"BABEŞ-BOLYAI" UNIVERSITY CLUJ-NAPOCA
THE FACULTY OF BIOLOGY AND GEOLOGY
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THE STUDY OF CONGLOMERATES FROM THE PIATRA CRAIULUI SYNCLINE

EXTENDED SUMMARY OF THE PhD THESIS

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INTRODUCTION

The aim of this study is to analyze and interpret the Lower Cretaceous conglomeratic deposits which are filling the Piatra Craiului syncline. To achieve the objective it was necessary a multidisciplinary approach. In Romania, the complex study of conglomerates has been less discussed, the most studied sequence of conglomerates being the one from the Bucegi Massif (Patrulius, 1969; Stanley & Hall, 1978; Jipa et al., 2013; Olariu et al., 2014). The work is progressing toward a complete analysis after which it can be shaped the source area and depositional environment, while trying to emphasize the link of these deposits with the regional tectonic events.

1. LOCATION

The Piatra Craiului Massif is located in north-eastern part of the Southern Carpathians. A special feature of this montaneous unit is the layout of the main ridge of the mountain massif perpendicular to the general direction of the Southern Carpathians (Fig. 1.1), stretching about 20 kilometers between the counties Zarnești and Podul Dâmboviței. The main geographical boundaries are represented by Bârsa Valley to the north and Dâmbovița Valley to the west. On the eastern side, the Massif is bordered by the Dâmbovicioara-Brusturet-Seaca Pietrelor on one side and by Vlăduşca-Mare River on the other (Cristea, 1971). The Piatra Craiului Massif consists of two major landforms: Piatra Craiului Mare with a maximum altitude of 2238 m (La Om Peak) and Piatra Craiului Mică with a maximum altitude of 1816 m. The entire ridge was divided, in accordance with some geographical norms, into two segments: the northern ridge which starts from north-northeast from La Om Peak and it also includes Piatra Craiului Mică and the southern ridge which is located south of the peak La Om and goes up to Pietricica.

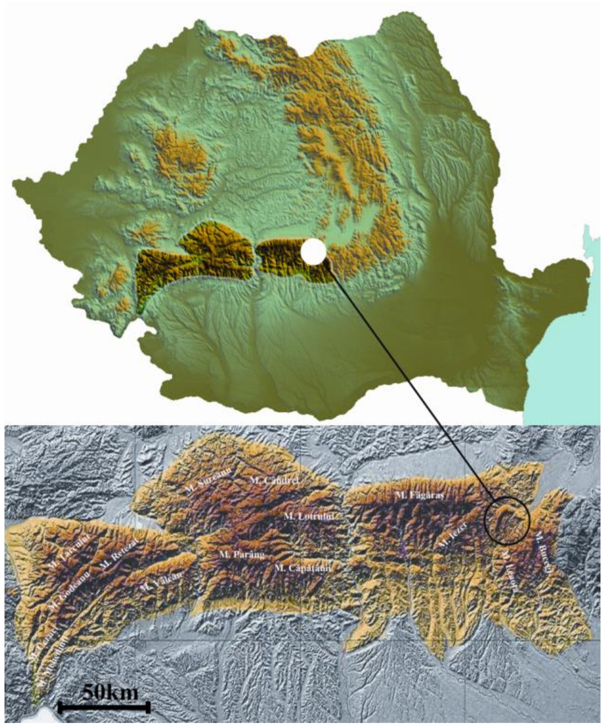

Figure 1.1: Location of Piatra Craiului Massif on the geographical map of Romania and on the map of Southern Carpathians.

2. THE HISTORY OF GEOLOGICAL RESEARCH

The impressive dimensions of the carbonate sequence, which forms the ridge of the Piatra Craiului Massif has attracted geologists since the nineteenth century (e.g. Hauer, 1859; Herbich 1888). The most important geological contributions from region were oriented towards the Upper Kimmeridgian-Valanginian carbonate rocks (e.g. Jekelius, 1938; Oncescu, 1943; Popescu, 1966; Patrulius, 1969; Bucur, 1978; Patrulius et al., 1980; Bucur et. al, 2009; Pleş et al., 2013; Mircescu et al., 2014) or the Callovian Oxfordian silicolites (e.g. Bucur, 1980; Meszaros & Bucur, 1980; Beccaro & Lazăr, 2007).

The studies up to the present, conducted on the conglomerates of the Piatra Craiului Massif referred only to a number of general issues. The first information on the conglomeratic deposits from the Piatra Craiului Syncline were offered by Jekelius (1938), who placed within Upper Albian and Cenomanian and he noted the presence olistoliths. Later on, Popescu (1966) and Patrulius (1969) indicated the presence of two distinct types of conglomerate: “The Gura Râului Aptian Conglomerates” and the Vraconian (late Albian age)-Cenomanian conglomerates". The first, outcrop in the north-east of the Piatra Craiului Massif while deposits from the Late Albian-Cenomanian appear only on the western flank of the syncline (Popescu, 1966; Patrulius, 1969). The work of Popescu (1966) contains the most detailed approach of the conglomeratic deposits that make up the filling of the Piatra Craiului syncline. The author makes the first macroscopic description and provides some information related to the microfaciesal and micropaleontological content of the limestone pebbles. Later on, lithological information about the pebbles of these deposits were provided by (Drăgănescu, 1985). Recently, Ungureanu et al. (2015) have studied in detail the Berriasian-Valanginian and Aptian deposits from north-western part of Piatra Craiului Massif. The study confirms the presence of the Upper Valanginian deposits in the Piatra craiului Massif and provides new data about the microfaciesal and micropaleontological content of the pebbles from the Aptian breccias and conglomerates.

3. GEOLOGY OF THE REGION

This region is part of a larger tectonical unit wich was defined as the Getic Nappe (Murgoci, 1905, 1910; Săndulescu, 1984). The latter is a part of a larger group of tectonic units knownas Median Dacides (Săndulescu, 1984) or Dacia Mega-Unit (Csontos & Vörös, 2004), which are pressumed to come from blocks detached from European margin during the Jurassic times (Săndulescu, 1984). It is considered that the Getic Nappe was outlined as a major tectonic unit in the Southern Carpathians (Săndulescu, 1984) due to the closure of the Eastern Vardar ocean in the Upper Jurassic (Maţenco, 2010) and to the continental collision from the Cretaceous (Schimd et al., 2008). The tectonic events associated with the Cretaceous collision were grouped into two phases (Codarcea, 1940): an intra-Aptian phase (Austric tectonic movements cf. Patrulius, 1969), where the thrusting of the Getic Nappe front over the Externa Dacide was produced (Codarcea, 1940 Săndulescu, 1984) and one intra-"Senonian" (Coniacian-Maastrichtian) (Săndulescu, 1984) (Laramic phase), where it took place the thrusting of the getic domain over the Danubian one (Săndulescu, 1984). The Piatra Craiului Massif is the western extremity of a bigger structural zone named the Dâmbovicioara Couloir (Patrulius, 1969), in whose territory outcrop sedimentary deposits of the eastern part of the Getic Nappe. The crystalline basement is composed of metamorphic rocks belonging to the Cumpăna and Leaota groups. Over these, there are disposed carbonatic, silicolitic and detrital sedimentary formations, from the Triassic-Cretaceous period which were grouped by Patrulius (1969) in "the Braşov Series" and "the pre-Leaota Series". In the sPiatra Craiului Massif the sedimentary succesion begins with detrital rocks belonging to Middle Jurassic (Oncescu 1943; Smith, 1966 Patrulius, 1969), followed by carbonate and silicolitic deposits assigned to the Upper Callovian-Oxfordian period (Oncescu 1943; Patrulius, 1957 Bucur 1980; Meszaros & Bucur, 1980; Beccaro & Lazarus, 2007), over which are disposed carbonate deposits with thicknesses of up to 1200 m, assigned to the Upper Kimmeridgian-Valanginian period (Oncescu 1943; Smith, 1966 Patrulius, 1969 Bucur 1978; Patrulius et al., 1980; Bucur et al., 2009; Pleş et al., 2013 Mircescu et al., 2014; Ungureanu et al., 2015) and the sequence is ending with late Aptian–Cenomanian conglomeratic deposits (Popescu, 1966; Patrulius, 1969; Patrulius et al., 1971) (Fig. 1.2).

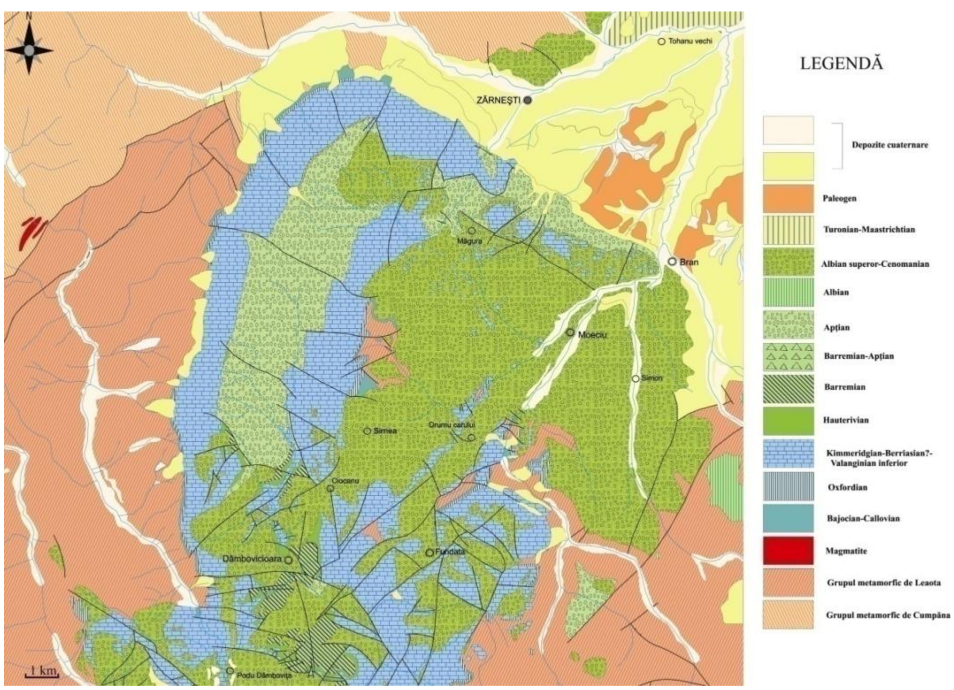

Figure 1.2: Geological map of the Piatra Craiului Massif (redrawn after Patrulius et al., 1971; Săndulescu et al.,1972 şi Dimitrescu et al., 1971, 1974).

4. MATERIAL AND METHODS

The activity within this work has carried out by combining the theoretical study with the practical one. The conglomeratic deposits from the Piatra Craiului Syncline were studied on the field for a period of four years, between 2011-2015. The field campaigns have involved identifying and studying outcrops, collecting pebbles, measuring the imbrications, measuring stratification and taking high resolution pictures. Following the investigation of the entire region there have been chosen nine main areas of study (Fig. 1.3). Approximately 1600 samples have been collected, from which there have been made several thin sections and around 1000 have been measured through morphometric study. There were measured the three axes of the pebbles (length-a, width- b, thickness-c) and parameters such as the size (D), the degree of flattening (A) and sphericity (S) were estimated using some mathematical formulas starting from the three measured axes (a, b, c) on the pebbles as it follows: D = (a + b + c) / 3 (Illenberger, 1991); A = (a + b) / c (Wentworth, 1922; Illenberger, 1991); S = (a * b * C) 1/3 / a (Krumbein, 1941). The roundness calculation based on direct measurements is very delicate and requires much time so that, in the present situation, we considered to be the most effective method using the visual comparison chart made by Powers (1953) and Macleod (2002).

The thin sections made from pebbles were analyzed at the binocular and petrographic microscope to identify lithologies, mineralogical assemblage of the metamorphic pebbles, respectively of the microfacies and the micropaleontological assemblage from the limestone pebbles while the silicolitic pebbles were observed both in terms of a mineralogical and a micropaleontological point of view. The microfacies description was was made after the standard classifications of Dunham (1962), modifed after Embry & Klovan (1971) and Wright (1992). Between 2015 and 2016 the data obtained were correlated, interpreted and synthesized to achieve the desired results and also there were drawn maps, sketches and figures so that the entire written information to be visually sustained.

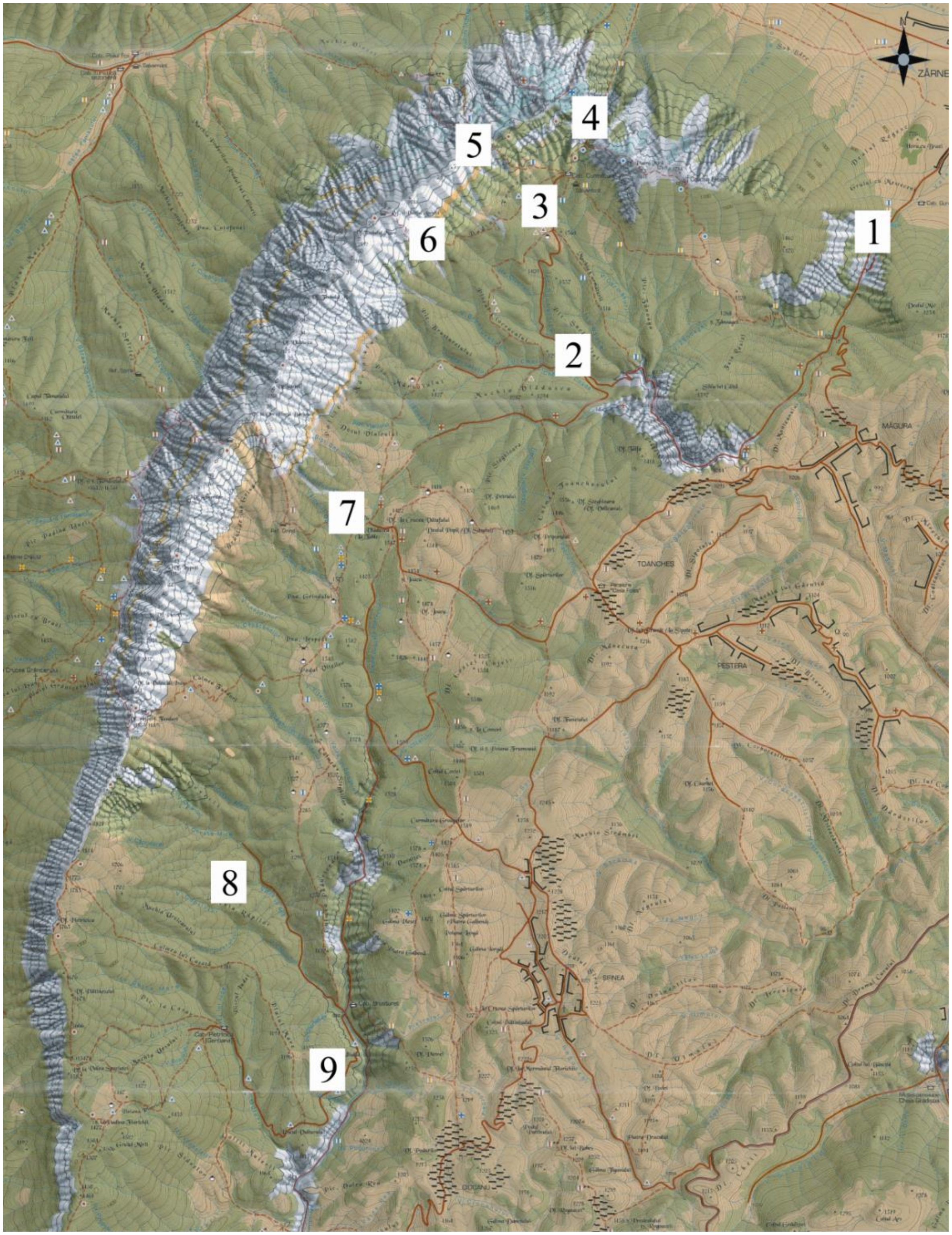

Figura 1.3: Location of the main study zones on the touristical map with level curves (source: http://www.cabanata.ro/hărți.html): **1** Gura Râului; **2** Prăpăstiile Zărneștilor; **3** Cabana Curmătura; **4** Șaua Crăpăturii; **5** Drumul lui Lehman; **6** Padinile Frumoase; **7** Refugiul Grind; **8** Brusturet; **9** Pietricica.

5. A THEORETICAL APPROACH IN CONGLOMERATIC DEPOSITS

For a better understanding of all the concepts used in this work it requires a brief introduction on the conglomeratic deposits and most representative studies that have contributed to their knowledge and description. Over the years there have been tried several ways of classifying the conglomerates which were based on the transport mechanism (Middleton & Hampton, 1973), genetic aspects (Pettijohn, 1975), descriptive characters (Walker Harms et al., 1975) or a combination of descriptive characters with the depositional mechanisms (Lowe, 1982). Surlyk (1984) demonstrates in his paper, that the study of conglomeratic deposits should be conducted for each particular deposit in part because each area has its own tectonical and stratigraphical specific. The author suggests that the use of standardized depositional models does not work for every situation, these ones being very useful for creating own models tailored to their subject of study.

6. THE GURA RÂULUI APTIAN CONGLOMERATES

6.1 General aspects

The Gura Râului Conglomerates are spanning from the northeast (Gura Râului) to the southwest (Pietricica) in parallel with the ridge of the Piatra Craiului Massif. These ones have been studied from seven areas where they have been observed restricted dawns and extended outcrops. Although the deposits occupy a significant area, most of them are covered in vegetation.

6.2 Sedimentological study of the Gura Râului Conglomerates

The Gura Râului deposits are polimictic extraformational paraconglomerates and orthoconglomerates. Most of them are highly fragmented due to the post-Aptian tectonic activity and intensely eroded. Within them there can be observed depositional aspects such stratification, grading, imbricated pebbles or channel fill structures . Most of the beds have 1 to 5 m and are frequently erosionally bounded. The descriptive study of the depositional characters allowed separating three conglomeratic facies characteristic to these deposits: massive conglomerates (ungraded) - facies 1; graded conglomerates - facies 2; conglomerates alternating with sandstone - facies 3 (Fig. 1.4). Facies 1 is characterized by beds (1.5-3 m) with erosional basis where there have been observed equigranullar pebbles (4-10 cm), which are most often imbricated or disposed parallel to the bedding plane. Facies 2 consists of two subfacies: one with inverse grading passing to the top to a normal grading and one of a normal grading, occurring either in the base or interbedded with the inverse graded sequences. Both subfacies are represented by erosionaly bounded beds and frequent imbrications in the base of normal graded sequences, respectively the top of the inverse grading ones. Facies 3 is characterized by the presence of sandstone beds or lenses and microconglomeratic beds of 15-30 cm thickness interbedded between the conglomeratic ones. Conglomeratic beds are normally graded, inverse graded or they have a massive appearance (ungraded). The sandstone levels are not always well defined, the top and the base of these being irregular, showing gradational or erosional contact with the conglomeratic and microconglomeratic beds. The depositional characters indicate the deposition of the first two facies took place from concentrated and hyperconcentrated flows (Mulder & Alexander, 2001) while facies 3 shows a transitional episode from a concentrated flow to a turbulent flow (Lowe, 1982; Mulder & Alexander, 2001).

6.3 Lithological study of pebbles that make the Gura Râului Conglomerates

The Gura Râului conglomerates are distinguished through a strong polimictic character in terms of lithological composition of both the pebbles and the matrix. In terms of petrology there are three types of pebbles: limestone, metamorphic and silicolitic.

6.3.1 The calcareous pebbles

The carbonate fraction is dominant within the deposit both as pebbles and also among matrix constituents. The macroscopic and microscopic study of the collected pebbles allowed the distinction of a whole diverse assemblage of microfacies that are characteristic to the depositional environments ranging from the peritidal zone to the basin. Based on paleontological aseemblages they were assigned to the Medium Jurassic (? Bajocian-Lower Callovian)-Lower Cretacic (Barremian-Aptian) age.

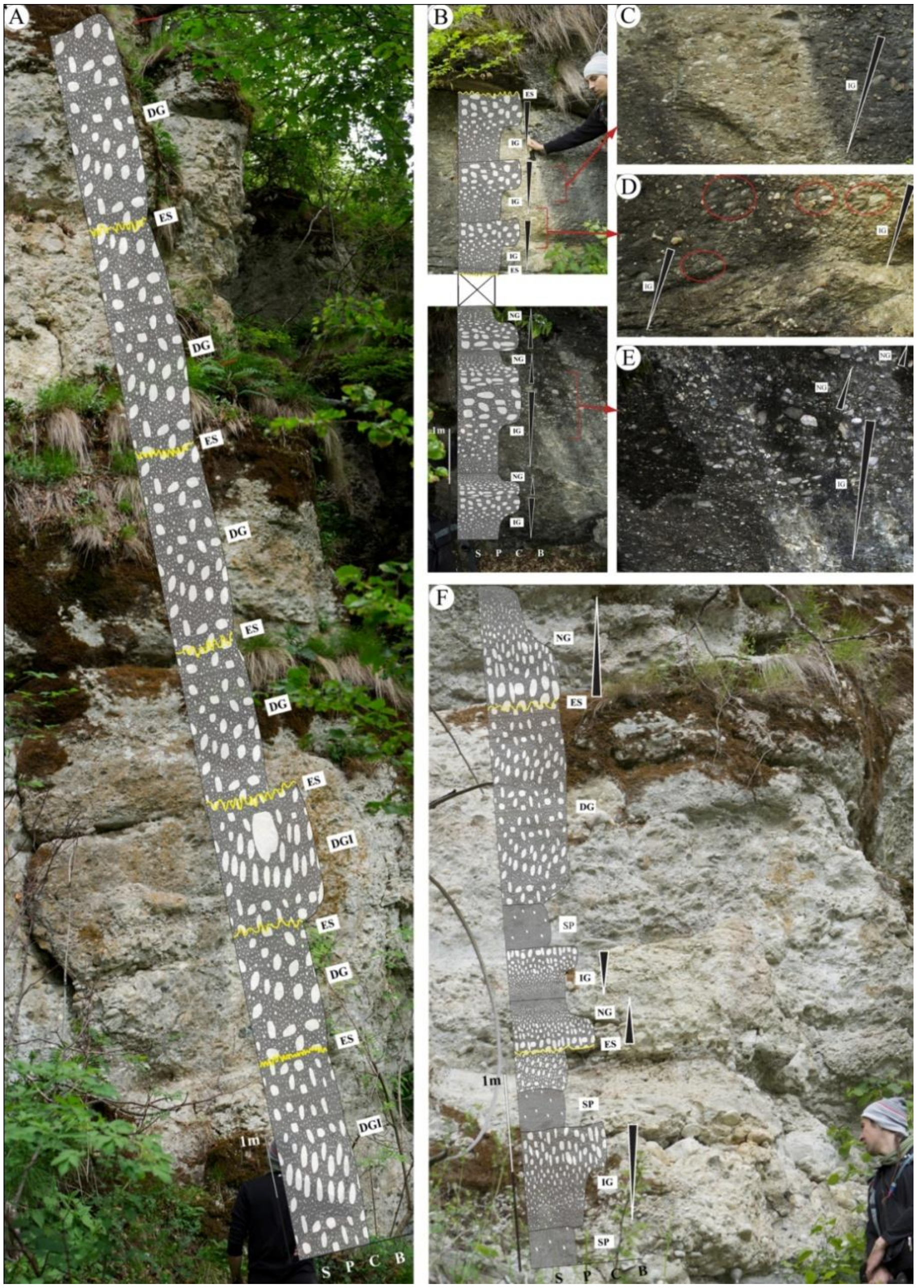

Figure 1.4: Conglomeratic facies characteristic to the aptian deposits: **A** Facies 1 - massive conglomerates (ungraded); **B-E** Facies 2 –graded conglomerates; **F** Facies 3 - Conglomerate alternating with sandstones (DG – ungraded gravel, IG –inverse graded NG - normal graded, ES - erosional surface).

The pebbles assigned to Middle Jurassic. The pebbles assigned to this period are characterized by facies rich in terrigenous material and bivalve fragments of different sizes (Fig. 1.5 A). It is noted, sometimes the presence of ruditic fragments of very well rounded quartz. The paleontological assemblage consists of fragments echinoids, bivalve fragments, sponges fragments, serpulide tubes and benthic foraminifera (? *Trocholina conica*, *Nodophtalmidium jurassicum*, *Coscinoconus* sp., *Lenticulina* sp.). The assignation of the pebbles to the Medium Jurassic was made based on the terigenous facies characteristic to the Bajocian-Callovian range in the Dâmbovicioara Couloir and on foraminifera *Trocholina conica* (Fig. 1.6 A) known from the inner platform areas of the Middle Jurassic (Bajocian-Callovian).

The pebbles assigned to Kimmeridgian-Tithonian. Clasts distributed to this period show a great abundance in the northwestern part of the aptian conglomerates and a low frequency if we refer to all the pebbles noticed. The dominant microfacies type are typical to the reef and platform margin environments (Fig. 1.5 B-D), being similar to the Štramberk type limestone. Rarely are being seen slope slope carbonates with siliceous nodules.

The facies described contain a highly diversified paleontological assemblage with: corals, sponges (*Ellipsactinia* sp., *Thalamopora lusitanica*), brachiopods fragments, echinoderms fragments, green algae (*Salpigoporella pygmaea*, *Petrascula bursiformis*, *Steinmaniporella* cf. *taurica*, *Campbelliella striata*), red algae ("*Solenopora* "sp.), benthic foraminifera (*Labyrinthina mirabilis*, *Protopeneroplis striata*, *Charentia evoluta*, *Coscinoconus alpinus*, *Mohlerina basiliensis*), worm tubes (*Mercierella dacica*, *Terebella lapilloides*), *Bacinella*-type structures, rivularian type cyanobacteria, Epiphyton sp.-like cyanobacteria, encrusting organisms (*Perturbatacrusta leini*, *Lithocodium aggregatum*, *Bacinella*-*Lithocodium*-type structures, *Radiomura cautica*) and microproblematic organisms (*Crescientiella morronensis*). Argumenting the age range mentioned is supported, besides the assembly of microfacies, also by the micropaleontological assemblage. In a part of the pebbles there have been identified some species typical to Kimmeridgian-Tithonian age (*Labyrinthina* *mirabilis*, *Petrascula bursiformis*, *Campbeliella striata*, *Steinmanniporella* cf. *taurica*, *Perturbatacrusta leini*, *Terebella lapilloides*) also with species that have a slightly wider distribution (*Protopeneroplis striata*, *Mohlerina basilensis*, *Coscinoconus alpinus* and *Charentia evoluta*) but frequently cited in this interval (Fig. 1.6).

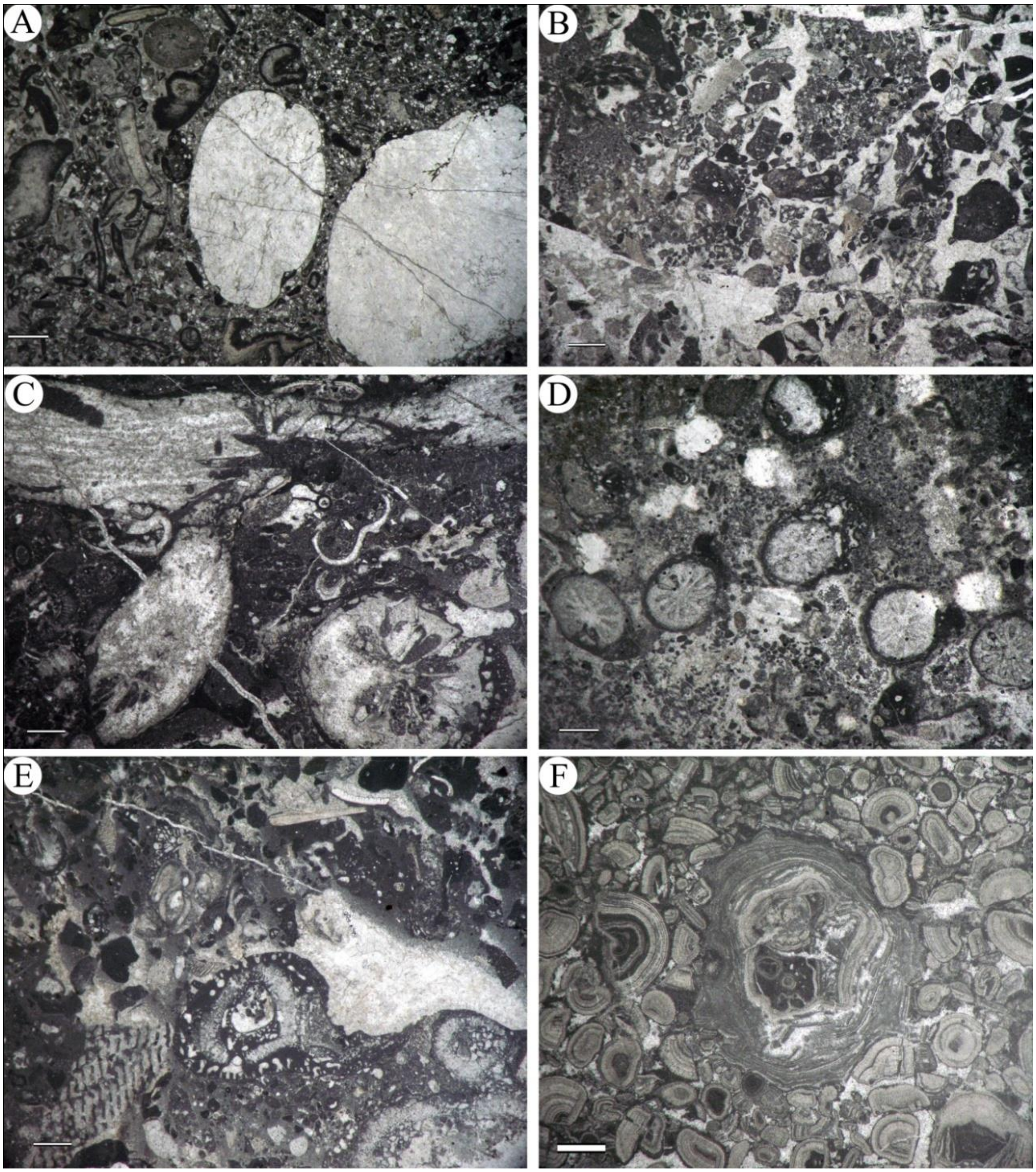

Figure 1.5: **A** Bioclastic-extraclastic grainstone/rudstone with ruditic fragments of terrigenous quartz and many mollusc fragments; **B** Intraclastic rudstone with intraclastic-bioclastic grainstone type sediment. Most of the intraclasts are subrounded and subangular; **C** Coral boundstone with corals encrusted by *Lithocodium aggregatum* and bioclastic-intraclastic wackestone as internal sediment; **D** Coral

boundstone with corals encrusted by *Lithocodium aggregatum* and intraclastic grainstone as internal sediment;**E** Bioclastic floatstone/wackestone with *Crescentiella morronensis*, *Lithocodium aggregatum*, green algae fragments, corals and intraclastic-bioclastic wackestone as internal sediment; **F** Ooidic-pisoidic grainstone with radial and tangential regenerated ooids and composite pisoids (Scale bar = 1 mm).

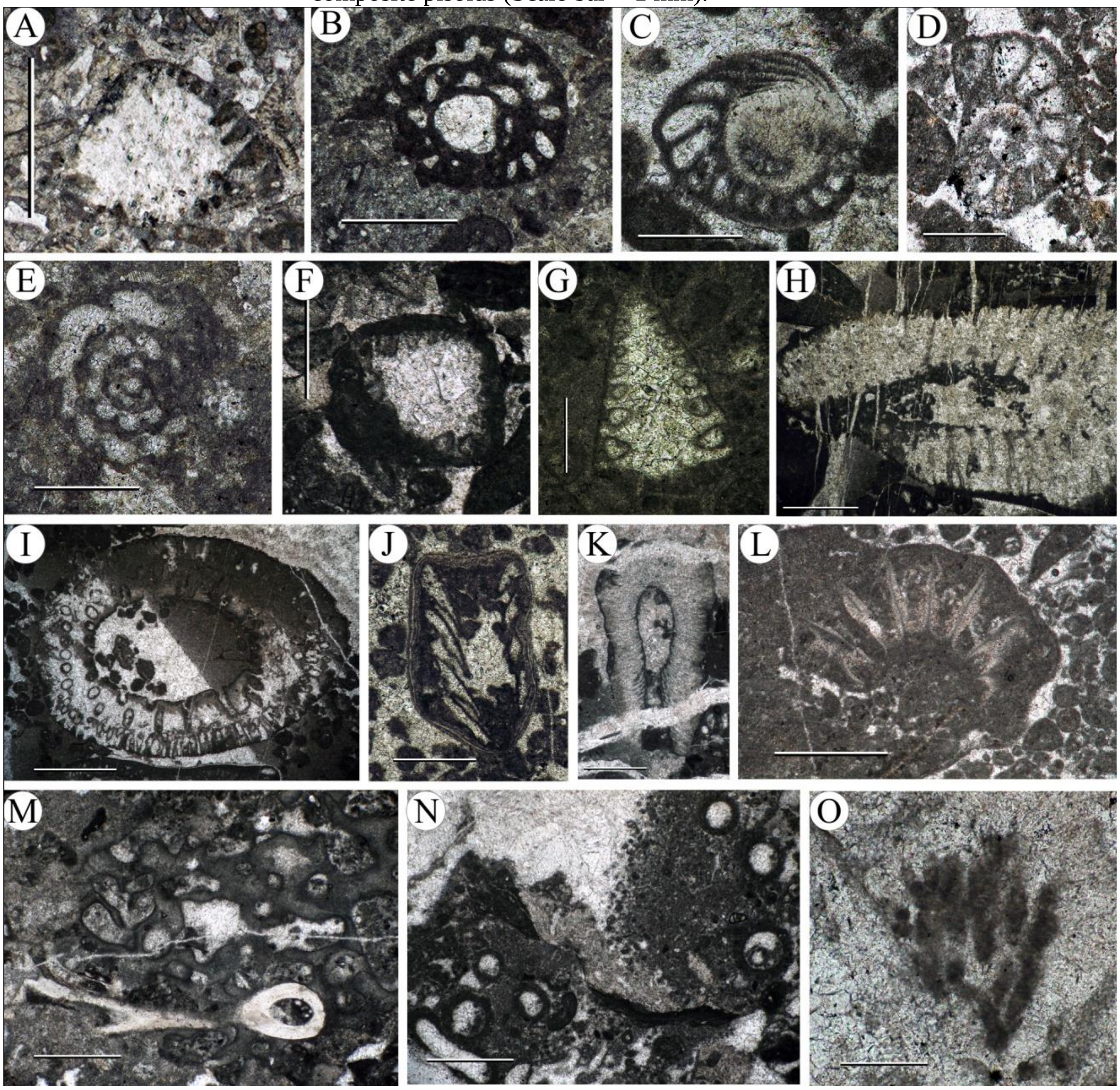

Figure 1.6: **A** ?*Trocholina conica;***B** *Labyrinthina mirabilis*;**C***Protopeneroplis striata*; **D***Protopeneroplis ultragranulata*; **E** *Charentia evoluta*; **F** *Coscinoconus alpinus*; **G** *Coscinoconus delphinensis*; **H***S teinmaniporella* cf. *taurica*; **I** *Petrascula bursiformis*; **J** *Campbeliella striata*; **K** ?*Pseudocymopolia jurassica*; **L** *Clypeina sulcata*; **M** *Perturbatacrusta leini* și *Carpathocancer* sp.; **N** *Terebella lapilloides*; **O** *Epiphyton* sp. (Scale bar: H,I, K, M, N = 1 mm; A, B, F, J, L = 0.5 mm; C, D, E, G = 0.25; O = 0.125 mm).

The pebbles assigned to Upper Tithonian-Lower Berriasian. The pebbles assigned to the limestones formed in this range are most common in aptian conglomeratic deposits. These include very diverse facies that can be attributed to several depositional areas such as: inner platform, platform margin, slope and basin (Fig. 1.5 E, F). Among these, the slope or basin microfacies types consists of calpionellid assemblages.

The paleontological assemblage contains mollusc fragments, green algae (*Clypeina sulcata*, *Salpingoporella pygmaea*, *Salpingoporella annulata*, *Pseudocymopolia jurassica*, *Pseudotrinocladus piae*), benthic foraminifera (*Mohlerina basiliensis*, *Protopeneroplis ultragranulata*, *Protopeneroplis* cf. *banatica*, *Coscinoconus alpinus*, *Coscinoconus chiocchinii*, *Coscinoconus* cf. *perconigi*, *Coscinoconus delphinensis*, *Coscinoconus campanellus*), rare coral fragments, encrusing organisms (*Lithocodium aggregatum*, *Crescentiella morronensis*), microbial oncoids and rivularian type cyanobacteria.

The allocation of these pebbles to this range was made based on microfacies characteristic in which there have been identified species of biostratigraphic importance such as *Pseudocymopolia jurassica* (Late Tithonian-Lower Valanginian) and *Clypeina sulcata* (Kimmeridgian-Berriasian). The two algae are frequently associated with foraminifera *Coscinoconus alpinus* and *Coscinoconus delphinensis* that are known from Upper Tithonian-Valanginian but also with *Protopeneroplis ultragranulata* which, despite a wider distribution (Middle Tithonian-Barremian) is often cited from Lower Berriassian-Valanginian high hidrodinamic environments such as ooidic shoals (Fig. 1.6)

The pebbles assigned to Upper Berriasian-Lower Valanginianian. The samples which are assigned to this period are mainly represented by typical microfacies of the both high hydrodynamics and peritidal restrictive environments from the inner platform (Fig. 1.7 A, B).

The micropaleontological assemblage consists of: benthic foraminifera (*Montsalevia salevensis*, *Coscinoconus delphinensis*, *Protopeneroplis ultragranulata*, *Coscinoconus chiocchinii*, *Paracoskinolina jourdanensis*, *Pseudocyclammina lituus*, *Haplophragmoides joukowskyi*, *Coscinoconus elongatus*, *Coscinoconus cherchiae*, *Pfenderina neocomiensis*, *Coscinoconus* cf. *molestus*, *Scythiolina camposauri*, *Coscinoconus* cf. *perconigi*, *Meandrospira favrei*), dasycladalean algae (*Salpingoporella* *pygmaea*, *Steinmaniporella* sp., *Terquemella* sp.) and udoteacean algae (? *Nipponophycus* sp.).

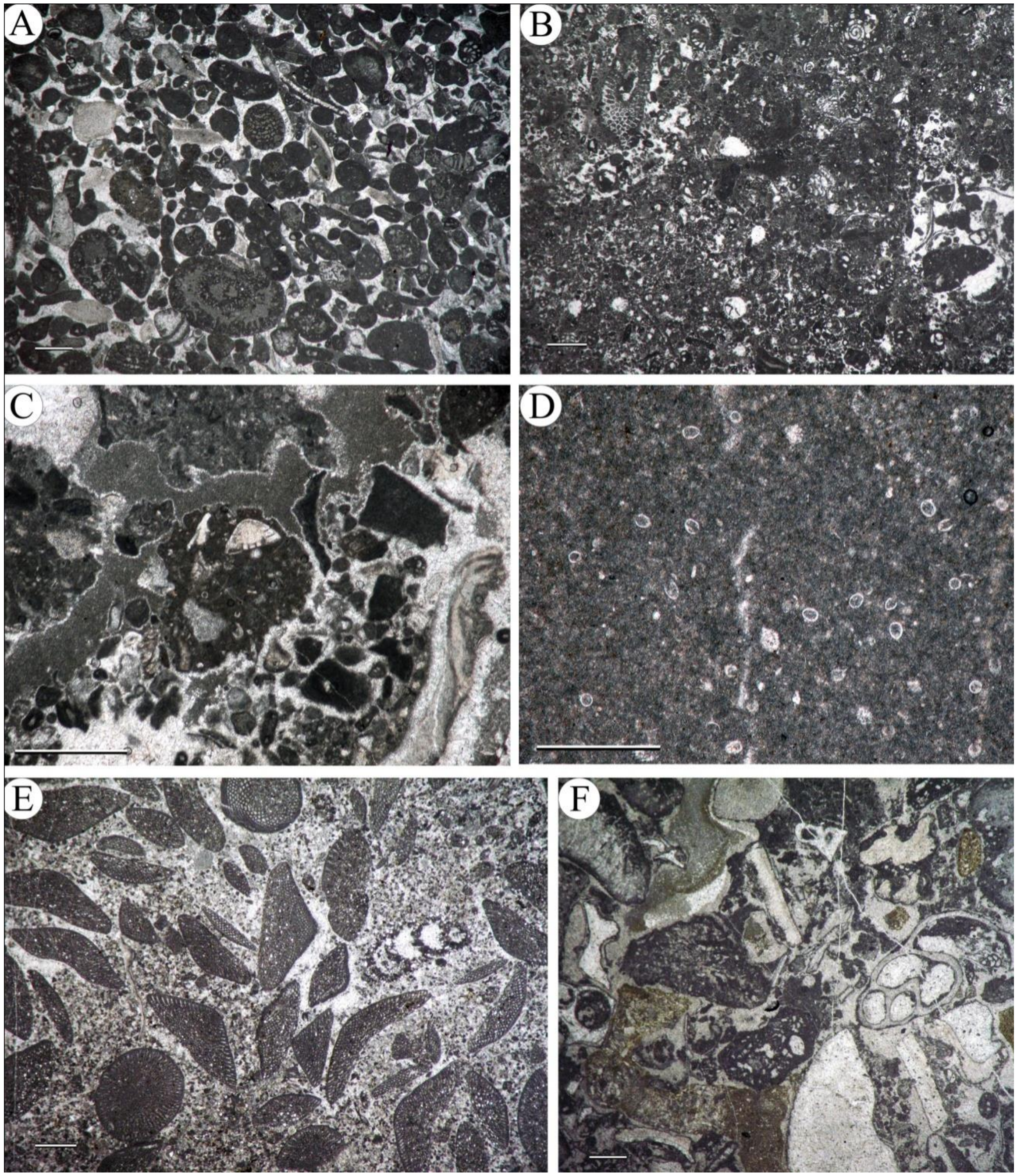

Figure 1.7: A Coarse bioclastic grainstone with large agglutinated foraminifera; **B** Bioclastic grainstone with green algae (*Salpingoporella pygmaea*) and benthic foraminifera; **C** Allodapic limestone with calpionellids, *Crescentiella morronensis*, *Neotrocholina valdensis* and voides filled with vadose silt and "dog tooth" cement;**D** Bioclastic wackestone with calpionellids; **E** Bioclastic wackstone/floatstone with orbitolinids and other agglutinated foraminifera; **F** Bioclastic/grainstone rudstone with large of molluscs fragments (e.g. gastropods), coral fragments and encrusting organisms (*Lithocodium aggregatum*) (Scalebar: A, C, E, F = 1 mm; D = 0.5 mm).

The Upper Berriasian and Lower Valanginian period was established based on the presence of *Montsalevia salevensis* and *Haplophragmoides jukowski* foraminifera which have as a distribution period the Upper Hauterivian-Berriasian. Beside these, it can be remarked a wide variety of genus Coscinoconus (e.g. *Coscinoconus delphinensis*, *Coscinoconus campanellus*, *Coscinoconus elongatus*, *Coscinoconus cherchiae*, *Coscinoconus molestus*, *Coscinoconus* cf. *perconigi*) which are described frequently in the Berriasian-Valanginian period (Fig. 1.8).

The pebbles which contain microfacies with calpionellids (Upper Tithonian - ?Lower Valanginian). Much of the pebbles collected (~40%) of the aptian conglomerate deposits show representative facies for the slope, base of slope or basin with micropaleontological assemblages dominated by calpionellids, radiolarians, sponge spicules and subordinated derived shallow-water fossils (Fig. 1.7 C, D). There can be observed percentual increase in the participation of these pebbles from the north zone (Gura Râului) of Piatra Craiului Syncline to its south (Brusturet and Pietricica), where the average sizes reach the lowest rates and their abundance is the highest. The assemblage cover the calpionellid zones: Crassicolaria (A), Calpionella (B, C)(Alpina and Elliptica Subzones), Calpionellopsis (D) (Simplex and Oblonga Subzones) and Calpionellites (E) (Remane, 1971; Pop, 1997).

The identified assemblage contains many calpionellids species (*Crassicollaria parvula*, *Crassicollaria intermedia*, *Crassicollaria brevis*, *Calpionella alpina Tintinnopsella carpathica*, *Calpionella elliptica*, *Lorenziella hungarica*, *Tintinnopsella longa*, *Calpionellopsis simplex*, *Calpionellopsis oblonga*, *Remaniella filipescui*, cf. *Calpionellites darderi*, *Sturiella oblonga*), calcispheres (*Colomisphaera* sp., *Cadosina minuta*, *Cadosina fusca*, *Stomiosphaera* sp., *Colomisphaera lapidosa*), radiolarians alongside occurring sponges fragments, corals fragments, radiolarians, echinoderm frgmantes, *Carpathocancer* fragments sp., foraminifera (*Neotrocholina valdensis*, *Patellina* sp. *Lenticulina* sp., *Monsalevia salevensis*, *Haplophragmoides jukowskyi*, *Meandrospira* sp., *Freixialina* sp., *Protopeneroplis* cf. *banatica*, *Mohlerina basiliensis*), dasycladacean algae [?*Terquemella* sp., ?"*Vermiporella*" sp., *Zujovicella gocaninii*, *Salpingoporella* sp., *Arabicodium* sp.), encrusting organisms (*Pseudorothplezella* sp., *Koskinobulina socialis*) and *Crescentiella morronensis* (Fig. 1.8).

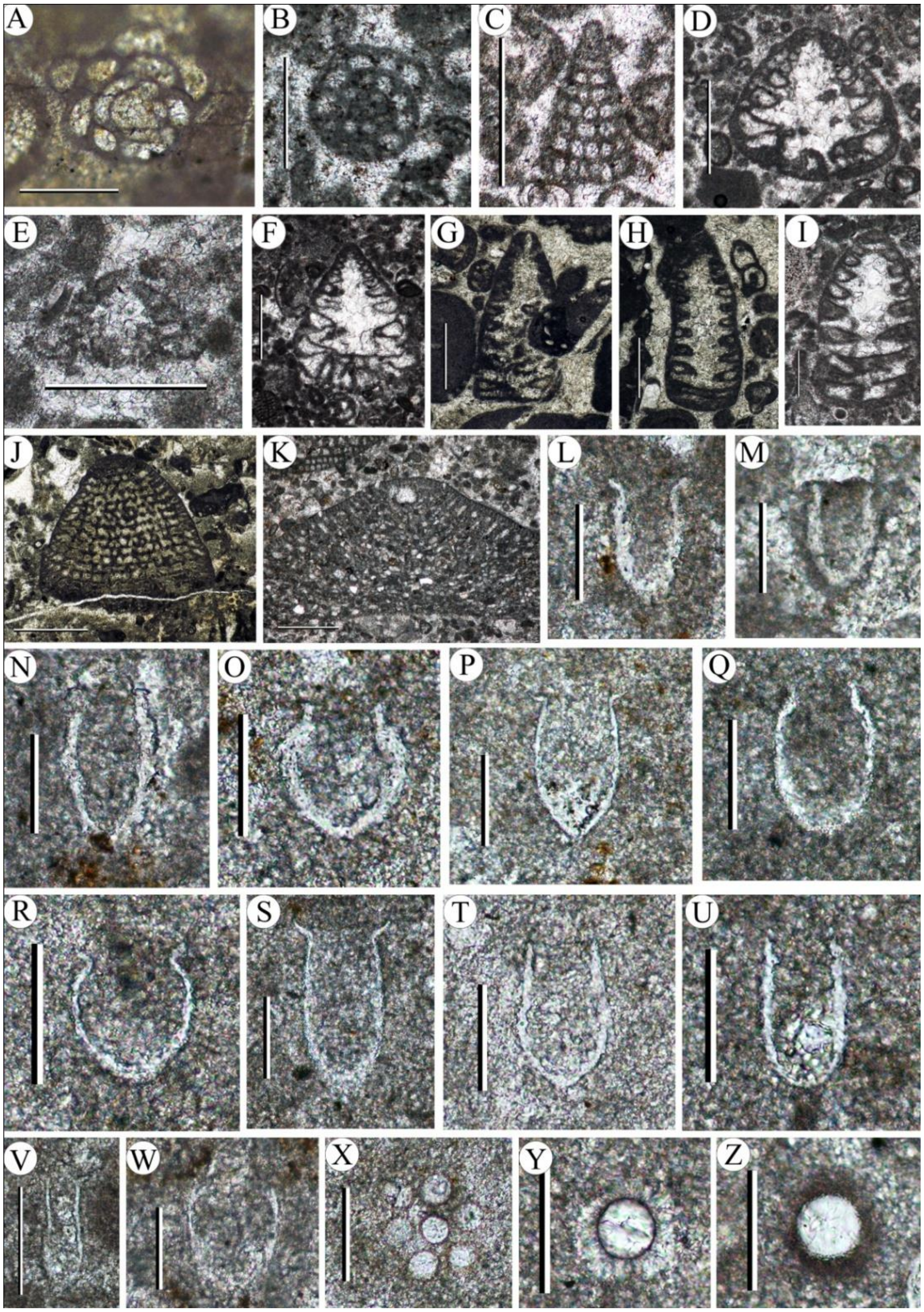

Figure 1.8: **A** *Meandrospira favrei*; **B** *Haplophragmoides jukowskyi*; **C** *Monsalevia salevensis*; **D** *Coscinoconus* cf. *chiocchinii*; **E** *Coscinoconus molestus*; **F** *Coscinoconus delphinensis;* **G** *Coscinoconus* cf. *perconigi;***H** *Coscinoconus elongatus*; **I** *Coscinoconus cherchiae*; **J** *Montseciella arabica*; **K** *Palorbitolina lenticularis*; **L** *Crassicolaria intermedia;* **M** *Crassicolaria brevis*; **N** *Crassicolaria* sp.; **O** *Calpionella alpina*; **P** *Tintinopsella carpathica*; **Q** *Calpionella elliptica*; **R** *Lorenziella hungarica*; **S** *Tintinopsella longa*; **T** *Calpionelopsis simplex*; **U** *Calpionelopsis oblonga*; **V** *Sturiella oblonga*; **W** cf. *Calpionellites darderi*; **X**

Cadosina minuta; **Y** *Colomisphaera lapidosa*; **Z** *Cadosina fusca* (Scale bar: B, D, F, G, H = 0.5 mm, C, E, I = 0.25, A = 0.125 mm; L-Z = 0.0625 mm).

The overall study of the pebbles with calpionellids indicates, based on the zonation of calpionellids, origins from deposits belonging to the Upper Tithonian-Lower Valanginian period.

The pebbles assigned to Barremian-Aptian. The pebbles that can be attributed to this period are present in a small number. The identified microfacies are typical to the reef or platform margin environments (Fig. 1.7 E, F).

The paleontological assemblage consists of: corals, sponges, encrusting organisms, microproblematic (*Crescentiella morronesis*), calcareous algae (*Neomeris creatcea*, *Arabicodium* sp., *Terquemella* sp.) and benthic foraminifera (?*Pfenderina* sp., *Montseciella arabica*, *Praeorbitolina* sp., *Palorbitolina lenticularis*,?*Paleodictyoconus* sp., *Choftatella decipiens*, *Everticyclammina hedbergi*, *Coscinophragma cribrosa*, *Haplophragmoide*s sp., ?*Novalesia* sp., *Meandrospira* sp., *Textularia* sp.).

From the described association the following foraminafera: *Montseciella arabica* and *Palorbitolina lenticularis* are biostratigraphic indicators of Upper Barremian- Lower Aptian while *Choffatella decipiens* is reported often in Aptian (Fig. 1.8).

6.3.2 Metamorphic pebbles.

The metamorphic pebbles do not exceed 16% of the total amout of pebbles from the Gura Râului deposits. The mineral assemblage has allowed the identification of three petrologic types: gneiss, quartzite and quartz schists. Out of these, the gneisses are the most abundant (~ 75%). They are remarked through advanced stages of metamorphism indicated by numerous quartz crystals with undulose extinction, pertitic structures, high frequency of microclin, deformational structures or well-developed crystals of albite. The descriptive characters are similar to the gneisses described from Cumpăna Group (Gherasi et al., 1966).

6.3.3 Siliceous pebbles

Silicolitic clasts are rarely reported amoung all pebbles from the aptian conglomerates (max 5%), and come mainly from nodular deposits (cherts) and less frequently from bedded deposits (biogenic silicolite). The nodules are often observed with the carbonate "host" rock in which they were formed. The micropaleontological assemblage observed in the carbonate rocks with siliceous nodules is made up of: sponges fragments, echinoiderm plates, benthic foraminifera (*Labyrinthina mirabilis*; *Nautiloculina/Charentia* sp.; *Meandrospira* sp.), dasycladalean algae (*Salpingoporella annulata*), microproblematics (*Crescentiella morronensis*) and rare sponges spicules. This association is a typical one for the Kimmeridgian-Tithonian period. The biogenic silicolites are represented by radiolarites (it can be observed species belonging to Spumellaria and Nassellaria orders) and spiculites. Following the similarity with resembling deposits from Piatra Craiului (Popecu, 1966; Patrulius, 1969; Beccaro & Lazar, 2007) it can be said that bedded silicolites belong to the Upper Callovian- Oxfordian period and nodular chert belongs to the Upper Kimmeridgian-Tithonian period.

6.4 The binder

The entire assembly of pebbles is supported by an clay-rich silt-arenitic matrix and rarely by a micritic cement.The matrix appears in all the facies and the cement was rarely seen only in facies 1.

6.5 The paleocurrent analysis

In three of the areas studied there can be seen the clast imbrication by axis a: Prăpăstiile Zărneşti, Brusturet and Pietricica. In these areas there were carried out approximately 300 measurements of the directions of paleocurents. The measurements recorded were represented on polar diagrams for each measurement area. After interpreting the data from these diagrams we can say that the general directions of flow (N) are from northeast to southwest and from northwest to southeast, respectively (Fig. 1.9). An additional argument for the direction of flow is brought by measurements made by N. Mihăilescu on the type-outcrop from Gura Râului and on the and conglomeratic deposits from threshold of Bran after which he set a general direction of flow from west to east (in Patrulius 1969, p. 118).

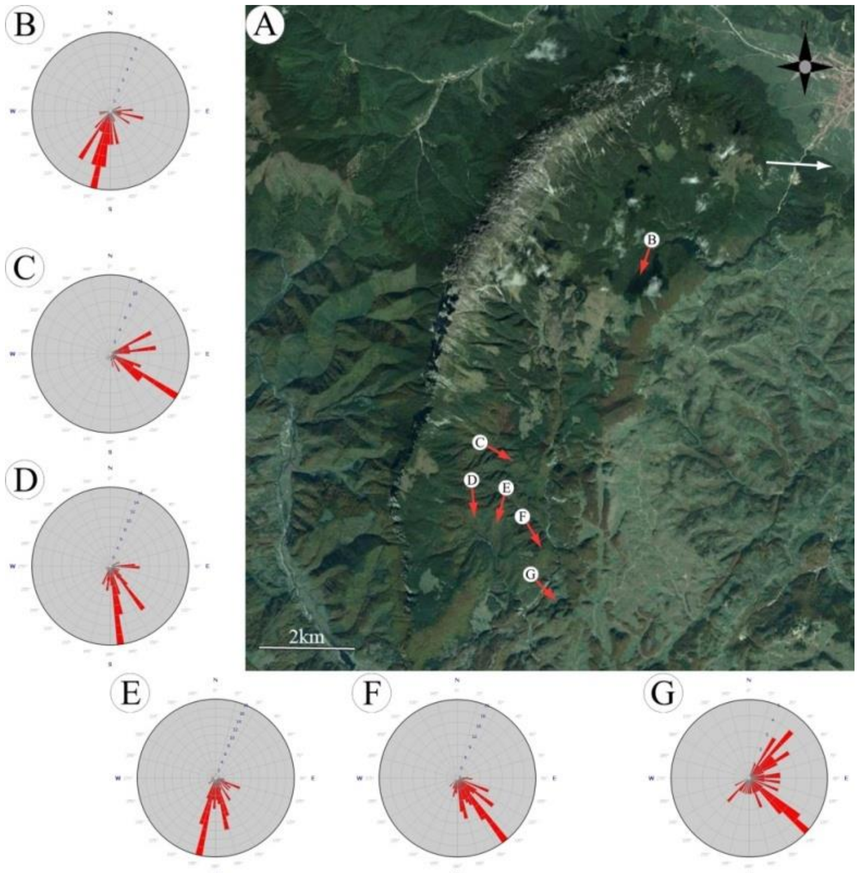

Figure 1.9: The results of the measurements on the imbricated pebbles from the aptian conglomerate deposits:**A** Placement of locations where measurements were made, the general direction of flow (N) (red arrows) and the direction mentioned by N.Mihăilescu (white arrow); **B-G** Polar diagrams with the measurements recorded in each location (B - N = 190˚; C - N 123˚; D - N = 170˚ E - N 192˚ F - N 145˚ G - N = 133˚).

6.6 The age of conglomerates

In previous work it was established the aptian age of these deposits, the main arguments being: blocks of such conglomerates were found in the Bucegi conglomerates, fact that confirms that they are older than Albian; in the matrix of these conglomerates there were found orbitolinids, which advocates for an Aptian age; in these conglomerates there are also fragments of urgonian limestones so that it can be assumed that they belong to the Upper Aptian (Popescu, 1966). In the present study there were identified pebbles belonging to Barremian-Aptian and rare fragments orbitolinids in matrix, these representing additional arguments for placing the deposits in the Aptian period.

7. THE LATE ALBIAN-CENOMANIEN CONGLOMERATIC DEPOSITS

7.1 General aspects

The late albian-cenomanian conglomerates were identified only in the north-eastern side of the Piatra Craiului syncline. They are bordered by the Piatra Craiului Massif in the northwest (Piatra Mare) and northeast (Piatra Mică) and by the Prăpăstiile Zărneşti in the southeast and southwest. The deposits spread on ~ 3 km between Şaua Crăpăturii and the Prăpăstiile Zărneşti and ~1 km between Prăpăstiile Zărneştilor and Piatra Mică and have a thickness of ~ 550 m. There are three areas where they were investigated: Prăpăstiile Zărneştilor; Curmătura and Şaua Crăpăturii.

7.2 The sedimentological study of late Albian-Cenomanian conglomerates

The late Albian-Cenomanian conglomerates are considered equivalent to those arising in Bran, but also in the entire Dâmbovicioara Couloir (Popescu, 1966). The surface on which these ones spread in the Piatra Craiului syncline is much narrower than compared with the Aptian conglomeratic deposits. Taken together, the late Albian- Cenomanian conglomerates can be characterized as extraformational polimictic orthoconglomerates. There were noted a number of characteristics of these deposits that make them differ from the Aptian conglomerates such as: the very weak sorting of the components, the presence of all degrees of roundness (clasts ranging from angular to well rounded), variable dimensions of components (from few centimetres pebbles to olistolits of tens of meters), monomictic breccia frequently interspersed with these deposits or regions where carbonate or metamorphic monomictic conglomerates dominate. The conglomerate sequence was divided into two facies: massive conglomerates (disorganized) with olistolits-facies 4 and oligomictic graded conglomerates-facies 5. In the fourth facies falls most of the late Albian-Cenomanian conglomerates.

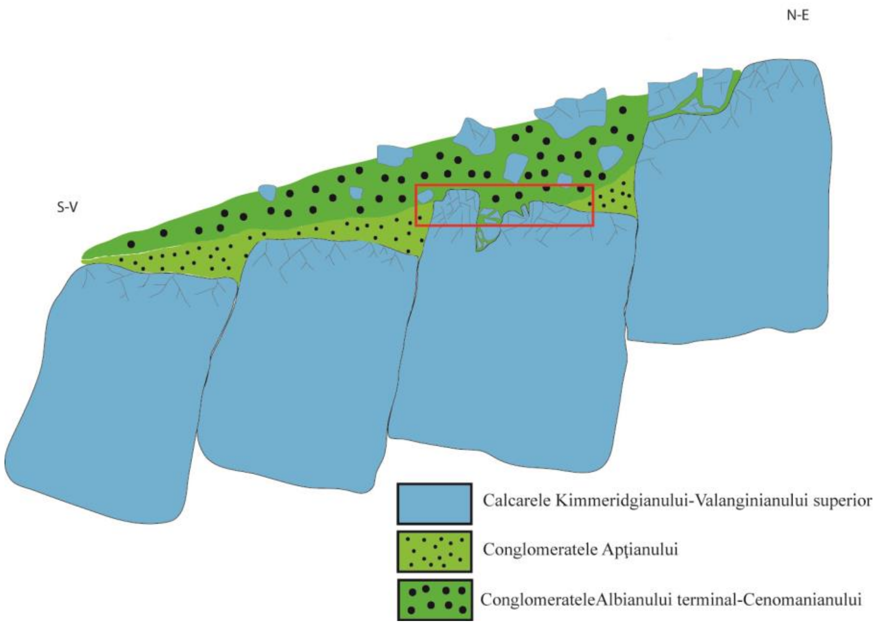

Figure 1.10: Explanatory illustration representing a section through the northeastern part of the Piatra Craiului Massif (drawing is not to scale). With the red rectangle it is located the sequence from Prăpăstiile Zărneştilor

The deposits earmarked to the fourth facies are characterized by very poor sorting and a chaotic disposal/arrangement of the components, ranging from 2-3 cm in diameter to blocks of tens of meters (olistolits) which are predominantly carbonate in origin. In the Prăpăstiile Zărneştilor area, the fourth facies is the best represented, so that above the Aptian conglomerates it can be seen the following sequence: massive conglomerates with carbonate olistolits, conglomerates interbedded with carbonate monomictic breccias, breccias-like limestones with cracks with conglomerate fillings typical to the fourth facies, a the structure that contains at its basis/bed angular and subangular blocks of carbonate above which come the conglomerate of the fourth facies with a predisposition of normal grading and in the upper side, typical Aptian deposits above which there are placed massive late Albian-Cenomanian conglomerates(Fig. 1.10). All the items listed suggest a sintectonic deposit of this sequence in the shape of a filling in the tectonic depressions formed by the movement of crustal blocks during the Albian. This structure of the blocks already generated at the lowermost Cretaceous, is a problem that has been repeatedly approached and in whose favour were recently brought arguments for the deposits in the Dâmbovicioara Couloir (Grădinaru et al., 2016). In the case of the Piatra Craiului Massif, the disposal in tectonic blocks is an aspect argumented by Coca (1998) that helps to explain the above metioned succesion. The late Albian-Cenomanian deposits were most likely put into place as a result of some high density debritic flows (Surlyk, 1984; Pickering et. Al .; 1989) whose deposition was achieved by "freezing" the flow during its advance on the slope caused by the intergranular friction and cohesion (Pickering et. al .; 1989).

The fifth facies was described in only one location: the outcrop with a limited extention from near Cabana Curmătura. This facies differs from the other studied outcrops because the total of the component clasts are exclusively of metamorphic nature. The pebbles belong to the same petrological variety as those identified in the case of pebbles from the late Albian-Cenomian conglomerates or from Aptian conglomerates, noting that here dominate schists. It can be remarked a low degree of consolidation especially rcompared to the the other two conglomerate deposits from Piatra Craiului Syncline. The sequence is defined by inverslz graded beds of maximum 1 m, separated by a discrete stratification plan in which most clasts have a reduced rounding degree. The presence of grading, of the statification and of the decimeter clasts concentrated in the upper side suggest that the transport mechanism was provided by hyperconcentrated flows with high viscosity (Mulder & Alexander, 2001).

7. 3 Pebbles belonging to the late Albian-Cenomanian conglomerates

Similar to the older deposits previously presented, these conglomerate deposits are also polimictic, having the same lithological constituents: carbonatic, metamorphic and silicolitic.

7.3.1 Calcareous pebbles

The carbonate clasts are dominant (~ 88%), being represented by, besides pebbles and cobbles, also by metric olistoliths. The microfacies and microfossils assemblage suggest that their belong to Middle Jurassic-Lower Cretaceous deposits.

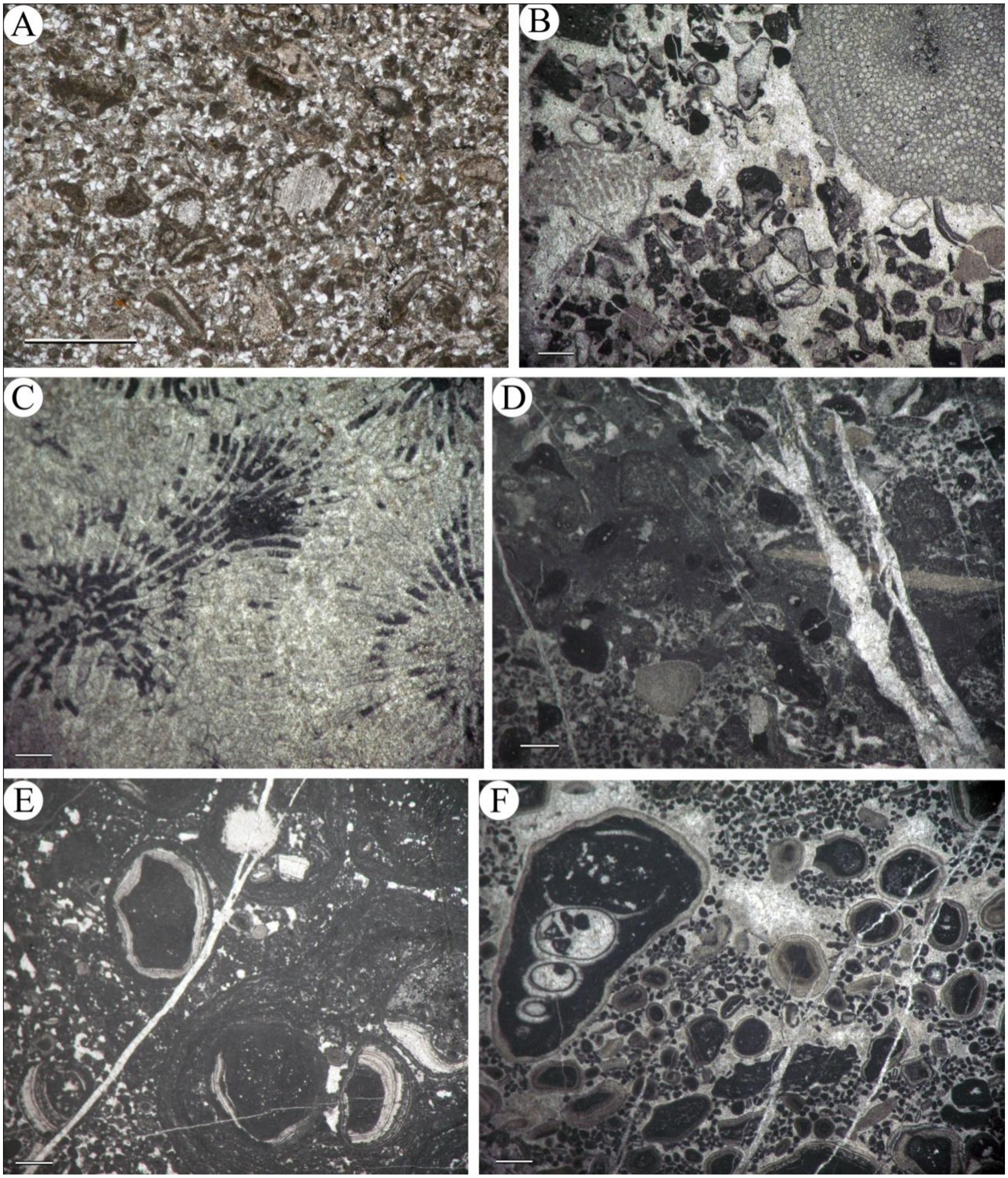

Figure 1.11: **A** Bioclastic-extraclastic packstone with gastropods, *Trocholina conica* and *Lenticulina* sp.; **B** Bioclastic-intraclastic grainstone/rudstone with sponges, corals fragments, udoteacean algae, *Crescentiella morronensis* and subangular intraclasts; **C** Coral boundstone; D Bioclastic-intraclastic grainstone with *Crescentiella moronensis*; **E** Oncoidic rudstone with composed oncoids and regenerated ooids; F Fenestrated bioclastic ooidic grainstone with large gastropod (Scale bar = 1 mm).

The pebbles assigned to the Middle Jurassic age. The pebbles belonging to the Middle Jurassic are very rare and are represented by microfacies rich in terrigenous material of arenitic dimensions characteristic to the areas of internal platform (Fig. 1.11).The specific paleontological assemblage is primarily dominated by many fragments of bivalves and gastropods alongside with rare benthic foraminifera such as *Trocholina conica* and *Lenticulina* sp.). The described microfacies alongside with *Trocholina conica* indicate that this pebbles belong to the Middle Jurassic.

The pebbles asigned to Kimmeridgian-Tithonian period. Nearly 15 percent of the collected pebbles were distributed in this period. The dominant microfacies are characteristic to the reef, inner slope and slope environment, being observed the many similarities with those described from the pebbles belonging to the Gura Râului conglomerates (Fig. 1.11 B-D).

The paleontological assemblage consists of: corals, sponges, brzozoans, f echinoiderm fragments, dasycladalean algae (? *Neoteutloporella socialis*, *Salpingoporella pygmaea*, *Clypeina sulcata*, *Suppiluliumaella delphica*), udoteacean algae (*Nipponophycus ramosus*), red algae (? S*olenopora* sp.), foraminifera [*Labiyinthina mirabilis*, *Protopeneroplis striata*,*Protopeneroplis ultragranulata*, *Mohlerina basiliensis*, *Coscinophragma cribrosa*), encrustig sponges (*Calcistella jachenhausensis*) microproblematic organisms (*Crescentiella morronensis*), cyanobacteria (*Girvanella* sp., *Diversocalis* sp.), worm tubes (*Mercierella dacica*) and juvenile ammonite.

The origin of these pebbles from Kimmeridgian-Tithonian deposits is confirmed by the presence of foraminifera such as *Labyrinthina mirabilis*, *Protopeneroplis striata* and *Mohlerina basiliensis*, *Clypeina sulcata*, algae such as *Neuteutloporella socialis*, *Supiluliumaella delphica* and by the presence of the encrusted sponge *Calcistella jachenhausensis* (Fig. 1.12).

The pebbles assigned to the Upper Tithonian-Lower Berriasian. The cobbles assigned to this period are characterized by microfacies specific to the inner platforms with hydrodynamic variations. One can observe a high abundance of ooidic facies (Fig. 1.11).

The paleontological assemblage has a reduced diversity and abundance. It contains: molluscs fragments, foraminifera (*Protopeneroplis ultragranulata*, *Coscinoconus* cf. *perconigi*, *Coscinoconus cherchiae*, *Coscinoconus delphinensis*, *Coscinoconus alpinus* / *campanellus*, *Coscinoconus* cf. *molestus*), dasycladalean algae (*Clypeina sulcata*, *Salpingoporella pygmaea*, *Salpingoporella annulata*), rivulariacean-type cyanobacteria, microproblematic organisms (*Carpathoporella occidentalis*, *Crescentiella morronensis*, aptychus fragments, *Carpathocancer* sp.fragments and peloidal stromatolitic structures.

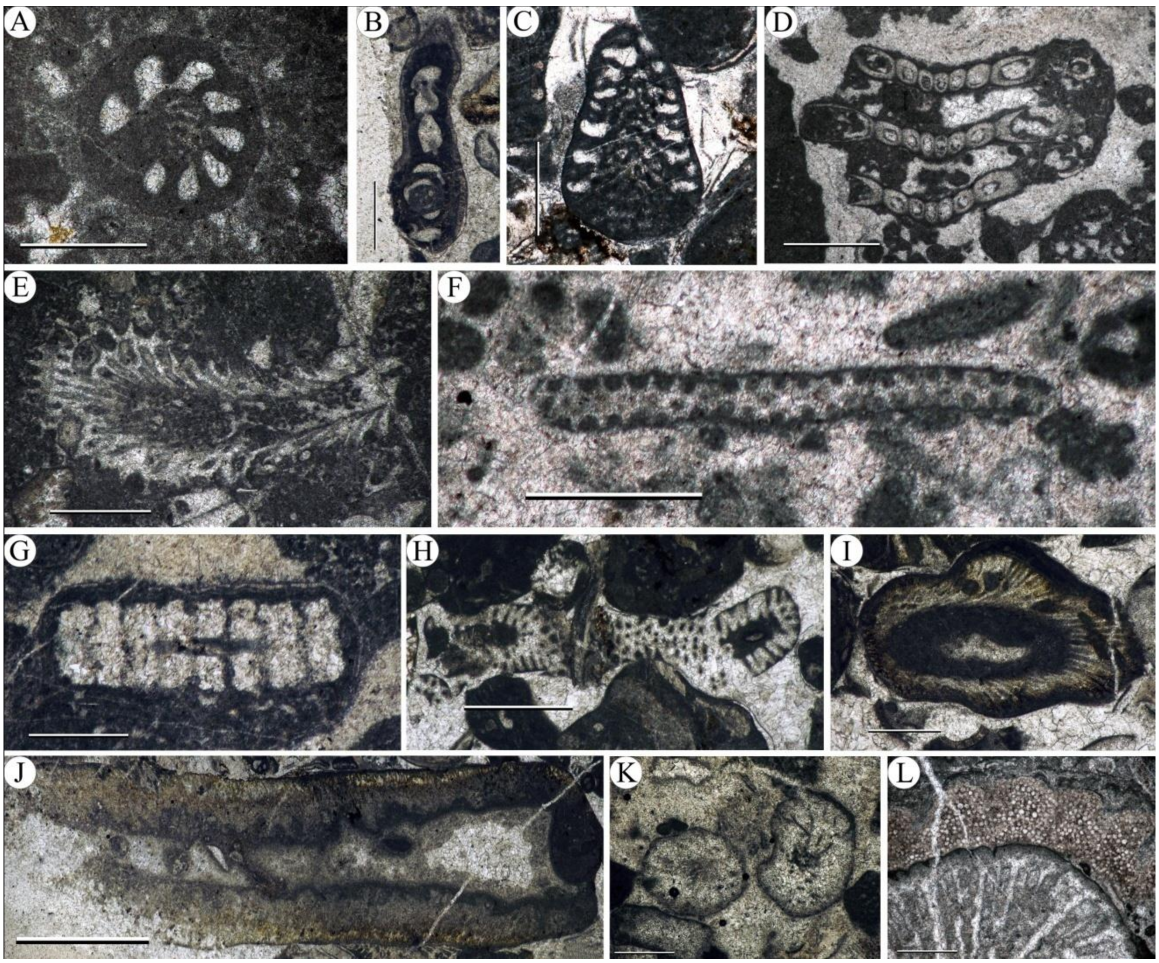

Figure 1.12: **A** *Pfenderina neocomiensis*; **B** *Danubiella cernavodensis;* **C** *Paracoskinolina jourdanensis*; **D** *Clypeina sulcata*; **E** *Suppiluliumaella delphica*; **F** *Neoteutloporella socialis*; F *Salpingoporella annulata*; **H** *Salpingoporella pygmaea*; **I** *Pseudocymopolia jurassica*; **J** *Permocalculus dragastani*; **K** *Nipponophycus ramosus*; **L** *Clacistella jochenhausensis* (Scale bar: D, E, H, J, L = 1 mm, B, C, F, G, I, K = 0.5 mm, A = 0.25).

Assigning the age of those pebbles was done based on the of ooidic and oncoidic facies (also described elsewhere in this period) associated with the presence of foraminifera belonging to different species of the Coscinoconus genus . Some foraminifera such as *Protopeneroplis ultragranulata*, *Coscinoconus delphinensis*, *Coscinoconus cherchiae* and *Coscinoconus perconigi* were described mainly from Lower Berriasian- Valanginian period.

The pebbles s assigned to the Upper Berriasian-Lower Valanginian. The pebbles belonging to this range are the most common, representing over 50% of those collected from these deposits. Within them the dominant facies characteristic are pointing to restrictive peritidal environments, rarelz beng observed tipical facies for high.energz environments (Fig. 1.13 A-D). This trend was observed also after the study of thin sections made from carbonate blocks. The paleontological assemblage consists of: dasycladalean algae (*Salpingoporella pygmaea*, *Pseudocymopolia jurassica*, *Actinoporella podolitica*), gymnocodiacean algae (*Permocalculus dragastani*), udoteacean algae (? *Arabicodium* sp.), microproblematic organisms (*Felixporidium* sp.), bacinelid-type strucutres, rivularian-like cyanobacteria, benthic foraminifera (*Coscinoconus campanellus*, *Coscinoconus cherchiae*, *Coscinoconus alpinus*, *Coscinoconus delphinensis*, *Paracoskinolina jourdanensis*, *Pseudocyclammina lituus*, *Montsalevia elevata*, *Danubiella cernavodensis*, *Montsalevia salevensis*, *Pfenderina neocomiensis*,? *Nautiloculina* sp.), gastropods, bryoyoans and ? *Carpathocancer* sp. fragments.

The whole association presented is a typical one for the Upper Berriasian-Lower Valanginian, this age being confirmed by the presence of species with biostratigraphical importance such as foraminifera *Montsalevia salevensis* (Upper Berriasian-Hauterivian), *Montsalevia elevata* (Berriasian-Valanginian or Upper Berriasian - Lower Valanginian) and *Paracoskinolina jourdanensis* (Valanginian-Lower Barremian) or green algae such as *Permocalculus dragastani* (Upper Berriasian -Valanginian) and *Pseudocymopolia jurassica* (Berriasian). An additional argument for the age is provided by the abundace presence of

Coscinoconus genus species which are characteristic for the Berriasian-Valanginian period (Fig. 1.12).

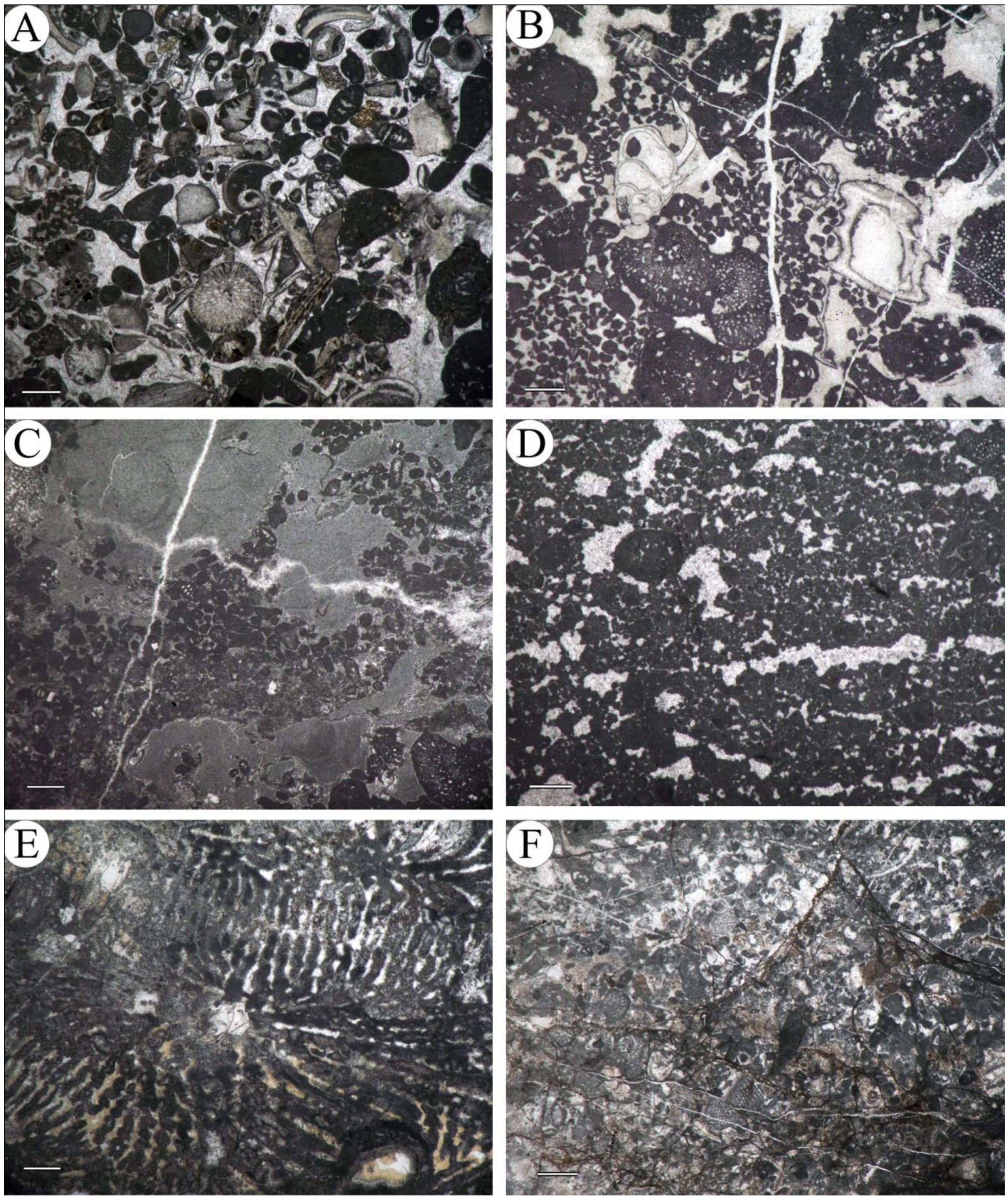

Figure 1.13: **A** Coarse intraclastic-bioclastic grainstone with many foraminifera belonging to the Coscinoconus genus, orbitolinids, brzozoans and well rouded micritic intraclasts; **B** Bioclastic grainstone / rudstone with large gastropods, rivulariacean-type cyanobacteria and *Clypeina sulcata*; **C** Fenestral intraclastic grainstone with vadose silt; **D** Fenestral intraclastic grainstone with predominantly parallel

fenestrae; **E** Coral boundstone; **F** Bioclastic-intraclastic packstone with orbitolinids and dasycladalean algae (Scale bar = 1 mm).

Pebbles containing facies with calpionellids. In three of the collected pebbles there are present caliponellids assemblages, the representative microfacies being represented by bioblastic wackestone. The calpionellid assemblage consists of: *Calpionella alpina Calpionella elliptica*, *Tintinipsella carpathica*, *Crassicollaria parvula*, *Crassicollaria intermedia*, *Crassicollaria brevis*. The identified assemblage are representative to the Calpionella Zone (Alpina and Elliptica sub-zones) which indicates low and middle Berriasian (Reman, 1971, Pop, 1994).

The pebbles asigned to Barremian-Aptian period. The pebbles related to this period represents a very small percentage (~ 5%) of the total of the collected ones from the of the Late Albian-Cenomanian conglomerate deposits. The main microfacies observed characterizes a reef environment and also the inner or outer slope environment (Fig. 1.13 E, F).The paleontological assemblage consists of: corals, sponges, bryozoans, brachiopods, echinoiderm fragments, encrustin organisms (*Lithocodium ggregatum*), benthic foraminifera (*Montseciella arabica*, *Rectocyclammina* sp.), algae (*Salpingoporella pygmaea*) and microproblematic organisms (*Carpathoporella occidentalis* , *Crescentiella morronensis*).

Assigning these pebbles to the Baremian-Aptian age was done both based on typical urgonian facies and also on species with biostratigraphical relevance such as *Montseciella arabica* orbitolinid foraminifera (Upper Barremian- Lower Aptian) and microproblematic organism *Carpathoporella occidentalis* (Barremian-Albian).

7.3.2 Metamorphic Pebbles

These ones have little participation in this detritic deposit, with only areas where metamorphic clasts of various sizes are concentrated (e.g. Curmătura). Compared with the metamorphic pebbles of the Aptian deposits, it can be noted that the one belonging tot he Late Albian-Cenomanian deposits have a wide range of sizes , in some outcrops being observed decimentric blocks. Based on the mineralogical association, the pebbles were assigned to five types of rocks: gneiss, quartz schists, quartzites, sericite-quartz schists and sericite(muscovito) -clorite schists. Similar to the Aptian deposits, the gneisses represent the dominant type, these showing a pronounced degree of metamorphosis (e.g. well-developed microclin crystals, mirmekitic or pertitic structures). It can be said that they all come from the Cumpăna Group. A special appearance among the metamorphic pebbles is the presence of quartz-sericite schists, sericite-chlorite and quartz epidote schists (relatively few in number). Such rocks, with a less pronounced metamorphism in the facies of amphibolites with almandine (Balintoni, 2005), are known from the metamorphic Group of Leaota (Gherasim, 1962 Gerasimos et al., 1966; Popovici, 1976; Dimitrescu, 1978; Gurău et al., 1985; Dimitrescu, 1990; Balintoni, 1997, 2005).

7.3.3 Siliceous pebbles

Like the Aptian conglomerate deposits, the Late Albian-Cenomanian deposits contain two types of silicolitic pebbles: coming (perhaps) from nodular deposits or from bedded deposits. The silicolitic pebles from the Late Albian-Cenomanian conglomerates presents various degrees of roudness,being found with shapes ranging from angular to very well rounded. The pebbles coming from silicolitic nodular deposits stands out both macroscopically and microscopically, due to the color which is different from the one of the host carbonatic rock. In some samples there could be seen the microfacies of the host carbonate rock which are of the intraclastic-bioclastic packstone type or bioclastic-intraclastic wackestone. Pebbles coming from bedded silicolits stand out macroscopically through a reduced degree of roundness and predominantly tabular shapes. In thin sections it can be observed a high abundance of radiolarians, the assemblage containing also sponge spicules.

7.4 The binder

The biggest part of the component clasts are in contact so that in most areas the binder is a carbonate cement or an clayly-arenitic matrix. The deposits investigated presents the testimonies of intense dissolution under pressure, frequently being observed pebbles that are in sutural contacts.

7.5 The directions of flow

In all of the outcrops studied there were no pebbles imbrications so that the only relevant information about the direction of flow is the presence of limestone olistoliths which present identical facies with the sequence of known from the top of the Piatra Craiului Massif (Bucur et al., 2013). Following the occurrence and distribution of these up to the Bran area it can be estimated that the general direction of flow was from northwest to southeast (Fig. 1.14).

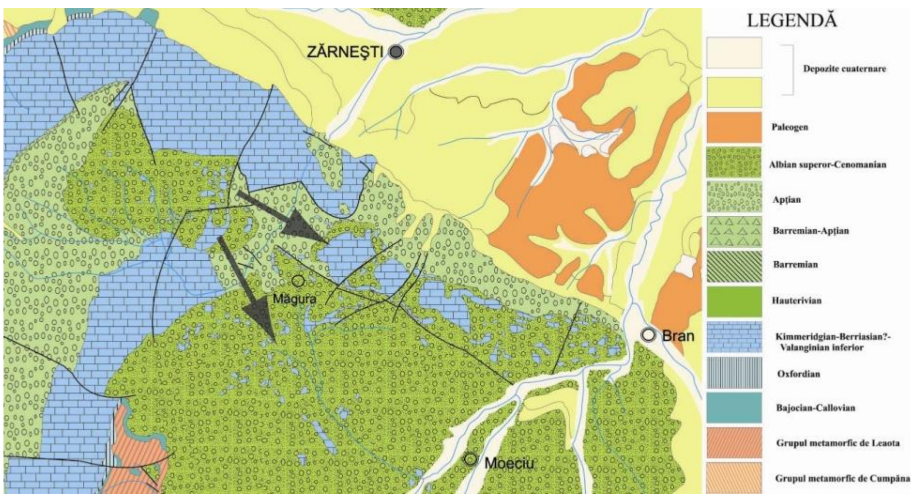

Figure 1.14: Probable flow direction of the conglomerates from the Late Albian-Cenomanian on th gological map of the region [redrawn after Patrulius et al. (1971), Săndulescu et al. (1972) şi Dimitrescu et al. (1971, 1974)].

7.6 The age of conglomerates

The age of these deposits was established after parallelization with similar deposits occurring throughout the Dâmbovicioara Couloir. The ascription of these to the "Vraconian" (late Albian) -Cenomanian was done after identifying an ammonite fauna in the sandstones from the Podul Cheii area(Toula, 1896; Simionescu, 1898; Popovici-Hatzeg 1899) (in Patrulius, 1969). An additional argument is brought by Patrulius (in POpescu, 1966) who discovers another ammonite fauna on the western slope of the Ghimbavu Mountain which he attributes also to the "Vraconianului". Knowing that deposits over which they sit are Aptian (Popescu, 1966 Ungureanu et al., 2015) and that they provided material to the Albian deposits from the Bucegi Massif (Popescu, 1966 Patrulius, 1969) ,it can be said that deposits of conglomerate with carbonate olistoliths from the northeast of the Piatra Craiului syncline belong to the Late Albian-Cenomanian.

8. DEPOSITS FROM THE CONTACT OF TITHONIAN-VALANGINIAN LIMESTONES ANDAPTIAN CONGLOMERATES

8.1 Introduction

A Part of the field and laboratory work was to identify and describe the succession from base/bed of the Aptian conglomeratic deposits. The contact zone between the sequence of lowerKimmeridgian-Valanginian carbonate (Bucur, 1978; Bucur et al., 2009; Mircescu et al., 2014) and Aptian conglomerates was studied in several regions, but only three of them are relevant for this study : Padinile Frumoase, Lehman's Road and Prăpăstiile Zărneştilor.

8.2 Description of the profiles studied

In the areas studied, three sections were sampled in order to determine the relationship between the conglomeratic deposits and the sequence over which they were disposed. In Prăpăstiile Zărneştilor section there are some tectonic complications so that the profile that was realized brings only partial information to the purpose that was followed. Padinile Frumoase and Drumul lui Lehman gave very useful information about the sequence from the contact area and about the age of the deposits studied.

Prăpăstiile Zărneştilor. In Prăpăstiile Zărneştilor we made a profile from the exit of the sinkhole to the first outcrop of conglomerates. The outcroping limestones are termed by Patrulius (1969) "superior massive limestone ". The sequence studied is easily identifiable on the field because all the outcrops observed present traces of intense erosional activity and they have a strong breccious aspect. The main types of microfacies identified are: coral boundstone/rudstone, bioclastic grainstone /rudstone, intraclastic-bioclastic grainstone /packstone, boundstone with encrusting organisms, intraclatic-bioclastic rudstone and bioclastic intraclastic grainstone.

The paleontological assemblage consists of: corals, sponges (*Ellipsactinia* sp.), bryozoans, molluscs fragments (mainly gastropods and brachiopods), foraminifera (*Protopeneroplis striata*, *Charentia evoluta*, *Coscinoconus alpinus*, *Protopeneroplis ultragranulata*,? *Paracoskinolina* sp.), green algae (*Clypeina sulcata*, *Salpingoporella pygmaea*, *Triploporella remesi*, *Petrascula bursiformis*,?*Griphoporella cretacea*, *Steimaniporella* sp.), encrusting organisms (*Lithocodium aggregatum*, *Perturbatacrusta leini*) and microproblematics (*Crescentiella morronensis*).

The main microfacies types and microfossils are characteristic to Tithonian-Lower Berriasian period. The top of the profile is marked by a fault filled with conglomerates, after which there is a part covered in vegetation and limestone olistoliths with a conglomeratic filling inside cracks. The direct contact between carbonate and conglomerate deposits can not be observed due to the tectonic complexity of the area and the abundant vegetation.

Padinile Frumoase. In this section it can be observed the boundary between the Berriasian- Lower Valanginian carbonate rocks and the Upper Valanginian marl/limestones (Fig. 1.15). The Berriasian-Lower Valanginian limestones consist of decimeter-meter thick beds while the Upper Valanginian marls/limestones close to the boundary are made of centimetric-decimeter thin layers (Fig. 1.15).The limestones belonging to the Lower Berriasian-Valanginian are characterized by facies specific to the peritidal environment (subtidal and intertdal) with a reduced fossil content (e.g rivularian-type cyanobacteria, rare foraminifera (*Pseudocyclammina lituu*s and miliolids), dasycladalean algae fragments, ostracods). The boundary of these limestones with upper Valanginian marly deposits is marked by a unconformity (Fig.1.15). At the contact zone of the two formations, the Lower Valanginian limestones show dissolution structures and pellicles iron oxides. The subaerian exposure of these limestones is indicated by the dissolution of both the component particles and also by the cement that binds these clasts. In the newly formed cavities there was vadose silt accumulated or it infiltrated into the deposited sediment during the Upper Valanginian.

The association identified below the border (*Salpingoporella praturloni*, *Pseudocymopolia jurassica*, *Haplophragmoides joukowskyi*, *Montsalevia salevensis*, *Pfenderina neocomiensis, Coscinoconus cherchiae, Coscinoconus delphinensis*, *Coscinoconus campanellus*) alongside with correlations with similar deposits from the Dâmbovicioara Couloir (Cheile Dâmbovicioarei Formation, Patrulius et al., 1980) points to Lower Valanginian age. Above the unconfority there is a package of 3 m of thin layers of marly limestones/limestones. They consist of alternating bioclastic wackestone with peloidal-bioclastic packestone. Bioclasts are represented by several small fragments of echinoirms, ostracods, rare mollusc fragments, bryozoans, small benthic foraminifera (*Montsalevia salevensis*, *Meandrospira favrei*), very rare calpionellids and calcispheres (*Cadosina fusca*, *Crustocadosina semiradiata*) (Fig.1.16 F, H, L, P, S, T, W).

The association described suggests an open marine environment tipical for the shelf slope or toe of shelf. The accumulation of this hemipelagic deposits over the subaerially exposed Lower Valanginian limestones took place during the Upper Valanginian transgression. The border between the shallow water carbonates and hemipelagic marly limestones marks a regional unconformity, recently studied in detail (Grădinaru et al., 2016). Above the thin bedded marly limestones comes a pack of about 2.5 m of decimetric beds. These are made up of alternating intraclastic-bioclastic grainstone, intraclastic-bioclastic packstone and intraclastic-bioclastic floatstone.

The paleontological assemblage comprises coral fragments, echinoderm fragments, *Lithocodium* sp. crusts or nodules, worms tubes, benthic foraminifera (*Pseudocyclammina lituus*, *Coscinoconus* cf. *cherchiae*, *Montsalevia salevensis*, *Meandrospira favrei*), very rare calpionellids, calcispheres (*Cadosina fusca*, *Stomiosphaera echinata*), green algae (*Terquemella* sp.), ostracods and molluscs fragments (Fig. 1.16 B, D, W, I, J, K, M, O, R, S, X, Y).Based on the types of intraclasts and bioclasts found in the matrix it can be said that these deposits have accumulated on the shelf slope or the base of the slope. They were formed due to several mass debris flows.

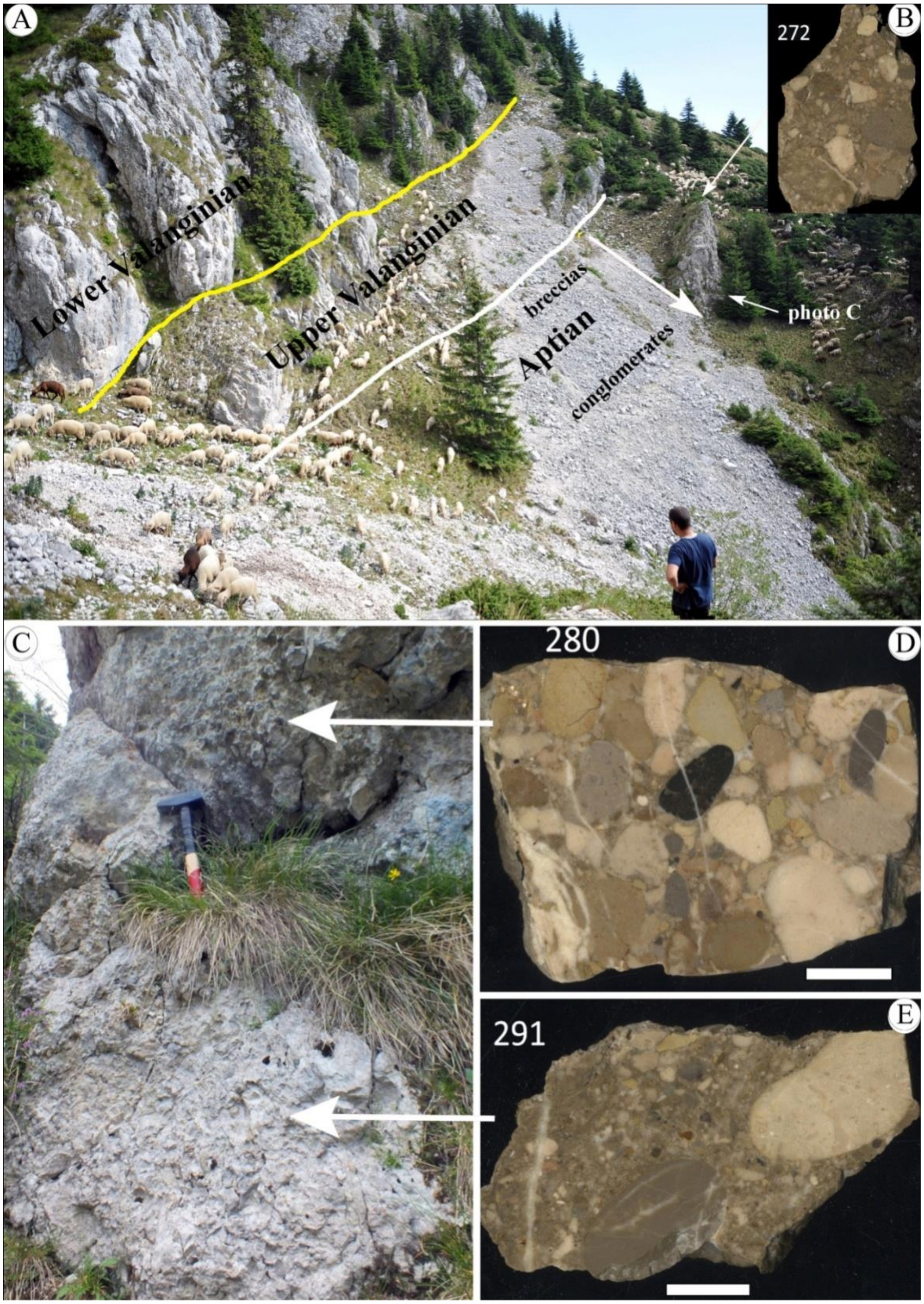

Figure 1.15: Padinile Frumoase outcrop: **A** The lower Valanginian-upper Valanginian unconformity (yellow line) and the transgressive contact between the Valanginian limestones and the Aptian deposits (breccia and conglomerates) (white line); **B** Monomictic breccia; **C** The first outcrop located above the contact area (~3m); **D** Monomictic orthoconglomerates with common carbonate pebbles; **E** Monomictic paraconglomerates with carbonate pebbles. 272, 280, 291 = sample numbers (Scale bar : B, D, E = 2 cm).

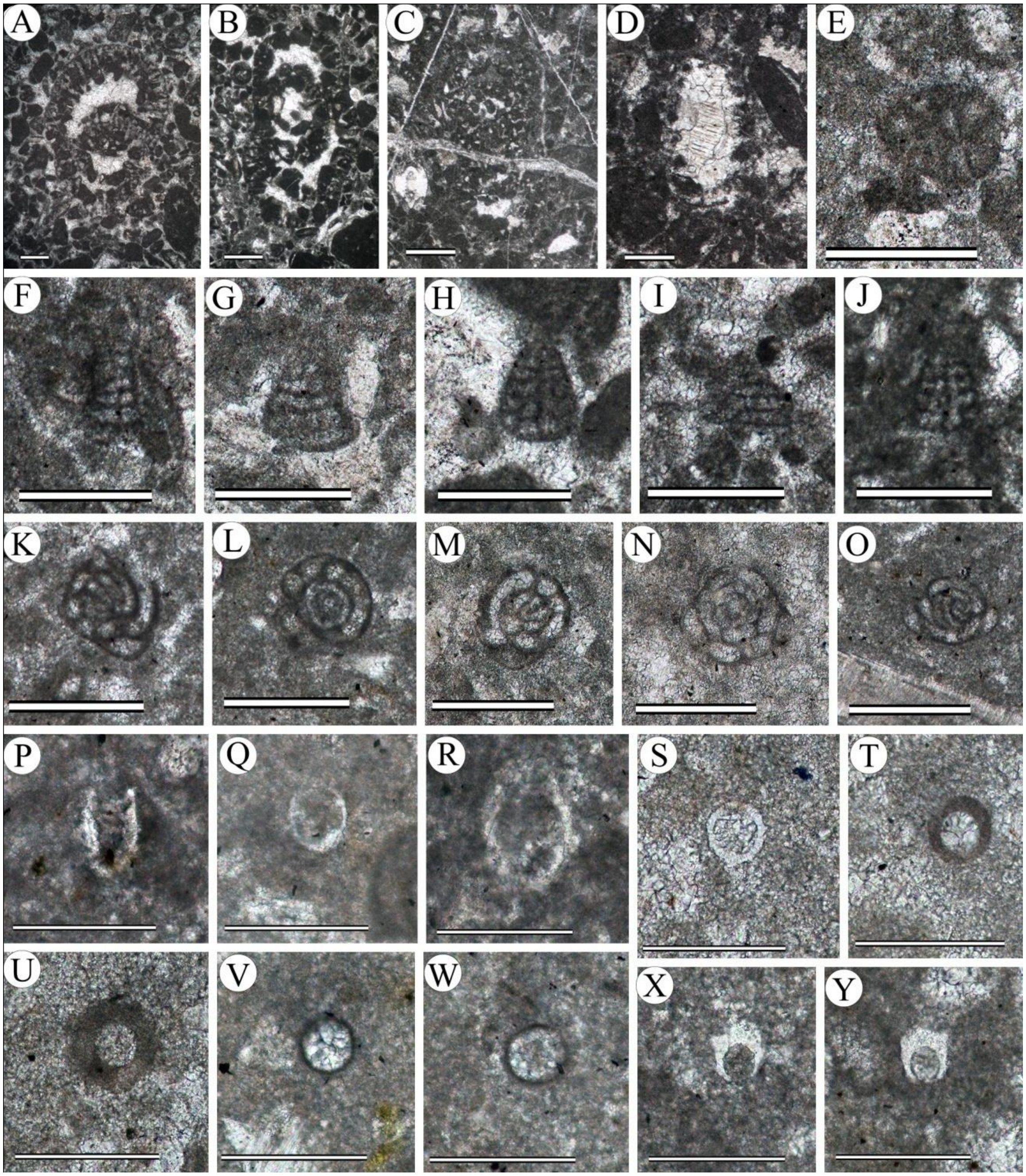

Figure 1.16: Microfossils from the lower Valanginian limestones and the upper Valanginian limestones/marly-limestones: **A**-**C** *Pseudocyclammina* lituus; **D** *Coscinoconus* cf. *cherchiae*; **E**-**J** *Montsalevia salevensis*; **K**-**O** *Meandrospira favrei*; **P**-**S** Unidentified calpionellids; **T**, **U** *Cadosina fusca*; **V**, **W** *Crustocadosina semiradiata*; **X**, **Y** *Stomiosphaera echinata* (Scale bar: A, B = 0.5 mm; C-O = 0.25 mm; P-Z = 0.125 mm).

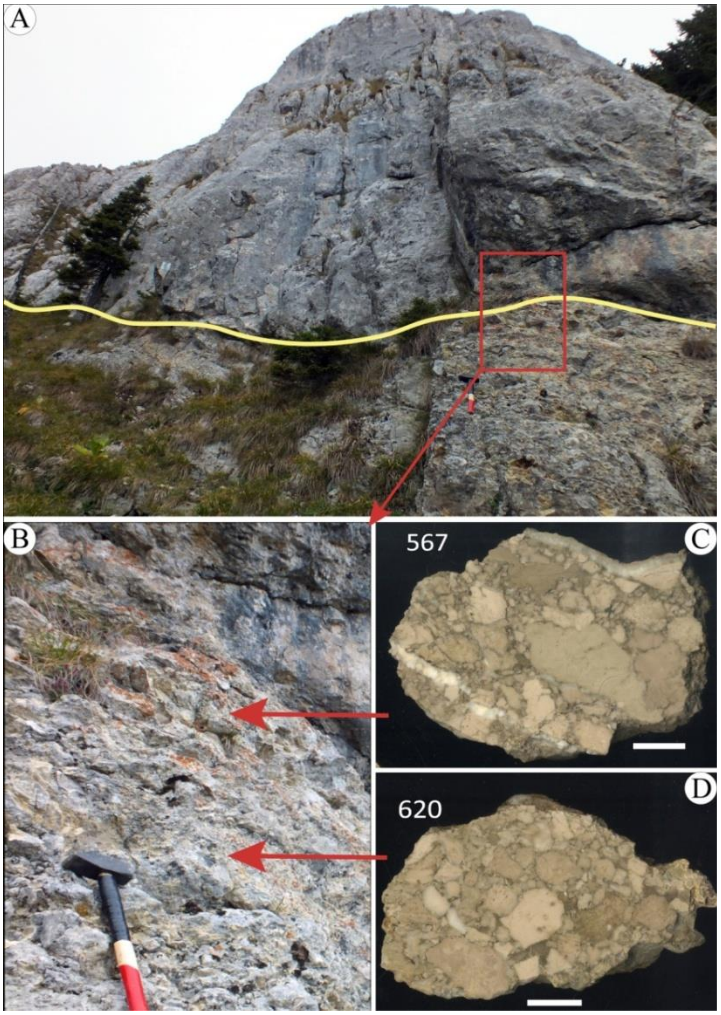

Figure 1.17: Drumul lui Lehman: **A** The stratigraphic contact between the Valanginian limestones and the monomictic Aptianbreccia (marked by white line);**B** Detail from the contact area;**C, D** Monomictic breccia (Scale bar: C, D = 2 cm).

In this area, the contact between the upperValanginian deposit and the Aptian breccias is covered by screes, but there could be seen a series of carbonate breccia just above the border with Valanginian limestones (Fig. 1.15). The Aptian breccia sequence is very short (2-3m), after which can be observed monomictic orto and paraconglomerates with limestone pebbles. The breccias/micro-breccias that appear above the contact zone contain clasts of various sizes and with different morphologies, entrapped in a micritic/clay-rich matrix. The breccias and monomictic conglomerates contain pebbles with microfacies similar to the Berriasian-Valangian and Barremian-Aptian limestones. Both the breccias and conglomerates matrix contains orbitollinids. In the monomictic conglomerates matrix overlaying the breccias we identified *Rectodyctioconus giganteus* and

Palorbitolina lenticularis orbitollinids which indicate the Aptian age.

Drumul lui Lehman. This section is very important because it can be observed the direct contact between Berriasian-Valanginian limestones and monomictic limestone breccias (Fig. 1.17). The Berriasian-Valanginian limestones found here are similar to those found in the upper Valanginina sequence from Padinile Frumoase, fact confirmed also by the identified microfosils (*Protopeneroplis ultragranulata*, *Montsalevia salevensis*, *Haplophragmoides* sp. and *Meandropsira* cf. *favrei*). Above these limestones there are monomictic limestone breccias with a massive structure that outcrops over a thickness ranging between 1-2.5 meters. The matrix contains orbitolinids, echinoderm plates, rudist and coral fragments and silty quartz grains. Both the breccias and conglomerates clasts show dissolution structures which indicates the subaerian exposure. Over the monomictic limestone breccias is a monomictic limestone paraconglomerate, that contains pebbles with microfacies and microfossils indicating the Berriasian-Valanginian and Barremian-Aptian periods.

8.3 Discussions

Clast analisys of the Padinile Frumoase and Drumul lui Lehman breccias and conglomerates show that that the exhumation of the Barremian-lowermost Aptian shallow-water reefal limestones and Berriasian-Valanginian peritidalites occurred during the Aptian. Monomictic breccias from the base of the Aptian detritic sequence represent deposits of debritic flows accumulated on the slope/toe of slope. The angular and subrounded clasts indicate that the source of these deposits was proximal contained bioclasts (orbitolinids) indicate a shallow marine depositional environment. Nowdays, Barremian-Aptian carbonates and marly limestones are outcropping only in the Dâmbovicioara Couloir. The source area for the Berriasian-Valanginian clasts could be the Piatra Craiului Massif since the outcrops are located near the western flank. In the Piatra Craiului Mountain lower Barremian-Aptian reef limestones are not present. Perhaps in this period of time, the block which forms the northern part of the massif was uplifted during this interval of time. The study of the contact area between Valanginian limestone, breccias and Aptian conglomerates showed that carbonate sedimentation from the mountain Piatra Craiului ended in the late Valanginian. This break in sedimentation was probably followed by an uplift of the entire region as a consequence of the incipient tectonic activity. The intesified tectonic activity and uplifted adiacent areas led to an increase in material input and slope angle so that the first debritic and granular flows can be explained. It can be observed the monomictic character of the components, a clear indicator of the fact that during the Barremian-Aptian period the source areas were exclusively carbonatic.

9. MORPHOMETRIC STUDY

The morphometric study of pebbles was concentrated on the zonal prediction of the mean values of the following variables: size, flatness, sphericity, shape and roundness. The results obtained after the morphometric analysis of the pebbles from the two conglomeratic deposits, alongside with a detailed lithological study, can bring important additions to the sedimentological description and help to identify the source providing useful data on transport mechanisms.

Morphometric analysis of the breccias from the limestone-conglomerate contact zone

Breccias are characterized by high values of sphericity and relatively low degree of flatteness and isometric forms. All observed parameters can indicate an early stage of processing or the provenience from of massive deposits. The roundness has average values located at the boundary between subangular and subrounded, which confirms a low rolling degree. Therefore, the study reveals morphometric characteristics of detritic deposit with clast that indicate short distance transport in an environment with high hydrodynamic energy..

Morphometric analysis of the Gura Râului Aptian conglomerates

The calculation of average mofometric values brings to the fore the fact that most pebbles (carbonate, metamorphic, silicolitic) vary in dimension between 3.8 and 5.3 cm. Noting the values of sphericity and flatteness, it can be inferred that tabular and isometric forms dominate. In what concerns the carbonate clasts, it can be seen an abundance of isometric forms in the northern side the deposit while in the central and especially southern the tabular forms dominate. Metamorphic pebbles are dominated by tabular forms n all the studied areas. The average values of the rolling degree of the pebbles from the Aptian coglomerates are all within 5 and 5.5 (1-angular; 6-well rounded) which means a dominance of rounded and very well rounded clasts. In all the investigated areas the cumulative percentage of well and very well rolled pebbles exceeds 70% of the total collected so that we can talk about transport on a significant distance from the source area to the current place of outcrop. The silicolitic pebbles show a different behavior from the overall trend, these ones being characterized by significantly smaller sizes, predominantly isometric shapes and degrees of rolling ranging from subangular to very well rounded. Knowing that silicolits tend break during transport, being able to record the same values of roundness in all areas of flow (Sneed & Folk, 1958) and the reduced percentage of their participation can be excluded from the final interpretations.

Morphometric analysis of the late Albian-Cenomanian conglomerates

The morphometric study of the pebbles from these deposits aimed exclusively the ones that make the main conglomeratic unit, without including large blocks (olistolites) becauese three axes could not be measured. The average size ranges from 4.3 to 6.2 cm. The metamorphic pebbles are those that deviate from the average of the deposit, registering a smaller size and high degrees of rouding. Limestone pebbles show lower values of flatteness and respectively higher ones of the sphericity suggesting the dominance of isometric forms which emerges also from the study of the shapes indicators. Unlike the Gura Râului conglomerates, the limestone pebbles comprise all stages of rolling, the average value being placed in the subrounded-rounded range. The morphometric parameters pleads for a shorter distance of transport if compared to the Aptian pebbles. The exception in the current deposit is represented by metamorphic pebbles which show many similarities to those studied in the Aptian deposits.

10. THE PROVENANCE OF PEBBLES FROM THE PIATRA CRAIULUI CONGLOMERATES

10.1 The probable source-area for carbonate pebbles

Carbonate pebbles that make up the studied conglomerate deposits were assigned, based on the microfacies association and micropaleontological assemblages, to middle Jurassic (Bajocian-Bathonian)–lower Cretacic (Barremian-Aptian) period. The first step in identifying the source area is localizing the deposits in the neighboring regions that have similar microfaciesal and micropaleontological characters.

Rich deposits in terrigenous material belonging to the middle Jurassic were described from western and eastern flank of the Piatra Craiului Massif, from the western side of Bucegi Mountains (e.g. Strunga-Strunguliţa) or from the surroundings of Braşov.

Sequences belonging to Kimmeridgian-Tithonian age are known from the entire Dâmbovicioara Couloir. Similar deposits were described also from adjacent areas of Braşov (e.g. the Postăvaru Massif or Codlea).

Upper Tithonian-Berriasian deposits are found in the central part of the Dâmbovicioara Couloir (Cheile Dâmbovicioarei) and in its western extremity (The Piatra Craiului Massif) respectively in the region of Braşov-Codlea (e.g. Coloniei hill, Piatra Mare Quarry).

Upper Berriasian-lower Valanginian carbonates with microfacies associations similar to those found in the pebbles are known from the Piatra Craiului Massif, Codlea area (Piatra Mare Quarry) and Piatra Mare Massif.

Deposits containing facies with calpionellids were identified in the northwestern and western flank of the Bucegi Massif. From this area, two locations were studied in detail over the years: Gaura Valley and Lespezi Massif. The age of carbonate deposits with calpionellids from the Gaura Valley were attributed to the Berriasian- lower Valanginian [Calpionella Zone (Alpina and Elliptica subzones), Calpionellopsis zone and Calpionellites zone (Darderi subzone)] (Patrulius, 1976) or upper Berriasian [Calpionellopsis Zone (Oblonga subzone] (Barbu & Melinte, 2006). In the area of the Lespezi Massif the calpionellids assemblage is characteristic to the upper Tithonian.upper Berriasian (Crassicolaria zone, Calpionella zone and Callpionellopsis zone) (Barbu & Melinte, 2008).

Calpionellid deposits have also been identified in Brasov surroundings: Codlea (Piatra Mare Qarry) (Bucur et al., 2014) and the Bunloc-Piatra Mare Massif. The calpionellid and calcisphere assemblages from the Piatra Mare Quarry suggest the upper Berriasian-Valanginian-?Hauterivian age and the one from the Bunloc-Piatra Mare Massif indicates an upper Berriasian-lower Tithonian age (Crassicolaria and Calpionella zones). It should be noted that in all the areas shown, the microfacies are dominated by micritic and allodapic calpionelid bearing limestones, many similar to those identified in the pebbles. Exception are the microfacies rich in terrigenous material allocated to the lower Valanginian and which have no counterpart in the deposits that,at present, outcrop the adjacent areas of Piatra Craiului Syncline.

The Barremian-Aptian carbonatic succesions were identified in the south and southeast of the Dâmbovicioara Couloir (e.g. Sasului Hill, Muierii Valley). In the Brasov surroundings (Piatra Mare-Bunloc Massif, Postăvaru Massif, Codlea) the Barremian-Aptian period is represented mainly by a marls/marly limestones with cephalopods.

10.2 The probable source-area for the metamorphic pebbles

The study of the two conglomeratic deposits from Piatra Craiului syncline confirms that the gneisses are the most abundant metamorphic pebbles. Thus, it can be said that the source-area of metamorfic clast is the Cumpăna metamorphic group (Voineşti-Păpusa Zone) which outcrop in the north and northwestern part of the Piatra Craiului Massif. In what concerns the late Albian-Cenomanian conglomerates, there were seen amoung the pebbles few chlorite-sericite schists and chlorite schists, so that it can be mentioned the Leaota Group as a secondary source. The outcrop near the Curmătura chalet, which consists mostly of schist, has as its primary source the Leaota Group and secondary the Cumpăna Group.

10.3 The probable source area of the siliceous pebbles.

Knowing the micropaleontological assemblages present in carbonate host rocks of siliceous nodules, it can said that most of them come from deposits belonging to the Kimmeridgian-Tithonian. The carbonate deposits with siliceous nodules are known from the Piatra Craiului Massif, Dâmbovicioara Couloir (e.g. Fundatica Valley, Cheia), the western flank of the Bucegi Massif (e.g. Strunga-Strunguliţa) respectively the southern Bucegi Massif (e.g. Colţul Tătarului, Cheile Răteiului). The assemblages in these regions are mainly of middle-upper Jurassic age.

The pebbles with radiolarite and spongolitie facies are most likely from the Callovian-Oxfordian period, such deposits being known from the Bucegi Massif, the surroundings of Braşov (e.g. Codlea) and the whole Dâmbovicioara Couloir (including the Piatra Craiului Massif).

10.4 Discussions

The carbonate pebbles belonging to the conglomeratic succesion from the Piatra Craiului syncline come from deposits belonging to the middle Jurassic-lower Cretaceous. Analyzing the probable source-areas through the lithological study, it can be said that the areas which probably provided material to these conglomerates are located in the following regions: Dâmbovicioara Couloir (including the Piatra Craiului Massif), the west and the south of the Bucegi Massif (" Pre-Leaota Series " cf. Patrulius, 1969) and the surroundings of Braşov (Codlea-Holbav sector, Piatra Mare-Bunloc Massif, Postăvaru Massif).

The source-area of the Aptian conglomerates

Linking the information about the facies, lithology of pebbles, morphometry and paleocurents manages to restrict the likely source -area of the Aptian conglomerates, establishing that it is in north respectively northeast of the Piatra Craiului Massif. The arguments that support this assertion are: the general directions of the paleocurents (from north to south and from northwest to southeast), the presence of the Calpionellites zone (Darderi-subzone, lower

Valanginian) in a microfacies rich in terrigenous material (which does not appear under this form in any area), the dominance of microfacies with calpionellid assemblages and alodapic microfacies, microfacies characterizing currently inexisting rocks in adjacent areas (e.g. facies with filaments, facies large bivalves, microfacies with abundant terrigenous material), breccias from the base of the conglomerates, containing angular, subangular and subrounded limestone pebbles of Barremian-Aptian age which, given the degree of roudness, were in the proximity of the depositional basin. The assembly of sedimentological and micropaleontological data argues the existence of an area in the northwest of the Piatra Craiului Massif, completely eroded during the first getic phase which, with the Codlea areas and the Piatra Craiului Massif supplied material to the Gura Râului Aptian conglomerates (Fig. 1.18).

The source-area of the late Albian-Cenomanian conglomerates

The lithological analysis of the carbonate pebbles indicates a percentual dominance of the peritidal limestones and to a lesser extent of the reef-edge platform. Most of the pebbles noticed come from the Berriasian-lower Valanginian and in a lesser extent to the Kimmeridgian-Tithonian deposits.The assembly of microfacies and microfossils is similar to the sequence described at the top of the Piatra Craiului Massif (Bucur, 1978; Patrulius et al., 1980; Bucur et al., 2009; Pleş et al., 2013; Mircescu et al., 2014) . Similar facies were identified in Poiana Zănoaga and Silha lui Caiţă olistoliths (Bucur et al., 2013). Both lithological and morphometric data indicate that the main source area of these deposits is the carbonate sequence from the Piatra Craiului Massif (Fig. 1.18) while the alignment of the olistolits indicates a flow from west to the east or from northwest to southeast.

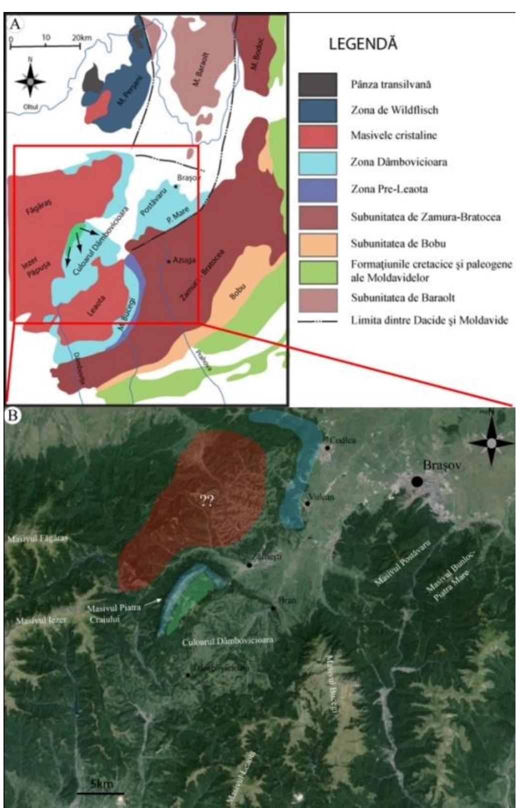

Figure 1.18: **A** The map with the internal units of the Carpathian Bend Zone (redrawn after Patrulius, 1969) (the green contour marks the Aptian

conglomerate deposits and the arrows mark the general directions of the paleocurents);**B** Location of the probable source areas (blue and red outline) of the Aptian conglomerates (green outline) (earth.google.com).

11. THE DEPOSITIONAL ENVIRONMENTS AND UPDATED SEDIMENTARY SUCCESSION FROM THE PIATRA CRAIULUI MASSIF

11.1 Interpreting the conglomeratic sequence of the Piatra Craiului sycline

In the Piatra Craiului syncline there were studied two distinct conglomerate deposits: the Gura Râului Aptian conglomerates and the late Albian–Cenomanian conglomerates. Both deposits were analyzed in terms of sedimentology, lithology and morphometry.

Gura Râului Aptian conglomerates. There have been described three conglomeratic facies: massive conglomerates (ungraded); graded conglomerates and conglomerates alternating with sanstones. The three facies were deposited mainly from hyperconcentrated and concentrated flows (Mulder & Alexander, 2001). The described facies idicate especialy channel infills and lobe structures. The sequence is represented by an alternation of channels and lobes specific to the submarine segment of a fan-delta depositional environment. Considering the shown sedimentological characteristics and the proximity to an active tectonic zone, it can said that the sequence studied represents an area of the shelf edges where the delta-fans prograde (Nemec & Steel, 1988) (Fig. 1.19).

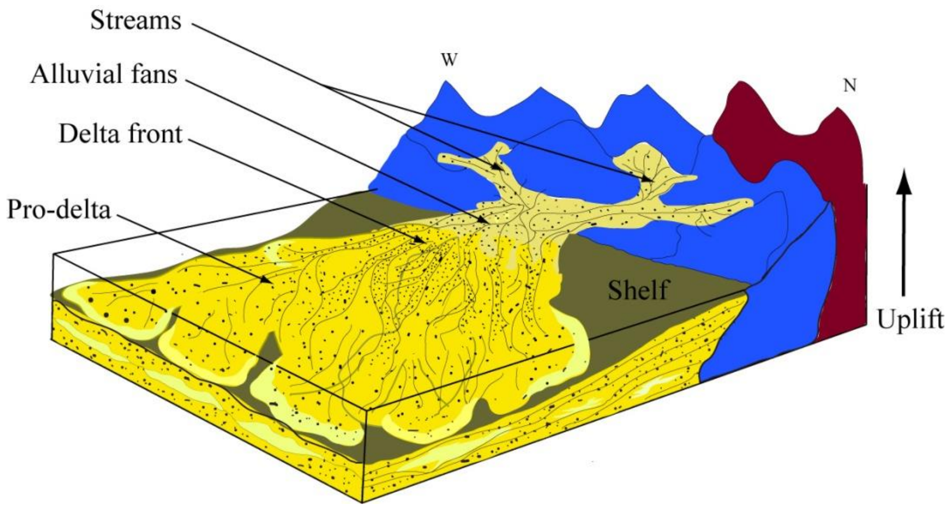

Figure 1.19: Reconstruction of the depositional environment for the of Gura Râului Aptian conglomerates based on sedimentological information. It can be seen a series of fan-deltas dominated by channel infills and lobes. There are also shown the deposits that have provided material (blue-sedimentary rocks, red-metamorphic rocks) (drawing is not to scale).

The upper Albian-Cenomanian conglomerates. Within these deposits dominates only one facies: massive conglomerates (disorganized) with carbonate olistolits, subordinatly being mentioned the graded ortoconglomeratic oligomictic sequence from the Curmătura area. The morphometric study indicates a low degree of rounding of the components and most likely a short distance of the transport. The disorganized facies, the ortoconglomeratic character, the low degree of rounding of the components, the extremely poorly sorting and the presence of olistolits suggest that the deposition was made of a combination of debritic and granular high speed flows that were generated due to the instability of the edge of the shelf. The generating mechanism is related to regional tectonic events from the last stage of the Austric tectogenesis (the uplifting of the subasment). The raise of this region has enabled the creation of a significant slope angle causing the break of the shelf margin. Loose fragments were moved by sliding and slumping simultaneously with debritic and granular flows.

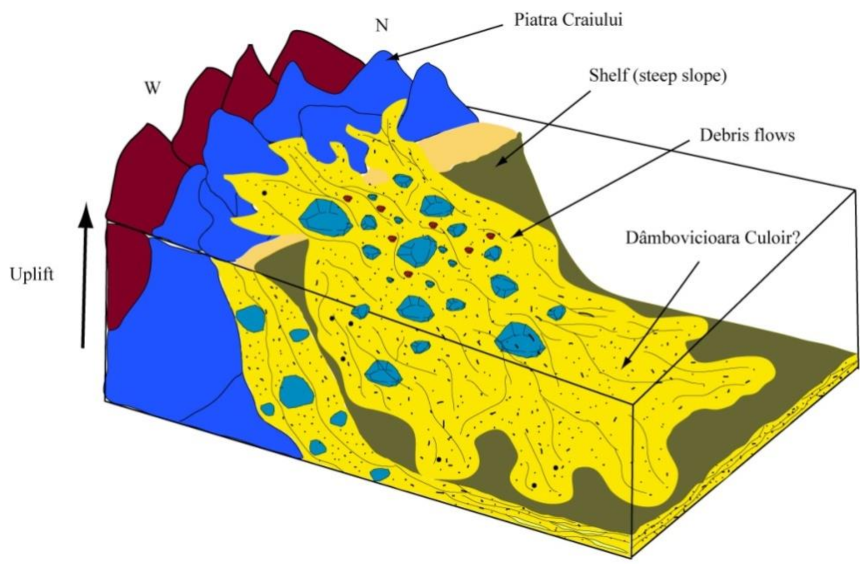

Figure 1.20: The reconstruction of the mass flow that produced the late Albian-Cenomanian conglomerates based on sedimentological information. It can be seen the coarse nature of the flow and the steep slope (drawing is not to scale).

The late Albian-Cenomanian conglomeratic deposits can be interpreted as being sintectonic because: they contain meters sized carbonate olistoliths, there were observed multiple fractures with conglomerate fillings and they are interbedded with carbonate breccias and intensely brecciated carbonate deposits. These present some similar characters with the conglomerates with olistoliths from Bucegi Massif, whose sintectonic deposition has already been proved (see Olariu et al., 2014).

11.2 The depositional events in the Piatra Craiului Massif

The Depositional activity in the Piatra Craiului Massif has its debut in the Middle Jurassic, the Bajocian-Oxfordian period being the result of a transgression.

Between the upper Kimmeridgian-Valanginian the sedimentation is exclusively carbonate. The lower Kimmeridgian-Valanginian sequence was interpreted as being a regressive megasequence (changing from the reef and slope environment to the restrictive one). At the end of the lower Valanginian, the top part of the sequence is subaerially exposed (Ungureanu et al., 2015). This shows a regional discontinuity (Grădinaru et al., 2016).

The carbonate sedimentation continued in the upper Valangian through hemipelagic deposits typical of an open marine environment (distal shelf) and carbonate debritice flows which mark a new transgressional episode.

After the upper Vallangian there is a switch to a detrital sedimentation. The first detrital deposits are represented by monomictic breccias with carbonate pebbles belonging to the Barremian-Aptian. The first debris flows on the shelf slope have a low intensity and have mobilized only proximal carbonate deposits. The intense tectonic activity and the uplifted adjacent areas are responsable for the accumulation of the first grain flow deposits, namely the carbonate monomictic conglomerates and the Gura Râului polimict conglomerates. The latter contain pebbles of various petrologic types prooving the exhumation of Middle Jurassic-lower Createaceous calcareous deposits and even of the crystalline basement.

A new regressional episode occurs in the early Albian, the Aptian deposits being subaerially exposed and heavily eroded. The main argument is represented by the fragments from the conglomerates from Gura Raului, which were identified as blocks in the middle and upper Bucegi conglomerates (Popescu, 1966 Patrulius, 1969).

In middle-late Albian the tectonic activity in the region is shown through the uplift of the Piatra Craiului Massif along with a new transgresional episode. This is due, perhaps, to the movements in the neighboring areas (Fagaras Leaota). The events take place on a compressional regime combined with a series of rupturral events and a high erosional activity. Several debritic and granular flows were generated and fragmentation / breaking of the shelf margin occured. The large metric fragmentes moved downslope bz sliding and slumping being embedded in the debritic flows.

The exposed carbonate sequence was completely eroded, the upper part of the conglomeratic sequence being composed of conglomerates exclusively made of metamorphic pebbles deposited from the hyperconcentrated flows. These were put in place, most likely during Cenomanian.

12. CONCLUSIONS

The aim of the present paper was the study the Piatra Craiului syncline, conglomerates in an attempt to identify the source area and the depositional environments characteristic of the two deposits: the Aptian conglomerates and the late Albian-Cenomanian conglomerates.

The current paper is the first multidisciplinary approach of the conglomerate deposits from the Piatra Craiului syncline. In order to fulfill these objectives, there were collected over 1600 samples out of which there were conducted ~ 1700 thin sections, 250 polished slabs, 1000 measurements on pebbles, about 300 measurements on imbricated gravel and 50 stratification measurements of nine main areas (Gura Râului, Prăpăstiile Zărneşti Padinile Frumoase, Drumul lui Lehman, Curmătura, Şaua Crăpăturii, Refugiul Grind, Brusturet and Pietricica).

For the first time, there have been described and illustrated conglomeratic facies that characterize these deposits. Out of the Aptian conglomerates there were described three facies (massive conglomerates - facies 1; granoclassed conglomerates - facies 2 and conglomerates interbedded with sandstones and microconglomerates - facies 3) and from the late Albian - Cenomanian conglomerates there were described two facies (massive conglomerates with olistolits - facies 4 and metamorphic oligomicti cconglomerates - facies 5). The facies assembly and the depositional particuliarities revealed two distinct depositional environments: a system of submarine fan-deltas for the Aptian deposits and an assembly made of slides and slumps on a tectonicaly fragmented shelf margin associated with debritic and granular flows for the late Albian-Cenomanian deposits.

The detailed lithological description of the conglomerate pebbles brings a significant amount of information about the eroded sequences that provided material to these detrital deposits. After the microfaciesal and micropaleontological analysis of the carbonate pebbles from the two deposits, there were identified associations of microfacies and microfossils from the middle Jurassic (Bajocian-Bathonian)–lower Cretaceous (Baremian-? Aptian).

The morphometric study of the pebbles brings additions and confirms the information extracted from sedimentological research of the deposits, it also helps to distinguish between the two deposits and also to estimate the distance of transport.

There were established the source areas of both conglomeratic deposits. The source area of the Aptian pebbles was located in the areas of sedimentation that were in the north and north-west (in the present geographic coordinates) of the Piatra Craiului Massif where, currently, there are carbonate deposits from the Codlea Area and the ones from the Piatra Craiului Massif, the rest of the area being composed of crystalline rocks.

The assembly of sedimentological information, flow directions and lithological studies of pebbles that were correlated to identify the source area points that during the Aptian in the north and northwest part of Piatra Craiului Massif there was ane xtended area with carbonate sediment that has been completely eroded at the end of the getic tectogenetic phase. This area exists todaz only through the conglomerate clasts. At the same time it is identified also the source area of the pebbles belonging to the late Albian-Cenomanian conglomerates as being the succession from the Piatra Craiului Massif (including the Aptian conglomerates).

There were studied in detail the deposits from the basis of the Aptian conglomerates, being offered this way the first image on the beginning of the detrital sedimentation in this region. The identification in the matrix of breccias and of monomictic conglomerates from the top of the carbonite sequence of and *Mesorbitolina parva orbitolinids* place these deposits in the Aptian. They were also investigated carbonate deposits beneath the breccias, being identified the surface of regional discontinuity at the boundary of lower-upper Valanginian.

It is for the first time argumented the presence of upper Valanginianin on the top of succession from the Piatra Craiului Massif in hemipelagic facies followed by carbonate debris flows.

It was identified the Epiphyton sp. taxon for the first time in this region. This was described in Romania only from carboatic deposits belonging to Upper Jurassic, being documented in other three locations (see Săsăran et al, 2014).

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