BULETINUL Universităţii Petrol – Gaze din Ploieşti	Vol. LXX No. 1/2018	17 - 28	Seria Tehnică

Petrographic Study of Limestone Lithoclasts in the Paraconglomeratic Eocene facies of the Podu Secu Formation in the Tarcău Unit of the Eastern Carpathians (Upper Part of the Buzău Valley)

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Abstract

In the structural development as imbricated folds structures of the Paleogene-Miocene Formations belonging to Tarcău Unit from Eastern Carpathian Curvature, one of the geological landmark can be considered the breccia deposit that repeats with increasing thickness from the inside to outside, revealing clear characters of debris-flow deposit. The several descriptive facies and their interpretative facies with genetical implications are supplemented in this paper with the petrographic study of the different categories of clasts included in the paraconglomeratic deposit of the Podu Secu Formation. In the paper are detailed the petrographic study of the carbonate lithoclasts divided in micritic limestones with Globigerinidae, calcirudites with elements of reef limestones, and bioconstructed coral limestones. The detailed mineralogo-petrographic description allows underlining of some assertions on the genesis and the source area of the paraconglomeratic deposits.

Key words: *Eastern Carpathians, internal Moldavides, debris flow deposits, Podu Secu Formation, limestone lithoclasts, petrographic remarks*

Introduction

In the bordering area of the Siriu dam, in the slope of the national road DN 10 (Siriu-Braşov), there are outcrops of the internal Paleogene flysch in the Tarcău Unit of the Moldavides in the Eastern Carpathians, in which several sedimentological facies can be recognized.

The present paper aims at studying the petrographic structure of the limestone lithoclasts pertaining to some paraconglomerates, interpreted as unusual debritic flows associated with the *Podu Secu Formation*.

Stratigraphic description

The Tarcău Lithofacies in the internal curvature of the Eastern Carpathians comprises several Paleocene-Eocene formations (*Tarcău sandstone formation* = Paleocene-Lutetian, *Podu Secu strata*, topped with *Globigerina marls* = Priabonian) (fig. 1, 2 and 3), which have the *Horgazu Senonian strata* at the base and are covered by the Oligo-Miocene *Pucioasa-Fusaru facies*. The *Podu Secu strata* (Băncilă, 1955), as internal facies of the Priabonian Tarcău unit, are made up of thick alternations of diaclased calcareous sandstones, gray and green marls and clays, sometimes with fucoids. Intercalations of gray marly limestones occur frequently. Red shale intersections are missing. The *Plopu strata* (Atanasiu, 1943), as outer facies of the Priabonian Tarcău unit, are represented by a sandy clay flysch of the hieroglyphic layer type in which, especially in its lower part, frequent red shales intersect. [1,2,3,4]

Both in the *Podu Secu strata* and in the *Plopu strata*, a marly-calcareous level, or *Globigerina marls*, can be identified at their marginal part. This level contains intercalations, or in some places is completely replaced by thick sandstone banks (*Fusaru type sandstones* = *basal Fusaru sandstone*, Băncilă 1955); in the *Plopu strata*, these sandstones are quartzous, greenish or whitish, like *Kliwa sandstones*, and are known as the *sandstones of Lucăcești*. [1,2,3,4]

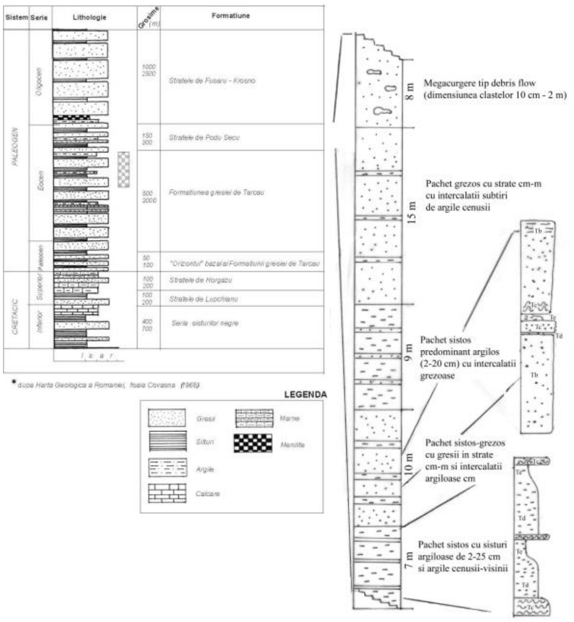

Fig. 1 *The stratigraphic context of the case study (after* [5] *modified).*

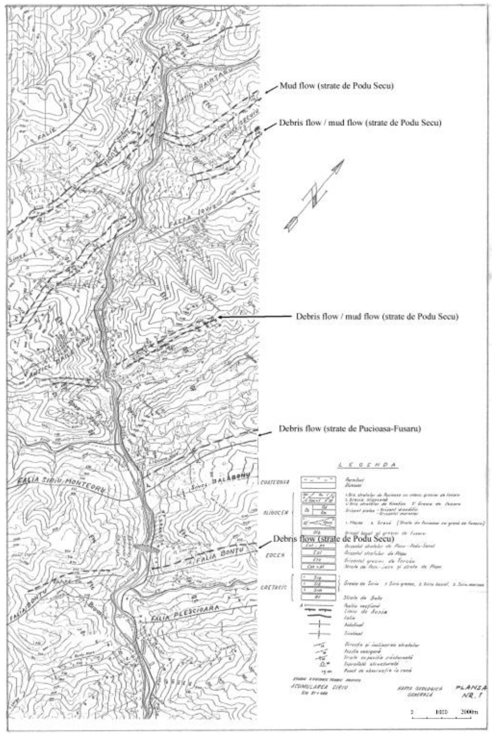

Fig. 2 *The geological sketch of the upper valley of the Buzău River in the area of the Siriu Dam (according to the ISPIF reports, modified)* [6].

Sedimentological description

Generally, the Paleocene-Eocene sequence is dominated by lithic sandstones (with subordinate polymictic conglomerates) and clays. The ruditic petrofacies is represented by paraconglomerates and orthoconglomerates with lithoclasts (quartzites, micaschists, and gneiss) in arenitic matrices. The arenitic petrofacies contains sandstones and graywacke that are litho-feldspathic, feldspatho-lithic and lithic. The binder is represented by a calcitic cement and a silto-lutitic siliciclastic matrix. The lutitic petrofacies consists of green and red clays, and marls or gray shaly clays. On different scales, there are sequences which, in point of their stratonomic characteristic, become *thinner-upward* or, in point of their granulometric characteristic, are *fining-upward*.

Previous sedimentological investigations [5,6,7] identified eight types of facies that were diagnosed compositionally, texturally and structurally; from a coarse granulometric structure to a fine one, the suite is as follows: F1 – unstratified (*bouldery*) paraconglomerates; F2 – (*pebbly*) orthoconglomerates in thick, amalgamated layers; F3 – slightly layered paraconglomerates and coarse sandstones; F4 – stratified coarse sandstones; F5 –stratified medium sandstones; F6 – stratified fine sandstones; F7 – fine sandstones in thin layers, and clays; F8 – laminated clays and finely stratified limestones.

The F1 facies consisting of non-stratified conglomerates suggests the following types of flows: *debris flow* or *debris flow-mud flow.* As far as the stratigraphic position is concerned, the F1 facies occurs in the Podu Secu strata where it is over ten metres thick (fig. 3 and 4) and in the Pucioasa-Fusaru formation (between the Giurca viaduct and Pascului quarry) where its thickness is submetric-metric. The Podu Secu strata present outcrops in four locations and have similar stratigraphic positions, related to the folded structure of the Tarcău unit; from the inside to the outside, they join the Secuiu syncline (adjacent to the confluence of the Buzău river with the Sasului brook) on the eastern flank of the anticline of the Siriu baths (in the area of Groapa Vântului near the confluence of the Buzău river with the Teherău brook), both having the characteristic of a *debris-flow* to a *mud-flow*; in the downstream area of the Siriu dam (in the roadside, close to the exploration gallery near the Bonțu fault and the sulphurous spring) (fig. 3 and 4), they have the characteristic of a *debris-flow*. [7]

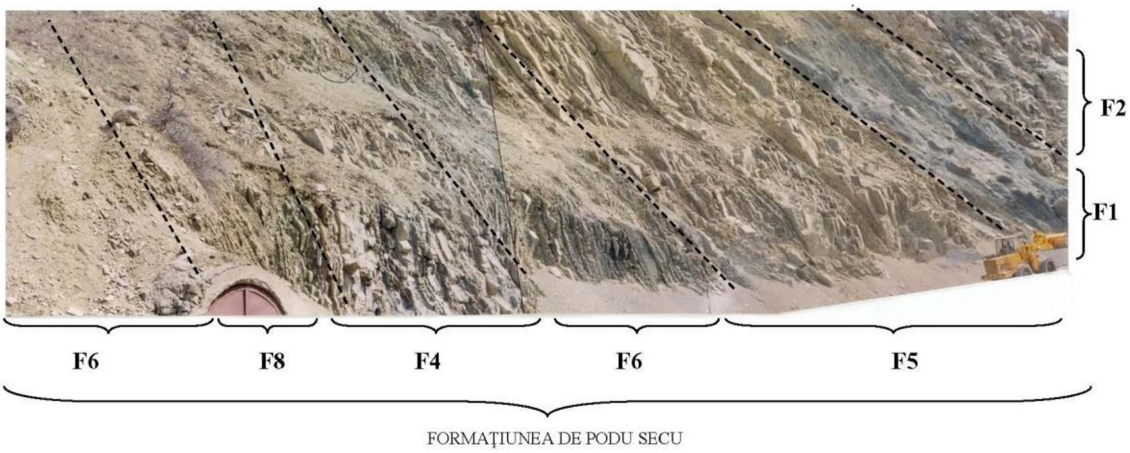

Fig. 3 *Panoramic view of the Eocene top that shows the contact between the Tarcău sandstone Formation and the Podu Secu Formation – the left slope of the Buzău valley, downstream of the Siriu dam, in the curve of the road adjacent to the base of the spillway.* [6,7]

This kind of *debris-flow* developed as a gray, unstratified matrix which, due to alteration, is brick-red in some places, and clearly delimited – at the top, it has exaggerated load-cast structures, related to the rapid accumulation of the F2 superjacent facies. The matrix is predominantly composed of an arenitic-siltic, slightly lutitic and micaceous material, with low percentages of fine clastorudites – metaclasts (sericite/chlorite schists, black and white quartzites, micaschists, and gneisses), and sediclasts (sandstones, limestones and marly limestones), which have a subparallel orientation to a fluidal pattern in comparison with the general stratification, predominant at the base of the sequence. The matrix encompasses decimetric and metric blocks, disposed in subparallel to fluidal layers with a general stratification tending to a chaotic arrangement, concentrated in the lower half and having a matrix-like structure (ruditic metaclasts, marly limestones, diagenized Mesozoic limestones, Tarcău-like sandstones, fine altered lithic sandstones, micaceous or conglomerate sandstones, clayey-siliceous shales and fine gray-blackish orthoquartzite sandstones). [7]

The F1 facies is interpreted as a product of a cohesive debritic flow, in the proximity of the source, or as a channel-mouth deposit (“mother-flow”) [8,9]. It is the product of a siliciclastic accumulation with a *slumping* evolution followed by a *debris-flow* during the movement along the slope. The fluidal texture of the elongated clasts suggests a laminar flow. [10,11]

Fig. 4 *Detail of a megaflow representing the debris flow type, in the Podu Secu Formation (the left side of the Buzău valley, downstream of the Siriu dam, in the first curve of the road near the large water spillway)* [6,7]

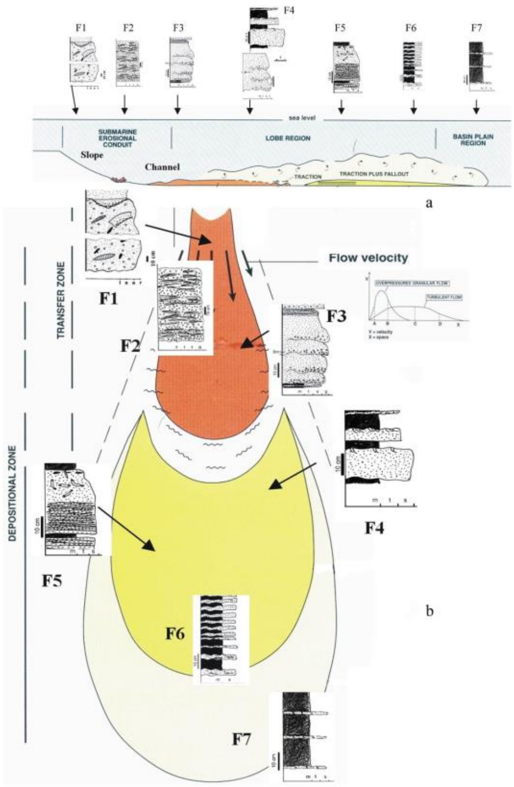

Fig. 5 *Sedimentary facies distribution: a – between the slope and the basin plain; b – within the depositional transfer areas of the turbidity system (after* [5], *according to* [8]).

Mineralogical-petrographic description

The paraconglomeratic body, interpreted as being formed through debris flow deposition, has poor sorting and a very complex composition, from both mineralogical and petrographical points of view. All granulometric fractions, respectively the ruditic, arenitic, siltic and lutitic fractions, are well represented in its composition. The lithoclasts are obviously best represented in the ruditic fraction, but they also occur in the subordinate coarse arenitic fraction. The largest lithoclasts have maximum dimensions exceeding 10 cm. Taking these large centimetric lithoclasts as a point of reference, the rest of the petrographic body, with all its granulometric variety, can be considered a matrix of the geological body. This matrix has a much larger volume than the volume of the centimetre-sized coarse lithoclasts. We consider that, besides the siltic, arenitic and lutitic granulometric fractions, the matrix also includes fine ruditic (microruditic) fractions. On a microscopic scale, the matrix of the paraconglomeratic body is structurally very heterogeneous, having the appearance of greywacke. In this matrix, fine ruditic epiclasts and arenitic epiclasts are found in a finer granulometric mass that largely consists of siltic granulation. From a compositional point of view, it is predominantly phyllosilicatic and functions as a binder. The phyllosilicates in this binder are mainly illite, chlorite and muscovite. The morphological characteristics of the muscovite suggest its terrigenous origin, whereas chlorite and illite may have been formed diagenetically. The degree of consolidation given by this phyllosilicatic fraction is variable from place to place. Thus, at a macroscopic level, the terrain presents areas where the matrix is very friable, as well as areas where coarse ruditic clasts (epiclasts) are relatively well retained in the matrix.

The arenitic fraction is predominantly siliciclastic consisting of both granoclasts and polygranular clasts. Lithoclasts are rare in this fraction. The most frequent arenitic granoclasts are quartz, feldspar (both orthoclase and plagioclase), partially chloritized biotite, chlorite and muscovite. Most polygranular arenitic clasts are polygranular quartz clasts or clasts containing the following mineral associations: quartz + mica, quartz + feldspar, quartz + chlorite, quartz + chlorite + feldspar. In the arentitic fraction, there are subordinate carbonate particles too: part of these may be limestone lithoclasts, others are bioclasts or tests, or clasts whose origin cannot be clearly established.

The lithoclasts found in this paraconglomeratic body belong to all three genetic categories of rocks: igneous, metamorphic and exogenous. Exogene rock lithoclasts, mainly consisting of sandstone and limestone, occur in the largest proportion. They constitute 50-60% of the total lithoclasts. They are followed by metamorphic rock lithoclasts and, in the smallest proportion, by igneous rock lithoclasts, which are the hardest to find in the field trial.

From a morphological point of view, lithoclasts have very diverse shapes, the degree of roundness being variable. In general, igneous rock lithoclasts have more advanced degrees of roundness. Metamorphic rock lithoclasts are slightly rounded and even angular (some fragments of schists). Exogenous rock lithoclasts generally have angular shapes, but with the exception of some white limestone lithoclasts.

The petrographic study was performed for both lithoclasts and the matrix of this paraconglomeratic body. More than one hundred samples were tested for this study and 64 thin sections were made. Before making the thin sections, a macroscopic selection of the lithoclasts and matrix samples was performed, aiming at better highlighting the diversity of the types of the present lithoclasts. The study of the lithoclasts is based on the microscopic analysis of thin sections made from both coarse ruditic epiclasts (the ones that are centimetre-sized) and the microruditic epiclasts of the matrix. In the study of the thin sections of the matrix, special attention was paid to the microruditic lithoclasts. The study of the lithoclasts in this paraconglomeratic body contributes to the understanding of the source area or areas and to the decipherment of some sedimentological aspects.

This paper deals with the study of limestone lithoclasts. These occur in a volume proportion that is lower than the detritic rocks lithoclasts, constituting about one third of the total exogene rocks lithoclasts. Thus, their volume ratio of the total lithoclasts would be about 15-20%.

Based on both the microscopic and macroscopic study of the centimetric ruditic lithoclasts, we separated the following types of limestones: 1. Micritic limestones with Globigerinidae; 2. Calcirudites with elements of reef limestones; 3. Bioconstructed coral limestones. Most limestone lithoclasts belong to the first type. They are exclusively angular and subangular. The lithoclasts belonging to the types mentioned in points 2 and 3 are very rare and have rounded or subrounded shapes.

Micritic limestones with Globigerinidae (biomicrites)

Micritic limestones with Globigerinidae contain more than 90% of micritic calcite. This micrite also contains the other components of the rock: carbonate biobodies and bioclasts, epiclasts belonging to the silt and arenite categories, as well as authigenic minerals.

Micritic carbonate

Micritic carbonate represents a matrix (base mass) for the other petrographic components. In the studied microscopic samples, we found either micritic carbonate that was relatively homogeneous from the point of view of granulation, with rare microdomains of fine granulation (with dimensions that can exceed 1mm) (fig. 6), or micritic layers with different alternating granulations (fig. 7). The thickness of these layers varies from less than 1 mm to more than 1 cm. Such microstratified structures cannot be macroscopically detected in samples, but they can be observed only microscopically. The boundaries between these layers are locally much curved, showing a relative parallelism. The finer granulation layers seem to be subordinate to those with a relatively coarse granulation.

Epiclasts

Epiclasts are mainly granoclasts and polygranular clasts are rare. In the descending order of their frequency, granoclasts are: quartz, muscovite, biotite, plagioclase feldspar, chlorite and zircon. Quartz and feldspar granoclasts are predominantly angular and subangular (fig. 8). Biotite is sometimes partially hydrolysed, but with relatively well-preserved optical properties (fig. 6). Chlorite granoclasts are most likely pseudomorphoses on biotite (fig. 10). In some samples, we noticed a tendency of local concentration of the epiclasts (fig. 12, 14) and in others, they are relatively uniformly distributed, the silicate ones being predominant (fig. 11). In the samples containing alternations of micritic layers with different granulations, such epiclastic concentrations are relatively parallel to the boundaries between the micritic layers (fig. 12). Zircon was rarely encountered in the form of euhedral granoclasts (fig. 18). The maximum dimensions of the observed granoclasts are: quartz – 0.41 mm, muscovite – 0.32 mm, biotite – 0.38 mm. Recrystallization of carbonate in the matrix, in the form of columnar microcrystals perpendicular to the granoclast, always occurs at the boundary with the mica granoclasts (biotite and muscovite) (fig. 13). The polygranular epiclasts that were found are mainly composed of quartz and are subordinate to quartz and oligoclase, their maximum size being 0.20 mm (fig. 15, 16).Generally, the granoclasts of phyllosilicate (muscovite, biotite and chlorite) do not show a preferential orientation consistent with stratification (fig. 17), but locally they can be parallel too (fig. 12).

Biobodies and bioclasts

Especially foraminifera, most biobodies are Globigerinidae (fig. 20, 21). Most of these tests are intact, any possibility of reshaping being excluded within carbonate block. Other types, including benthic foraminifera, are rarely present. There are also fish bones (fig. 22) and spherical biobodies with a special structure: microgranular in the centre and fibrous at the periphery (fig. 23). The distribution and frequency of foraminiferal biobodies in the micritic matrix vary according to the sample: they can be frequent and relatively uniform, or rare and locally grouped. Most of the biobodies have the interior filled with microsparite carbonate (fig. 20, 21), but rarely, biobodies whose interior is filled with opaque mineral can also be found.

Authigenic minerals

The authigenic minerals are: opaque mineral (pyrite) and glauconite. Pyrite occurs in very small proportions in several forms: isolated crystals and microaggregates locally concentrated in certain microdomains (fig. 25), micronodules (fig. 26), microlayers (fig. 27, 28) and as filling material of integral or relatively integral tests (fig. 19, 24). The microaggregates of pyrite crystals range from <0.01 mm to> 0.08 mm. The micronodules are 0.15-0.40 mm in size; they occur rarely and are isolated. The pyrite microlayers can have a random path (fig. 27), or, in the samples where micritic layers with different granulations were found, their trajectory may be relatively parallel to the boundary between the micritic layers (fig. 28). Glauconite is very rare and occurs as relatively isometric microaggregates that are 0.06-0.09 mm in size (fig. 29).

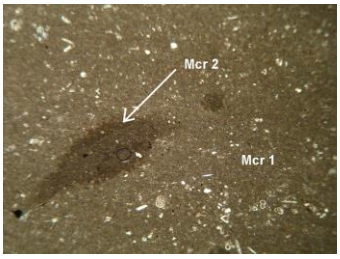

Fig. 6 *Relatively homogenous micritic matrix (Mcr 1) with rare fine grain nests (Mcr 2) and uniform distribution of the biobodies and epiclasts (N II, 40x)*

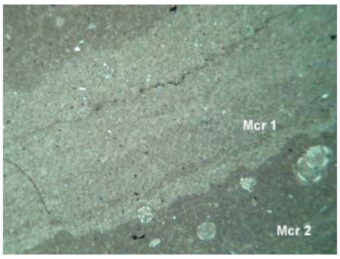

Fig. 7 *Alternation of different granulation microdomains; the finest crystalline microdomains (Mcr 2) are darker (N +, 40x).*

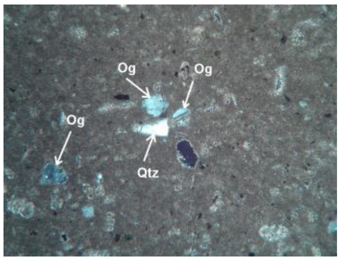

Fig. 8 *Angular and subangular quartz granoclasts (Qtz) and oligoclase (Og) (N +, 100x)*

Fig. 9 *Rare biotite granoclasts (Bi). Some of these are partially hydrolysed. On the right side of the biotite granostlast there is a carbonate bioclast (BC) (N II, 250x)*

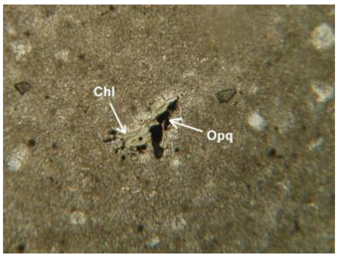

Fig. 10 *Chlorite granoclast (Chl) associated with opaque authigenic mineral (Opq). Chlorite is most likely pseudomorphoses on biotite (N II, 250x)*

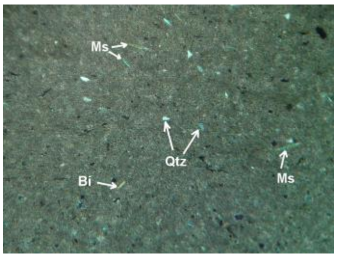

Fig. 11 *Siltic quartz granoclasts (Qtz), muscovite (Ms) and biotite (Bi) partially hydrolysed. The lack of preferred orientation of the mica can be noticed (N +, 100x)*

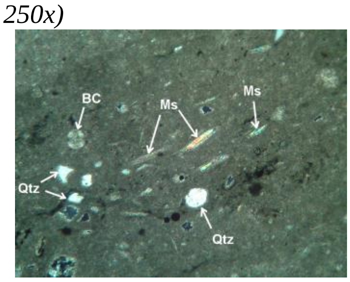

Fig. 12 *Microdomain rich in granoclasts (the quartz (Otz) and muscovite (Ms) ones are predominant). On the left side, there is a biobody (BC) made of fibrous carbonate with a fibro-radial structure (N +, 100x).*

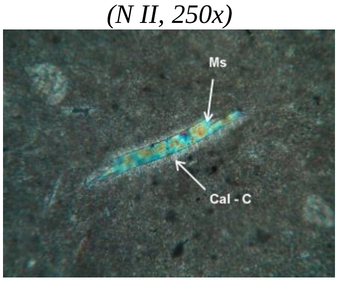

Fig. 13 *Larger recrystallization of carbonate around muscovite granoclasts (Ms) in the form of columnar microcrystals (Cal-C) perpendicular to the clast (N +, 250x)*

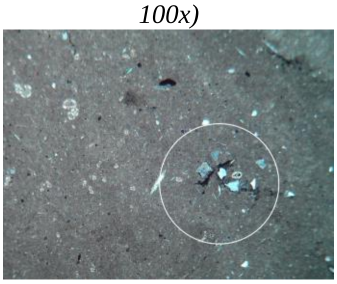

Fig. 14 *Local concentration tendency of the granoclasts – marked field (N +, 40x).*

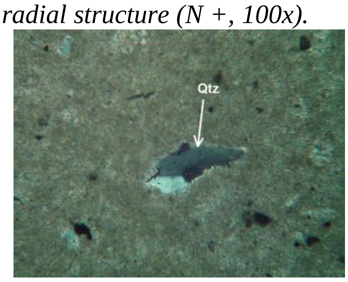

Fig. 15 *Angular polygranular quartz with an apparent size of 0.19 mm (N +, 250x).*

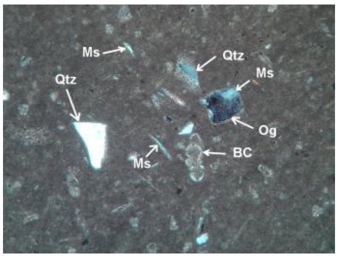

Fig. 16 *Angular quartz granoclasts (Qtz), muscovite granoclasts (Ms), polygranular clasts made up of quartz and oligoclase (Og) and carbonate biobody (Bc) (N +, 100x).*

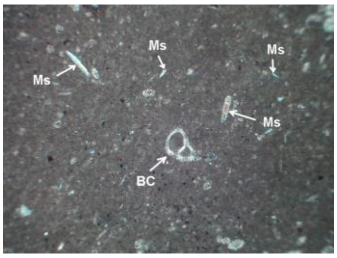

Fig. 17 *Muscovite granoclasts (Ms) and carbonate test (BC). Randomly oriented muscovite granoclasts (N +, 60x).*

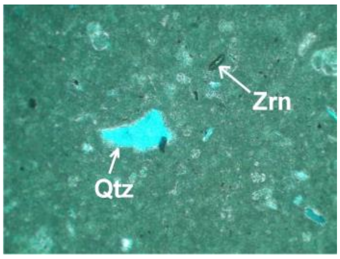

Fig. 18 *Angular quartz granoclast and zircon granoclast (N +, 250x).*

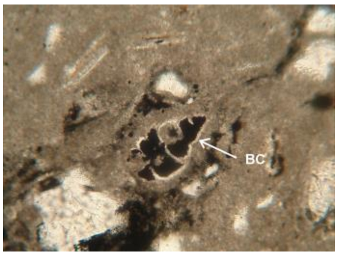

Fig. 19 *Benthic foraminiferal (BC) test having the inside filled with opaque authigenic mineral (N II, 250x).*

Fig. 20 *Globigerinidae tests (N II, 100x).*

Fig. 21 *Detail of a globigerinidae test (N II, 250x).*

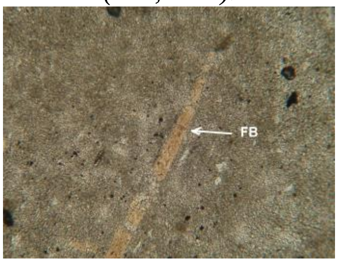

Fig. 22 *Fish bone (FB) with apatite composition (N II, 250x).*

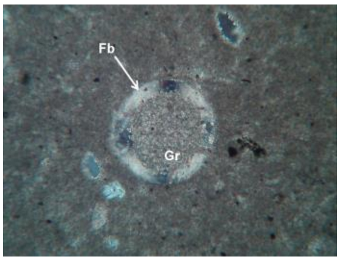

Fig. 23 *Possible carbonate test with granular structure (Gr) in the centre and fibrous structure (Fb) at the periphery (N +, 250x).*

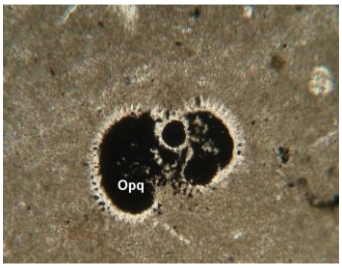

Fig. 24 *Globigerinidae test that has the inside filled with opaque diagenetic mineral (Opq) (N II, 250x).*

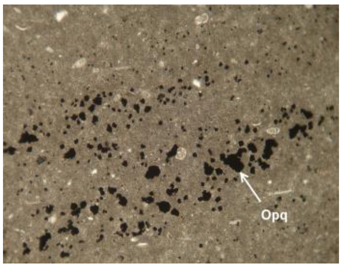

Fig. 25 *Microdomain in which authigenic pyrite is concentrated (Opq): there are both isolated crystals and microgroups of crystals (microaggregates) (N II, 100x).*

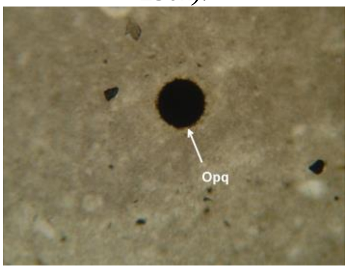

Fig. 26 *Micronodule of opaque diagenetic (Opq) mineral (pyrite). Apparent diameter = 0.19 mm (N II, 250x).*

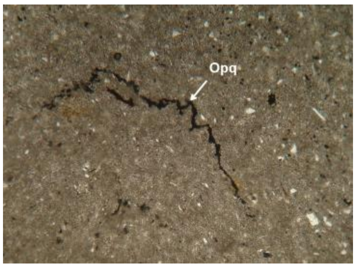

Fig. 27 *Microveins (Opq) of diagenetic opaque mineral (pyrite), irregular in shape (N II, 100x).*

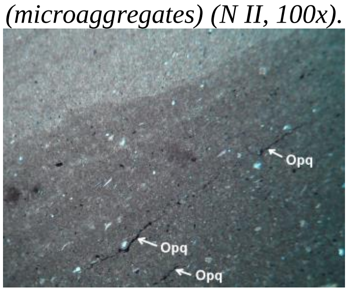

Fig. 28 *Microveins of opaque mineral (Opq), relatively parallel to the boundary between the micritic layers with different granulations (N +, 40x).*

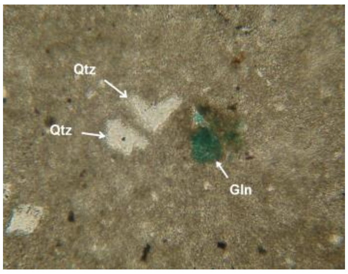

Fig. 29 *Angular quartz granoclasts (Qtz) and authigenic glauconite microaggregates (Gln) (N II, 250x).*

Large, isolated sparithic crystals (fig. 30) occur rarely in the micritic matrix. They are either clasts or former carbonaceous bodies that crystallized in the form of a single crystal (but it is less likely). Microsparite microdomains can also be found in the micritic matrix. They have partial geometric shapes including rare siltic epiclasts of quartz and muscovite (fig. 31).

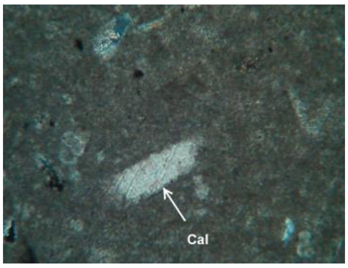

Fig. 30 *Sparitic carbonate (calcite) crystal (Cal) in the micritic matrix (N +, 250x)*

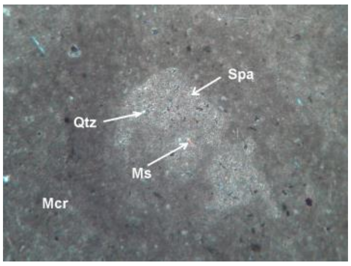

Fig. 31 *Microsparite microdomains (Spa) with relatively geometric shapes containing subordinate quartz (Qtz) and muscovite (Ms) of siltic dimension in the micritic matrix of the rock (Mcr) (N +, 100x).*

Calcirudites with elements of reef limestones

From a structural point of view, calcirudites are composed of the following fragments:

a. ruditic fragments of organogenic limestones – the reef ones are predominant (fig. 33); subordinate allochemical limestones are also present (fig. 32); their allochems consist of various micritic clasts and highly diagenized bioclasts which are difficult to classify. As relatively integral biobodies, bryozoa (fig. 34) and gastropods (fig. 35) were distinguished.

b. Arenitic fragments of organogenic limestones;

c. A sparite binder that occurs in two forms: the columnar type (fig. 32) and the mosaic type (fig. 33, 36).

The intense diagenesis of these rocks eroded many organic structures through recrystallization processes, making it difficult to distinguish the boundaries between the cement and the arenitic clasts. The boundaries between the microruditic clasts and the columnar sparitic cement are the easiest to distinguish. Cementation is total, that is, no pore was found. There was no siliciclast in these rocks. From a mineralogical point of view, the rock is wholly calcitic.

There are diaclases of sparitic calcite that go through both clasts and the allochems in them, as well as the rudite binder. These diaclases and their corresponding microcracks were formed in several stages. Microscopic displacements of the blocks separated by some microcracks (which currently are diaclases) were identified on the basis of the inconsistencies they caused in other fractures (diaclases) that they crossover (fig. 37).

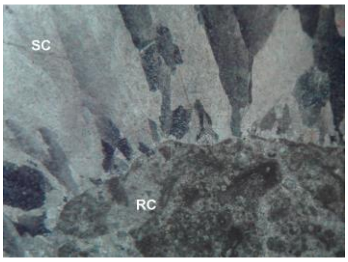

Fig. 32 *Ruditic clast of allochemical limestone cemented with columnar sparite (SC) (N +, 40x).*

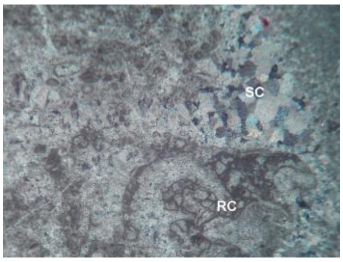

Fig. 33 *Ruditic clast of reef limestone (RC) cemented with mosaic-type sparite (SC) (N II, 40x).*

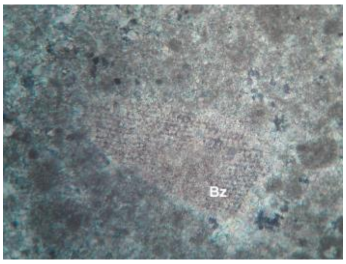

Fig. 34 *Bryozoan skeleton (Bz) in one of the allochemical limestone ruditic clasts (N +, 100x).*

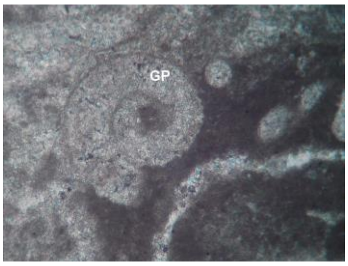

Fig. 35 *Gastropod skeleton on the periphery of a reef limestone lithoclast (N +, 1000x).*

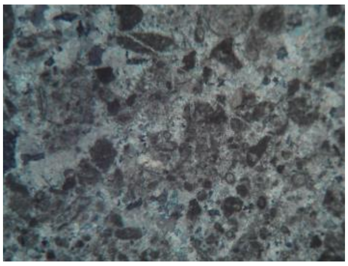

Fig. 36 *Rock domain with arenitic limestone clasts, cemented with mosaic-type sparite (N +, 100x).*

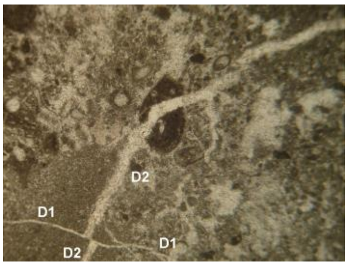

Fig. 37 *Diaclases formed after calcirudite cementation (N II, 40x).*

Bioconstructed coral limestones

These limestones are structurally composed of a colonial skeletal framework and a carbonaceous filling of the inter- and intraskeletal space. They were microscopically studied using both longitudinal and transverse thin sections. All of the carbonate belonging to the colonial skeletal framework recrystallized as sparite. Moreover, the carbonate formed diagenetically in the intra- and interskeletal space is sparitic. However, after sparite granulation, a distinction can be made between the former colonial skeleton and the filling part formed diagenetically. The latter is made up of crystals which optically are larger and clearer (fig. 38, 39).

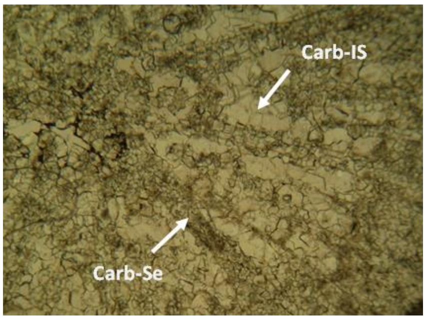

Fig. 38 *Microscopic image through coral limestone; we can notice a fine crystallized sparitic carbonate that corresponds to the former septa (Carb-Se) and a secondary diagenetic carbonate filling the interseptal space (Carb-IS) (N II, 40x).*

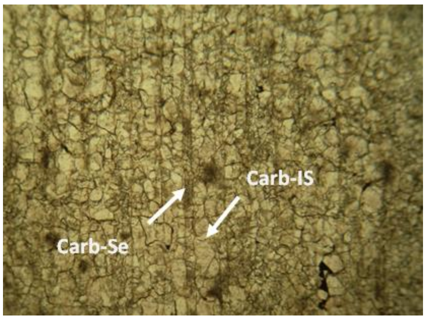

Fig. 39 *Microscopic image through coral limestone; we can also notice a fine crystallized sparitic carbonate that corresponds to the former septa (Carb-Se) and a secondary diagenetic carbonate filling the interseptal space (Carb-IS) (N II, 40x).*

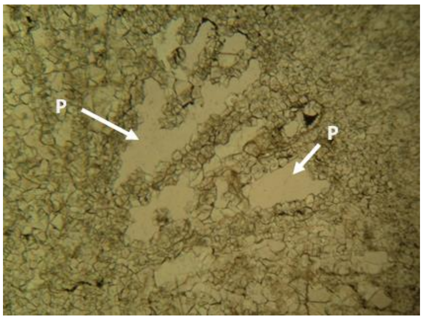

Fig. 40 *Pores (P) in the coral limestone in cross-sections; the pores are mainly located in the former interseptal spaces (N II, 40x).*

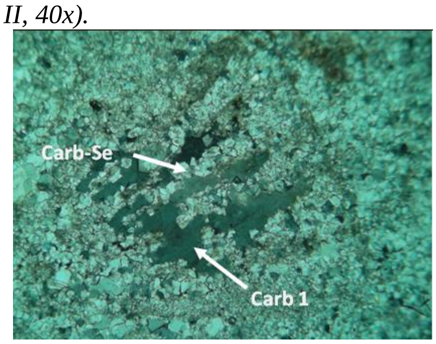

Fig. 41 *Several neighbouring interseptal spaces diagnetically filled by a single relatively large carbonate crystal (Carb 1); part of the former septa, now recrystallized (Carb-Se) (N+, 40x), can also be noticed.*

There are pores in these limestones. The pores are interseptal spaces (fig. 39) that were not completely filled with carbonate. The maximum pore size is 1.5-1.6 mm in cross sections and 1.12-1.14 mm in longitudinal sections. Locally, several neighbouring interseptal spaces, which became or were intercommunicating, were filled with a single carbonate crystal (fig. 41) in the diagenetic stage. The advanced diagenetic processes of these limestones, as well as the lithoclast transport processes, wiped out the elements that could indicate the genus to which these corals belonged.

Conclusions

Following macroscopic and microscopic study of centimetric ruditic lithoclasts three types of limestones were identified: micritic limestones with Globigerinidae (biomicrites), calcirudites with elements of reef limestones, and bioconstructed coral limestones. Most of the limestone lithoclasts belongs to the first type. These limestone lithoclasts have exclusively of angular and subangular shapes. The lithoclasts belonging to the two and three types are very rare and have rounded and subrounded shapes.

Micritic limestones with Globigerinidae are composed of over 90% of micritic calcite. This micrite also contains the other components of the rock: carbonate biobodies and bioclasts, epiclasts belonging to the silt and arenite categories, as well as authigenic minerals. In micritic carbonate the microscopic analysis reveal the presence of the rhytmites of subcentimetric micritic mats with different granulometry. The epiclasts are mainly granoclasts of quartz, muscovite, biotite, plagioclase feldspar, chlorite and zircon, while the polygranular clasts (quartz and oligoclase) are rare. Granoclasts of quartz and feldspar are predominantly angular and subangular. Frequently the acummulations of epiclasts are in line with the boundaries between micritic mats. Isolated granoclasts have arenite dimensions while the polygranular epiclasts have silt dimensions. The orientations of phyllosilicate granoclasts are irrelevant for the environment diagnosis in the time of the micritic mats deposition. Biobodies are especially foraminiferas, most of them Globigerinidae. Most of these tests are intact, any possibility of reshaping being excluded within carbonate block. It is outlined the idea that these limestones are the consequence of deposition in an Eocene marine batial environment pointed by the presence of minerals of anoxic environment. In the batial environment of the fine micritic matrix are present also relicts of sparitic crystals or the enclaves of microsparite from previous generations of microsparite with epiclasts.

The calcirudites with elements of reef limestones are dominated by the biogene reef limestones, subordinate associated with allochemical limestones or bioclasts embedded with fragments of arenite dimensions in a columnar or mosaic sparitic binder. The aspect of the wholly calcitic rock, without siliciclasts, emphasizes belonging to previous generations of bioconstructed limestones, tectonized within several phases, argumented by the different generations of fissures and diaclases. Bioconstructed coral limestones are argumented by the colonial skeletal framework with carbonate filling of the interskeletal and intraskeletal space visible in longitudinal and transverse sections.

The advanced diagenesis and the degree of rolling of the lithoclasts are premises of a poor diagnostic of the apartenence of these limestones to the coraligeneous types. The rounded morphofacies of calcirudites with elements of reef limestones as well as the bioconstructed coral limestones suggest older generations, multiple reworked, of Mesozoic limestones compared to the angular lithoclasts of limestones with Globigerinidae from a newer generation.

The alternance of thin mats of carbonate with fine granulations with the ones of carbonate with coarser granulations and associated with acummulations of epiclasts reveals the effect of the ciclicities in the sedimentary environment. The different diagenetic filling of some biobodies suggest several primary diagenetic phases such as pyrite deposition in the anoxic batial environment separated by the late/secondary diagenetic carbonate filling.

The diagnostic of the limestone clasts suggest the multiple reworked apartenence of Mesozoic limestones of Central Carpathic Unit. Mesozoic limestone clasts coexist in sedimentary deposit with clasts of limestones with globigerinidae from more recent Eocene environments.

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Studiul petrografic al litoclastelor de calcare din faciesul paraconglomeratic eocen al formaţiunii de Podu Secu din unitatea de Tarcău a Carpaţilor Orientali (zona superioară a Văii Buzăului)

Rezumat

Pe fondul structural al dezvoltării in cute solzi a formațiunilor paleogene ale Unității de Tarcău de la curbura Carpaților Orientali, unul din repere poate fi considerat depozitul brecios ce se repeta cu grosimi crescătoare de la interior către exterior, relevând caractere nete de depozit de tip debris-flow. Cele cateva faciesuri descriptive si corespondentul lor de faciesuri interpretative cu implicatiile lor genetice sunt completate in lucrare cu studiul petrografic al diferitelor categorii de claste continute in depozitul paraconglomeratic al formațiunii de Podu Secu. In lucrare se detaliaza studiul petrografic al litoclastelor carbonatice separate in calcare micritice cu globigerinide, calcirudite cu elemente de calcare recifale si calcare bioconstruite coraligene. Descrierea mineralogo-petrografica detaliata permite sublinierea unor asertiuni legate de geneza si aria sursa a depozitelor paraconglomeratice.