of quarry waters evacuation, modification of surface waters quality from various reasons etc.

– **underground waters**, in which case one observes a change in the physical-chemical balance of waters, produced by the drilling, dewatering and pumping activities during the construction of the water supply drillings, hydro-geological, geological drillings, shafts and other catchments works; modification of the relationships between the aquifers by the change of the flow regime of the underground waters or the appearance of some new supplies and drainage ways, disappearance of some existing aquifers and the appearance of some new ones, due to low work bench marks etc.

The water quality is mainly harmful affected by the activities within the mining exploitation perimeter (NTPA 001 – 2002; NTPA 002 – 2002). A positive effect upon the environment is that induced by flood control and sewage works, having the role of protection against floods, as well as water supply. The potential environmental impact upon the surface waters is related to the accident or catastrophes risk.

3. The impact on air and climate

The impact induced by the coal exploitation activities on air in the Lupoaia open pit is local and temporary, referring to: suspended particles emission; burning gas emissions and sedimentable powder into the air, due to the internal combustion machines works and transport vehicles within the mining perimeter; volatile hydrocarbons emissions etc. The quality of the air is damaged mainly by the suspension dust and sagging solids locally discharged and by the activities within the mining site.

The detailed climatic studies performed had pointed out the impact of the open pit lignite exploitation upon local climatic conditions of the area, related by the occurrence of a peculiar quarry topo-climate characterized by winter cooling and thermal inversions and by the opacity of the air masses, with an effect of indirect radiation increase, in detriment of the direct radiation filtration in summer.

4. The impact upon the ecosystems

The impact induced upon the ecosystems is local, but sometimes regional too, generally long lasting and referring to:

– **flora**: destruction of the local flora as a consequence of soil emptying activities, reduction of the stock of wood by deforestation of the quarry and external dumps, as well as the complete disappearance of the forest ecosystems on these surfaces; decrease of the exploitable wood mass; reduction of the predominant ecosystems equilibrium in the area; decrease of the yield of ecological ecosystems or even the extinction of some vegetal assemblages; restoration of natural vegetation with the species assemblages specific to this area in long periods of time;

– **fauna**: reduced species and individuals richness within the invertebrate fauna; disequilibrium of the ecosystems by the disappearance of some key faunal groups, of some species; numerical decrease of individuals due to the stress factors; migration of the reptiles and terrestrial amphibians in areas located near the exploitation; change of birds spreading area, especially of hatching ones; decrease of the number of mammal species by their migration towards outer bordering areas to the mining site.

The quality of the flora and fauna is affected first of all by a pronounced disequilibrium caused by the complete disappearance, migration or decrease of the number of individuals from most of the species in the mining perimeter under exploitation. The environmental potential impact is maintained during the entire exploitation period, being manifested by a permanent increase of the vulnerability of vegetal and animal species towards the activities developed within the mining site.

5. The impact upon the human settlements

The impact produced by the coal exploitation activities within the Lupoaia mining perimeter, upon the human communities has a complex purpose, with negative but also positive, local and regional effects, and refers to: change of the utilities and regime of land property; partial decommissioning of the villages situated within the sites of the quarry, dump or industrial structures; relocation of the inhabitants with psychological effects and a rootless feeling on people, although the new village surfaces and buildings have better utilities regarding the comfort; change of water sources of the communities, which had once mainly individual wells; temporary and local pollution of the communities with coal powder and dust when the weather conditions favour such spreading; noises and vibrations due to heavy auto traffic; increase of the distances that the relocated inhabitants have to make to the agricultural/forest lands remained in the former surface of the village; industrial landscapes specific to exploitation and dumping during long periods of time (tens of years) instead of the natural ones; instability of some areas and favouring landslides, occurrence of some professional and unprofessional diseases within the populations. As a positive effect we mention the economic and social developments of the neighbouring localities.

Conclusions

As a result of the environmental impact assessment, it should be concluded that the most affected environmental components are the soil, underground waters, flora and human settlements which, in many cases, were completely destroyed. Fauna and air were less affected by the lignite extraction activity, while the surface waters were nearly affected; sometimes the quality of waters discharged from the quarry was even higher than that of the emissary. The socio-economic impact is somewhat positive, and this is one of the main arguments supporting the activities continuity.

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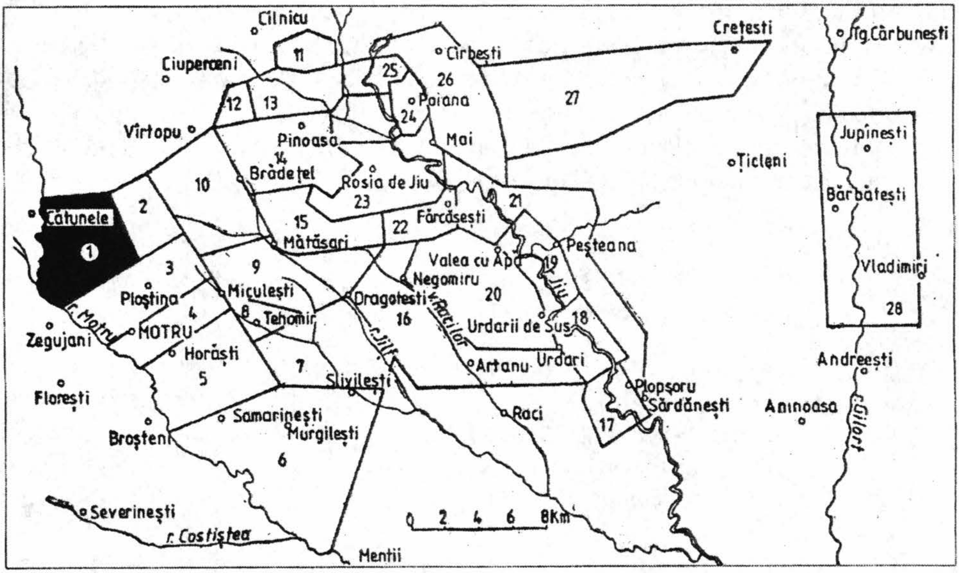

Fig. 1. - Location of Lupoaia open pit area

CONSIDÉRATIONS CONCERNANT LES COMPLEXES CHARBONNEUX DU SECTEUR DANUBE – MOTRU (SUCCESSIONS LITHOLOGIQUES, FACIÈS, RYTHMES)

Florina DIACONU

Résumé: Dans le secteur Danube – Motru sont présents seulement deux complexes charbonneux: le Complexe de Valea Visenilor, caractéristique pour ce secteur et, ayant un développement réduit, le Complexe de Motru.
Durant les forages d'exploration des gisements charbonneux du secteur Danube – Motru, dans la succession lithologique des dépôts daciens et romaniens avec charbons, ont été observées (Diaconu, 2000) des séquences lithologiques de différents types. La fréquence la plus élevée appartient aux séquences du type semblable à celui qui peut être examiné dans le périmètre de l'exploitation à ciel ouvert de Husnicioara, tant dans les forages que dans les affleurements présents sur le versant est de la Dépression de Severin.
La succession des dépôts du Complexe de Valea Visenilor, périmètre Husnicioara, commence avec les Sables de Cocorova, suivent les Sables de Lazu et une couche mince d'argile gris -verdâtre, superposée de la couche I de charbon. Dans la couverture charbonneuse se trouvent des argiles gris -verdâtres, blanchâtres, ensuite du mince gravier et des sables jaunâtres, à laminage oblique, suivies d'argiles et de la couche IV de charbon. La couche IV de charbon est superposée d'un paquet mince d'argiles avec grand nombre d'impressions de plantes (lequel, dans la carrière Husnicioara contient dans sa partie finale les dépôts du Complexe charbonneux de Motru, représentés par des sables), finalement d'une alternance d'argiles jaunâtres, faiblement sablonneuses et de couches minces, déci métriques de charbon, identifiées comme équivalentes des couches V, VI et VII.
Mots clés: complexes carbonneux, secteur Danube-Motru, succession lithologique, faciès, rythmes.

Introduction

La caractéristique principale des dépôts d'âge pliocène d'Olténie est donnée par la présence des charbons qui forment 22 couches. En fonction de leur genèse, l'appartenance à une des trois unités litho stratigraphiques, leur aire de distribution et les couches de charbon d'ici, ont été groupées en trois complexes charbonneux (Andreescu et al, 1985):

– Le complexe de Valea Visenilor (les couches A, D et I-IV) qui appartient à la Formation de Berbesti, d'âge gétièn;
– Le complexe de Motru, le plus important du point de vue économique (les couches V/XIX) de la Formation de Jiu-Motru, d'âge parscovien- roumanien;
– Le complexe de Balcesti, développé seulement dans l'aire centrale du bassin, ayant une importance réduite (les couches XV-XVIII).

Dans le secteur Danube – Motru sont présents seulement deux complexes charbonneux: le Complexe de Valea Vişenilor, caractéristique pour ce secteur et le Complexe de Motru, avec un développement réduit dans le cadre de ce secteur, où apparaissent seulement les couches V-VIII, exploitables seulement dans la partie de nord-ouest (le périmètre minier Motru Vest).

Pour les couches de charbon des deux complexes, pour l'instant sont dessinés et exploités des gisements dans les périmètres Husnicioara (les couches I, III, IV) et Zegujani (la couche no. I).

Succesions lithologiques, facies, rythmes

Entre les gisements énumérés plus haut, le plus représentatif est celui de Husnicioara, où sont exploités à ciel ouvert, par conséquent accessibles à la recherche, les couches principales (I, III, IV) du Complexe de Valea Visenilor, caractéristique pour ce secteur.

Dans les forages d'exploration pour charbon du secteur Danube – Motru, dans la succession lithologique des dépôts daciens et romaniens avec charbons, ont été observées (Diaconu, 2000) des séquences lithologiques de différents types.

La fréquence la plus grande ont les séquences du type semblable à celui qui peut être suivi dans le périmètre de l'exploitation à ciel ouvert Husnicioara, tant dans les forages que dans les affleurements du versant est de la Dépression de Sévérin, qui coupe à l'ouest les dépôts daciens et romaniens.

La succession des dépôts du Complexe de Valea Visenilor du périmètre Husnicioara commence avec les Sables de Cocorova (fig.1) qui forment un paquet uniforme de couleur jaune, à l'épaisseur d'environ 10 m. Sédimenté dans de larges espaces (lacs de grandes dimensions). Le pétro faciès de ces sables est caractérisé par un passage gradué des particules – plus fines vers la base – à des éléments plus épais vers la partie supérieure. De plus, par le rangement parallèle et horizontal des sables, le morpho faciès indique des conditions lacustres.

Au-dessus des Sables de Cocorova se trouvent les Sables de Lazu (fig. 2), blancs, quartzeux, avec une épaisseur de 15-18 m.

La grande dispersion des Sables de Lazu, qui affleurent d' Izvorul Aneştilor vers le sud, jusqu'à Cărămidari vers le nord, lesquels vers l'est sont rencontrés dans les forages jusqu'à Filiaşi (Enache, 1976), ainsi que la grande épaisseur, peuvent être expliqués seulement comme provenant des sables et graviers quartzeux badeniens et sarmatiens de l'ouest, y compris de la Dépression Bahna – Orşova,

Le granule faciès des sables est fin jusqu'au moyen, avec des particules à peu près sphériques, semblables aux sables éoliens ou marins, transportés à grande distance. La grande étendue du lac pliocène a déterminé la formation des vagues et des courants, imprimant un caractère de type marin dans le triage des matériaux.

La succession continue avec une couche mince d'argile gris verdâtre, superposée de la couche I de charbon (fig. 3). Dans la couverture charbonneuse se trouvent des argiles gris verdâtre, blanchâtres ensuite des graviers minces et sables jaunâtres, avec laminage oblique, suivis d'argiles et de la couche IV de charbon (fig.4). Les intercalations sablonneuses d'entre les principales couches de charbon (I et IV), contiennent parfois des sables avec une structure croisée et avec laminage oblique du type delta sous-marin.

La couche IV a dans la zone de l'exploitation à ciel ouvert Husnicioara, des épaisseurs de 6-10 m et est composée de plusieurs bancs séparés entre eux par des intercalations d'argiles grasses, plastiques et d'argiles charbonneux (fig.4). Dans la succession, sur la couche IV de charbon, suit un paquet d'argiles dans lequel ont été identifiées (Diaconu 2000, 2002) nombreuses impressions de plantes (*Glyptostrobus, Carpinus, Salix,* et. al.) dans la partie basale. Les argiles n'ont pas de continuité sur toute la superficie, par endroits les sables et même les graviers s'asseyent discordant sur le charbon. On peut déduire que dans les zones marginales du bassin, dans la phase fluviale, les cours d'eau ont érodé, parfois, les argiles déposées dans les périodes lacustres antérieures.

La partie finale de la succession visible dans l'exploitation à ciel ouvert de Husnicioara comprend les dépôts du Complexe charbonneux de Motru, représentés par des sables et ensuite une alternance d'argiles jaunâtres, peu sablonneuses et de minces couches de charbon, identifiées comme étant les couches V, VI, VII (fig.4). Les sables et notamment les graviers minces sont bien roulés, hétérogènes, avec des dimensions des particules qui indiquent un transport fluvial, au moins dans leur partie inférieure.

Le caractère rythmique (Enache, 1976, Pauliuc et al, 1981, Ţicleanu et al 1997) des dépôts de charbons est évident, aussi comme la distribution des séquences lithologiques, la structure, leur contenu et la répétition cyclique des phases télmatique, lacustre, fluviale et fluvial-lacustre.

D'après Ţicleanu (1992), dans l'évolution du bassin charbonneux pliocène d'Olténie, à cause des oscillations dans l'évolution de la subsidence, se sont succédés plus de rythmes qui comprennent les phases rappelées plus haut, quand se sont formées les principales couches de charbon. La deuxième cause de la rythmicité a été donnée par le mécanisme de divagation fluviale, qui a conduit à la formation des couches plus minces, qui apparaissent en rythmes incomplètes.

Les couches de lignite (I, IV) de l'exploitation à ciel ouvert de Husnicioara, sont couvertes en grande partie avec argiles qui comprennent parfois, du détritus végétal bien conservé et une faune lacustre d'eau douce, constituant la meilleure preuve du fait qu'aux phases télmatiques génératrices de tourbe, suivent les phases lacustres (fig. 5,6). Mentionnons que dans d'autres endroits la couche IV de charbon a dans le toit des argiles avec cardiacées comme j'ai précisé dans un ouvrage antérieur (Diaconu, 2005) ou, comme fait mention Ticleanu et al. (1997), dans le périmètre Izvoru Aneştilor – Livezile, où apparaissent des argiles avec *Prosodacna orientalis, P. stenopleura, P. rumana, P. cucestiensis* etc. Ces argiles représentent la dernière succession des eaux salmastres dans la partie ouest du Bassin Dacique, ultérieurement existant seulement une faune lacustre.

Par endroits, dans le paquet sablonneux -argileux, d'au-dessus de la couche IV de charbon, les travaux d'exploitation ont intercepté une séquence lithologique formée de deux types petrologiques: - de grands blocs de quelques kilogrammes jusqu'à quelques tonnes de grés fin, moyen, ou même conglomératique gris; - concrétions en général sphériques, jaunâtres, formées d'un matériel granulaire avec des dimensions semblables au sable moyen.

Toujours dans les dépôts du Complexe de Valea Visenilor, mais dans des argiles, apparaissent sporadiquement des cristaux de gypse de dimensions centimétriques, les uns maclés (fig. 7,8), qui ont résulté d'un processus d'autoallumage dans les couches V-VII de charbon.

Conclusions

La succession des dépôts du Complexe de Valea Visenilor, périmètre Husnicioara, commence avec les Sables de Cocorova, suivent les Sables de Lazu et une couche mince d'argile gris -verdâtre, superposée de la couche I de charbon. Dans la couverture charbonneuse se trouvent des argiles gris-verdâtres, blanchâtres, ensuite du mince gravier et des sables jaunâtres, à laminage oblique, suivies d'argiles et de la couche IV de charbon. La couche IV de charbon est superposée d'un paquet mince d'argiles avec grand nombre d'impressions de plantes (lequel, dans la carrière Husnicioara contient dans sa partie finale les dépôts du Complexe charbonneux de Motru, représentés par des sables), finalement d'une alternance d'argiles jaunâtres, faiblement sablonneuses et de couches minces, déci métriques de charbon, identifiées comme équivalentes des couches V,VI et VII.

Ce type de succession montre la composition fréquente des rythmes pour les couches principales de charbon du secteur recherché, comme d'ailleurs de toute l'Olténie, et reflète la succession et la répétition des phases: telmatique, lacustre, fluviale et fluvial lacustre.

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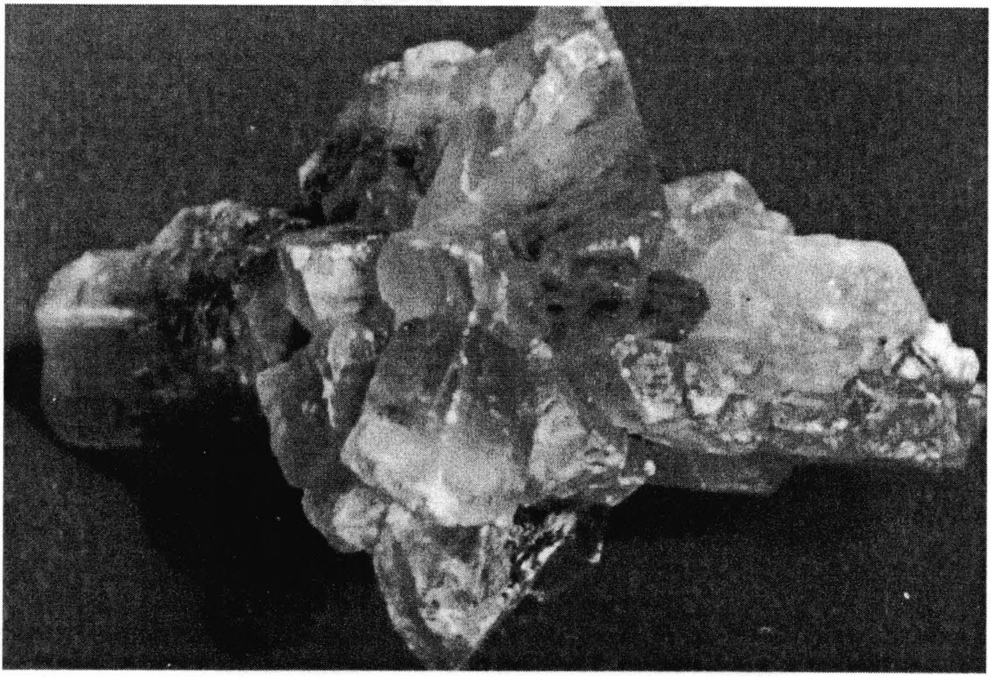

Fig. 1 Gyps „Creastă de cocoş”

Fig. 2 - Gyps „Coadă de rândunică”

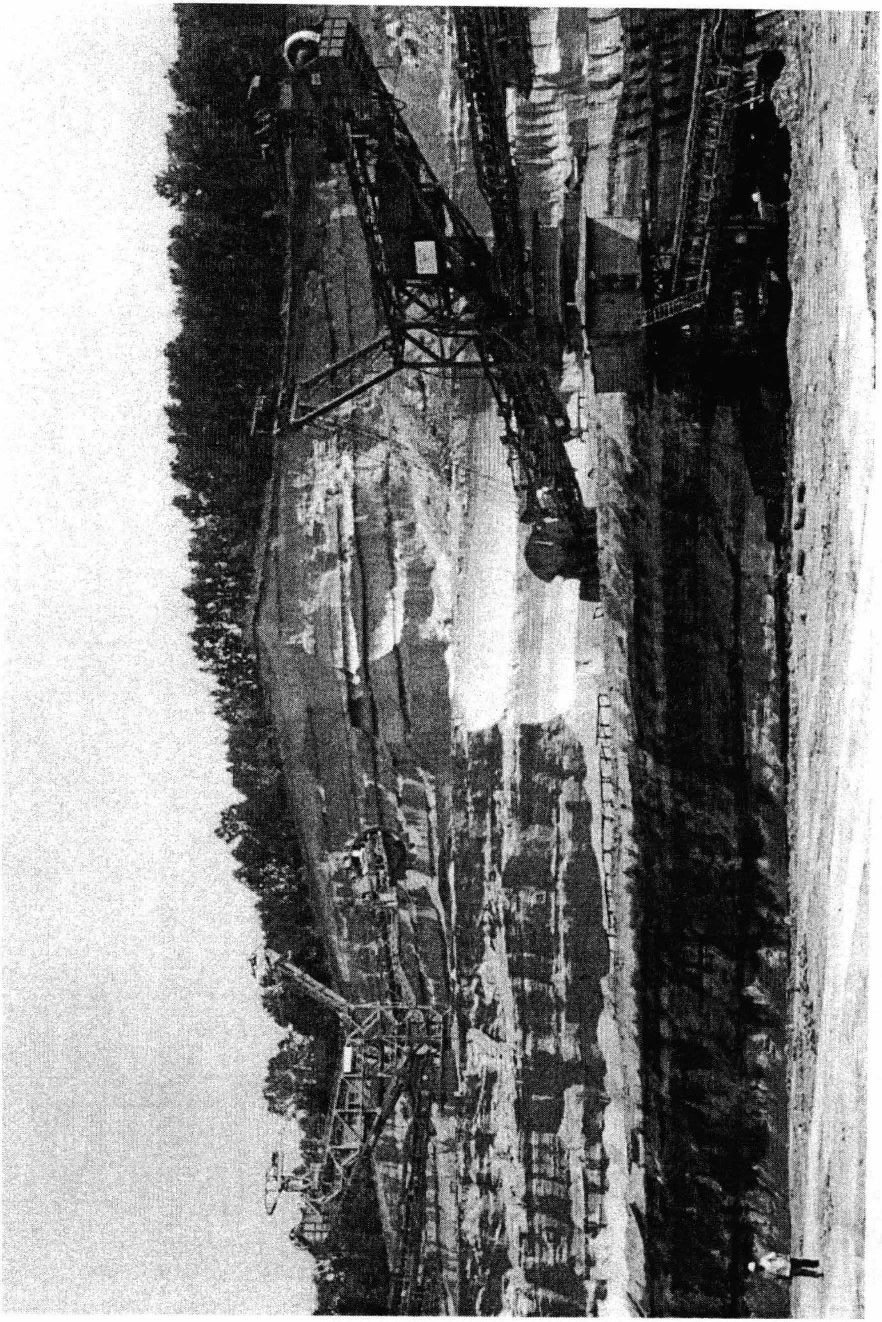

Fig. 3 - La couche IV de charbon. Périmètre Husnicioara

GEOGRAPHY

GEOMORPHOLOGICAL LANDSCAPES WITHIN THE INTRUSIVE MAGMATIC MASSIFS OF ŢIBLEŞ AND TOROIAGA

I. BÂCA*

Abstract. The intrusive magmatic massifs Ţibleş and Toroiaga are set within the northern group of the Oriental Carpathians and belong to the neogen eruptive chain. As a function of the relief's features which reflect the lithostructural conditionings (the layer form of the eruptive structures, the petrographic consistency of these ones), the tectonic and morphogenetic ones (climate, agents, processes, mechanisms, the strain upon the local and regional base levels), we localised within the two massifs the following geomorphological landscapes: the landscape of the massifs, of the hillocks, the periglacial, the side one, that of the valleys, of the interflows and the anthropic one.
Key words: intrusive magmatic massifs, geomorphological landscapes

The geomorphological landscapes within the area of the two massifs are represented by an association of forms (morphosystems, subsystems) of the same genesis, evolution, aspect, dynamics and functionality, spreaded along a certain surface. Each landscape reflects the interaction in space and time of the geographic elements in the area and henceforth has a specific identity which reveals certain information on the morphostructural processes that have contributed to its individualization.

Along the two massifs we identified the same landscape types, which underlines their common morphostructural features, and yet quantitatively and qualitatively distinct ones (aspect, functionality), due to the differences in what concerns their surface, altitude, the structural layer form, etc. This way, according to the relief's features which reflect the lithostructural conditionings (the layer form of the eruptive structures, the petrographic consistency of these ones), the tectonic and morphogenetic ones (climate, agents, processes, mechanisms, the strain upon the local and regional base levels), we localised within the two massifs the following geomorphological landscapes: the landscape of the massifs, of the hillocks, the periglacial, the side one, that of the valleys, of the interflows and the anthropic one.

The landscape of the magmatic massifs is represented by an imposing relief, detached from the main eruptive bodies, characterised by complexes of forms, resulted along several modelation cycles. In Ţibleş this landscape includes the elevated sector Arcer-Ţibleş-Bran, that dominates with 200-400 m the tectonomagmatic top to which it belongs, as a heavy "island", marked by the three mentioned peaks, alligned at 1840 m, out of which there spring towards North and South interflows with a contrafort aspect or "legs", derived from the

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sides of the intrusive structure. In Toroiaga this landscape includes the entire eruptive edifice, under the shape of a main top sinuously alligned between the valleys of Mihoaia and Secu, leaned, as in Ţibleş, on secondary tops with a contrafort aspect. The top's profile is marked by residual peaks, situated at the average height of 1600-1700 m şi ensaddlements, carved during the periglacial age.

All around the two edifices, at the origins of the valleys that dissected the magmatic masses, there lay accumulation basinets shaped as semi-funnels, often fragmented by valleys of a semioval profile or U-shaped ones, inherited from the periglacial period when they functioned as crionival corridors. Through their altitudes, the two sectors belong in the subalpine level, covered by a herbal vegetation, clusters of junipers and mountain pines, which mirrors in a plan morphodynamic plan. Thus, the intensified pasturing affected the equillibrium of the slopes, by sectioning their surface and forming of the biogene terracettes which represent a primary stage in the uncovering process of the periglacial detritic fund and the appearance of some detritus fields resulted from the the action of washing, dripping, sufosion, soliflixion and nivation. The presence of the veins of polimetalic sulphures determined the development of mining activities, which have contributed to the strong anthropization of the landscape by the stimulation of the modeling processes and the development of a specific mining relief (steryl dumps, decantation dumps) and a subsequently associated relief (roads, embankment batters, anthropogenuous abrupts, canals, dams, etc), which can be seen on the valleys of Tomnatec, Izvorul Rău, Izvorul Băilor, in Ţibleş, and Dosu Măcârlau, Colbu, Secu, Novăţ, etc., in Toroiaga.

The hillocks' landscape is represented by morphological formations of cone or dome aspect, flanked by very squint slopes with inclinations of over 30^0, fragmented by torrential valleys and crionival corridors, which dominate the surrounding areas. These formations overpose upon some magmatic structures foredoomed by their layer form and their dimensions to inherit, under the action of the modellating processes, a such configuration, as lacolytes (Hudin), pillars (Stegior, Hudieş), small dykes (Măgura, Piatra Arşiţei, Dl. Jneapănului). In some cases, the hillocks individualized themselves through the carving of bigger structures as the one of a stok type from Ţibleş, out of which there separated Măgura Neagră and Arsuri.

In Ţibleş, the hillocks got detached by selective erosion from the plan of the main tectonomagmatic top, whereas in Toroiaga these appear isolated, at the massif's periphery. Their altitudes range between 1200-1600 m and are well afforested (spruce fir, mixtures), which attenuates the dynamics of the current morphological processes. In patches, the anthropic intervention through clearings (the south-eastern side of Hudin, the northern side of Măgura in Baia Borşa) and the construction of forrest roads (Măgura Neagră, Hudin, Măgura), gave way to the morphosculptural, liniary şi areal processes, thus shaping surfaces of an accelerated dynamics and intensely anthropised landscapes.

The periglacial landscape is well represented within the area of the two massifs especially in Toroiaga, owing to the larger surface, higher altitudes and a bigger degree of morphological perfection. Although the periglacial relief in the two areas is not characterised by the glamour of those in the crystalline massifs, this one stands out by its genetic, physiognomical, functional and morphodynamic variety, due to the specific morphosculptural conditions. Henceforth, there can be distinguished several cathegories of periglacial geomorphological landscapes such as: that of the residual peaks and crests, of the crionival semi-funnels and corridors, of the abrupts and dingles, of the glacio-nival basins and deposits and the landscape of the detritus fields.

The landscape of the residual peaks and crests is present within both massifs, being more spectacular and aggressive in Toroiaga on account of the larger area and higher altitudes, as well as of the orohydrographic configuration of the massif. The individualization of the residual peaks and crests took place by processes of fragmentation, retraction, canting and flattening of the slopes, meant to determine the sectioning of the initial interflows. This phenomenon is visible especially in the case of the main tops, where at the origins of the former crionival corridors one can distinguish osscilations and ensaddlements to separate peaks or rocky prominences.

The landscape of crionival semi-funnels is dominant within the two massifs, developing as a morphological streak around the main tops, at the origin of the larger valleys whose initial accumulation basins were modelated in the superior pleistocene through gelifraction and nivation processes. The crionival semi-funnels are characterised by openings that range between 150-1020 m, energies of 200-400 m and have semioval transversal profiles, splayed towards the superior part. The detailed morphology of these formations is represented by straight and concave slopes, often fragmented by crionival corridors, crests and residual shoulders, gelifraction fields, and at their bottom, in certain places such as the origins of Măcârlău and Miraj, we deal with glacio-nival micro-basins. On the inferior side, the crionival semi-funnels can be prolongued by valley segments of a U shape, such is the case of the origins of Novăţ, Novicior, Miraj, Mesteacăn, Bran, set out by slight inclination ruptures downside, to go on with the so called river bed. Through their superior position and aspect the crionival semi-funnels constitute the most evident proof of the periglacial modellation.

The landscape of the crionival corridors is represented by the former allignments to evacuate the detritic material functioning at the origins of the larger valleys (Novăţ, Ţiganu, Murgu, Măcârlău, Izvorul Rău, Izvorul Neted, etc). Their genesis is linked to certain morphological conditions such as the preexistent relief, the big value of inclination and relief energy, the more severe microclimate, etc. The transversal profile of the crionival corridors is splayed and their bottom is of a semioval or U shape, being herby, sectioned by a narrow thalweg or covered by detritus trains (in Valea Colbului and Valea Netedului). Nowadays these formations mostly function as avalanche corridors that concentrate important flows of energy.

The landscape of the abrupts and gelivation dingles is present in the high sectors of the massifs, intensely exposed to the gelifraction processes (Arcer, Bran, in Ţibleş, Măcârlău and Toroiaga), as the case is for even larger and deeper valleys (Colbu, Netedu, Novăţ, in Toroiaga, Izvorul Rău, Izvorul Neted, in Ţibleş) where the microclimate was more rigurous. This landscape distinguished itself through abrupts sectioned by dingles that have on their bottoms deposit batters fosilised by vegetation or with active gelifraction.

In certain areas there also appear cliffs (on Izvorul Rău) and walls (on Izvorul Rău, at the origin of Izvorul Branilor) of modest dimensions. Along with the residual peaks and crests, the abrupts' landscape makes the places look spectacular, arousing the tourists' interest.

The landscape of the glacio-nival microbasins is more restraint due to the litostructural and morphological influences and is to be met only on the north-eastern side of the massifs where it was favourised by the morphogenetical conditions, namely at the origins of Măcârlău and Miraj in Toroiaga as well as Fundău în Ţibleş. At the origins of Măcârlăul de Jos, this landscape is more expressive, being represented by two glacio-nival morphological formations, situated under the top of Toroiaga-Gura Băii, at the altitude of 1670m, separated by a low residual crest and limited on the inferior part by evident inclination ruptures that give way to the fluvial valley.

On the bottom of the crionival semi-funnel at the origins of Miraj, under the peak Ţiganul, at the altitude of 1550 m, there's a microbasin of a circular shape, limited at its inferior part by an inclination rupture and giving way to the fluvial valley of a U shaped transversal profile, which extends itself over several hundred meters. Such a glacio-nival microbasin is also to be found within the massif of Măgura, on the eastern side of the ensaddlement between the peaks of 1600 şi 1550 m, at thealtitude of 1500 m. this has an oval shape, is limited downside by a crest of hard rocks of about 3-5 m and houses a beautiful mountain lake (Tăul Măgurii).

In Ţibleş, at the springs of Fundău, on the western side, there can be seen at the altitude of 1600 m a small circular excavation whose genesis could be owed to the modellating glacio-nival processes.

The landscape of crionival accumulations is localised at the origins of Măcârlău, in Toroiaga, where the conditions favourised the cryogene and glacio-nival modellation. The glacio-nival valley complex in this sector is represented by forms of relief carved within the magmato-crystalline edifice (crionival semi-funnels, glacio-nival microbasins, crionival corridors, abrupts, dingles, residual crests, etc) and by crionival deposits accumulated within the valley over an area of 0,5 km^2, among which the liniar erosion cut interfluvial bridges, torrential valleys, tops and teraces that form an extremely interesting and distinct morphological assembly.

The landscape of the detritus fields is represented by surfaces with pleistocen-superior gelifracts exhumed through areal şi liniar processes. Their frequency is bigger in the overpastured and cleared areas, where the protective cover of soil and vegetation was removed. The aspect of these fields is influenced by the terrain's inclination. On the bigger slopes they have a prolongued, tentacular form that suggests the deplacement of the fragments, whereas on the less inclined surfaces they get oval or circular shapes.

The elements that compose the detritus fields are geometrically diverse, being represented by blocks, angles and small elements moved through processes of creep, crumbling, gelifluxion, biogene settling, etc.

The valley landscape is extremely complex due to the specific litostructural and morphosculptural conditions, and one can distinguish several valley morphosystems, function of their size, orientation, geometry, raportation to the magmatic or morphological structures, etc. The individualization of this landscape has been done gradually, alongside the exhumation of the intrusive edifices and the organisation of the fluvial network, in close connection with the regional morphohydrographic context. Because of the differences of surface, configuration and degree of morphological perfection of the eruptive structures, some particularities took shape within each massif. Thus, in Toroiaga, the valley landscape is more various, due to the tabular configuration and large surface of this massif. The main valleys are disposed transversally to the development of the morphostructures, they have an antecedential and epigenetic character, and represent sheer transfer corridors for the matter and energy flows from the eruptive massifs towards the peripheral areas, showing the morphofunctional integration of the intrusive edifices in the regional landscape. In Ţibleş, some of the valleys have their origins on the sides of the Hudin and Ţibleş massifs, prolonguing upon the sedimentary formations, whilst others, such as Izvorul Neted, Izvorul Rău, Tomnatec, penetrated more into the main magmatic structure, and other ones develop exclusively on sedimentary rocks, as the case is on the valleys having origins under the top Hudieş-Şătriţa (Izvorul Şurii, Stegior, the afluents of Baicu). In Toroiaga, most of the valleys have sectioned the eruptive massif, and some of them entirely cross it, having their origins on crystalline and sedimentary formations, as Secu, Colbu and Netedu.

The valley morphosystems are deeply inwrought in the magmatic edifices and limited by very inclined slopes that keep traces of the pliocen-cuaternary erosive levels in certain places. Their transversal profile has the shape of a pointed V and it includes reception basins of a semi-funnel shape towards its origins. The basis morphology on the main valleys is complex, being represented by river beds carved into hard or alluvionary rocks, narrow sectors of meadows in patches, colluvial batters at the base of inclined slopes, dejection cones of larger dimensions at the mouths of side affluents, steryl basins on the slopes, decantation ponds (on Colbu, Novăţ and Ţîşla, in Toroiaga), canalised sectors with concrete dams, forrest and mining roads, etc.

The secondary valleys drain the original basins and the slopes of the larger valleys, having specific morphofunctional features. Those situated in the reception basin of the main valleys derive from the former crionival periglacial corridors and are mainly undrained (on Izvorul Rău, Izvorul Branilor, Novăţ, Novicior), functioning as avalanche corridors and being sectioned alongside by small thalwegs, inwrought in the detritic deposits or in the hard rocks. The valleys on the slopes are generally more developed, with river beds inwrought into the rock, a transversal V profile that opens with splayed origin basinets, but there are cases when they inherit the former crionival corridors and have an oval or U shape (the basins of Novăţ, Novicior, Colbu, Secu, Netedu, Ţiganu), or they can even be filled with detritus (the basins of Netedu, Colbu, Secu), or undrained (the basin of Ţiganu). At the mouth of these valleys the torrential activity builds huge dejection cones whose gross material is taken along by the main water flows and carried downstream.

The slopes' landscape is represented by the morphological surfaces characterised through geomorphometric parameters (inclination, length, energy) of high values and an accentuated morphodynamic potential, against the current modellation dominated by the anthropic action in the mountainly temperate climate. From a genetic point of view, there can be distinguished primary slopes (structural), which derive from the sides of the eruptive bodies, and secondary slopes (fluvial), carved through erosive processes along with the exhumation and disection of the structures. Their geometry is diverse, which reflects the intensity of the shaping processes along the modelling cycles that succeeded from the inferior pliocene and until the cuaternary, in corelation with the litostructural conditions. Thus, there can be distinguished slopes with straight profiles slightly concave, slightly convexe and mixed, a situation that illustrates evolution mechanisms through retraction, refragmentation, canting and accumulation. The detail morphology of the slopes inherits the periglacial information, acquired in the superior pleistocene when these ones suffered a major shaping, in addition with the anthropic information, very consistent for the current modellation, resulted by mining (mine vents, leveled steryl basins, roads, anthropogenous abrupts, embankment batters, etc.), pasture (biogene teracettes) şi forestry activities (roads, downgoing ditches, etc.).

The superficial deposits to cover the slopes of the magmatic structures have a detritic character and were prepared during the periglacial period, being composed of polyedric gelifracts covered by a shallow layer of soil. These deposits errupt from place to place as detritus fields with an aspect of wreaths, fringes, ribbons, etc, function of the inclination. Through their structural characteristics the superficial deposits respond to the processes of washing, dripping, geliflowing, sufosion, creep, crumbling, downfalling, flowing, settling, etc., determining the aparition of some specific morphological formations to be observed on the slopes' façade such as gutters, ditches, detritus fields and batters, slidings-crumblings, teracettes and gelifluxion mounds, biogene teracettes, etc. The actual morphodynamics of the slopes is accelerated by the anthropic activities such as clearings, downgoing wood, mining and forest transportation (on the valleys of Secu and Ţîşla), intensive pasturing.

The interflows' landscape occupies large surfaces within the two magmatic massifs, distinguishing itself through specific morphological and functional features, with particularities imposed by the configuration and the surface of the eruptive structures as well as by the position of the local and regional main levels. The detachment of the interflows system has been done gradually, as the intrusive edifices were exhumated and incised by the fluvial organisms, thus sketching the orohydrographic features of the intrusive massifs. The main tops present specific aspects, according to the surface configuration of the structures, because they derive from the upper part of the eruptive bodies. In Ţibleş, the main interflow of a tectonomagmatic character gathers the eruptive structures Hudin, Hudieş, Groapa, Stegior and Ţibleş, whereas in Toroiaga it has the aspect of a sinuous top with a residual character, marked by pointed peaks, narrow sectors and ensaddlements.

In the longitudinal profile of the main interflows there can be seen several leveled segments, conditioned by magmatic factors (the intensity of the magmatic injections, the polyphasic character of the eruptions) and tectonic ones (the vertical movement of its structures and their frgmentation).

The secondary interflows are disposed transversally to the main tops, under the shape of contraforts or "legs", to support the magmatic edifice, passing on the surrounding formations (sedimentary, crystalline). In Ţibleş, the "feet" landscape is common to the northern side of the main massif, their profile having 2-3 steps imposed by the presence of some apophysal bodies that penetrate the sedimentary (Piciorul Ţibleşului, Piciorul Mesteacănului, Piciorul Arsuri, Piciorul Negru). There are also to be seen "legs" carved on magmatic formations such as Piciorul Calului and Piciorul Tomnatecului. On the southern and eastern sides there's the landscapes of the high hills, which preserve in their profile surfaces of denivelation pliocene inferior, parasitated in certain places by apophysal bodies (Culmea Grohot, Culmea Piatra Rea, Culmea Păltiniş). Around the Hudin massif the tops range radiary-divergent towards the valleys of Arieş, Minget şi Brad.

In Toroiaga the situation is a bit more complex, due to its large dimensions and the higher degree of morphohydrographic perfection. Some secondary interflows derive from the upper side of the eruptive structure, as Piciorul Ţiganului, Culmea Gradului, Culmea Stâna lui Verticu and Piciorul Caprei, Culmea Colbu and Culmea Netedu, whereas others got detached from the sides of the intrusive body, passing over the surrounding formations where they often intersect apophysal structures (Culmea Mihoaia, Culmea Mirajului, Piciorul Gradului, Piciorul Caprei). The "feet" landscape is specific to the north-western side of the massif (Piciorul Ţiganului, Piciorul Gradului, Piciorul Caprei), while on the North (the basin of Vaser) and South (the basin of Ţîşla) the interflows are geometrised as huge irregular angles, frontally cut at 1000-1300 m. Where they intersect apophysal bodies, the secondary tops contain irregularities as steps, pointed or blunt peaks and rocky prominences (Culmea Mihoaia, Culmea Colbu, Culmea Netedu, Piciorul Caprei, Piciorul Hriţ, Piciorul Gradului).

Within the Toroiaga massif the interflows' landscape is very diverse both geometrically and physiognomically, which shows a strong fluvial and periglacial processing. The tops are generally of a residual character inherited in the superior pleistocene, being flanked by inclined slopes or abrupts that often have on their base detritus fields to cover the bottom of the former crionival corridors, as the case is on the valleys of Novăţ, Colbu and Netedu.

The anthropic landscape is a reflexion of the economic potential of the two massifs. Owing to their mineral resources, their forests and pastures, the degree of human inhabitation is high, especially for Toroiaga, a fact that strongly influenced the relief and the other ambiental components (vegetation, fauna, flowing waters, socio-economic relations). The intensive modellation of the secondary layer leaded to the formation of an anthropogenuous relief with specific morphofunctional features that overposes itself upon the preexistent morphology and for which we propose the following classification scheme:

A. Mining relief

a) Forms of relief resulted by extraction activities:

– mine vents, abrupts, detritus batters, concreted surfaces;

b) Forms of relief resulted by prospection activities:

– prospection pits and ditches, mounds of soil;

c) Forms of relief resulted by pool extraction activities:

– steryl basins, mounds of steryl, stone-pits, excavations to extract clay (in Baia Borşa);

d) Forms of relief resulted by ore processing:

– the decantation basins from Baia Borşa;

B. The relief associated with mining activities

a) Forms of relief resulted by the improvement of Baia Borşa and some points to coordinate the extraction activities (Secu, Gura Băii, Măcârlău, Tomnatec):

– concreted surfaces, drainage ditches, mounds of soil, basins and mounds of domestic garbage;

b) Forms of relief resulted by the construction of communication means:

– asphalted surfaces on the valley of Ţâşla and on the western side of the top of Piciorul Caprei, rough surfaces on most of the valleys, batters of embankment and excavation, anthropogenuous abrupts formed by slope sectioning, drainage ditches;

d) Forms of relief resulted by forestry:

– ditches and traces of downgoing logs, excavations resulted by tree-cutting, mounds of sawdust on the valleys of Secu and Ţâşla;

e) Forms of relief resulted by agricultural activities, around the town of Baia Borşa:

– fields, balks, batters, mounds of stones, drainage ditches;

f) Forms of relief for the protection against floods and torrential activities:

– dams on the valleys of Netedu, Colbu, Recele, Secu;

– canals, on the Colbului valley;

– concrete walls on Ţâşla and Secu;

g) Forms of relief resulted by special activities:

– mounds of soil within the ammonition deposits (dynamite) on the valley of Ţâşla;

– graves at Baia Borşa;

According to the economic activities and their impact on the relief, there can be distinguished four categories of landscapes: the mining landscape, the pastural, the forestry and the human settlements landscapes.

The mining landscape is well represented within the area of Toroiaga massif, where the exploits were more intensive, being set on the valleys of Secu, Măcârlău. Novăţ, Colbu, Arinieş, etc. In Ţibleş this kind of landscape can be found on the valleys of Tomnatec, Preluca, Izvorul Băilor, Izvorul Minelor, Stegior, but of a rather modest aspect and structure. Its composing elements are the erosive-accumulative relief forms, the afferent constructions – both functional (at Gura Băii, on Secu, on Tîşla) and nonfunctional, electricity pillars, transportation pipes (on Novăţ, on Ţîşla and Colbu), abandoned machinery, communication equipment.

The pastural landscape is widely spread within both massifs, especially in the upper forrester sector. Its composing elements are the biogene relief of cattle paths, the aferent constructions (sheepfolds, shelters, stalls, huts, stables), water equipment (hydrants, sources), pastural roads. The cattle paths are the result of transversal, oblique and longitudinal sectioning of the slopes and interflows, constituting rupture surfaces for the morphodynamic equillibrium and starting factors for the liniar and areal erosive processes. These formations generate real amphitheatres at the origins of the valleys, within the reception basins.

The forestry landscape is well represented within the two massifs, being set into the larger valleys such as Izvorul Neted, Tomnatec, Pârâul Calului, Valea Mare, Arcer, Valea Arieşului, Izvorul Şurii, Stegior in Ţibleş, and in the valleys of Secu, Netedu, Măcârlău, Miraj, Mihoaia, Novicior, in Toroiaga. Its composing elements are cleared surfaces, forrest roads accompanied here and there by abrupts, gutters, ditches, the afferent constructions (cabins, log loading ramps, etc). The clearings stimulated the slope processes which led to the apparition of gutters, ditches, and the exhumation of the detritic fund, whereas the placement of the acces roads determined the apparition of abrupts, downfall precipices, land-slidings, distinctively mobile formations. The activity of log downgoing gives birth to deep ditches, subsequently taken by water and transformed into torrential organisms. It also determines the strong chiseling of the thalwegs and their continuous canting in some valleys with hard rocks.

The landscape of the human settlements is represented by the town of Baia Borşa, whose center is placed at the confluence of Secu with Ţâşla, at the lap of Toroiaga massif. The settlement is liniar, downstream the inferior Ţîşla until Borşa, spreading on the slopes and entering the valleys of Fătului and Valea Rea. The town of Baia Borşa grew on account of the mining in the area, but after 1990 this activity decreased along with the bankruptcy of several mines and the population needed to re-direct towards others sectors among which carpentry has to be mentioned. There are several wood-cutting machines in the area, and the resulted sawdust is deposited as mounds on the valleys of Secu and Ţâşla. The domestic garbage depositation led to the aparition of several mounds on the road sides on the valley of Ţâşla, as well as of the huge basin at the mouth of Arinieş. The agricultural activities are preponderous, being oriented towards the culture of potatoes, barley, mangel-wurzel, as well as zootechny (sheep, cows, horses).

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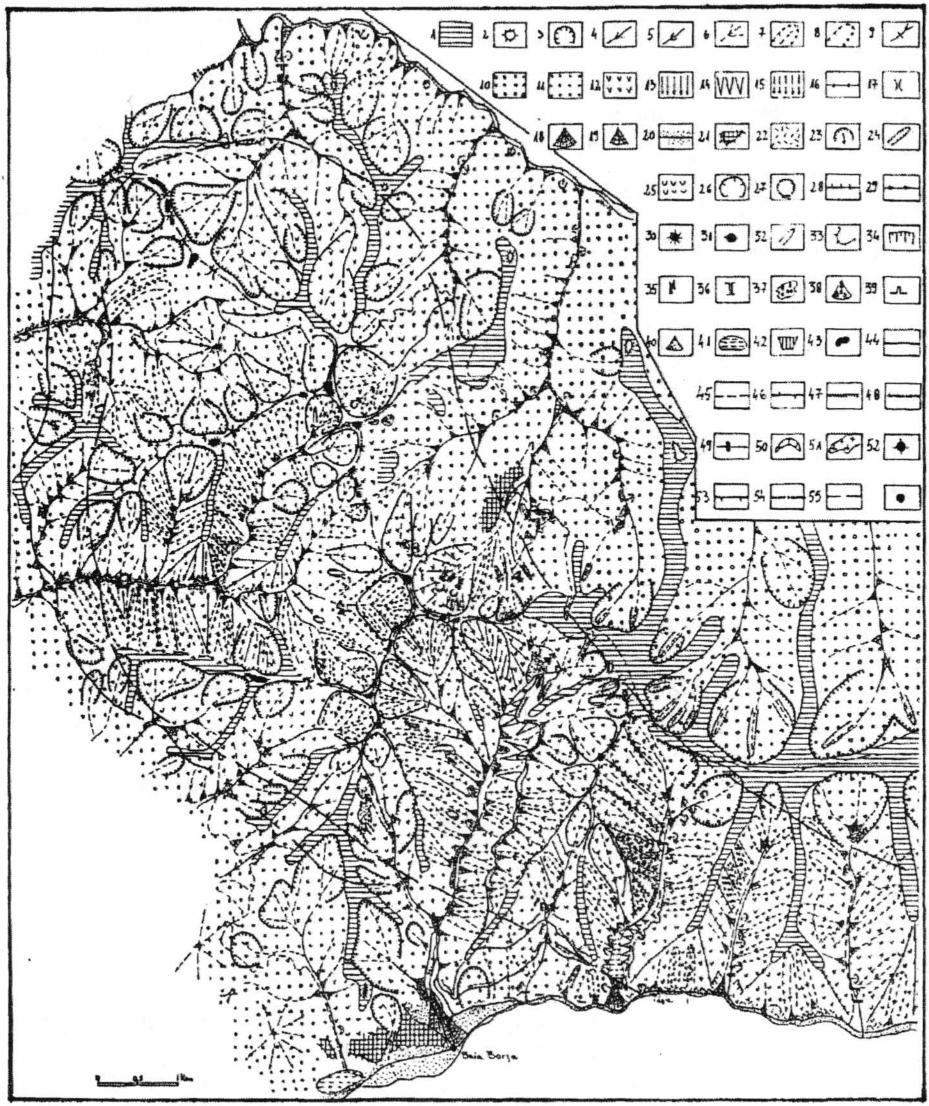

Fig. 2 – The geomorphological map of the Toroiaga magmatic massif

1.The inferior pliocen erosion surface 2.Erosion witnesses on crystalline and sedimentary formations 3..Erosion basinnetes 4.V-transversal profile valleys 5. U-shaped or semi-oval bottom valleys 6.Torential valleys 7. Drained flared valleys with a semi-oval profile 8 Undrained flared valleys with a semi-oval profile, 9. Declivity talveg ruptures 10.Deluvial slopes 11.Slopes formed on magmatic structures 12.Slopes formed on apophysal bodies and crystalline formations 13.Residual slopes (residual crests, rocky protuberances, cryonival corridors, etc) 14.Edge-like slopes 15.Radiary-divergent slopes 16Rounded top 17.Origin ensaddlements 18.Old dejection cones 19.Recent dejection cones 20.Meadow 21.Terraces 22.Colluvial billows 23.Superficial slidings 24.Beds and ravennes 25. Waves and mounds on cryonival deposits 26. Cryonival semi-mouths 27.glacio-nival microcircs delimited by bridges 28.Residual ridges 29.Sharp tops, formed in the periglacial period 30.Sharp peaks carved on magmatic formations 31.Rounded peaks on magmatic formations 32.Canals 33.Residual shoulders 34.Abrupts 35.Isolated rocky formations 36.Gelifraction ensaddlements .37.Gravel fields 38.Gravel cones 39.Mine mouths 40.Steryl stacks 41.Decantation ponds 42.Dam 43.Antropic lake behind a steryl stack 44.Asphalted road 45.Unasphalted road 46.Forest railway 47.Antropogene abrupts 48.Canalized beds 49.Dams 50.Quarries 51.Structural surface derived from the top of the magmatic body 52.Knolls shaped on magmatic bodies 53.Overlapping line 54.Inter-river line 55.The limit of the magmatic body 56.Dwelling places

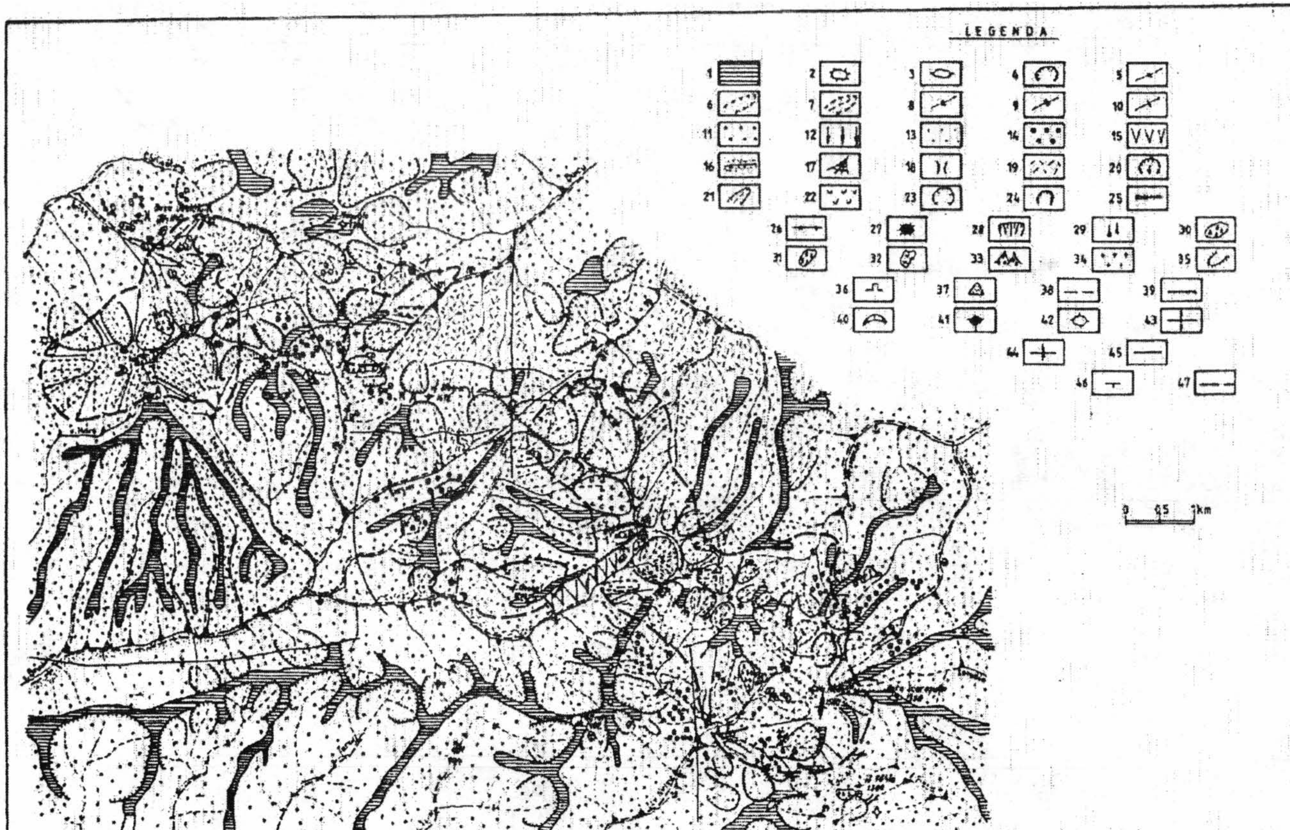

Fig. 1 – The geomorphological map of the Tibles magmatic massif

1.The inferior pliocen erosion surface 2.Sharp peaks formed on sedimentary rocks 3.Rounded peaks formed on sedimentary rocks 4.Erosion businnetes 5.V-profile valleys 6.Undrained flared valleys with a semi-oval profile 7.Drained flared valleys with a semi-oval profile 8. U-shaped bottom valleys 9. Declivity talveg ruptures 10.Waterfalls 11.Deluvial slopes 12.Primary slopes 13.Slopes formed on magmatic structures 14.Slopes formed on apophysal bodies and sedimentary rocks 15.Residual slopes 16.Meadow 17.Dejection cones 18.Ensaddlements 19.Glacises 20.Superficial slidings 21.Beds and raveenes 22.Waves and mounds of cryonival deposits 23.Cryonival semi-mouths 24.Glacionival excavation 25.Residual ridges 26.Sharp tops, formed in the periglacial period 27.Sharp peaks carved on magmatic formations 28.Abrupts 29.Isolated rocky formations 30.Gravel fields 31.Gravel tracks 32.Detritic edges 33.Cones and laps of fixed gelifracts 34.Morphological surface with a structural character, derived from the top of the magmatic body 35.Erosivo-structural shoulders 36.Mine mouths 37.Steryl stacks 38.Unasphalted roads 39.Antropogene abrupts 40.Quarries 41.Knolls shaped on eruptive formations 42.Knolls shaped on sedimentary rocks 43.Anticlinal axle 44.Sinclinal axle 45.Fractures 46.The inclination direction of the rock layers 47.The limit of the magmatic bodies

A FEW HABITATIONAL INDICATORS USED IN DEFINING OF RURAL SPACE TYPES IN THE TRANSYLVANIAN PLAIN

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Abstract. A few habitational indicators used in defining of rural space in the Transylvanian Plain. The geographical position of Transylvanian Plain within the Transylvanian Depression shows with relevance its favorability and developing assumptions. Despite of this, the region was kept outside of the major infrastructural and economic trends. We could, also, include the Transylvanian Plain into a typical rural "central isolation" relating on this historical-political tendencies, concluding on different types of rural spaces.
Key words: habitational indicators, rural space.

The present study makes a comparison between selected indicators from national official data and scientific reports existing in Romania – Environmental Assessments and relevant Studies, Urban General Plan, Legal Normative, Environmental Protection Agency reports and OECD environmental indicators. First category reveals:

a) The environmental indicators which are regarding to: terrain attributes, water, atmospheric features, natural vegetation, fauna, soils, buildings, habitational space, green spaces, and landscape indicators;

b) The quality of life indicators (social, economic, health) are focusing on: human health, life expectancy, rate of unemployment, educational achievement, level of incomes.

The OECD environmental indicators as cultural landscape indicators and socio-economic indicators are also relevant, but our paper avoids those indicators which are inconclusive for the study purpose.

The environmental indicators in this paper will not be similar to those used in the OECD documents (GHG, CO_2 emissions, sulfurs, etc.), nor to those projected by the environmental indicators initiative of EPA, because the studied region is an exclusively rural and agricultural one, and this kind of indicators are not totally relevant. In this case, the selected environmental indicators will aim only those that are representative for the cultural landscape.

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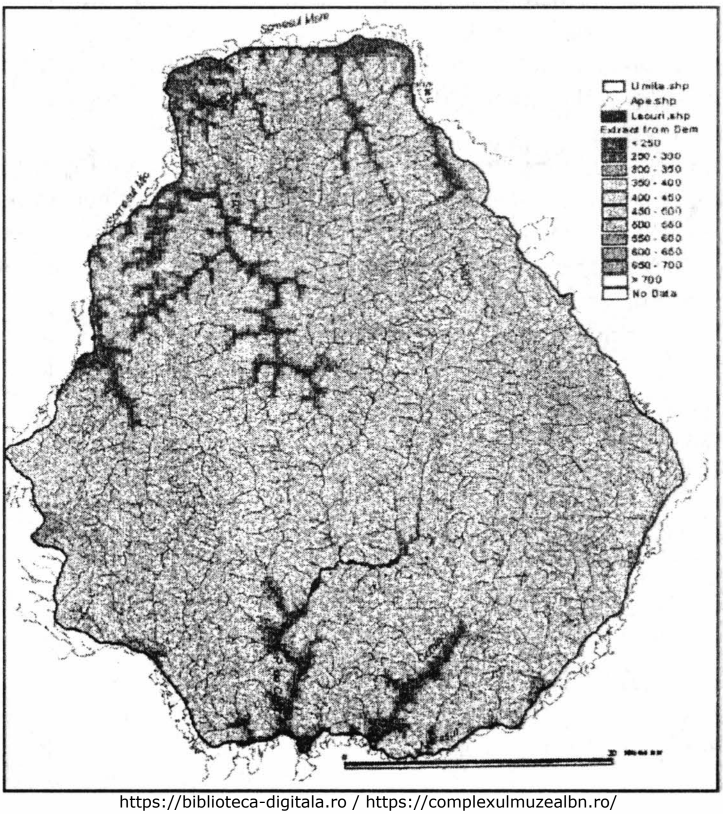
Components of the Geographic Landscape

1. Morphometric and morphographic features

When we characterize the relief (Map 1), the morphometric and morphographic elements have a capital role. As regarding the first element, the average altitude in the Transylvanian Plain range between 450-500 m, varying on different sectors, with higher altitudes to the north (in Dumbralivezi Hills with 639 m height and a relief energy of 300-320m) and getting lower to the south, up to 400m height and a relief energy of 150-160m.

The horizontal fragmentation constitutes a important and at the same time interesting morpho-hydrographic issue because of its relevance to the study of land using, to the distribution and development of the settlements and transportation networks. The phytopedologic covering is also directly correlated to this aspect. Important differences can be noticed between the Someş Plain and the Mureş Plain, but also within these subunits. This parameter ranges between 0.50 km/km^2 (on the monoclines reverses) and 3.0 km/km^2 (on the front of the cuesta and in the spring sector) in the Luduş Basin. In the Fizeş Basin the fragmentation is less intense to the north (0.35-0.45 km/km^2), where, in turn, the energy of relief is higher in the central-southern part, with more evident erosion processes (0.50 km/km^2).

Map 1. The Hypsometrical Map of the Transylvanian Plain



The presence of the cuesta monoclines relief, the frequency of slope processes, among which the most typical are the landslides, as well as the high extension of the river flats ("pseudo-river flats"), discordant to the flowing regime and to the discharge of the rivers (incompetent), are the most characteristic morphological elements of the Transylvanian Plain landscape.

2. The climate and its role

The climate of the Transylvanian Plain is characterized by quasiuniformity of the its elements manifestation, although at topoclimatic level there are some differentiations. Thus, the main differences can be noticed between the north and the south, and, as an influence of the Apuseni Mountains proximity, the well-known shadow of precipitations from the south-western sector, in contrast to the eastern one, where the oceanic like air masses reappear. The north-western part is also subject to favonian influences, especially regarding the vegetation, coming from the Meseş Mountains, even if the distance to them is rather long: the presence of the thermophilic species of oak trees (Quercus pubescens) on the sunny slopes (thermonemoral phyto-landscape). The actual correlation between the climatic elements and the development of the vegetation covering should be understood as a resultant in time of the dynamics and it could be extrapolated to more complex analyses which to include other elements too (the soil and the human activity).

Table 1. Absolute and Relative Values of Precipitations in June

Station/year/ Monthly/%	Turda	Budeşti	Chiochiş	Cojocna	Cozma	Luduş	Săbed	Sărmaşu
Annual (mm)	495.9	500.08	562.8	562.1	625.6	546.9	598.04	539.1
Month VI (mm)	84.7	75.1	72.9	84.4	93.9	86.3	87.3	82.4
Percentage	17.08%	15.01%	12.9%	15.01%	15%	15.7%	14.6%	15.3%

The upper table (Table 1) illustrates the correlation between the location of the station within the Plain and the local climatic expressions.

3. Ground Waters

In the Transylvanian Plain the ground waters have a major importance, underlining the possibility of the development of some settlements or the location of others, as well as the sustenance of efficient agricultural practices. The physical-geographical conditions allow the differentiated storing of the ground water at various depths and uniformize them throughout the whole studied region.

The reduced volume of the ground waters determines a temporary and non temporary character to almost all the surface waters during summer till the beginning of autumn (the Comlod River, the most typical example in the region, especially in the median and upper sectors, Lechinţa River throughout its entire length, The Meleş and the Pârâul de Câmpie Rivers in the upper sectors, the Fizeş tributaries). It is also worth mentioning the value of the real evapotranspirations, that is of 550-600 mm between April and October, generating an annual deficit of 50-100 mm, half of which is registered during the summer months having direct negative consequences upon agriculture and the development of natural vegetation.

4. Surface Waters

The interior network includes low discharge rivers: Dipşa 1,58 m^3/s (430 km^2), Comlod 1,04 m^3/s (325 km^2), Gădălin 0,61 m^3/s (290 km^2), Meleş 1,16 m^3/s (289 km^2), Luţ 1,26m^3/s (268 km^2). The flowing regimes of these rivers are not permanent and are discontinuous, excepting the rivers which were modified by man-made or natural storing lakes, as in the case of the following rivers: Pârâul de Câmpie (55.7 km), Fizeş (41.5 km) or Şar. As it can be noticed, the discharge of the rivers is not correlated with their basins, but with the precipitations regime, characterized by uniformity.

Habitational indicators

Settlements and population

From the social-economical point of view, the Transylvanian Plain was completely rural, until September 2003, the towns being situated on the margins: Luduş and Iernut on the Mureş River, Gherla on the Someşu Mic River and Beclean on the Someşu Mare River. Besides these, there were 71 villages. Five of them have not the administrative center within the Transylvanian Plain (Cuci, Ogra, Sânpaul, Ungheni, Iclod) and other 14 have not all the surface included in the studied region.

Starting with September 2003, Sărmaşu village became town and in April 2004 Ungheni received the same status.

The population decreased from 311388 inhabitants in 1966 to 297348 inhabitants in 1992 that is 18.3%. The reason is the negative migration balance (the demographic export, the aging of population, an increase of the mortality. The situation became more and more dramatic, in 2002 the population being a bit more than 280000 inhabitants.

An interesting and very important demographic indicator is the dynamics of the population between 2002/1996 (table 2). The analysis shows that there was an absolute uniformity in the demographic decreasing in the Transylvanian Plain. Thus, in 2002 the population exceeded with 80% the amount of 1966. All the above-mentioned factors unbalance the demographic structure of the studied region for good.

Table 2.
The Dynamics of the Population in the Transylvanian Plain between 1966-2002

County (settlement belonging to the Plain)	1966	1992	2002	The dynamic between 2002/1966
BN	62319	53946	51291	82.3
CJ	129944	111663	107817	82.9
MS	160085	131739	123713	77.3

The Structure of the Population According to Age. It indicates a strong disequilibrium between age groups as well as a strong tendency to aging (table 3). The census of 1966, 1992 and 2002 emphasize the discrepancies between age groups as well as the important increasing of the aged population with direct consequences upon the economy (land use) and the ecological equilibrium.

Table 3. The evolution of the population over 60 years (%) in the localities of the Transylvanian Plain

Village Name	The Population of the Village 1966 (Total)	Aged Population 1966 (%)	The Population of the Village 1992 (Total)	Aged Population 1992 (%)	The Population of the Village 2002 (Total)	Aged Population 2002 (%)
Budeşti	3113	11.4	2174	26.8	2089	32.2
Chiochiş	5604	12.8	3807	26.9	3567	30.5
Nuşeni	4734	13.7	3475	28.4	3264	31.1
Urmeniş	4315	11.3	2430	29.7	2280	30.8
Band	9755	12.6	7587	21.6	7726	21.6

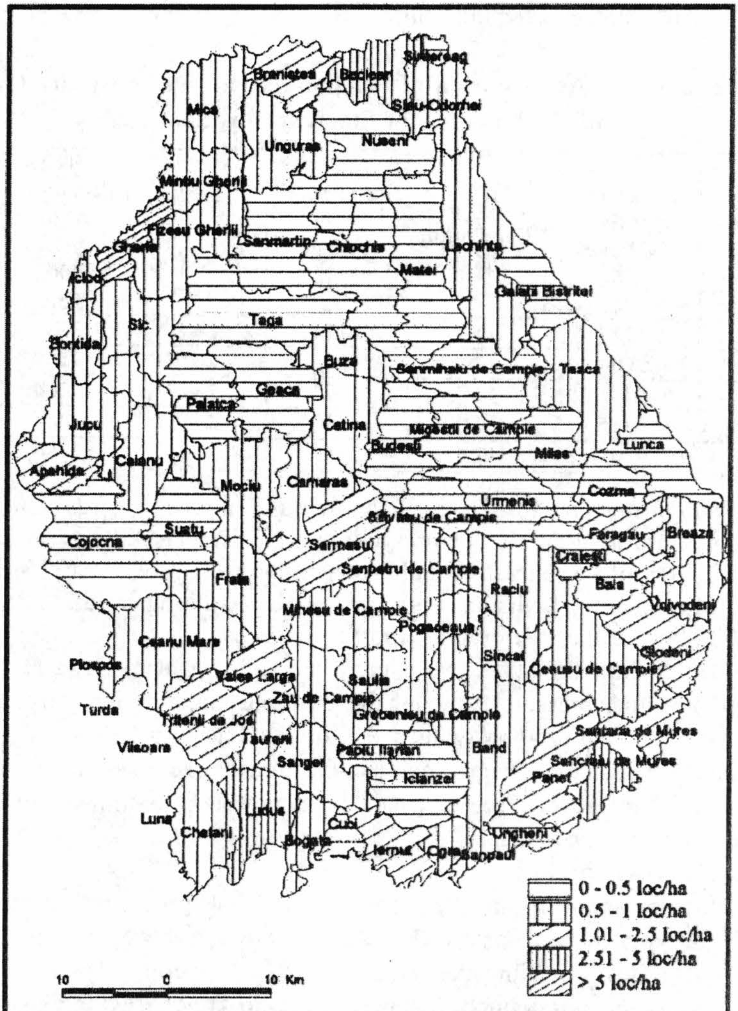
Physiologic density (inhabitants per agricultural surface – map 2) shows the intensity of human pressure reported to main rural activities; Settlements' density (map 3) has importance in studying of the infrastructural pressure, the weight of cultural landscape in the regional framework. The both indicators were calculated during the last three census (1966, 1992, 2002), but our maps refer to the most recent census.

The Settlements' density is a very interesting one, because gives additional information related on human pressure. Although the territorial configuration of the villages creates an image of a regional uniformity, their density is an heterogeneous one. We can notice discrepancies between the villages areas and the number of small villages (halmets) in the Mures Plain. The low level of settlements' density reveals an assumption of defining of the rural spaces, critical and aging.

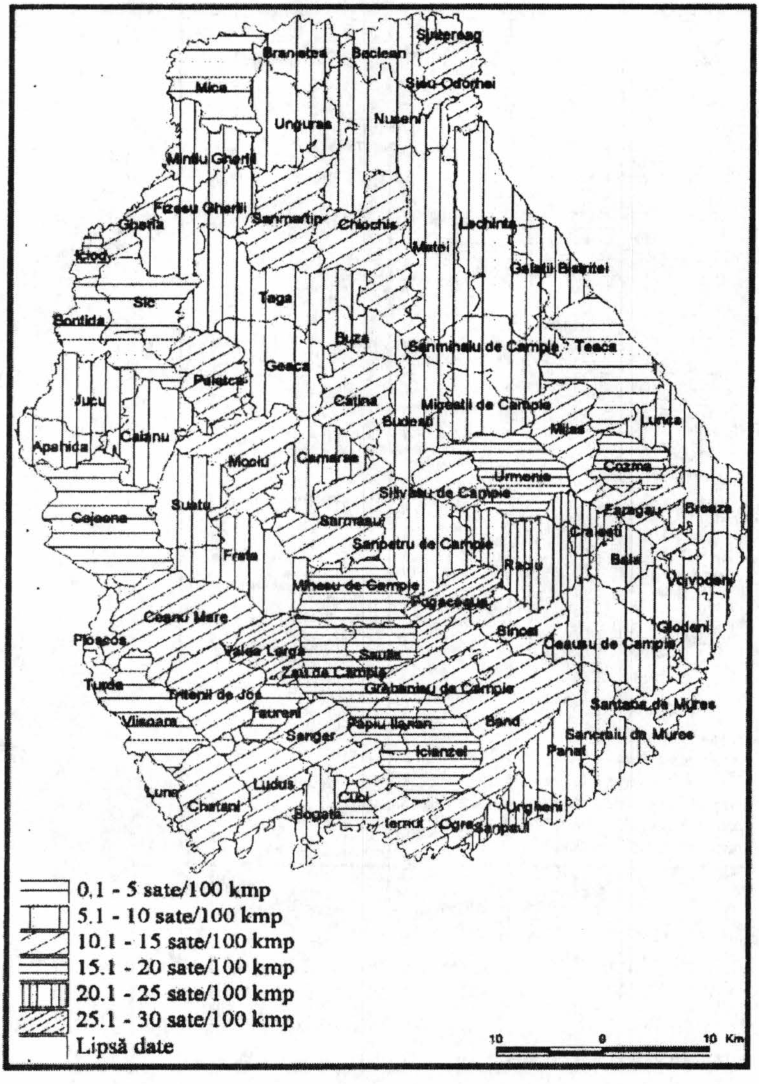
Types of rural areas

We made comparisons and we correlated the whole previous indicators and we established two types of rural spaces which have highly relevance: the critical rural spaces (areas) overlaps the north with elder and decreasing population and highly integrated rural spaces on the south, well defined rural network (map 4). We tried to make a comparison between land cover (CORINE, 1992) and age structure knowing that they could relieve similitude. The decrease of arable surface and increase of pastures one are in relating with growing of elder population and it shows the labor force handicap.

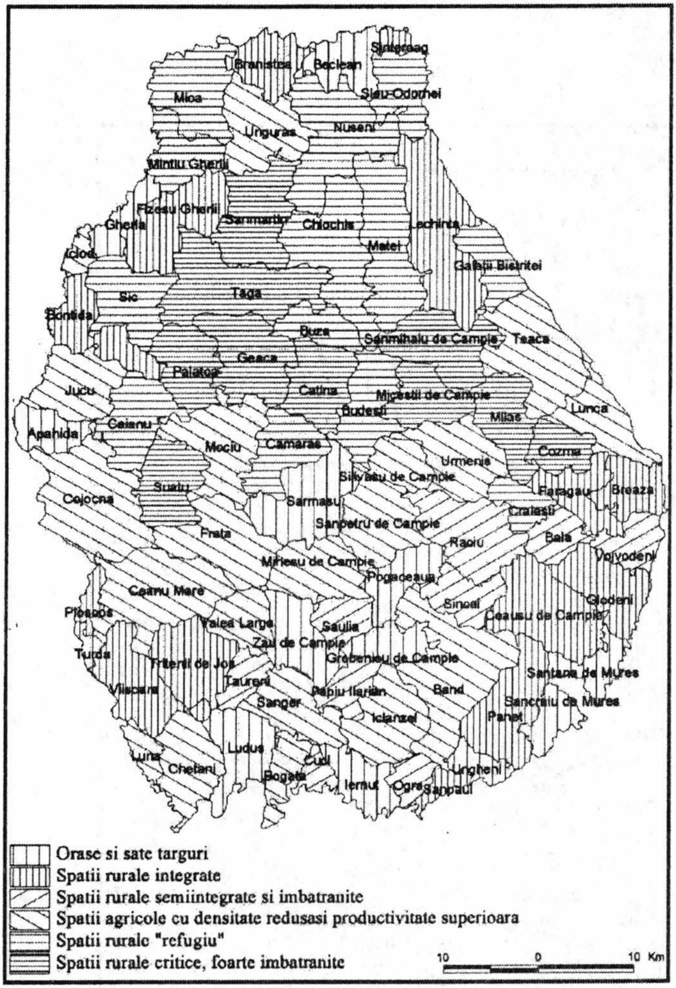
Following the previous ideas, because of the permanent population diminution and its aging, the human pressure reduces, and this is a good premise/precondition for the appearance of a secondary natural landscape (embryonic landscapes).



Map 2. Physiologic density in 2002



Map 3. Settlements' density in 2002



Map 4. Types of rural spaces (adapted after Violette Rey, 2002)

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THE HUMAN RESOURCES SYSTEM IN SILVANIA'S GEOGRAPHYCAL AXIS

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Abstract: The human resources system in Silvania geographical axis. Nature, society and economy are indissolubly linkeed, forming an integral spacial system, as a result of the rhythmic integrations, of a feed-back type. There are also societies which do not depend on the very own spacial space (including countries, cities, districts etc.), wether they are poor and consequently exploited or helped, wether they are rich and consequently exploit and help others, or if they are within these limits. This fact also applies to economies, some of them being not too much dependent on the societes which they exist in (dependent from the point of view of number of working people; e.g. – The input of foreing capital or robotisation). Anyway, within the actual local circumstances be they regional or global, it is difficult to anticipate and figure out the human capabilities which can take the shape of "resource" for the durable development of the respective geographic space. The case is relevant for the city industries withing this geographic areal, such as the circumstances under which Zalău is to be found, which possesses very "exotic" industries if we speak from the point of view if we take into consideration raw materials, because they are mostly necessary in the import of raw materials: iron, copper, natural rubber, cotton etc.
Key words: human resources, geographycal axis.

1. Introduction

Nature, society and economy are indissoluble bounded, setting up a special integral system, as a result of rhythmic integration, as feedback. There are also societies which don't depend of the economy of their own space (even countries, towns, counties) either its are poor and so exploited or supported, nor are rich and so exploit or support, either its are on the average. It is valid for economies too, some of them are not depending to much of the societies (like number of workers) in which take place (for example, infusion of foreign capital or robotisation).

Anyway, in the actual local, regional and global conjunction it is difficult to anticipate and foresee the reserves with human tendency, which can participate in the shape or "resource" at lasting of a geographical space. In another way of speaking, we cannot exclude from this category one or the other from the basis activities as industry or trading and this comes justified.

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In order not to deviate from the idea of establishing human resources and place these resources in lasting development spheres, we must conceive for the geographical analyzed space another action systems, based on the traditional one, which has to answer exactly to the new created situation of the present and through which it has to realize the valuating of the whole potential that the certain geographical axis has now.

We can see that, almost at the whole level of the country, there is a falling of the socio-economical systems, decline that is an answer to a fast and chaotic implementation of an industry, in a first prosperous faze, capable to attract labor (rural exodus), but without a raw material local base incapable resisting a rival system that the market economy releases.

The case is very eloquent for the industry of the towns from this geographic area, we illustrate the situation of Zalău city, which has a very "exotic" industry from the raw material viewpoint, being necessary: the iron, the copper, natural rubber, cotton, in their large majority imported raw materials. In these conditions, it is almost impossible to assure the local or regional prosperity, because it is inadmissible to lose twice at the same thing, or better said even three, four or five times.

It seems that the only human resource capable to release the durable development algorithm in this space it is the population itself by consciousness and knowledge, other wise it is the only human resource which isn't now on free falling.

The "population-development" sinthagma, so frequently used today by specialists and the great public, is a relatively recent creation, even if, the concerns about rapport between population and the other system from society-territory, nourishment, agriculture, creation etc., are ancient. Results that the main moving factor is the human being, rational substance capable to ponder through their correct action and thinking.

2. The human action

What we must establish further on for "human resources" stencil in geographical space of the Jibou – Zalău – Şimleu Silvaniei – Marghita axis, is the way, the starting point and route which the human action must follow.

a) Transportation. The firs system notices the action for transportation, with everything which these axis requires and involves: systematization, infrastructure, modernization, changing, synchronization. Within the frame work of this first system, the action will be taken depending on coordinates of durable development, as for the whole subsystem of transportation.

The railways from the axis: represent a connection between fare three (Bucureşti – Oradea – Episcopia Bihorului) and fare four (Bucureşti – Satu Mare – Halmeu), between Oradea and Jibou, on next route: Oradea – Săcuieni – **Marghita – Şimleu Silvaniei** – Sărmăşag – **Zalău – Jibou;** they are not electrified, and depend in a large measure on the circulation spread on those two through fares (time-table, times, quantity, reserve, commends, quality); they pass over sectors subjected to earth movement (for example the Zalău – Mirşid piece of railway); they systematically interrupt the road circulation; in the category of wares we come across prevalent limestone: Mirşid; furniture: Zalău, Şimleu

Silvaniei; rolled: Zalău; oil products: Suplacu de Barcău; in essence, more local raw materials; they represent a more emphasized pollution factor (restrictivity,the fuel, procarious situation, noise, comfort, great times); it provides "gate to gate" transportantions, in case of enterprises catering with industrial lioves, having a low price, so limited benefical.

The rutier route, at which add cars, are suitable for goods and travelers transportation, at which the speed and the remove of transshipping are important, but especially on short distances. Current, it is seen even on national level, that the road transportations are favored to the railway ones.

At axis level, in what this type of transport concerns, we mention: precarious infrastructure, at which it is possible to add, the lack of local administration interest, which must be conscious that without a road infrastructure of at least medium level it is impossible to attract private investors, because these do not have their own railways they; the existing road network, has the role of connecting the road axis between Cluj-Napoca – Baia-Mare (Cluj-Napoca, Gherla, Dej, Răstoci, Şomcuta Mare, Baia-Mare, oriented to direction S-N) and the road axis Cluj-Napoca – Oradea (Cluj-Napoca, Huedin, Aleşd, Oradea, oriented to direction SE-NV);Silvania's geographycal axis is crossing from South to North in the Zalău – Hereclean sector by national modernized road between Cluj-Napoca – Satu-Mare; however the biggest part of the road networks from the axis enter in the county and communal zone of interest, low lasting aspect in a depending economy. The spheres not mentioned from the categories of transportation (for example, air ones, or the methane gas, the water etc.) are desired for the axis, for the habitats from the adequate localities, whether talking about their implementations or referring to their contents or their safety.

The problem which is put on the axis isn't that of transportations statistics, but that of making transportation from every sphere efficient (durable development). The previously described statistic has a general character, for the whole gearing of the axis.

The transportations study is being requested, in a pragmatically way, towards particularization and not generalization. The most lasting optimization models must be discovered in transportation, at every levels of the axis.

Among the factors which fit (to attraction and integration) in a model system for the axis we have: the cooperation of the transportation ways, the cooperation improvement, extending the modern technologies, transportation security, the tariff system etc.

Trying a configuration scheme, a hierarchical of transportation sectors, to a whole but also to parts of the axel, concerning the transportations, better as far as transport concerns, better in what the system pointed out by the action relationship reveals: population-transportation, different situations result, situations which can indicate in an almost exactly way factors, directions, demands (function situation) lasting development of the axis, from this point of view.

The **Jibou – Zalău** sector (25 km). Among the most remarkable particularities of this axis segment, from the point of view of transportation we state: an easies connection with railway through fare number four, because of vicinity; city Jibou is an important junction railway point, with three directions (to Zalău, Baia-Mare, Dej), with reparation railway workshops at the same time the quarry from Prodăneşti, production from area (cereals products) facilitating the travelers transportation towards the capital of the country and other destinations. It was a transit point for the salt transports with rafts on the Someş river, to Viena; on this sector, in locality Mirşid takes place raw material loading from quarry with processing societies destination; lacks the connection of rural sites to methane gas; an urgency problem is water transport from road artery vicinity.

The **Zalău – Şimleu Silvaniei** sector (30 km). This sector represents for the axis, especially in administrative territory of country Sălaj, the junction area with the biggest material, energetics and informational load. However we must notice the fact that in this sector the railway connection is intermediated by locality Sărmăşag, a locality which is situated to much in the North given the most proper configuration of the axis.

It is that part of the axis in which the local interest centre and not only has oscillated in time between Şimleu Silvaniei and Zalău. It is the most favorite place for the construction of an airport. From the point of view of working area of North-Vest region, this area belongs to critical areas. From presented analyses, it is observed these easy statement of two authors. We make up only by saving that we aren't talking about a triangle, but it is a trapeze which eclipses given by the cities Cluj-Napoca, Baia-Mare, Satu-Mare, Oradea.

The **Şimleu Silvaniei-Marghita sector**. The most far away sector of the axis, where is also found the border between Sălaj and Bihor counties. So it is an inter-county sector that introduces this characteristic to the whole axis. The possibility for creating an inter-country area in Suplacu de Barcău – Ip zone (unpropitious zone) of a great long-term perspective.

b)The habitat. Going to the second system in which interferes the definite variable of settings, must be realized through a value jump in the first system, jump which will allow placing the subsystem of the setting on another floor, on a new tread in territorial hierarchy of the axis.

The statutory of the subsystem transports between population and places has the transition role, or in another way said, the role of determining a continuous becoming of the reality, what would impose a permanent adaptation of the analyzed area to the intervened mutations.

c) The agriculture. The traditional resources, starting with agriculture, penetrate in the system only beginning with the third faze. Thus the third system, in which the connection between population and agriculture realizes by transports and setting subsystem, must get a new outline, a new configuration. These can realize by endorsing and adjusting the new statements in this domain. Especially it can be realized through valuing agricultural products under the form of vital resources, but also under the form of change materials resources, energetic, informational and financial, knowing the potential mainly tree growing and wine growing of the axel.

d) The industry. The fourth system, a combination between S_3 (population, transports, setting, agriculture) on the one hand and industry on the other hand, seems the most drawn back with the smallest chances of becoming a viable system, because industry stopped sustaining, being herself actually sustained. However, a strict program, realized through passing subsystem – transports, settings, agriculture – from population to industry will foresee only the development of those industries which can maintain through owns methods, and that are predominantly in the extraction industry: lignite at Sărmăşag and Ip, oil in area of Barcău.

The strain balance through industry to lasting development of the area can realize with the different participation of industrial activities of small scale from rural space (wood, pottery, milling) but to state intervention (industrial park from Jibou).

e) The trade. The next system, marked by the integration of the trade in the systemic hierarchy of the human resources seems something more competitive that the previous one, with specification that in this case entrances depend in the majority of their part of their outside side and the outgoing are locally attributes.

The remediation of the space can be done through changing the commercial flux directions, that means that the autochthon entrances must to record biggest percentages, thus going out (production from axel), to participate in fact to local lasting algorithm.

f) The tourism. The most seducing variable which can solve in a certain measure the durable order problems seems to be the tourism present in combination and interaction with other subsystems, which participate each other with their own offer to sustain the new created system.

The drawback is owed to the fact that the tourism in axis is in an incipient stadium, the possibilities of crystallization of it being based only on the natural resources (thermal water, mineral springs, view of crystalline knoll, narrow paths, vegetal cover etc.) and human made (botanic gardens, wooden churches, historical vestiges, ethnographic elements, Roman castle, feudal fortresses, museums, new banks, traditional activities, villages) and a solution would consist in creating conditions for amplification the week-end tourism, but also in setting up some tourist pensions.

3. Conclusions

Reviewing in this way the human resources, has the role to clear the fact that "economical rise" notion so naturalized must yield the place of a great detail draft, and certain that of "lasting development", in which together with the human component are taken in consideration natural and historical dimensions too.

To make efficient the analyze, problems should be treated – it is necessary to said this? – in an interdisciplinary and systematic way, in this way we make room for the affirmation of a new concept, that of "life quality". We should take into detailed analyzing all the systems already mentioned.

The intelligibility of the system made by human resources starts from the fact that human beings live and work as part of some systems, and their whole activity reflects the systemic structure from the nature. In this way we say that human resources which participate on lasting development of the taken in analyze area represent only a structure with role to correlate the facts and human observations which can participate in the future prosperity of the local system, and not only.

Historical resources, natural resources and human resources that this space has (the geographical axel of Silvania), are between most variable and at the some time the most authentic. The structure of these in a particularly way, evidence in a clear way the potential which has for participation of lasting development desideratum in the zone. Global analyses of this realities (the axis), consolidate our thinking that the respective area has the necessary materials to going out from the fallback.

The human resources problem, should be visualized like a system with reserve connection not as an open system, because it is known that an open system is characterized by outgoings which answer the entrances in the system, but outgoing are isolated by entrances and don't have any influence under these. In exchange, a system with reverse connection is influence by it's own last behavior.

A reverse connection system has a form like a closed loop, which uses the action results of the system for ordering the next action. Establishing the objective too, which is that of lasting development, and admitting unimpaired of this objective, we register that the type of beneficial system for action in area is that with negative reverse connection.

The difference between the systems with negative reverse connection and those with positive reverse connection is that the first ones have an goal and their evolution is generated by a consequence of unimpaired this goals, and those from the second category generate rising processes in which the result of action produces a continue amplification of the action. It should be admitted that a system with a reverse connection commands the action based on previous action results.

To illustrate, we think about the whole axis and population of this region a negative reverse connection system when that what the system has to offer gives note to the lasting development, things that are taken like a goal, case in which all the aspects which belong to this geographic space must be "retouched" by population subsystem, for eliminate the minuses or pluses which can allow attainment of the propose desideratum.

In as part of this system bound up by in the same snapshot, a decision which demand the action with the level of system and information about level system. The supplied information about the situation of the axel, is the base of currently decision which order the action. The action at the level of an subsystem from axel, change the level of the whole system axel.

The real level at daily of axel, is the principal generator of information about whole sum which should be done at the whole ensemble system of the axel. The presented action, correspond the present decision (of lasting development), which at its turn, depend about the presented information, which was accumulated in time.

The present situation of the axel, don't depend of present action, but it is a sum, an accumulation of the whole action already done. Only the situation future of the axis, will depend by the present actions too.

This information itself is one of the level of system given by the axel, and this change, what show obvious that it depends by the real value which suppose that represent it. The information about the axel, isn't determined by present conditions, by the real situation of the axis, which isn't exactly available in a momentary way, which is governed by a situation already consumed, which were observed, transmitted, analyzed and processing.

Differences between real situations (the wheal geographic scale) of the axel, and information which lies at the basis of decision it is always from theoretic point of view, but for practice, information are acceptable, so that very poor it note any difference between theoretical situation and practical one of the axel, managing, we think the taking some decision.

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ÖKOTOURISMUS IM RODNA-GEBIRGE-NATIONALPARK – GRUNDLEGENDE DIMENSION DES NACHHALTIGE ENWICKLUNGS-KONZEPTES

M. MUREŞIANU,* E. SCHUSTER,* A. HĂDĂRĂU**

Abstract: Ecotourism in the Rodna-Mountain National Park – fundamental dimension of the concept of sustainable development. The initiation of projects concerning the delimitation of areas that should be protected against any economic activity is fully justified, regarding the amplification of the human pressure on the components of the geographical environment. The Rodna-Mountain National Park became, beginning with the 1st May 2004, a protected, functional area, and its administration, based in Rodna, tries by special strategies to encourage the development of ecotourism, as a fundamental part of the concept of sustainable development.
Key word: Ecotourism, Rodna Mountain National Park

Der Rodna-Gebirge-Nationalpark, Biosphären – Reservat – konzeptuelle Anhaltspunkte

Die Nationalparks sind natürliche Gebiete die dazu bestimmt sind, die ökologische Integrität eines oder mehrerer Ökosysteme für die jetztige und zukünftige Generationen zu bewahren, den Raubbau oder die zweckwidrige Tätigkeiten auszuschließen, den Menschen trotzdem ökologisch und kulturell kompatible geistliche, wissenschaftliche, bildende und erholende Gelegenheiten anbietend.

Die Biosphären-Reservate sind Gebiete mit im Rahmen des UNESCO-Programms **Mensch und Biosphäre** (MAB) international anerkannten Ökosystemen, die ein weltweit ausgedehntes Netz bilden. Jedes Biosphären-Reservat muss drei Grundfunktionen erfüllen:

• **die Schutzfunktion** – zur Landschaftspflege, zur Erhaltung der Ökosysteme, der Arten und der genetischen Vielfalt beitragen;

• **die Entwicklungsfunktion** – durch ökologische Tätigkeiten die nachhaltige wirtschaftliche und humane Entwicklung zu unterstützen;

die logistische Funktion – Unterstützung für Forschung, Überwachung, Ausbildung und Informationsaustausch auf lokaler, nationaler und globaler Ebene zu liefern, um das Streben nach Erhaltung und nachhaltige Entwicklung zu fördern.

Allgemeine geografische Aspekte

Der Rodna-Gebirge-Nationalpark ist das ausgedehnteste Schutzgebiet im Norden der Ostkarpaten, mit einer Fläche von 46.388 Hektar und die höchsten Gipfel der Ostkarpaten aufweisend (Pietrosu-Gipfel – 2.303 m und Ineu-Gipfel – 2.279 m).

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Die beachtenswerte Höhe und die Mächtigkeit des Rodna-Gebirges sind ein Resultat der petrografischen Zusammensetzung und der geotektonischen Bedingungen. Das Gebirge erscheint in Form eines aus kristallinen Schiefer zusammengesetzten, von tiefen Verwerfungen umgebenen Horstes: Dragoş Vodă (im Norden) und Rodnei (im Süden). Die kristallinen Schiefer erscheinen in drei Serien: Bretila, Repedea und Rebra. Am südlichen Rand des Rodna-Gebirges erscheinen neogene vulkanische Gesteine, in Form von entlang der morphologisch-hydrographischen Achse des Grossen Somesch angeordneten Erhebungen. Die Ablagerungsgesteine kretazischen und paläozänen Alters (Mergel, Sandstein, Konglomerate und Kalkstein) die das Massiv umgeben wurden von den steirischen Bewegungen betroffen und verleihen dem Relief einige charakteristische Züge.

Aus der ganzen Gebirgskette der Ostkarpaten erhaltet das Rodna-Gebirge die Spuren der quartären Gletscher am besten. Das Gletscherrelief ist auf dem Nordhang gut entwickelt, wo bedeutende Gletscherkare vorkommen (Pietrosu, Buhăiescu, Negoiescu etc.). Auf dem Südhang ist das Gletscherrelief schwächer vertreten: einige hängende Gletscherkare, Lalas Gletschertal, mit der schönsten Moräne der Karpaten, talaufwärts des Lala Mare-Sees gelegen, glazio-nivale Kare und Nivationsnischen.

Der Kalk der südlichen Hälfte des Rodna-Gebirges hat das Erscheinen eines durch Karren (Izvorul Cailor, Valea Rea), bemerkenswerte Höhlen (Cobăşel, Izvorul Albastru al Izei, Baia lui Schneider, Peştera lui Mihai etc.) vertretenem Karstrelief erlaubt.

Durch seine Mächtigkeit stellt das Rodna-Gebirge ein hydrographischer Knotenpunkt dar, wobei der Abfluss nach vier Hauptkollektoren stattfindet: Goldene Bistritz, Grosser Somesch, Vişeu und Iza.

Die Seen stellen eines der charakteristischen Landschaftselemente dieser Gebirge und liegen in Höhen zwischen 1800 und 1950 m. Genetisch werden sie der Kategorie der Gletscherseen zugeteilt und liegen in Karen oder Täler ehemaliger quartärer Gletscher.

Durch seine geografische Lage befindet sich das Massiv am Kontakt zweier Einflussgebiete: baltisch und ozeanisch, die Unterschiede zwischen dem Nord- und dem Südhang bewirken.

Das Regime und die Verteilung der klimatischen Elemente unterliegen den Gesetzen der Höhenstufung, da der Unterschied zwischen der maximalen Höhe (2.303 m, Pietrosu-Gipfel) und den Randgebieten des Parks, in cca. 700 m Höhe gelegen, beachtlich ist.

Floristisch beinhaltet dieses Gebiet besondere Arten der alpinen und subalpinen Stufe. Einige Endemismen, dazu Wacholderformationen mit Siebenbürgischer Alpenrose und Zierbelkiefer sind besonders wertvoll für die spontane Flora.

Faunistisch, kommen hier Bär, Hirsch, Luchs, Gämse, Alpenmurmeltier, Steinadler vor, dazu in den kristallinen Gewässer der Flüsse und Gletscherseen Bachforelle, Regenbogenforelle und Huchen.

Als Folge der biogeografischen Wichtigkeit wurde der Rodna-Gebirge-Nationalpark zum Biosphären-Reservat erklärt.

Strategien zur Förderung des Ökotourismus und Perspektiven der nachhaltigen Entwicklung

Das rasche Wachstum der Anzahl der im Gebiet des Rodna-Gebirge-Nationalparks ihre Freizeit verbringenden Touristen generieren das Risiko der Degradierung der geografischen Umwelt, die sowieso der Degradierung durch eine Reihe traditoneller Tätigkeiten wie Bergbau, Forstarbeit und Weiden unterworfen ist.

Im Namen des Tourismus findet manchmal die Zerstörung wundervoller Landschaften statt, und die Touristen selber hinterlassen oftmals tonnenweise Abfälle.

Das Konzept Ökotourismus ermöglicht dem Menschen sowohl sich weiterhin an den vielfachen Wohltaten der Natur zu laben, als auch einzurichten, wiederherzustellen und zu erfrischen, was er früher zerstört hat.

Für den Rodna-Gebirge-Nationalpark stellt der 1. März 2004 ein Hauptmoment dar: damals wurde zum ersten Mal in der Geschichte dieses Schutzgebietes eine einheitliche Verwaltung eingesetzt, gründend auf einer Gruppe von Spezialisten (Forstspezialisten, Biologen, Wirtschaftswissenschaftler), zusammen mit einem Wissenschaftsrat, zusammengestellt aus 20 akademischen Persönlichkeiten (Universitätskader, geografische Forscher, Biologen, Forstspezialisten), welche die ganze Funktionalität dieses Schutzgebietes zusammen einheitlich koordinieren.

Eine erste Monitorisierung der touristischen Tätigkeiten wurde im Jahr 2005 vorgenommen, als man die Erlangung der quantitativen und qualitativen Beurteilung der touristischen Ströme in bestimmten Schlüsselpunkten verfolgte.

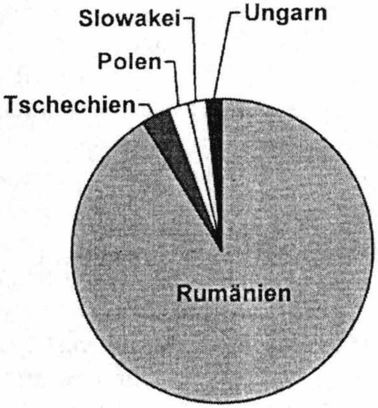
So wurden im Jahr 2005 an einem der wichtigsten Eingangspunkten im Park, das Blaznei-Tal, im südlichen Teil gelegenen, über 650 Touristen monitorisiert, darunter über 50 Ausländer (Abb. 1).

Tabelle 1. Herkunftsgebiet der im Jahr 2005 im Park durch das Blaznei-Tal eingetretenen Touristen

Lfd.Z.	Herkunftsland	Touristenzahl
	Rumänien	601
	Tschechien	20
	Polen	15
	Slowakei	12
	Ungarn	11
	Gesamt	659

Vertreter (für den Tourismus zuständig) der Verwaltung des Rodna-Gebirge-Nationalparks haben diese Monitorisierung durchgeführt und stellten fest das der Anteil der ausländischen Touristen noch gering ist, wobei diese in kleinen Gruppen (2-5 Personen) und für 1-2 Tage den Park besuchen.

Abb. 1 Herkunftsländer der durch das Blaznei-Tal im Park eingetretenen Touristen (2005)



Je eine Gruppe aus jedem Land wurde gebeten, einen Fragebogen in englischer Sprache auszufüllen, wobei Fragen über starke und Schwachpunkte des Rodna-Gebirge-Nationalparks gestellt wurden. Die meisten der Befragten schätzten die besondere natürliche Umgebung, das Relief und die bemerkenswerte Landschaft, blieben aber von der für einen modernen, zivilisierten Tourismus nicht geeignete Infrastruktur dieses geografischen Raumes enttäuscht.

Aufgrund der Fragebögen die sowohl den rumänischen, als auch den ausländischen Touristen die 2005 im Park durch das Blaznei-Tal eintraten verteilt wurden könnten die wichtigsten Aspekte hinsichtlich der Enwicklung des Ökotourismus in diesem Schutzgebiet zusammengefasst werden.

Die Beurteilungen der Touristen und die aufgrund dieser durchgeführten Analyse ermöglichten uns die Ausarbeitung eines Übersichtschemas der starken und Schwachpunkte, der Gelegenheiten und der externen und internen Bedrohungen (Abb. 2).

Die Analyse des gegenwärtigen Zustandes und der Wirkungsfaktoren heben die Einflüsse, die vorkommenden Hindernisse und die Stärken und Schwächen hervor.

Die Entwicklung des Ökotourismus oder des grünen Tourismus ist unentbehrlich für diesen Park, als Folge der Einflüsse die er auf der Erhaltung der Biodiversität und der lokalen Traditionen ausübt. So haben wir, durch das Treiben dieser Tourismusart, die Möglichkeit, die die natürlichen Lebensräume zerstörenden Tätigkeiten zu kontrollieren und einzuschrenken, den Massentourismus und dessen negative Einwirkung auf die Biodiversität zu verringern und den Lebensstandard der lokalen Gemeinschaften zu steigern.

Durch das Treiben des Ökotourismus kann folgendes erzielt werden:

• die Erziehung der Gäste im Sinne der Verantwortung hinsichtlich der Natur

• die Steigerung des Nutzungsgrades der lokalen Unterkunftseinheiten (Pensionen, Familienhäuser)

• die Ermutigung der Touristen, Fachführer zu benutzen

• die Anziehung mehrerer Gäste im Park, soweit möglich auch ausserhalb der Spitzensaison

• die Orientierung des von Touristen ausgegebenen Geldes zu den lokalen Gemeinschaften, zum Zweck der Unterstützung traditioneller Produkte (Nahrungs- und Nichtnahrungsprodukte)

Die Identifizierung aller Werte und die Feststellung aller Möglichkeiten, die den nachhaltigen Tourismus und dessen Hauptelement – der Ökotourismus – unterstützen können, werden im Rodna-Gebirge-Nationalpark eine bemerkenswerte wirtschaftliche Entwicklung aller menschlichen Habitate, die um dieses Schutzgebiet gravitieren, bewirken.

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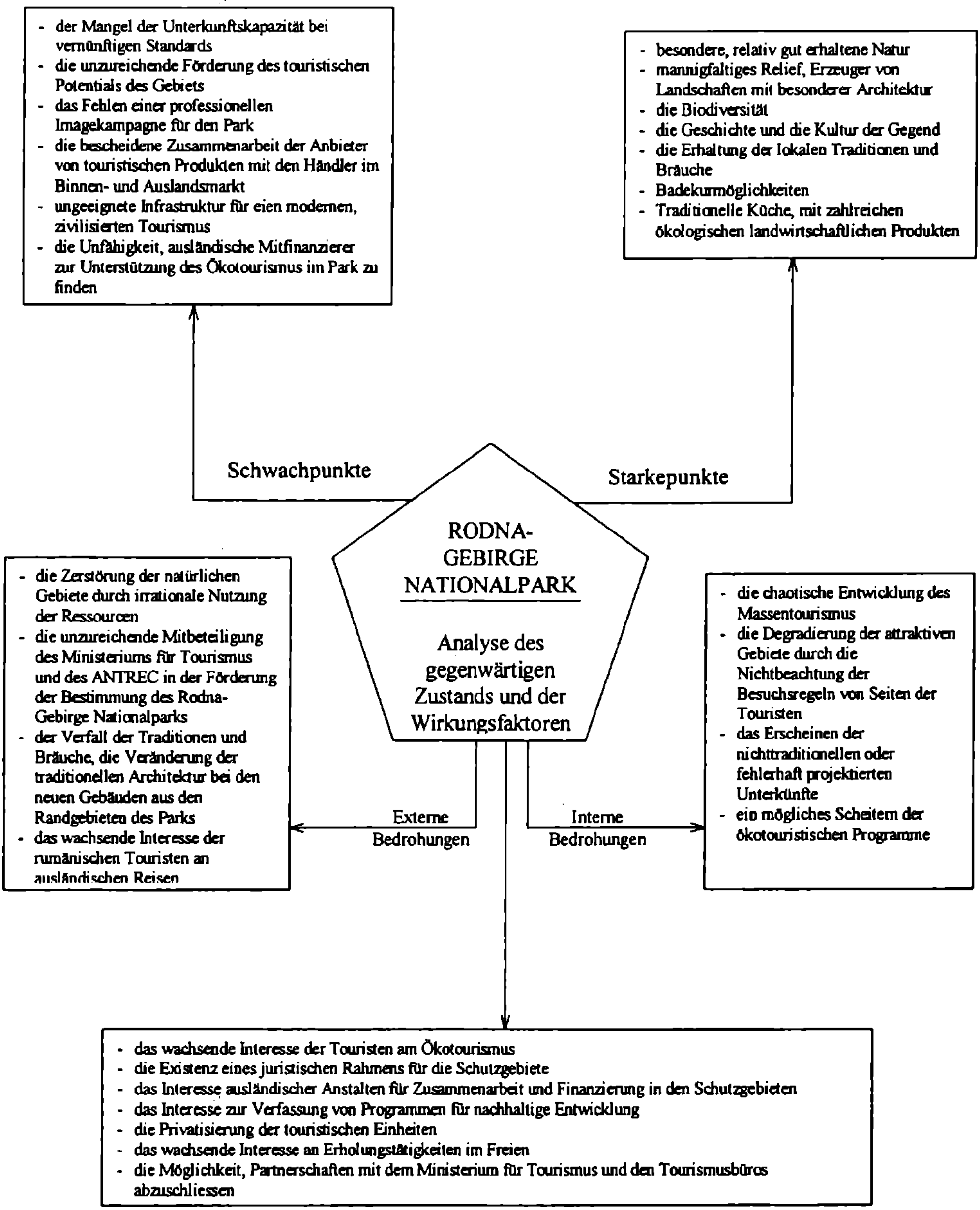

Abb. 2. Der Rodna-Gebirge-Nationalpark - Das Übersichtsschema des gegenwärtigen Zustandes und der Wirkungsfaktoren

Abb. 3. Pietrosu-Gipfel

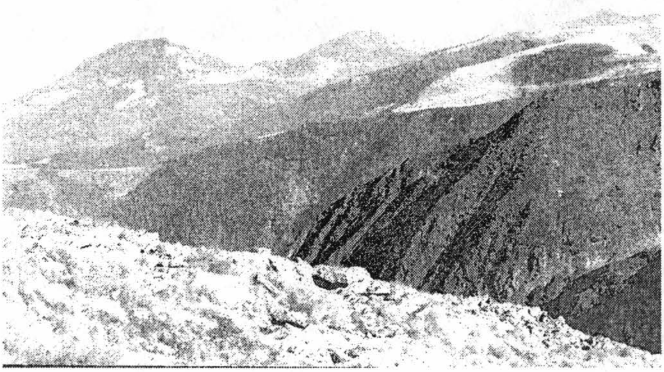

Abb. 4. Rodna-Gebirge – allgemeine Ansicht

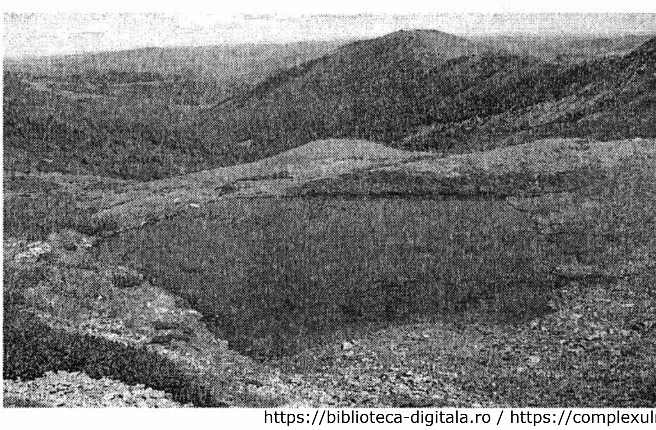

Abb. 5. Lala-Sea

Abb. 7. Lärchen – und Fichtesetyloinge, yur Umsaat bere reit. in der Pietrosu-Genend

Abb. 6. Rodna-Gebirge-Nationalpark-Logo

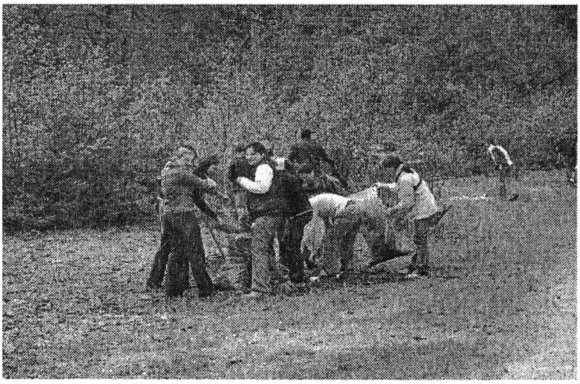

Abb. 8. Ökologierungsaktion des Izvorul Băilor-Tal

Abb. 9. Schüler des Ökologiecamps Valea Blaznei in einer Ökologierungsaktion

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