Current Trends in Natural Sciences Vol. 8, Issue 15, pp. 162-168, 2019

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

THE MINERALOGICAL ANALYSIS OF THE LIMESTONE IN THE NORTH-WESTERN AREA OF LEAOTA MASSIF SOUTHERN CARPATHIANS, ROMANIA

Magdalin Leonard Dorobăț [1], Codruța Mihaela Dobrescu [1,]*

[1] University of Piteşti, Faculty of Science, Physical Education and Informatics, Department of Natural Sciences, Târgu din Vale Street, No. 1, 110040, Piteşti, Romania

Abstract
The present paper aims to analyze the mineralogical composition of the limestone from the Leaota Mountains (the northwest region) which is actually an extension of the karst area from the Piatra Craiului Mountains. The behavior of limestones towards external modeling agents depends on this mineralogy. These limestone scree, through their free interclastic spaces, form a mesovoid shallow substrate (MSS), named also shallow subterranean habitat (SSH), populated with a variety of faunistic components, especially invertebrates. The more interclastic spaces that communicate between each other and which are linked, as far as possible with deep underground environment (caves), but also with the surface (edaphic environment), the microfauna is more diverse. Chemical and biochemical alteration processes (whether meteorization) in turn lead to the stabilization of the scree (superficial underground environment) through the appearance of residual clays, the installation of vegetation, the filling of the interclastical voids. In this way, the gradual disappearance of these free spaces, which allow to live the invertebrates. For this reason, we analyze the mineralogical composition of these limestones, indirectly this composition influencing the existence of the invertebrates in the scree.

Keywords: Leaota, limestone, mesovoid shallow substratum (MSS), mineralogical composition, scree, shallow subterranean habitats (SSHs)

1. INTRODUCTION

By analyzing the geomorphological map of Leaota Mountains (Fig. 1), we can notice that, from the lithological perspective, we meet the following large relief categories: relief developed on crystalline schists
(74% of the massif's surface); relief developed in limestone (4% of the surface); relief developed in detrital rocks (21%); relief developed in magmatic rocks (1%) (Murătoreanu, 2009). The karstic relief is also specific to parts of Leaota Massif, especially on the north-western sector (Fig. 2), area in which we carried out our research, but also in the area of the reservoirs of Rătei and Brătei Rivers, located in the south-eastern part of the Massif.

In Romania, the most intense development of the endo- and exokarstic processes can be notice, on large surfaces, in the Mesozoic limestone (Trufaş and Sencu, 1967). This type of limestone (alongside the dolomite) spread on 626 km^2 in the Southern Carpathians (Sencu, 1968).

Practically, the karstic area between the north-western part of Leaota geologically represents a continuation of the karst in the neighboring mountains, Piatra Craiului. This limestone is part, from

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences Vol. 8, Issue 15, pp. 162-168, 2019

Current Trends in Natural Sciences (on-line) Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-953X ISSN: 2284-9521
ISSN-L: 2284-9521 ISSN-L: 2284-9521

the geological perspective, of the Middle Jurassic – Aptian sedimentation cycle (Mutihac and Mutihac, 2010; Dorobă□, 2016).

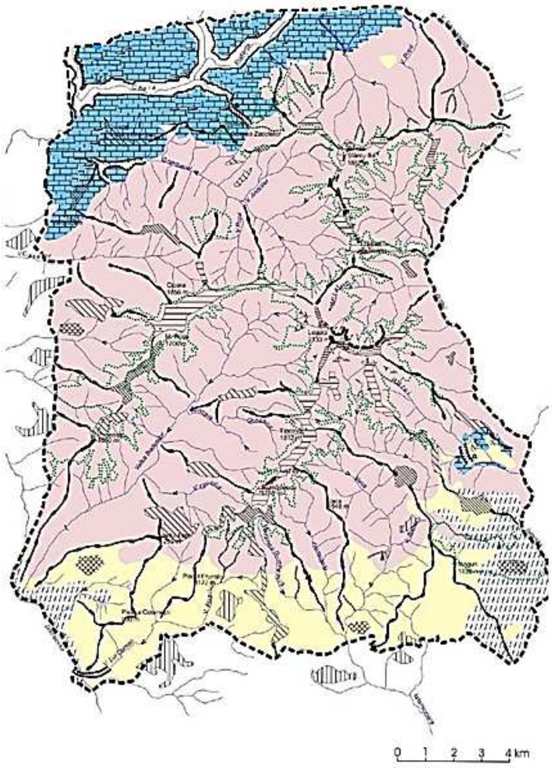

Figure 1. Geomorphological map of Leaota Mountains (after Murătoreanu, 2009, modified and simplified)

Legend: a limestones rocks; b cristaline schists rocks; c detrital sedimentary rocks

This cycle consists of sedimentary deposits which, in the synclinal of Piatra Craiului – Dâmbovicioara, are displayed on both sides, spreading towards the Cheii Valley and in the Ghimbav Gorge and also in the upper part of the Dâmbovicioarei Gorge. In the Rucăr-Dâmbovicioara Basin, the limestone deposits are a continuation of the ones met in the southern area of the neighboring Massif, Piatra Craiului (Ilie, 1969; Mutihac, 1990; Mutihac and Mutihac, 2010) and are Middle Jurassic (Dogger) or Superior Jurassic aged (Malm). The limestone in Cheii Gorge are seen by Ilie (1971) as representing, in fact, a continuation, on approximately 1.5 km, of the limestone deposits in Dâmbovi□ei Gorge.

As a result of the shaping of the limestone relief, especially through the gelifraction, limestone scree resulted in the area, which itself represents an interesting living environment, individualized through certain ecologic particularities, called the Mesovoid Shallow Substratum (MSS) or Shallow Subteranean Habitat (SSH), a type of habitat that hosts a specific invertebrate fauna. The process of generating limestone scree or the emergence and development of the soilification processes, through the emergence of residual clay (as a result of chemical alteration) depend on the limestone substratum. This is why the macroscopic, mineralogical content analysis of the limestone represents the object of the researches in this paper, in order to analyze the susceptibility of limestone towards the creation of scree or towards stabilization through clay material and and indirectly to facilitate or not the existence of faunistic components.

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

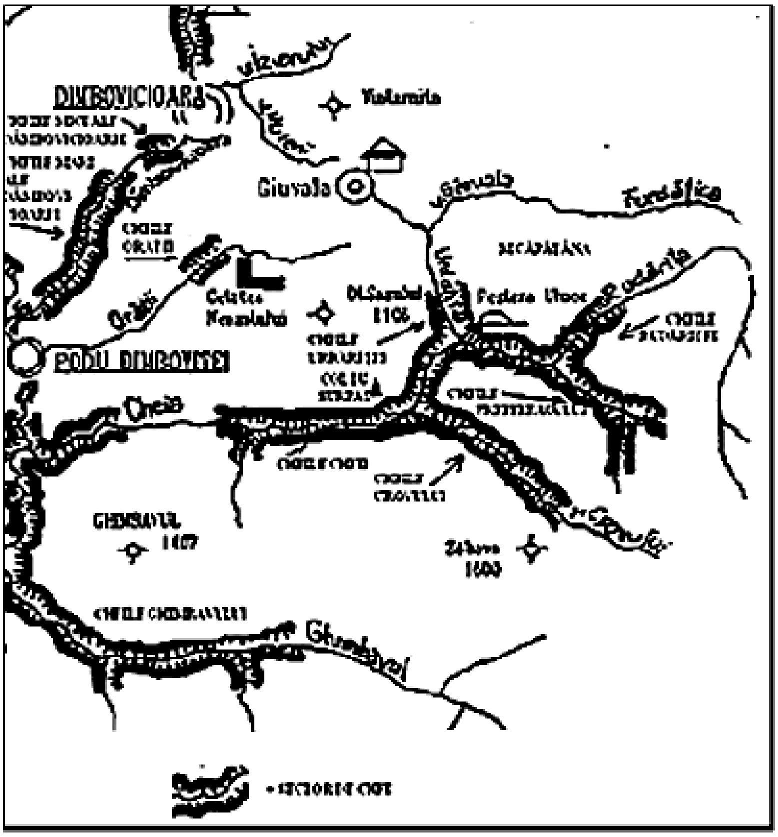

Figure 2. The gorge complex in the north-western part of Leaota Massif (Alexiu, 1998, modified by Dorobăț, 2016)

2. MATERIALS AND METHODS

For the macroscopic, mineralogical determinations, we have randomly collected, from different areas of the north-western sector of Leaota Massif, large enough samples so that we could build thin sections for the microscopic analysis. From the limestone scree areas, we have collected more than 300 kilos of samples from each type of rock.

As one can notice from the map (Fig. 1) showing the location of the areas we have collected from, limestone is geologically identical.

We have collected, from the scree, samples that are highly representative, from fresh cracking, which would not display chemical alteration.

The mineralogical analysis of the thin sections was made using a *Carl Zeiss Jena Amplival Pol* mineralogical microscope with polarized light, which has compensators and polarizers, quartz feathers with rotating platinum. Thin sections allow the trespassing of the light and thus they can be microscopically analyzed in polarized or non-polarized light.

3. RESULTS AND DISCUSSIONS

From the macroscopic perspective, prevailed samples are with compact aspect, sometimes with brown-reddish stains, due to the content of limonite in the limestone.

Limestone in the prevailed samples from the field are white (Fig. 3) which shows that they have a low content of clay minerals, which could color their surface as a result of the (hydro)oxidation processes.

Some limestone samples display micro cracks (Fig. 4).

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Figure 3. White limestone in scree

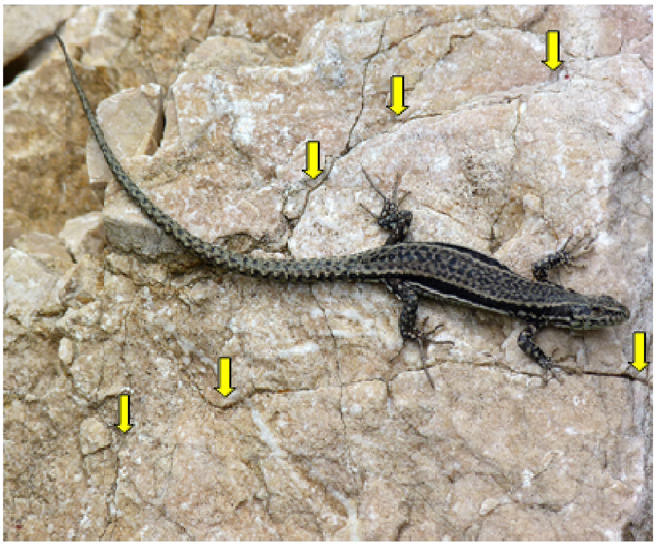

Figure 4. Limestone with micro cracks

Mineralogical analysis supposed the creation of six thin samples and the usage of a polarized light microscope. This microscopic analysis have led to the establishment of the following quantitative mineralogical content of the researched limestone (Table 1).

Table no. 1 Mineralogical composition of limestone

Crt. No.	Mineral	Chemical formula	Size (mm)	%
1.	Calcite	$CaCO_3$	0.002-0.4	99
2.	Quartz	SiO_2	<< 0.001	< 0.5
3.	Limonite	$FeO(OH)*nH_2O$	< 0.005	traces
4.	Clay minerals	$(Al,Mg,Fe)_2(Si,Al)_4O_{10}(OH)_2(Ca,Na)_x*4H_2O$ $Al_4SiO_{10}(OH)_8$	< 0.001	traces

By analyzing the data in table 1, we can argue that:
Calcite is 99% (mass percentage) included in the composure of the analyzed limestone. Calcite has a biogenic origin, which can be observed with the microscope, the bioclasts (allochemical constituents) between 0.1-0.7 mm; the binder is micritic, with sizes between 0.002/0.005 mm. The unequally granular structure of limestone is a result of the different sizes of bioclasts compared to the ones of the binder. One can also notice, in the mass of the binder, recrystallization of the micritic calcite materials, due to diagenetic transformations. The thin sections which were microscopically analyzed show that bioclasts are almost entirely opaque or semi-opaques, as sometimes the calcite that is part of the bioclasts has a largely crystallized aspect (Fig. 5).
Quartz is present in an insignificant percentage in the limestone (< 0.5%).
Limonite only appears as traces on the surface of limestone, as some thin layers, as a result of the chemical alteration of the clay material, at their contact with air/water.
Clay materials are found in insignificant volumes in the analyzed limestone, as traces. The microscopic study has barely emphasized their existence under a weak opacity of the clasts in the microscopic field and, sometimes, of the micritic binder.

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences Vol. 8, Issue 15, pp. 162-168, 2019

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

The mineralogical aspects of the analyzed limestones, also observed using the microscope are presented in figures 5 – 9.

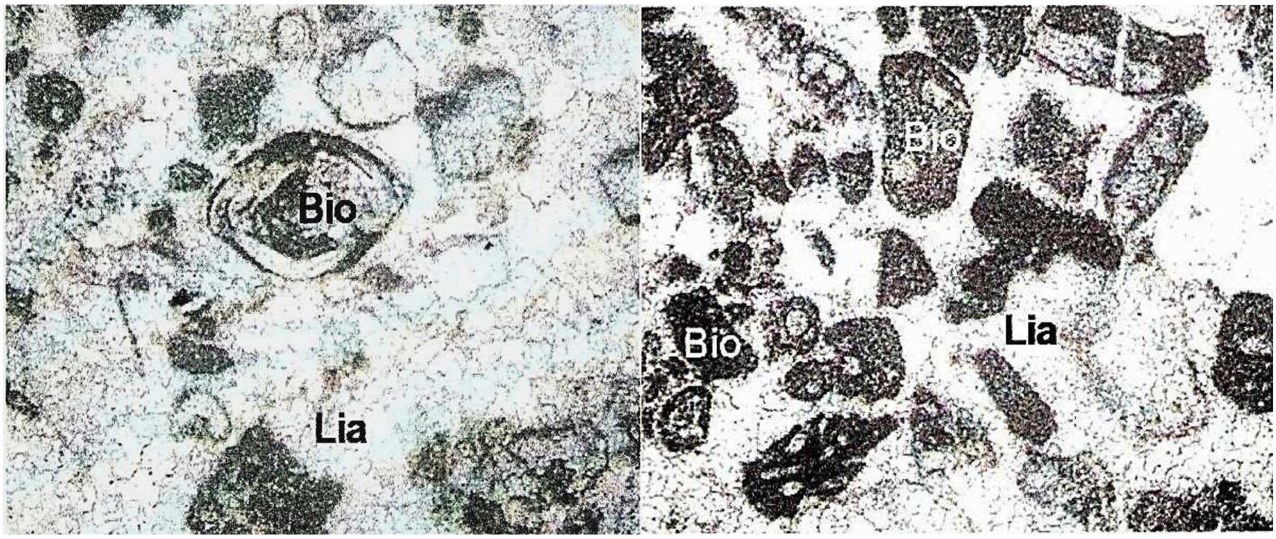

Figure 5. Organogenic limestone (x 257; N II; x = magnification of image; N II = normal light image)

We can observe the bioclasts (Bio) caught within the micritic binder (Lia). Bioclasts have a different size, which provides an uneven granular structure to the rock. The texture is massif.

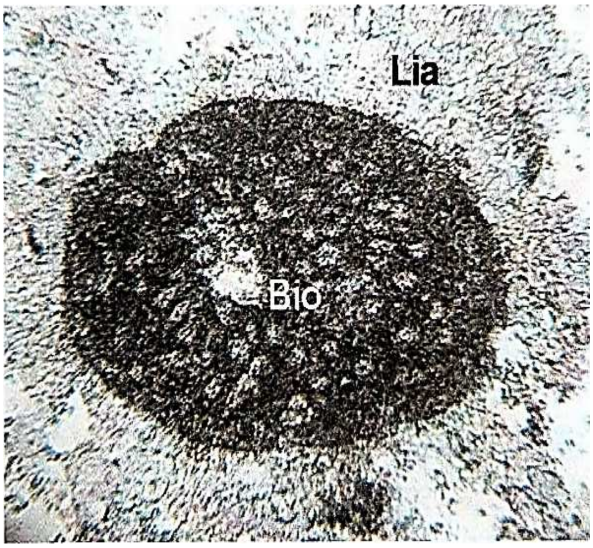

Figure 6. Organogenic limestone (x 821; IIN)

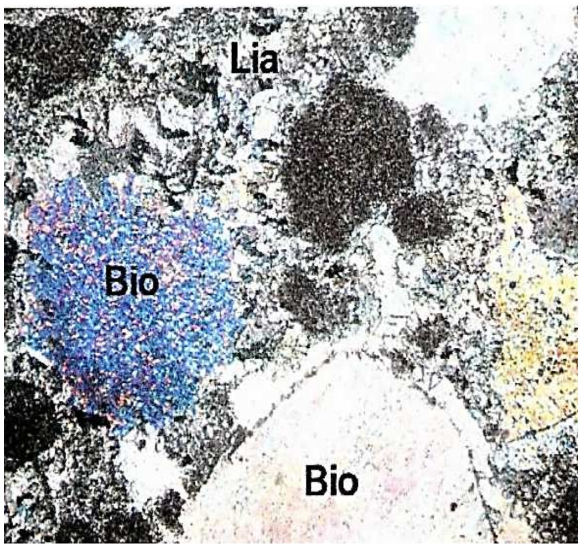

Figure 7. Organogenic limestone (x 257; N+; N+ = imagine in polarized light)

We can notice large recrystallized calcite crystals within some bioclasts (Bio), caught in a micritic calcite binder (Lia). The texture is massive; the structure is uneven granular (Figs. 6 and 7).
In figure 8 we observe a bioclast (Bio) caught in a micritic calcite cement (Lia); Calcite (Ca) is widely crystallized. In the upper corner of the image, it is crystallized within a bioclast. The texture is massive; the structure in uneven granularly.

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

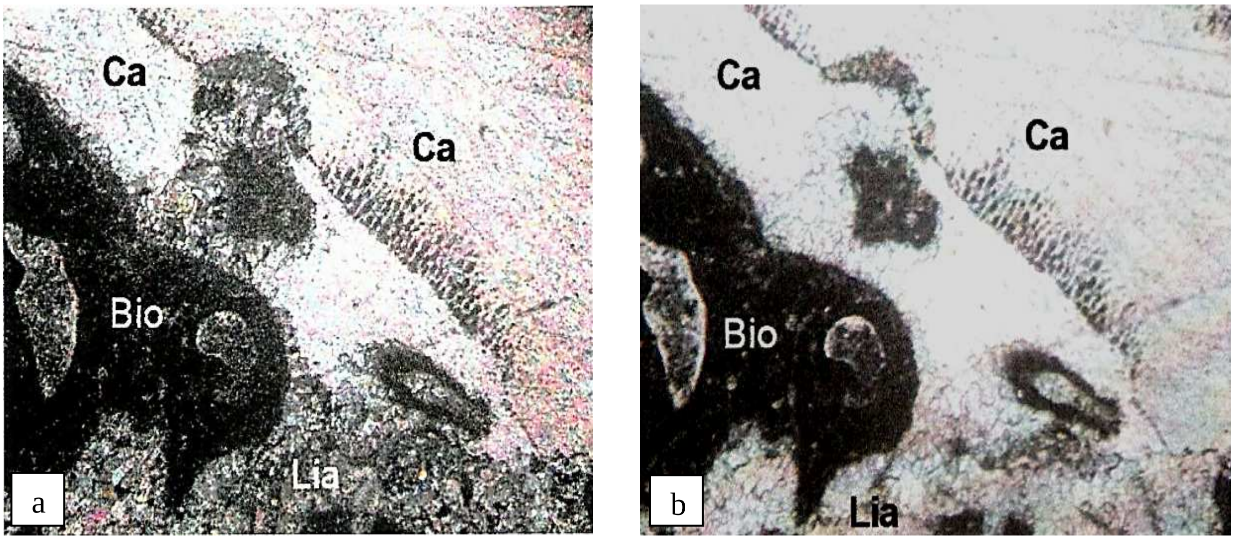

Figure 8 a and b. Organogenic limestone (a: x 257; N+. b: x 257; N II.)

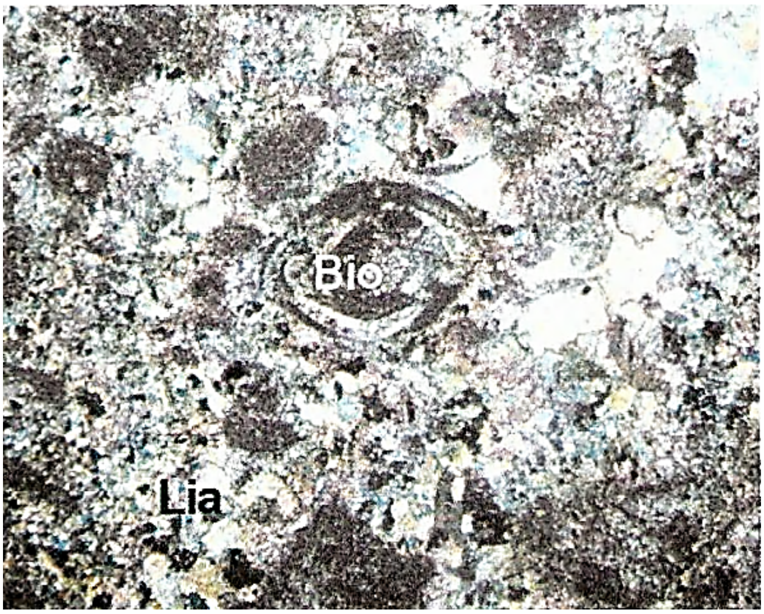

Figure 9. Organogenic limestone (X 257; N II)

Practically, subsequently to the eventual dissolving and levigation of the calcium carbonate, it only remains a tiny quantity of insoluble residual clay (under 1% of the initial mass of limestone) which would stay at the basis of the soilification process. The macro porosity of scree (we call it interclastic; Dorobăț, 2016), is very high and the meteoric water rapidly flows towards the interior, as there is no sufficient time such to start surface chemical reactions between the rock and the water which would lead to an accentuated chemical alteration. The lack of clay minerals in the limestone, which are to be "set free" from the mass of the rock through alteration after the levigation of the soluble part leads, in our case, to no secondary clay products. A significant feature of the MSS (SSH) is that is presents interstitial spaces which intercommunicate and to ease the circulation of living creatures in the undergrounds (Boitan-Ilie, 2001).

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

4. CONCLUSIONS

The limestones have an organogenic origin and contain approximately 99% calcium carbonate (calcite).

Considering from the speleological perspective, we can claim that limestone scree, reported to the other geological kind of scree, is far more favorable from this perspective, thus providing a lot of free empty interclastic spaces allowing for the existence of a diverse microfauna with many invertebrate species.

As a corollary of the previous conclusion, the existence of clay minerals in a tiny volume, 1%, also explains the slow soilification process in the area of the limestone scree. Until the soilification process, the scree is very unstable, mobile, nude (without vegetation) or almost nude.

5. REFERENCES

Alexiu, V. (1998). Vegetația Masivului Iezer-Păpuşa. Studiu fitocenologic. [The vegetation of the Iezer-Păpuşa Massif. Phytocenological study]. Editura Cultura, Piteşti.

Boitan-Ilie, V. (2001). Mediul subteran superficial (M.S.S.) – un compartiment al mediului mai puțin cunoscut. [Mesovoid Shallow Susbtratum (MSS) - a lesser known compartment of the environment]. *Ecocarst nr. 2*, S.R.S.C. – Bucureşti.

Dorobăț, M.L. (2016). Cercetări asupra mediului subteran superficial din sectorul nord-vestic al Masivului Leaota (Carpații Meridionali). Teză de doctorat. [Researches on the superficial underground environment of the Northwestern Massif of the Leaota Massif (Southern Carpathians). Thesis]. Universitatea din Piteşti.

Ilie, M. (1969). Geologia județului Argeş. [Geology of Argeş County]. *Analele Muzeului Județean Piteşti - Studii şi Comunicări*, p.9-33.

Ilie, M. (1971). Geomorfologia județului Argeş. [Geomorphology of Argeş County]. *Analele Muzeului Județean Argeş, Piteşti - Studii şi Comunicări*, p.9-41.

Murătoreanu, G. (2009). Munții Leaota – Studiu de geomorfologie. [Leaota Mountains - Study of geomorphology]. Editura Transversal, Târgovişte.

Mutihac, G., Mutihac, V. (2010). Geologia României în contextul geostructural central-est-european. [The geology of Romania in the Central-East-European geostructural context]. Editura Didactică şi Pedagogică, Bucureşti.

Mutihac, V. (1990). Structura geologică a teritoriului României. [Geological structure of the territory of Romania]. Editura Tehnică, Bucureşti.

Sencu, V. (1968). Le carte du carst et du clasto-carst de Roumanie. [The map of the karst and clasto-karst of Romania]. *Rev. Roum. Géolog., Géophys. et Géogr.- Série de Géographie*, Bucarest, *12 (1-2)*: 35-41.

Trufaş, V., Sencu, V. (1967). Tipuri litologice de carst în România. [Lithological types of karst in Romania]. *Analele Universității Bucureşti, seria Ştiințele Naturii, Geologie-Geografie*, *XVI (1):* 115-121.

*Corresponding author, E-mail address: codrutza_dobrescu@yahoo.com