

EARLY LATE CRETACEOUS (CENOMANIAN) FOSSILIFEROUS DEPOSITS FROM THE OHABA-PONOR AREA, SW ROMANIA - PRELIMINARY STUDY

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Abstract

Early Late Cretaceous (Cenomanian) fossiliferous deposits from the Ohaba – Ponor area, SW Romania – Preliminary study

The main outcrops that contain a rich fauna representing a marine environment, mainly shelf of low depth, are the ones at “Dealul cu melci” and “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”.

The palaeontological material is represented by macro and micro-fossils, both of which come to sustain the Cenomanian age of the outcrops.

The main lithostratigraphic unit found in the study area is represented by the Valea Dreptului Formation (Cenomanian – basal Coniacian), that comprises the sedimentary deposits which form the objective of this study.

The most abundant invertebrate fossils are represented by bivalves, gastropods, indeterminate fragments of ammonites and regarding the micro-fauna, ostracods and foraminifera are often found.

The literature concerning the evolution of the fauna in this area mentions the presence of corals, aberrant pachyodont bivalves (*Hippurites*) and diverse ammonites, which are still to be found.

Key words: Ohaba-Ponor, fossiliferous deposits, early Late Cretaceous, Cenomanian

Rezumat

Depozite fosilifere din Cretacicul târziu timpuriu (Cenomanian) de la Ohaba – Ponor, SW României – Studiu preliminar

Principalele aflorimente din arealul studiat care contin o faună bogată, reprezentând un mediu marin, în special de shelf de mică adâncime, sunt cele de la “Dealul cu melci” și “Rezervatia paleontologica de moluste de varsta Mezozoic și Terțiar - Ohaba-Ponor”.

Materialul paleontologic este reprezentat de macro- și micro-fosile, ambele tipuri de fosile venind să susțină varsta Cenomanian a aflorimentelor.

Unitatea litostratigrafică care se întâlnește aici este reprezentată de Formațiunea Valea Dreptului (Cenomanian bazal – Coniacian), care cuprinde depozitele sedimentare care sunt obiectivul acestui studiu.

Cel mai des întâlnite fosile de nevertebrate sunt reprezentate de bivalve, gastropode, fragmente nedeterminabile de ammoniți și în ceea ce privește micro-fauna, sunt foarte frecvente ostracodele și foraminiferele.

Literatura privind evoluția faunei din aceasta regiune specifică și un număr relativ mare de genuri de corali, bivalve aberante (*Hippurites*) și numeroși amoniți, acestea din urmă nefiind întâlnite în depozitele studiate.

Cuvinte cheie: depozite fosilifere, Ohaba-Ponor, Cretacic târziu timpuriu, Cenomanian

Introduction

Geographically, the Hațeg-Cioclovina-Pui-Bănița region that includes the Ohaba-Ponor area, is found at the southwestern extremity of the Sebeș Mountains and on the northwestern slope of the Retezat Mountains, being mostly developed in the hydrographic basin of the Strei river (Fig. 1).

The deposits that belong to the Upper Cretaceous sedimentary cycle from the region represent the last sedimentary accumulations from the Alpine evolution period of the Pui area and are mainly formed by fossiliferous sandstones, periodically intercalated by fine marls, rich in micropalaeontological material (STILLA 1985).

The two outcrops I have studied are represented by the “Dealul cu melci” and “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”.

The outcrop at “Dealul cu melci” is outstanding through the presence of a very prominent calcareous horizon and by the abundance of the exclusively gastropod fauna it contains.

The Reserve is extremely rich in fossil fauna, represented by gastropods of small dimensions, bivalves, corals and rare fragments of ammonites. The main sedimentary deposits in the Reserve are formed by sandstones, marls, silty clays and gravel.

The area of Ohaba-Ponor was not investigated in detail, concerning the invertebrate fossils, since the 1980's. The main lithostratigraphic unit found here is represented by the Valea Dreptului Formation (Cenomanian – basal Coniacian, STILLA 1985; POP 1990) that comprises the sedimentary deposits which are the objective of this study.

There is a need for a detailed study of the many specimens that are to be found in this region, in order to obtain a more complete image of the geological (sedimentary, stratigraphical, palaeoecological) processes that took place here.

The diverse marine palaeoenvironmental conditions characterizing the NW and SE regions of the Hațeg Basin during the Upper Cretaceous are well illustrated by previously published studies (POP et al. 1990; MELINTE-DOBRINESCU 2009).

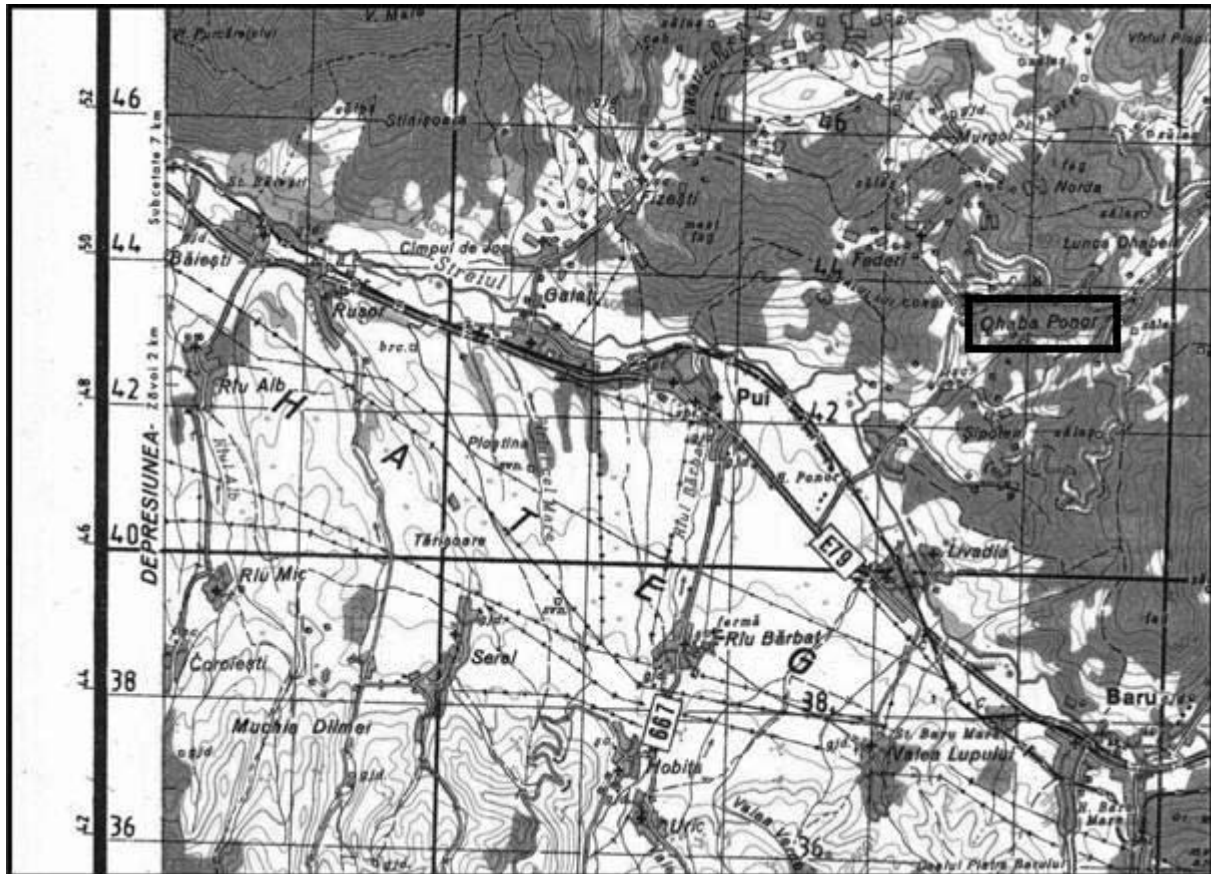


Fig. 1 – Topographic map for the Ohaba-Ponor-Pui region

At the beginning of the Late Cretaceous, mainly hemipelagic sediments accumulated in the Hațeg region, followed by deep-water deposits in the NW, and by shallow-water ones in the SE (LUPU 1966; POP et al. 1973; STILLA 1983; MELINTE-DOBRINESCU 2009). The marine sedimentation ended towards the top of the Cretaceous, being replaced by continental deposits (in both the NW and SE parts of the Hațeg region).

Geological setting

STILLA (1985) identifies the base of the Albian – Lower Cenomanian as being formed by conglomerates and quartzous, rarely argillaceous, sandstones. This succession is covered by micaceous sandstones and rare alternances of argillaceous sandstones. Stilla also observed the presence of lumachelle bancs with gastropods, containing in the lower horizon, almost exclusively nerineans (*Nerinea incavata* Bronn, *Nerinea (Plesiostygmatis) caucasica* Oppel), and in the upper horizon – an agglomeration of *Ytruvia coquina* (*Ytruvia abbreviata* (Phillipi)). He considers this to be the main reason why LUPU (1965) named this whole “layer” the ‘gastropod sandstones’. There are several rudist taxa that Lupu determined (*Praeradiolites*

fleurianus (d'Orb.), *Eoradiolites* aff. *rouseli* Toucas, *Sphaerulites astrei* Lupu, *Medeela* sp., *Durania conectus* Lupu) which are all found in association with the lumachelle bancs.

In the continuation of the sediments in the base of the Lower Cretaceous, there are sandstones and limestones, with a fauna represented by corals, exogyres, pectinids and orbitolines (STILLA 1985).

For the Middle Cenomanian, Stilla observed, in continuation of sedimentation, especially fine-grained formations, being proof for a deepening of the sedimentary domain. The main sedimentary deposits are represented by marlstones and micaceous-sandstone clays.

HALAVÁTS (1898, 1899) cites from the left side of the Ohaba Valley, at the entrance in the Ohaba-Ponor village, the following taxa: *Acanthoceras rhotomagense* Defr., *A. mantelli* (Sow.), *A. morpheus* Stol., *A. schluterianum* Laube, *Puzosia planulata* Sow., *Crioceras* sp., *Sonneratia* sp.

The palaeontological inventory of the limestones and marlstones of the Middle Cenomanian is completed by the research of Lupu (1965), who determined from the “layer with marly sandstones with ammonites”, the following taxa: *Calycoceras* sp., *Mantelliceras mantelli* (Sow.), *Anisocardia hermitei* Choffat, *Arca carinata* Sow., *Callista plana* (Sow.), *Pina cretacea* Schlot., *Nautilus munieri* Choffat, *Acanthoceras rhotomagense* Defr., and POP & SZÁSZ (1973) cited, from the “marls complex”: *Acanthoceras rhotomagense* Defr., *Calycoceras pancinodatum* Crick., *Puzosia* sp., *Pseudocalyoceras* aff. *judaicum* Taub.

There are certain specimens which stand as proof for the Middle Cenomanian age of these sedimentary deposits: *Acanthoceras rhotomagense* DEFR., *A. cenomanense* (PICTET), *A. cf. discoidalle* KOSSM., *Calycoceras spinosum* KOSSM., *C. pancinodatum* CRICK., *Puzosia subplanulata* (SCHLUT.), *P. planulata* SOW.

Stilla describes the Upper Cenomanian – Middle Turonian as being mainly formed by grey argillaceous sandstones, sometimes blackish, intercalated with limestones and marlstones, at the upper part of the deposits. These deposits contain diverse organic remains, in which POP & SZÁSZ (1973) have determined an ammonite association: *Eucalycoceras pentagonum* JUKES-BROWNE & HILL, *E. gothicum* (KOSSM.), *Acanthoceras withei* MATSUMOTO, *Calycoceras* cf. *newboldi* (Kossm.) and many more.

The lithostratigraphic unit that outcrops in the region where I have been in the field is the Valea Dreptului Formation, which is preceded by the Federi Formation (Late Albian - Cenomanian), formed by conglomerates in the base, sandstones and subordinated grey and blackish silts.

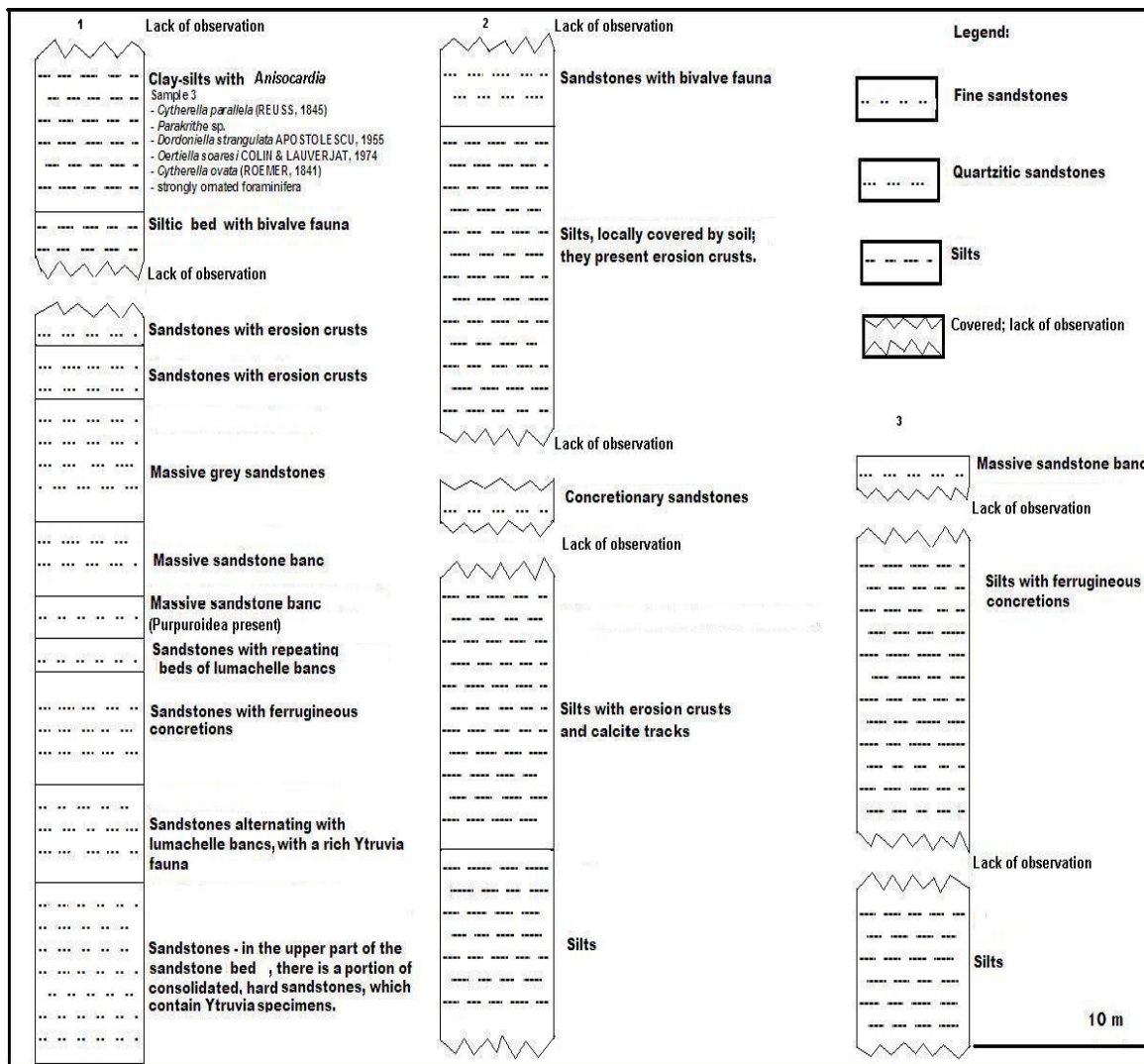


Fig. 2. Litostratigraphic section for the site at "Dealul cu melci"

The Valea Dreptului Formation (Cenomanian – basal Coniacian), which has a marine origin and reaches a thickness of 200-250 m in some sections, contains three members and overlies unconformably on older sedimentary deposits and sometimes, over the crystalline basement.

The Slatina Member is the lowest member and it often presents lateral variations of the facies, containing sandstones and microconglomerates with rare brachiopods (NW of Fizești), or slightly argillaceous sandstones, with *Actaeonella* and *Ytruvia* (LUPU 1966; STILLA 1985), between Costeni and Ponor. The facies of these deposits suggests a littoral-sublittoral environment (POP, 1990).

This member has been recently defined for the Early Cenomanian (the upper part) – (Melinte-Dobrinescu, in press), especially based on the occurrence of the ammonite species

Mantelliceras mantelli (STILLA, 1985), characteristic for the upper part of the Lower Cenomanian.

The Ohaba-Ponor Member (Middle Cenomanian) is the middle member of this unit and is mainly represented by marlstones which present bivalve and ammonite moulds (the marly complex; POP & SZÁSZ 1973; MELINTE-DOBRINESCU & BOJAR 2008).

These deposits are locally widespread, this being the reason why laterally, they turn into silty and sandy marls, which sometimes, together with the overlying deposits, make a different lithostratigraphic unit.

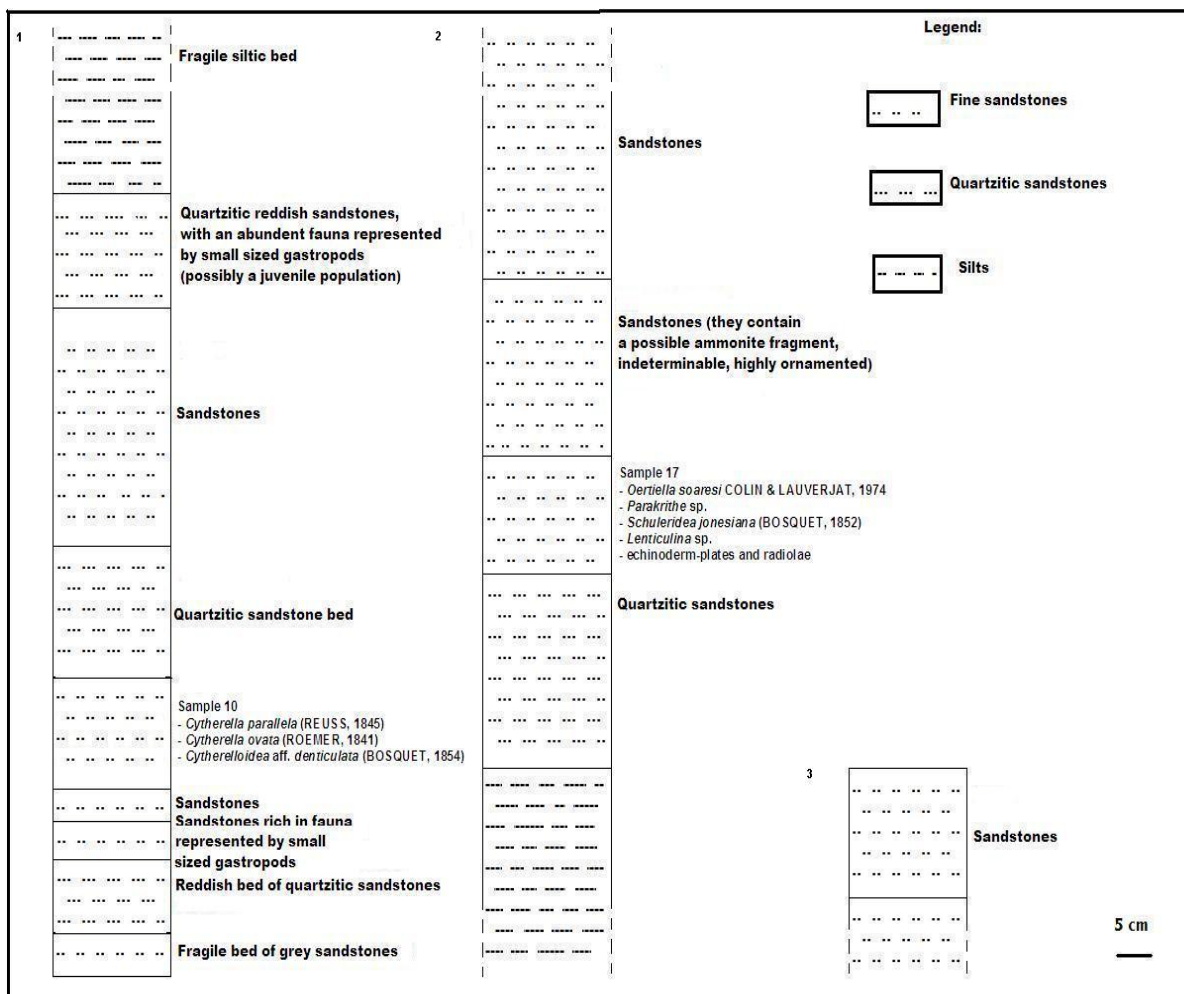


Fig. 3. Lithostratigraphic section for the site at the Palaeontological Reserve Ohaba-Ponor

The deposits belonging to this member of the Valea Dreptului Formation indicate an outer shelf environment, and this transition, from a littoral-infralittoral facies (in the previous member) to an outer shelf environment stands as proof for a rising of the sea level.

SZÁSZ in Pop et al. (1990) observed that the ammonite species found here indicate the presence of the *Acanthoceras jukesbrowni* zone, of the Middle Cenomanian, for the upper part of these deposits, and the *Acanthoceras rhotomagense* zone, for the lower part of the deposits.

These first two members of the Valea Dreptului Formation are the ones I have studied in the field (Fig. 2 and Fig. 3).

The Coroi Member (Late Cenomanian – Basal Coniacian) was defined by POP & SZÁSZ (1973) as an argilleous-sandy complex. It represents the main part of this unit and is mainly formed by micaceous sandstones, argilleous silts and grey and blackish marls (which form decimetric and submetric layers, with more or less obvious limits).

There are lateral and vertical variations of facies, where one of the type of sediments listed above dominate. The facies of these deposits suggests an environment which marks the limit between the inner and the outer shelf.

In the inferior part of this member (Gruzoni, Costeni), there are ammonite species which suggest the presence of the *Acanthoceras jukesbrowni* zone from the upper part of the Middle Cenomanian, and in the basal levels, that cover the Ohaba-Ponor Member (W of Ohaba-Ponor), ammonites that indicate the lower part of the *Eucalycoceras pentagonum* zone, from the Late Cenomanian.

POP (1990) mentions a particular fourth member of the Valea Dreptului Formation: the Valea Părului Member, NW of Livadia, composed of a deltaic complex, which unconformably overlies the Urganian limestones. This member was previously attributed to the Basal Cenomanian, but the discovery of an association of continental microflora known in the Late Turonian – Coniacian (*Atlantopollis choffati*, *Complexiopollis complicatus minor*, *C. cf. praeatumescens*, *Triangulipollis parvus*, *Palaeohystrichophora infusorioides*) (ANTONESCU in: POP et al., 1990) made the age of these deposits become more recent.

MELINTE-DOBRINESCU (2009) considers the lithology of this member (microconglomerates and sandstones with oblique internal bedding) to be similar to the lithology of the above mentioned Federi Formation and assumes this member to be a lateral variation of this unit.

A second reason for this opinion is that the Valea Părului Member also overlies the Urganian limestones, being in the same stratigraphical position as the Federi Formation (MELINTE-DOBRINESCU 2009). This member is obviously younger than the Federi Formation (which was placed in the Early Cenomanian by POP, 1990), but this is a consequence of the frequent lateral variations and the interfingering of the lithological units.

The general facies of the Valea Dreptului Formation presents a more subsident shelf environment during the Middle Cenomanian – Basal Coniacian. At the end of the Turonian, probably certain active faults have caused intense erosional processes and the formation, transport and accumulation of heavy sediments belonging to the Valea Părului Member, into a marginal marine environment (POP 1990).

Material and methods

In the summer and autumn of 2008, I have been in the field and studied the two outcrops, by making litostratigraphic sections and collecting fossil specimens, represented by macro- and micro-invertebrates, found in both of the outcrops.

The innovative part of my study is the first occurrence and mention of ostracod species, in the region. The previous published works only mentioned foraminifera and nannofossil specimens, in what regards the micro-invertebrates discovered in these Cenomanian deposits.

The macro-invertebrate fossils were processed using an air compression device (BAMAX 2005; tension: 230 V, power: 2.0 HP, frequency: 50 Hz, pump: D10, tank, 24 l, noise: 84 dBA) and then photographed with a Canon A 530 camera. The methods applied in

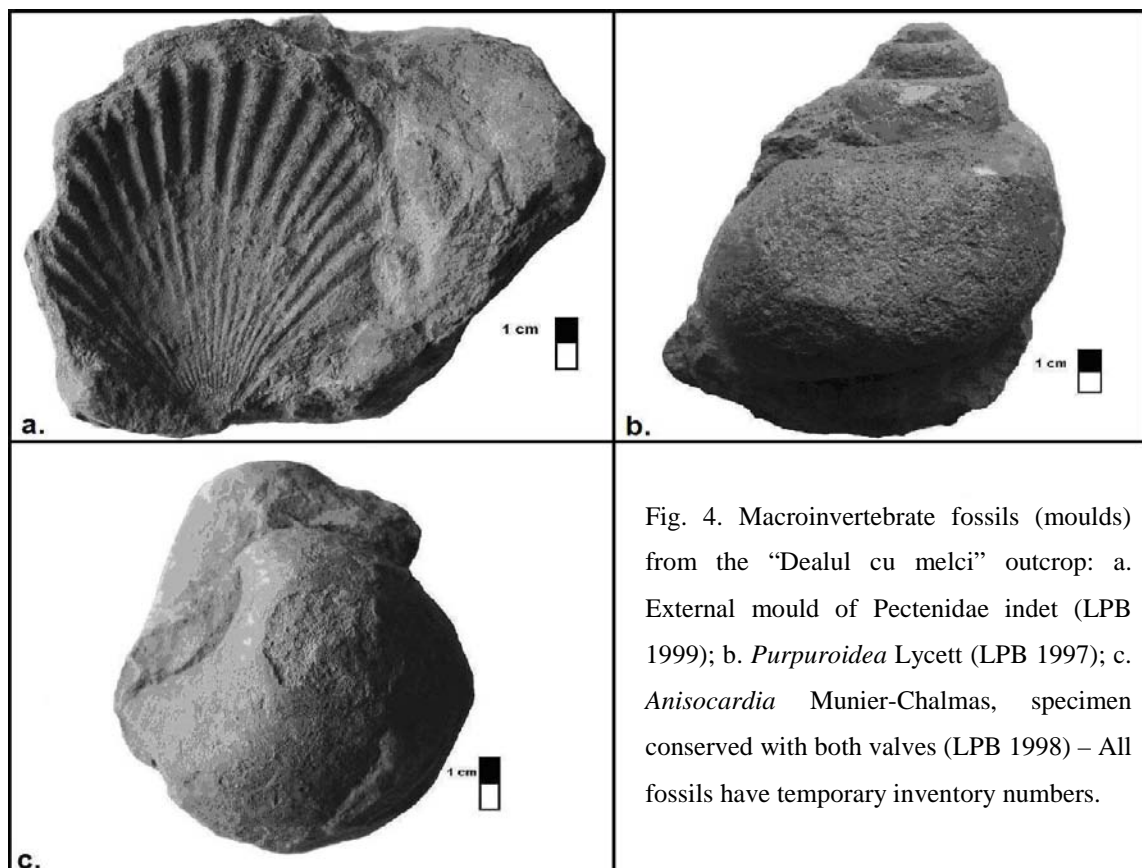


Fig. 4. Macroinvertebrate fossils (moulds) from the “Dealul cu melci” outcrop: a. External mould of Pectenidae indet (LPB 1999); b. *Purpuroidea* Lycett (LPB 1997); c. *Anisocardia* Munier-Chalmas, specimen conserved with both valves (LPB 1998) – All fossils have temporary inventory numbers.

the study of the micro-fossils are represented by screen-washing and then drying of the material, and the ulterior study at the optical microscope (Zeiss GSZ).

Palaeontological content

The macropalaeontological material is represented by numerous specimens of bivalves (*Anisocardia*, *Pecten*, *Ceratomya*), gastropods, remarkable by the abundance of *Ytruvia* in the lumachelle limestones, and the presence of a very well preserved specimen of *Purpuroidea*, with a shell of large dimensions.

The environment that the fossils indicate is a shallow shelf environment, according to the presence of:

- *Anisocardia* – infaunal bivalve, suspension feeder, facultatively mobile (Fig. 4-c);
- *Pecten* – epifaunal, free swimming bivalve (Fig. 4-a);
- *Ceratomya* – infaunal bivalve, suspension feeder, facultatively mobile;
- *Purpuroidea* – epifaunal, actively mobile, living in shallow-shelf marine environments (Fig. 4-b) (NEAGU et al. 2002).

The micropalaeontological material (NEAGU 1989; ARMSTRONG 2005) is represented by specimens of ostracods and foraminifera, some of which are characteristic for the Cenomanian.

For the “Dealul cu melci” outcrop, the microfossil assemblage contains:

- *Cytherella parallela* (REUSS, 1845) (Fig. 5-b)
- *Parakrithe* sp. (Fig 5-c)
- *Dordoniella strangulata* APOSTOLESCU, 1955 (Fig 5-g)
- *Oertiella soaresi* COLIN & LAUVERJAT, 1974 (Fig 5-d)
- *Cytherella ovata* (ROEMER, 1841) (Fig. 5-a), along with
- strongly ornamented foraminifera.

This assemblage of ostracods are suggestive of a Mid – Late Cenomanian age and indicate an epicontinental facies dominated by poorly preserved marine ostracods.

For the outcrop represented by “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”, the main ostracod taxa sometimes coincide with the ones from the previous outcrop and are represented by:

- *Cytherella parallela* (REUSS, 1845) (Fig. 5-b)
- *Cytherella ovata* (ROEMER, 1841) (Fig. 5-a)
- *Cytherelloidea* aff. *denticulata* (BOSQUET, 1854) (Fig. 5-e)
- *Oertiella soaresi* COLIN & LAUVERJAT, 1974 (Fig. 5-d)

- *Parakrithe* sp. (Fig. 5-c)
- *Schuleridea jonesiana* (BOSQUET, 1852) (Fig. 5-f), as well as
- echinoderm plates and radiolae.

A second sample from this outcrop is dominated by the ostracod species *Oertiella soaresi* Colin & LAUVERJAT, 1974, but it also contains the species *Cytherella parallela* (REUSS 1845), *Cytherella ovata* (ROEMER 1841) and the foraminifer genus *Lenticulina* sp., along with echinoderm plates and radiolae.

The ostracod genus *Cytherelloidea* (Fig. 3e) is better adapted to oxygen depletion than other genera and the ostracod species *Oertiella soaresi* is known only from Cenomanian deposits (described also in Spain-Aragon, Portugal-Mamarrosa, France-Charente Maritime, Aquitaine, Provence).

Discussions

The main sedimentary deposits here are represented by sandstones, marls and sometimes silts, which prove to be very rich not just in macroinvertebrates, but also in micropalaeontological material.

The deposits where these fossils are found indicate a shallow shelf environment and the two main outcrops are represented by “Dealul cu melci” and “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”.

The outcrop at “Dealul cu melci” stands out for the presence of a very important calcareous horizon and by the abundance of the gastropod exclusive population that it contains. Although this front may be reworked by the torrents, this is unlikely to have happened, because the two calcareous bodies that form this certain horizon present the same lithology and the same palaeontological content, exclusively indicated by the *Ytruvia* specimens. The entire outcrop has been uncovered and brought to light by the repeated action of rain that formed powerful torrents.

There are a series of calcareous blocks that are dislocated, and that can be characterized by organogenic limestones, interesting mostly from the point of view of the palaeontological content, exclusively represented by specimens of the gastropod *Ytruvia*.

The massive deposits of sandstone, repeated at certain intervals, become covered by soil, which disappears and reappears at intervals. In this kind of sandstones, there are often found bivalve fragments, of small dimensions, that still keep the elements of ornamentation, which are well visible.

But as we proceed along the outcrop, the fossils become rare, and the sandstones now present slight transportation tracks, as well as calcite-filled fissures. There are rare fossil plant remains and sideritic concretions.

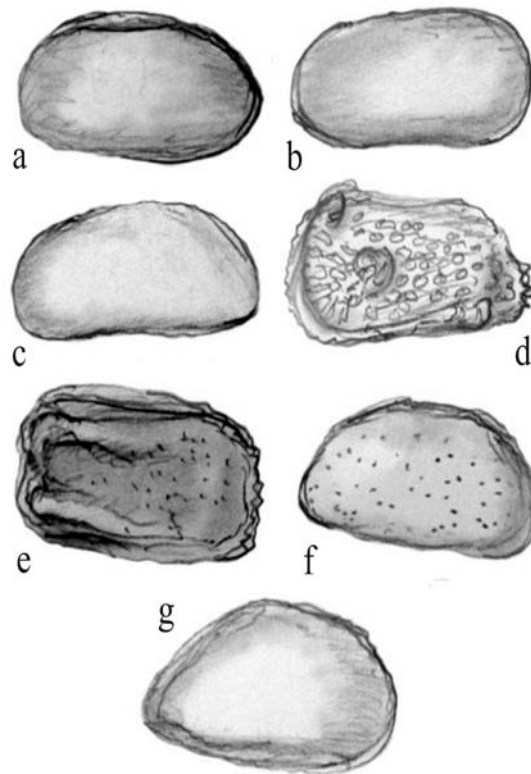


Fig. 5. Ostracods from the “Dealul cu melci” outcrop and “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”: a. *Cytherella ovata* (ROEMER, 1841); b. *Cytherella paralella* (REUSS, 1845); c. *Parakrithe* sp.; d. *Oertiella soaresi* COLIN & LAUVERJAT, 1974; e. *Cytherelloidea* aff. *denticulata* (BOSQUET, 1854); f. *Schuleridea jonesiana* (BOSQUET, 1852); g. *Dordoniella strangulata* APOSTOLESCU, 1955. The drawings are meant to give a general view of the morphology of the shell. They are not at scale (dimensions are usually under 1 millimeter).

The sandstone deposits that are abundant in the outcrop at “Dealul cu melci” are of Cenomanian age and represent a shallow shelf environment, in which was possible the later formation of the lumachelle limestones that are so often found at the base of the outcrop. The depth of the environment was, generally, a reduced one.

The fact that fossils become rarer proceeding along the outcrop, may indicate a deepening of the shelf environment, perhaps even the transition between the infra-littoral palaeoenvironment to the outer shelf palaeoenvironment, passing again to an inner shelf setting around the Cenomanian/Turonian boundary (Melinte-Dobrinescu, in press).

The second important outcrop is represented by “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”. The Reserve is extremely rich in fossil fauna, which is represented especially by gastropods of small dimensions, which are present

in many dislocated pieces of rock, possibly suggesting a premature death of some juvenile populations, from yet unknown causes.

The outcropping deposits are formed by fissured sandstones, but there is lots of gravel because of the high value of the strata dip, and also because of the repeated action of waters and rain (the reason why reworked fossils are so often found). The fossils from these sandstones are represented by bivalves, gastropods, corals and fragments of ammonites.

On the way back from the reserve outcrop, there is a horizon with a very dense population of gastropods (*Ytruvia*), similar to the one found in the outcrop at “Dealul cu melci”.

The resemblance between the two fossiliferous points (concerning the two areas that contain lumachelle limestones) and the resemblance of the petrographic constitution can lead to the idea that they belong to the same Cenomanian age and the same sedimentation environment, represented by a shallow shelf, with high-energy waters and an abundance of organisms.

The two outcrops represent the first two members of the Valea Dreptului Formation (the Slatina Member and the Ohaba-Ponor Member), with the difference that in the case of the “Dealul cu melci” outcrop, the two members are in place and in the case of the Palaeontological reserve, the sediments have been reworked and affected by the repeated action of rain, so that the lumachelle limestones (containing *Ytruvia* fossils) are found displaced here, while in the “Dealul cu melci”, this calcareous horizon is found in place.

Conclusions

- The deposits are remarkable because of the rich invertebrate fauna they contain, represented by both macropalaeontological and micropalaeontological material (bivalves, gastropods, corals, fragments of ammonites, as well as ostracods and foraminifera).

- The fossil specimens found are indicative of a shallow marine environment, of a shelf area where the organisms found the exact conditions they needed to thrive.

In general, continental shelves are places of great biodiversity and marine life due to the relative abundance of sunlight available in their shallow waters.

- The resemblance between the two fossiliferous sections (concerning the two areas that contain lumachelle limestones) and the resemblance of the petrographic constitution can lead to the idea that they belong to the same Cenomanian stage and the same sedimentary environment, represented by a small depth shelf, with agitated waters and an abundance of organisms.

- It is a fact that ostracods appear to be powerful environmental indicators for sea-level changes, oxygenation or food supply, so they maintain their role in our case too, hereby indicating a general shallow marine environment (nonetheless, showing through the genus *Cytherelloidea*, a better adaptation for oxygen depletion conditions, so being a proof of a total “zonation” of the organisms, according to the environmental conditions, but all living in a general shallow marine water environment).

- The abundance of the mollusks is remarkable, especially of shelf inhabiting forms of invertebrates, which were found in successive sandstone-levels on the field, as is the frequency and the repeating at certain intervals of the lumachelle limestones, rich in *Ytruvia* specimens (which also indicate a shallow-water environment).

- The first two members of the Valea Dreptului Formation are best seen on the field in the “Dealul cu melci” outcrop, being largely undisturbed by the erosive action of rains (the same deposits are heavily reworked in “The Palaeontological Reserve of Mesozoic and Tertiary Molluscs from Ohaba-Ponor”), the transition from the Slatina Member to the Ohaba-Ponor Member being clearly indicated by the lithology and palaeontological content (sandstones, microconglomerates, sandstones with *Ytruvia*, calcarenites; grey marlstones, with bivalve moulds; ostracod species present are: *Cytherella parallela*, *Parakrithe* sp., *Dordoniella soaresi*, *Cytherella ovata*, etc).

- The first ostracod specimens found in the studied deposits are represented by the Cenomanian species listed above; previous published works only mention foraminifera and nannofossils from the micro-invertebrate assemblage.

- The ostracod species *Oertiella soaresi* is known only from Cenomanian deposits (described also in Spain-Aragon, Portugal-Mamarrosa, France-Charente Maritime, Aquitaine, Provence); its presence supports the Cenomanian age of the deposits, previously based on macroinvertebrates.

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