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NEW SPECIES OF THE LOWER CRETACEOUS GENUS *MATHERONIA* MUNIER-CHALMAS (BIVALVE HIPPURITIDA) IN ROMANIA

Jean-Pierre Masse[1*], Mukerrem Fenerci-Masse[1] & Ioan I. Bucur[2]

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Abstract Barremian-lower Aptian requieniid rudists from the Southern Carpathians and the Apuseni Mountains, in Romania, are represented by four new species of the genus *Matheronia* Munier-Chalmas: *Matheronia dacica*, *Matheronia nerae*, *Matheronia carinata* and *Matheronia silvaeregis*. In the study stratigraphic interval these species possess a potential biostratigraphic value. Their evolution trough time is essentially characterized by shell size increase. *Matheronia* looks restricted to the North Mediterranean Tethyan margin and the new Romanian species are interpreted as markers of the Carpatho-Cimmerian rudist province.

Keywords: Rudist bivalves; Requieniidae; Matheronia; Barremian-Lower Aptian; Carpathians; Romania

INTRODUCTION

The genus *Matheronia* was proposed by Munier-Chalmas (1873) for *Caprotina virginiae* Gras (1852), but its description was due to Douvillé (1887, 1915), complemented by Paquier (1897, 1900, 1903). It is one of the oldest and the most primitive member of the family Requieniidae (Masse, 2002; Skelton, 2013). The oldest species of the genus is *Matheronia romani* Paquier (1897) of Tithonian age. *Matheronia rougonensis* Mongin & Trouvé (1953) was described from the Berriasian-Valanginian. Valanginian forms are represented by *Matheronia eurystoma* (Pictet and Campiche) and *M. jaccardi* (Pictet & Campiche) two species originally placed in *Requienia*, by the authors in 1869 and subsequently ascribed to *Matheronia*, but insufficiently documented (Paquier, 1897; Masse, 1976). The above four species were recorded from SE France and Switzerland. Two additional species were described from the Valanginian of Crimea and Caucasus: *Matheronia baksanensis* (Yanin,1983), originally described as a *Requienia*, and *Matheronia*? *taurica* Yanin (1985). In SE France and Portugal, the genus *Matheronia* is represented by poorly known Hauterivian species in need of description (Masse, 2002). Some of the Urgonian (Barremian-lower Aptian) *Matheronia* species from SE France, described by Matheron (1842, 1878) have been moved from *Requienia* to this genus or vice versa (see discussion in Douvillé, 1887, 1915; Paquier, 1903; Masse, 1976, 1994, 1996, 2002). According to the recent taxonomic revision of this group of Requieniidae only three Urgonian species were considered valid: *Matheronia virginiae* (Gras), *M. aptiensis* Matheron and *M. munieri* Paquier (Masse, 2002; Masse et al., 2020).

It is worth recording that the former *Matheronia salevensis* of Favre in Joukowsky & Favre (1913) from the Mont Salève, of Tithonian age (Charollais et al., 2023) has been transferred to *Hypelasma* (Masse, 2002; Gourrat et al., 2003). Moreover, the genus *Lovetchenia* was proposed by Masse (1993) to accommodate the former "*Matheronia*" Urgonian species described by Paquier (1903), Atanassova Deltcheva (1978) and Yanin and Tchernov (1979) from the sub-alpine region of SE France, Bulgaria, and the Ukrainian Carpathes, respectively.

The objectives of the present paper deal with the description of a set of new species of *Matheronia*, a genus poorly known hitherto in the Balkans, partly misinterpreted, or ignored by many palaeontologists, including a recent publication of Masse et al. (2023). This investigation aims at revising former publications (e.g. Mercus, 1959; Neagu et al., 1977) and a glimpse on Romanian rudist faunas performed earlier (Masse et al.,1999). Our study combines the taxonomic description, the geographical location of the new species, comments their biostratigraphic and biogeographic values, and includes a comparison with their West European counterparts. We also discuss their evolutionary and environmental significance.

GEOGRAPHICAL, GEOLOGICAL AND STRATIGRAPHICAL SETTINGS OF *MATHERONIA* BEARING BEDS IN ROMANIA

The *Matheronia* bearing samples were collected from two regions of the Romanian Carpathians (Fig. 1): Reşita-Moldova Nouă Zone in the Southern Carpathians (SW Romania), and Pădurea Craiului area in the Apuseni Mountains (NW Romania).

In the Reşiţa-Moldova Nouă area, the onset of the Lower Cretaceous (Bucur, 1997) starts with the Lower Berriasian, represented by the Marila Limestones, and the Upper Berriasian-Lower Valanginian by the Crivina Marls, both formations corresponding to basinal deposits

[1] Aix-Marseille University, Place Victor Hugo. 13331 Marseille Cedex 03, France, jean-pierre.masse@hotmail.com
[2] Babeş-Bolyai University, Department of Geology and Center for integrated geological studies, Str. M. Kogalniceanu 1, 400084 Cluj-Napoca, Romania.
* Corresponding author

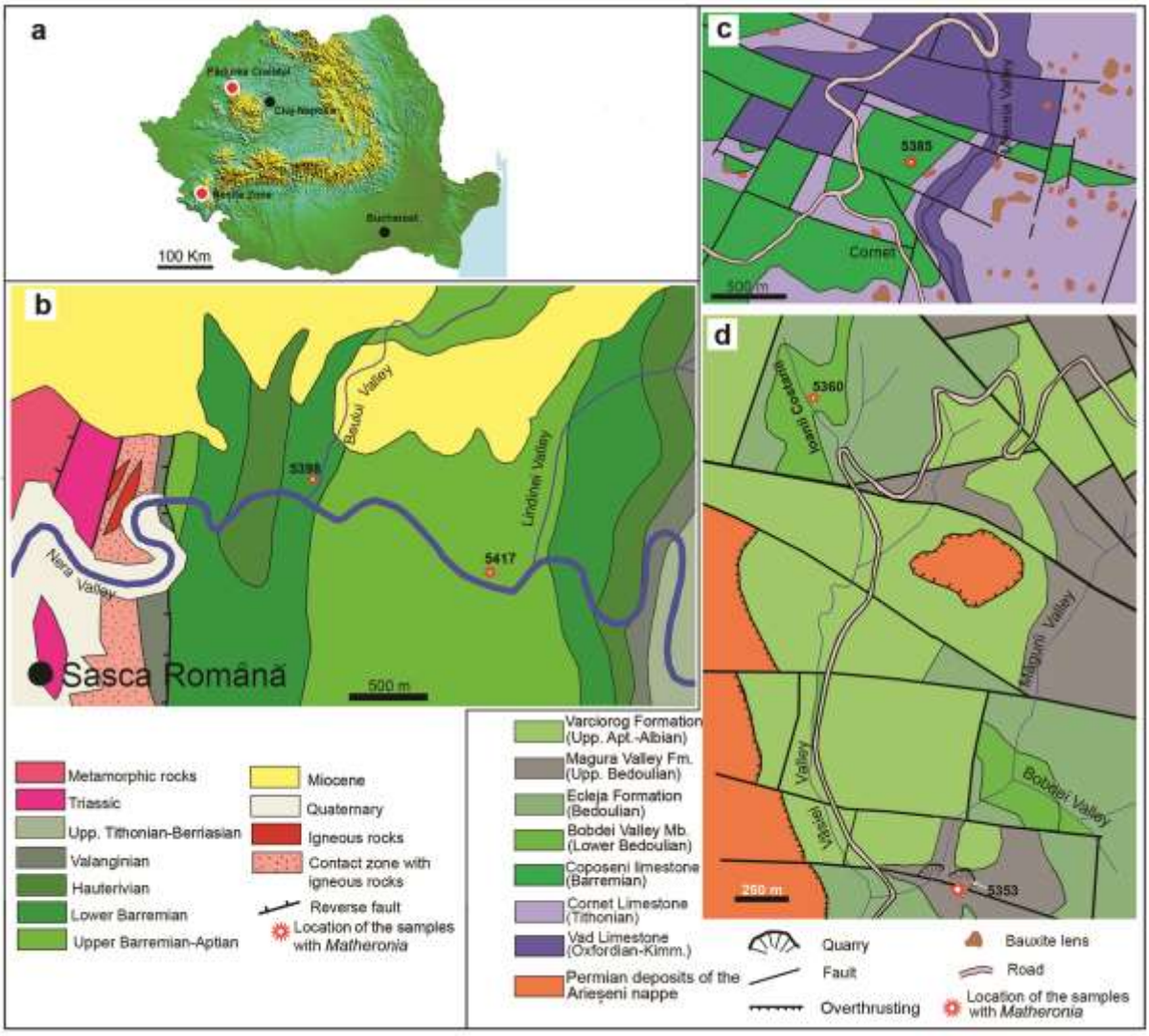

Fig. 1a. Geographic distribution of Lower Cretaceous rudist bearing localities in Romania, with location of *Matheronia* beds. **b**. Geological map of the Nera valley area (Reşiţa-Moldova Nouă zone). **c**. Geological map of the Cornet area (Pădurea Craiului). **d**. Geological map of the area north of Dobreşti (Pădurea Craiului).

with calpionellids and ammonites. The Valea Lindinei Limestones (upper Valanginian-Hauterivian), make the transition from the basinal to the overlying shallow carbonate platform deposits. The corresponding Urgonian beds (Fig. 2a) includes the Valea Nerei Limestone Member, which consists of bioclastic limestone, sometimes with corals, chaetetids and rudists, i.e. *Pachytraga carpathica* Masse et al. (Masse et al., 2023) and *Matheronia dacica* sp. nov. The micropaleontogical assemblage of orbitolinid foraminifera and dasycladale algae: *Moulladella jourdanensis*, *Cribellopsis thieuloyi* and *Salpingoporella muehlbergii*, documents the Lower Barremian (Bucur, 1997).

The overlying Valea Minişului Limestone Formation (Fig. 2a) consists of bioclastic limestones, with marly intercalations. The orbitolinid association is twofold: the lower assemblage consists of *Paracoskinolina maynci*, *Montseciella*? *arabica*, *Palorbitolina lenticularis* and *Praeorbitolina cormyi*, of late Barremian – early Aptian age, these beds yield *Matheronia nerae* sp. nov. and *Matheronia carinata* sp. nov. The content of the upper assemblage, *Mesorbitolina parva, Mesorbitolina texana* and radiolitids, indicates a late Aptian age; the overlying Golumbu sandstones may belong to the "Clansayesian" (Bucur, 1997).

In the Pădurea Craiului Mountains, the Lower Cretaceous deposits start with bauxitic rocks, followed by micritic lacustrine-paludary limestones, i.e. the Dobreşti Member of the Blid Formation, of Berriasian-Hauterivian pro parte age (Bucur, 2000; Cociuba, 2000) (Fig. 2b). The upper member of the Blid Formation, i.e. the Coposeni Member, consists of micritic-fenestral and bioclastic limestone, with rudists including *Matheronia dacica* sp. nov. Foraminifera and calcareous algae *Pfenderina globosa, Moulladella jourdanensis, Salpingoporella genevensis, S. melitae, S. muehlbergii*, document an early Barremian age. In its upper part, the Coposeni Member contains *Palorbitolina lenticularis*, so that the overall age of the Coposeni deposits is Hauterivian *pro parte* – Barremian.

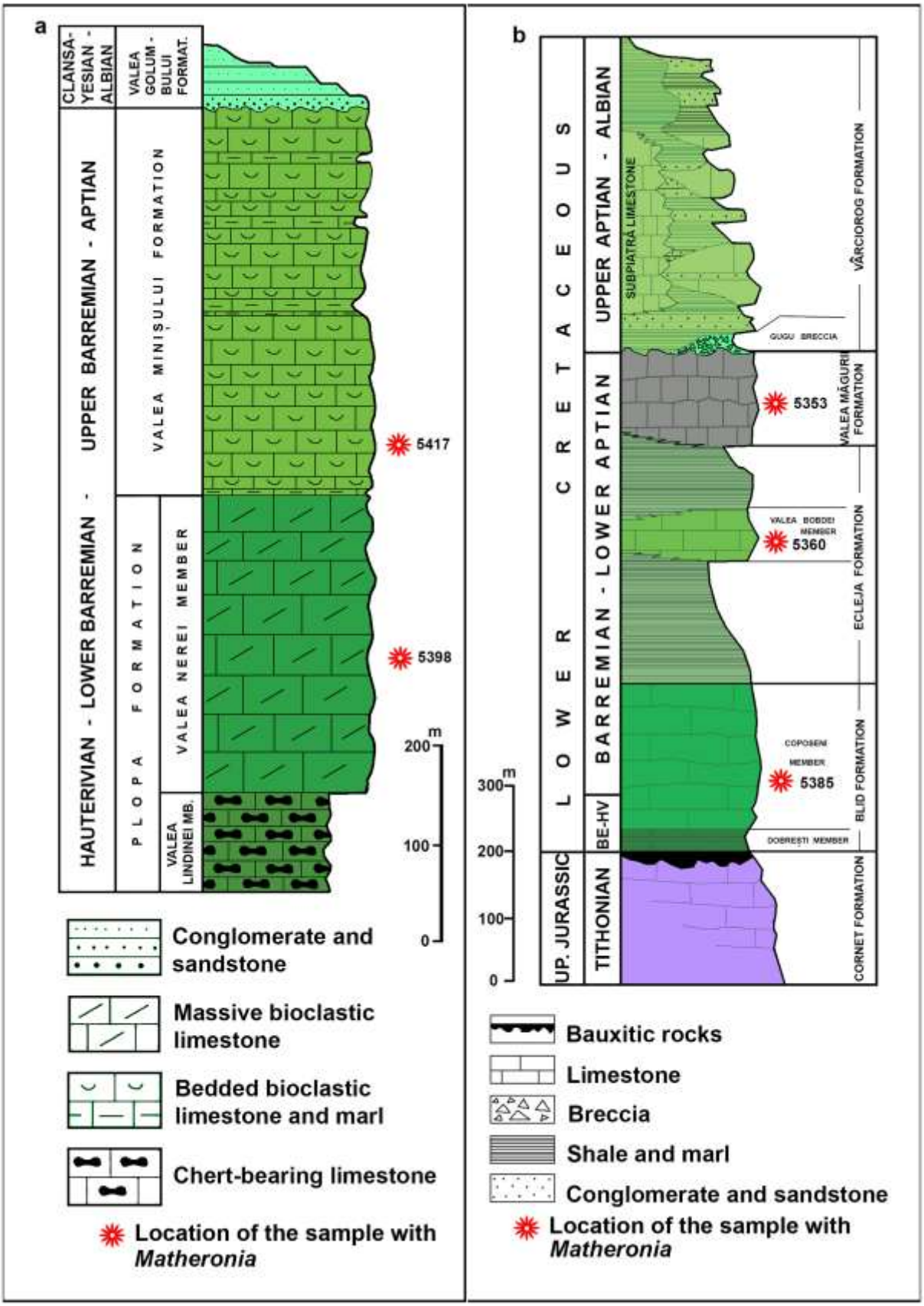

Fig. 2. Stratigraphic logs of Lower Cretaceous successions with position of *Matheronia* bearing beds. **a.** Nera valley area (Reşiţa-Moldova Nouă zone). **b**. Cornet and north Dobreşti areas (Pădurea Craiului).

The succession continues with the Ecleja Formation, its carbonate upper part, the Bobdei Valley Limestone Member contains *Palorbitolina lenticularis, Akcaya capitata, Paracoskinolina maynci* and *Salpingoporella popgrigorei*, an association that suggests a possible early Aptian age. The Ecleja formation is covered by the

Măgurii Valley Limestone Formation with rudists including *Matheronia silvaeregis* sp. nov., *Lovetchenia*, *Horiopleura* and caprinids. The associated Orbitolinidae: *Palorbitolina lenticularis*, *Orbitolinopsis cuvillieri*, *O. kiliani*, *O. buccifer*, and *O. pygmaea*, document an early Aptian age (Cociuba, 2000). This dating is corroborated by the age of the overlying marls, characterized by *Dufrenoya*, a late early Aptian ammonite.

SYSTEMATIC PALAEONTOLOGY

Abbreviations used for the taxonomic description. LV-left valve, RV-right valve, AV- attached valve, FV-free valve, A-anterior, P-posterior, D-dorsal, V-ventral, Dap-antero-posterior diameter, Ddv- dorso-ventral diameter (see discussion below), BC-body cavity, pmc-posterior myophoral crest, am-anterior myophore, at-anterior tooth, pt-posterior tooth, as-anterior tooth socket.
Samples collected by the authors (referred as JPM for Jean-Pierre Masse and IB for Ioan I. Bucur) are housed at the Musée de Paléontologie, Aix-Marseille University, Centre Saint-Charles.
The classification of the Hippuritida used herein refers to Skelton (2013).

Order Hippuritida Newell
Suborder Requieniida Skelton, 2013
Superfamily Requienioidea Kutassy,1934
Family Requieniidae Kutassy,1934
? Subfamily Matheroniinae Scott et al., 2010
Genus ***Matheronia*** Munier-Chalmas, 1873
Type species *Caprotina virginiae* Gras, 1852

Generic characters of the genus *Matheronia* and comments on the subfamily Matheroninae

The shell is attached by the LV, mostly matheroniform sensu Masse (2002), i.e. spirogyrate. RV uncoiled with growth lines concentric to the apex. On antero-posterior transverse sections the RV pm is a crest, am a bulge. LV myophores being on inner shell wall. The striking difference with the other Requieniinae, e.g. *Requienia*, is the existence of a RV posterior myophoral plate, lacking in *Matheronia*, as established by Douvillé (1915).
The foregoing shows that among the Requieniidae the generic identification of *Matheronia* requires the presence of both valves, especially the RV which bears the diagnostic myophoral characters; an antero-posterior section showing the posterior myophoral crest and the anterior myophoral bulge is necessary and sufficient for this purpose.

Emended diagnosis

Shell attached by the LV, mostly matheroniform, i.e. spirogyrate, with a short beak. RV uncoiled with growth lines concentric to the apex, The RV pm is a crest, am a bulge. LV myophores being on inner shell wall. Radial bands usually absent or inconspicuous.

Several additional characters

The presence of a well-defined LV anterior tooth socket was considered by Paquier (1903) as a diagnostic character of M*atheronia*, a point of view shared by Mongin (1971), but not retained by Douvillé (1915) and most of the subsequent workers.
The existence of an additional tooth (PII) was noticed by Douvillé (1915) in the LV cardinal area of *Matheronia virginiae*, but this feature, recorded in some other rudists, is considered to have a negligeable taxonomic value.
The dorso-ventral length of the RV anterior and posterior myophores is distinct: ma being longer than mp (Douvillé, 1887; Paquier, 1903).
Radial bands (pro siphonal bands of Douvillé, 1915) appear to be lacking in most of *Matheronia* species, whereas they are present in *Requienia* species (Douvillé, 1915, 1918; Mongin & Trouvé, 1953; Mongin, 1971). Nevertheless, radial bands are somewhat crudely outlined in *Matheronia baksanensis* and *M. aptiensis*, but not frankly sketched in *Requienia migliorinii*, even if the generic name of this taxon cannot be ascertained (Masse, 2002).
There is consensus among palaeontologist to recognize the short beak of LV and the absence of coiling of RV, two correlated characters, as typical attributes of *Matheronia*. But this trait does not match the morphology of the Valanginian *Matheronia*? *taurica* Yanin (1985), an atypical form with a LV having a corkscrew shape, a RV with a raised dorsal margin and a myophoral organisation close to that of *Hypelasma*.
By contrast the large size and thick shell of *Matheronia* invoked by Paquier (1903), Douvillé (1935) and Dechaseaux et al. (1969) as an attribute of the genus, cannot be retained, e.g. *Matheronia aptiensis* has a modest size and a limited shell thickness, some of our new species described herein belong to this category.
The definition of the subfamily Matheroniinae (in Skelton, 2013; after Scott et al., 2010) states that "the LV myophores are as expanded plates on the valve wall": a character which applies to *Lovetchenia* Masse but not to *Matheronia*, and the "RV pm extends from the cardinal platform" (see also Dechaseaux et al., 1969) a character lacking for instance in *Matheronia virginiae*. As noticed earlier (Masse, 2002) the shell morphology of *Matheronia* is not always "matheroniform", for instance it is "requieniform" in *Matheronia? taurica* and somewhat "toucasiform" in *Matheronia baksanensis*. The foregoing shows that the definition of the subfamily Matheroniinae has to be reappraised.
In the following we compare the Romanian material with the classical Urgonian species of SE France. *Matheronia aptiensis*, *M. munieri* and *M. virginiae*, here illustrated to document some of their generic attributes (Fig. 3).

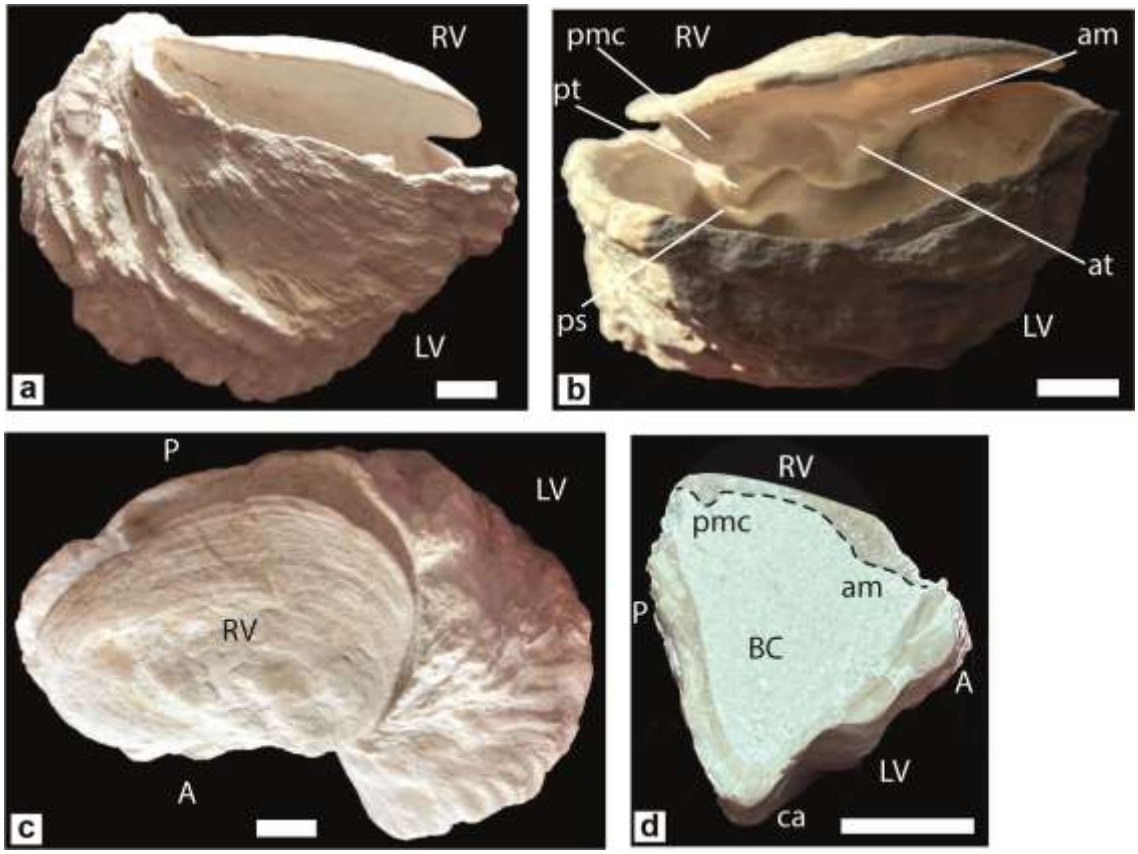

Fig. 3. Illustration of classical *Matheronia* species from the Barremian type locality of Orgon (SE France). *Matheronia munieri* Paquier. **a**. posterior view of a bivalve specimen showing the LV lamellar habit and flat RV (sample DG 110). **b**. internal view showing the myocardinal apparatus of the RV (sample DG 113); **c.** same specimen showing the uncoiled RV. **d.** *Matheronia aptiensis* Matheron, transverse antero-posterior section showing the myophores (Urgonia Museum collections). Specimens **a** to **c**, reference DG (Urgonia Museum), have been cleaned and prepared by Dominique Gesbert. Scale bar 10 mm.

Comparisons are based on the recent revision of the corresponding species collections stored in the Urgonia Museum of Orgon. The age of this reference fauna is Barremian (Frau et al., 2018; Masse et al., 2020).

By contrast with the Urgonian species from SE France represented by well-preserved whole shells, the Romanian forms, but one, are represented by variously oriented sections; we have selected the rather rare, bivalve, antero-posterior sections exhibiting the RV myophores, but such material makes uncertain the recognition of the radial bands. Hence the vast majority of sections represent left valves, which cannot be safely assigned either to *Requienia* or *Matheronia* and are just identified as "requieniids", excluding *Toucasia* with a myophoral crest or ridge on LV.

Specific attributes of *Matheronia* combine the following traits: size (Dap and Dvd), transverse cross sectional shell outline, presence or absence of a ventral carina, development of the LV shell lamellar surface, usually more important on the anterior side, and shape of the RV. The use of Dap as a size parameter, is a standard for requieniids, but Dvd does not fit the common use of this parameter. The usual dimensional approach for requieniids deals with the W/L ratio (e.g. Masse et al., 1998) in which W is the width, equivalent to Dap, L being the distance between the dorsal and ventral shell margin, i.e. Ddv sensu stricto, acquired in the plane of the RV. In the following Ddv does not conform this definition but corresponds to the distance between the ventral margin of the LV and the plane of the RV, hence the smeasurements of Dap and Dvd are tranversally orthogonal. This method was introduced to acknowledge a quantitative approach based on transverse sections rather than well-preserved entire specimens.

DESCRIPTION OF SPECIES

***Matheronia dacica* sp. nov.**

Figure 4a, b

Derivation of name. From Dacia the ancient, Roman name for Romania.

Holotype. A section (IB 5391) of a bivalve specimen from Carasova Valley (Fig.4a).

Study material. Our samples come from two localities of the Nera valley area: Beiului Valley (IB 5398) and Carașova (IB 5391) and consist of four double faced serial sections. A section recorded from Cornet (IB 5385) (Pădurea Craiului), is tentatively included into our new species.

Geographic location and stratigraphic position (Fig. 1b, c; Fig. 2a, b). The study material recorded from the Nera

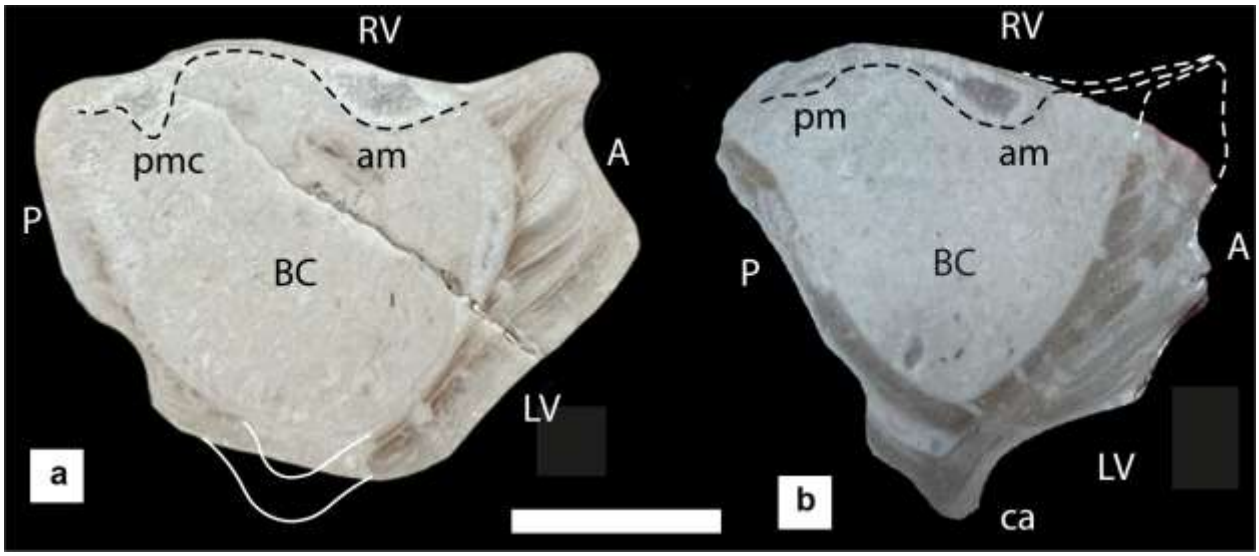

Fig. 4. *Matheronia dacica* sp. nov. Antero-posterior transverse sections of bivalve specimens showing the transverse outline and focusing on the myophoral organisation of RV. **a.** holotype, specimen IB 5391, from Caraşova Valley. **b**. ibidem, specimen IB 5398 from Beiului Valley. Scale bar 10 mm.

Valley Limestone Member of the Reşiţa zone contains *Pachytraga carpathica* Masse et al., (2023), *Moulladella jourdanensis*, *Cribellopsis thieuloyi*, *Salpingoporella muehlbergii*, whereas specimens from Coposeni Member of the Bild Formation (Pădurea Craiului) are associated with *Pfenderina globosa*, *Moulladella jourdanensis, Salpingoporella genevensis, S. melitae* and *S. muehlbergii*. The micropaleontological assemblage documents an Early Barremian age.

Generic placement. The RV myophores are represented by an anterior, low, protruding internal bulge (Fig. 4a, b) and a posterior marginal cross-sectional triangular crest, LV myophores are on shell wall. This organisation is typical of *Matheronia*.

Specific assignment. Average dimensions are as follows: Dap = 24 mm (20 to 26 mm), Ddv = 19 mm (17-22 mm). The LV has an anterior, lamellar surface (2 to 5 mm thick), the posterior side is nearly smooth and thinner (about 1 mm), the ventral side bears an acute carina. (Fig. 4B). The am is about 10 mm wide, the protrusion of the pmc is 2 mm. The RV is slightly convex and the anterior pallial margin relatively wide and oblique, the posterior depressed.

Diagnosis. Small carinate *Matheronia* with Dap larger than Ddv, LV anterior with salient lamellae, posterior side thin and smooth. RV with a low convexity.

Comparisons. *Matheronia dacica* sp. nov. has a smaller size than *Matheronia aptiensis, M. munieri* and *M. virginiae*, the size and protrusion of the RV myophores are more limited and the ventral carina more acute. But it is far larger than the thin shelled, non carinate, *Matheronia rougonensis*. It lacks the strong lamellar outer shell surface and the thick inner originally aragonitic shell layer recorded in the two later species. The anterior pallial margin is smaller than that of the larger West European species. Evidence for longitudinal anterior ribs similar to that of *Matheronia baksanensis* is lacking. This is the smaller species of the Romanian *Matheronia*.

***Matheronia nerae* sp. nov.**

Figure 5a-e

Derivation of name. From its geographical origin Valea Nerei, the Romanian spelling of the river Nera valley, referring to the name of the river.

Holotype. Conjoined sections of sample, IB5417A1-2.

Study material. Ten sections and 5 rock fragments from Valea Nerei (IB5417). Two serial sections from the Ioanii Costanii riverbank (IB 5360). Specimens recognized from field observations at Valea Măgurii seem to match the characters of *Matheronia nerae* sp. nov. The foregoing locations shows that the fossil material comes from both the Apuseni Mountains and the Reşiţa-Moldova Nouă area

Geographic location and stratigraphic position (Fig. 1b, 2a), Nera valley region, lower part of the Minişului Valley Formation with *Montseciella*? *arabica*, *Neomeris* cf. *cretacea*, *Boueina hochstetteri* and *Bakalovaella elitzae* assigned to the late Barremian-earliest Aptian.

Generic placement. The RV myophores are represented by an anterior, low, protruding internal bulge (Fig. 5a, b) and a posterior, cross-sectional triangular marginal crest. LV myophores are on shell wall. This organisation is typical of *Matheronia*.

Specific assignment. Our description is mostly based on samples from the Valea Nerei. The anterior portion of the RV, above the am, is slightly depressed and the posterior portion, above the pmc, is slightly inflated (Fig. 5a, b with arrows). The apical, ventral part of the antero-posterior tranverse outline of the LV is either triangular or flattened with a double keel, the postero-ventral been more salient and more acute (Fig. 5a, b). The overall transverse outline is therefore either

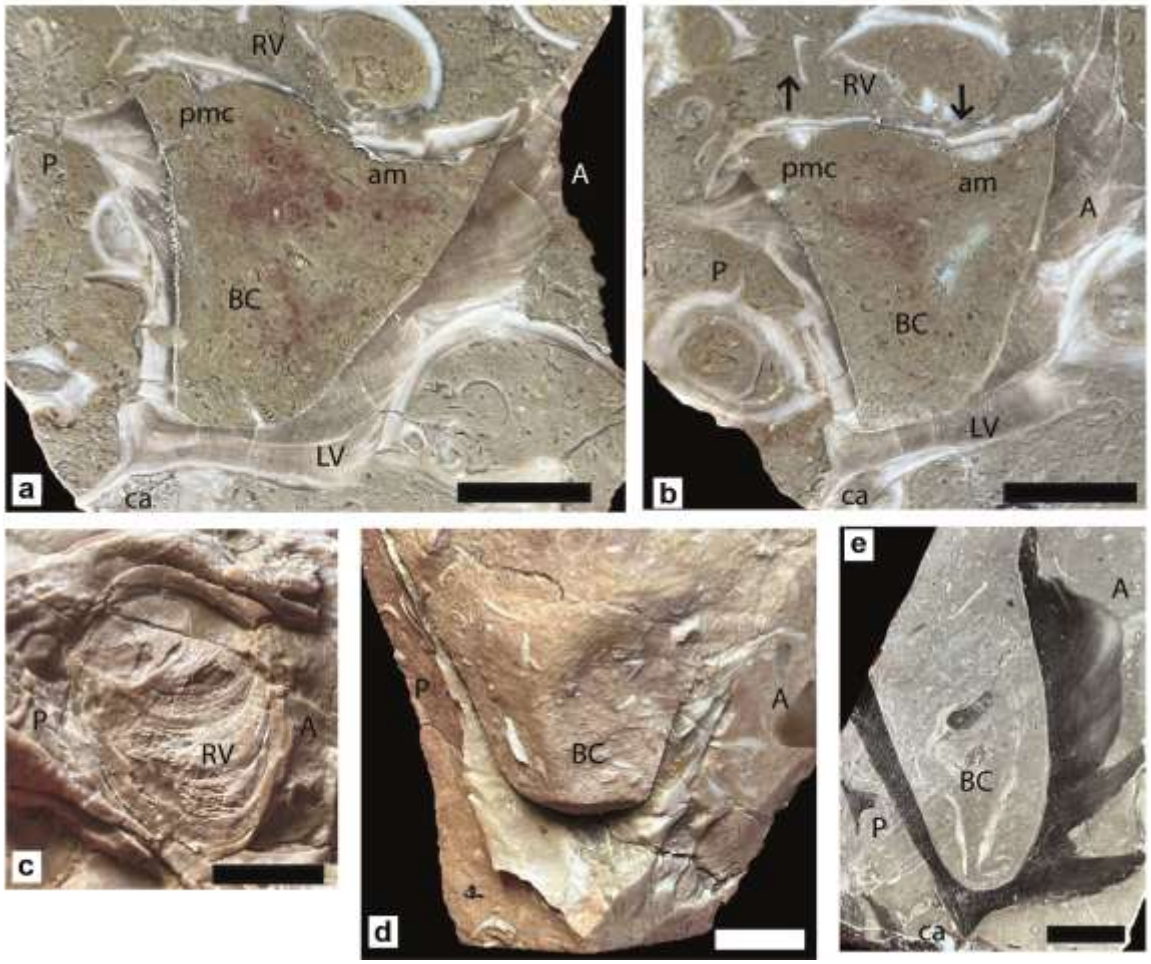

Fig. 5. *Matheronia nerae* sp. nov. **a** to **d**, Nera valley. **a, b**. Antero-posterior transverse sections of bivalve specimens showing the transverse outline and the myophoral organisation of RV (specimen IB 5417A), holotype, conjoined sections. Arrows point to the convexity and concavity of the RV facing the myophores. **c.** external view of RV (specimen IB 5417C). **d.** transverse section of a LV showing the antero-posterior shell asymmetry (specimen IB 5417B). **e.** section of a LV showing the ventral double keel and antero-posterior shell asymmetry (specimen IB 5360, from Valea Măgurii quarry, Dobresti). Scale bar 10 mm.

subrectangular or subtriangular. Concentric growth lines issued from the dorsal side are characteristic features of the RV (Fig. 5c) which bears a ventral blunt carina. The LV has a thick (5 -12 mm) dense lamellar anterior side with an oblique pallial, triangular end, and an elongated, thinner (2 mm) posterior side (Fig. 5a, b). The average dimensions are as follows: Dap = 40 mm (35-50 mm), Ddv = 48 mm (45-60 mm). The RV (one specimen) is 39 mm long and 19 mm wide.

Diagnosis. *Matheronia* with a medium to large size. RV concave anteriorily above the am, and convex posteriorily above the pm. Dvd larger than Dap. LV with a cross-sectional triangular to rectangular habit, frequently double keeled on ventral side.

Comparisons. The transverse undulation of the LV coupling a concave (anterior) and convex (posterior) is a key attribute of the species, no *Matheronia* species has this character, also recorded in *Requienia zlatarski* (Paquier, 1903). *Matheronia nerae* sp. nov. is larger than *M. aptiensis* and smaller than *M. munieri* and *M. virginiae*. The size of the species is larger than that of *M. carinata* sp. nov. and smaller than that of *M. silvaeregis* sp. nov.

Matheronia carinata sp. nov.

Figure 6a-d

Derivation of name. From the LV carina associated with an antero-posterior shell compression

Holotype. IB 5443-1, Valea Minişului.

Study material. Five broken specimens and two rock fragments from Valea Nerei (IB 5417E 1 to 5). Four rock fragments with large shell fragments from Valea Minişului (IB 5443 1 to 5). This material comes from the Reşiţa-Moldova Nouă area.

Geographic location and stratigraphic position (Fig. 1b; 2a). The holotype was collected from upper Barremian-lowermost Aptian limestones cropping out in the Miniş Valley (central part of the Reşiţa zone). The material from Nera valley was collected in the same place as *Matheronia nerae* n. sp.

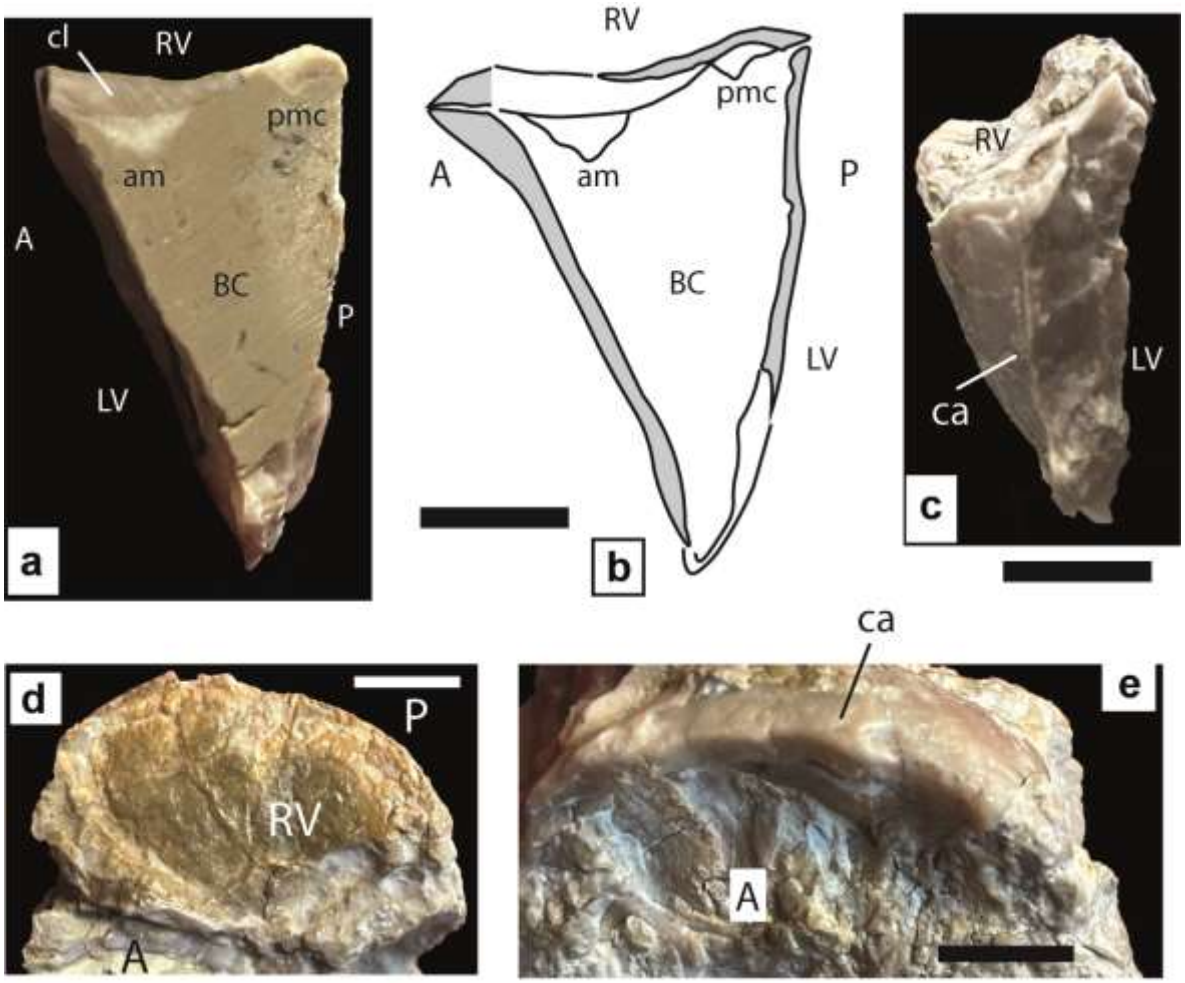

Fig. 6. *Matheronia carinata* sp. nov. from Valea Minişului. **a**. Transverse section showing the myophoral organisation (specimen IB 5443-1, holotype), specimen partly damaged, almost shell free. **b**. ibidem, reconstitution. **c**. ibidem, ventral view of the LV showing the acute ventral carina (ca). **d.** External view of RV with concentric growth lines (specimen IB 5443-3). **e**. Anterior view of a LV showing the acute carina (ca) slightly overriding the anterior shell side (specimen IB 5443-2). Scale bar 10 mm.

Generic placement. The RV myophores are represented by an anterior, low, protruding internal bulge (Fig. 6a, b) and a posterior, cross-sectional triangular marginal crest. LV myophores are on shell wall. This organisation is typical of *Matheronia*.

Specific assignment. LV myophores on shell wall, absence of radial bands on the posterior side of the LV, its short beak and the uncoiled RV are common attributes of the genus *Matheronia*. The overall transverse outline is subtriangular with an antero-posterior compression (Fig. 6a, b). Concentric growth lines issued from the dorsal side are characteristic features of the flat RV which ends by a ventral blunt carina (Fig. 6d). The LV has a lamellar, thick (up to 5 mm) concave anterior side, and a thin (about 1 mm) convex smooth or irregular posterior side. The carina is acute (Fig. 6c) asymmetric; it tends to slightly override the anterior shell side (Fig. 6e). Average dimensions and ranges are as follows: Dap = 30 mm (2.5 -40 mm), Ddv = 27 mm (20-32 mm); RV length = 60 mm (55-65 mm), LV length= 35 mm.

Diagnosis. *Matheronia* with a medium size, toucasiform, i.e. with an antero-posterior compression, LV anterior side concave, with an acute ventral carina.

Comparisons. The size of *Matheronia carinata* sp. nov. is in the range of that of *M. aptiensis*, i.e. smaller than *M. munieri* and *M. virginiae*. It also differs from the West European species by a more concave LV anterior side and a more acute carina. The radial bands of *M. carinata* sp. nov. are inconspicuous, hence different from that of *Matheronia baksanensis* and *M. aptiensis*, somewhat outlined. Due to its antero-posterior compression coupled with the acute carina, *M. carinata* sp. nov. looks like *Toucasia*, it is the only toucasiform *Matheronia* species known so far. Dap is larger than Ddv, two dimensions nearly equivalent in *M. aptiensis*.

***Matheronia silvaeregis* sp. nov.**

Figure 7a, b

2023 *Requienia* sp.1, Masse et al., fig. 2 B1-2.

Derivation of name. From its geographical origin Pădurea Craiului (Apuseni Mountains) the Romanian

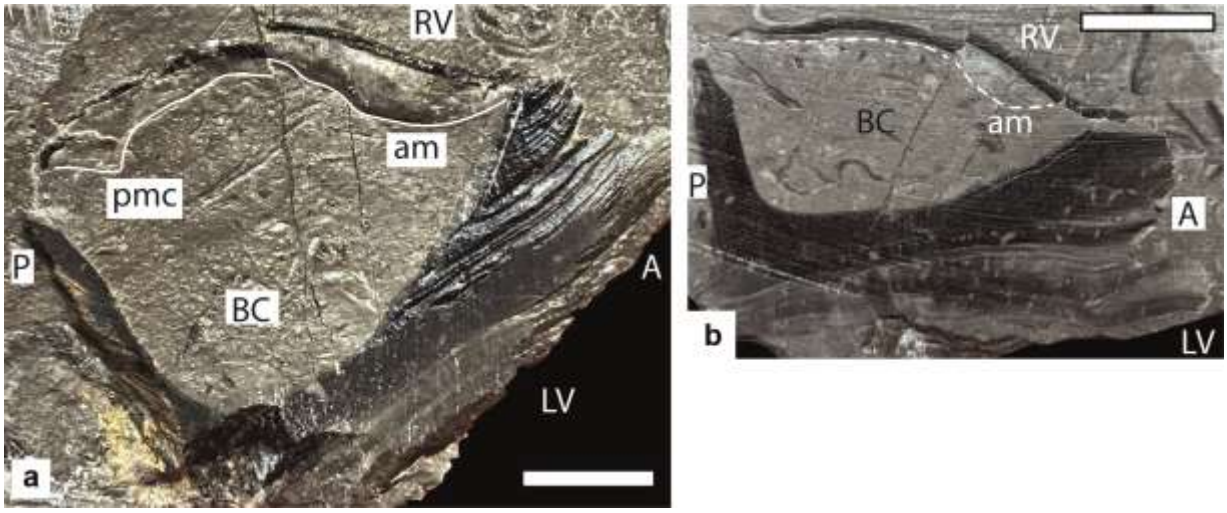

Fig. 7. *Matheronia silvaeregis* sp. nov. Valea Maguri. **a, b**. Transverse antero-posterior serial sections (specimen IB 5353C-A, B) showing the RV myophores, the strong antero-posterior LV asymmetry, the compact thick lamellar anterior side and convex outside RV. Notice on section b the reduction of the pmc. Scale bar 10 mm.

spelling for the "king forest" hence *silvae regis*.
Holotype. Two double faced serial sections IB 5353C1-2.
Study material. Sample IB 5353C 1-2, represented by two serial transverse sections get from a specimen recorded in a rock sample.
Geographic location and stratigraphic position (Fig. 1d, 2b). Măgura Valley Formation, (Pădurea Craiului Mounts, Apuseni Mountains) described by Cociuba (2000). This taxon has not been recognized in the Reşiţa-Moldova Nouă area. Its stratigraphic position is the Lower Aptian, an age based on the presence of *Palorbitolina lenticularis, Orbitolinopsis cuvillieri, O. kiliani, O. buccifer, O, pygmaea* and *Praeorbitolina cormyi.* Associated rudists include *Lovetchenia* sp., *Horiopleura* sp. and Caprinidae.
Generic placement. The RV myophores are represented by an anterior, low, protruding internal bulge and a posterior cross-sectional triangular crest, the LV interior myophores are on shell wall. The posterior myophoral crest is an attribute of *Matheronia*, hence the name *Requienia* sp.1 used formerly by Masse et al. (2023) must be rejected.
Specific assignment. The larger section has a relatively large size (Dap = 6 cm, Ddv = 5 cm) and a subtriangular transverse outline. The LV has a blunt carina and is strongly asymmetrical, with a relatively thin (3 -5 mm) compact posterior side and a thick anterior, dense lamellar side, in the range of 10-12 mm. The lamellar structure is internal and apparent only on the anterior pallial margin (Fig.7a). The RV is moderately convex, the central side being slightly inflated. The transverse dimension of the am is 22 mm, the pmc being 8 mm and its protrusion 4 mm, notice that the pmc is not apparent on section (b), showing that the mophore is dorso-ventrally relatively short. The outer calcitic shell layer is thick on the LV and thin (1-2 mm) on the RV (Fig. 7a, b), the LV internal, formerly aragonitic, shell layer is very thin. There is a dense foliated structure of the outer shell layer of LV, the lamellae /foliae are tightly packed and the lamellar structure is visible only near the commissural area, hence both shell sides are smooth. In the study material the calcitic outer shell layer is black and the inner layer is white, non-translucent. We underline that this habit has no taxonomic significance and results from diagenetic processes. The preserved inner shell layer on RV suggests that the LV reduction in thickness of this layer is a taxonomic trait and did not derive from a diagenetic alteration.
Diagnosis. Moderate to large size *Matheronia* with Dap larger than Ddv, a thickened anterior, LV outer shell layer; thin inner shell layer. Dense lamellar LV shell structure apparent at the anterior pallial margin. Blunt ventral carina on LV.
Comparisons. *Matheronia silvaeregis* sp. nov. is similar in size to *M. munieri*, slightly smaller than *M. virginiae*, and far larger than the thin shelled, non carinate, *Matheronia rougonensis*. It lacks the strong lamellar outer shell surface and the thick inner originally aragonitic shell layer recorded in the two former species. Evidence for longitudinal anterior ribs and an acute carina similar to that of *Matheronia baksanensis* are lacking, *M. aptiensis* has smaller dimensions, both species having a thinner shell and a limited antero-posterior asymmetry in shell thickness.

DISCUSSION

Our work shows that the Lower Cretaceous genus *Matheronia* which has been ignored (Masse et al.,1999) or misinterpreted (Masse et al., 2023), i.e. erroneously regarded as *Requienia*, is actually well represented in Romania. Moreover, most of the previous occurrences of the genus, reported in the literature from the Carpatho-Cimmerian rudist province, cannot be maintained. The first example is given by *Matheronia affinis* figured by Matheron (1878) subsequently described and illustrated

by Paquier (1903) whose internal characters are unknown, precluding the safe placement of the taxon in *Requienia* or *Matheronia*. The morphology of the type specimen (housed in the Musée de Marseille) and the configuration of the radial bands, are close to *Requienia ammonia* and was interpreted as a juvenile of the species in question (Masse, 1976). Therefore, specimens of *Matheronia affinis* from Bulgaria and the Ukrainian Carpathes are hardly acceptable (Masse et al., 2023). The second example deals with the taxonomic revision of some *Matheronia* from the Ukrainian Carpathes and Bulgaria, subsequently assigned to the genus *Lovetchenia* (see Masse, 1993). The last example was the misinterpretation of *Requienia gryphoides* assigned to *Matheronia* (Neagu et al., 1977; Jankicevic, 1978).

The four species belonging to the genus *Matheronia*, recognized in the Barremian-Lower Aptian from the Southern Carpathians and the Apuseni Mountains, differ from their contemporaneous forms from Western Europe. The specific diversity of Romanian taxa is similar to that of the corresponding time interval of Urgonian carbonates of SE France. Actually, the three *Matheronia* species reported from SE France (see above) are essentially Barremian (Masse et al., 2020) but a fourth one, to be described, from the early Barremian, is also present. It is worth noting that other regions of Romania are known for their requieniid bearing assemblages, e.g. Dobrogea (Neagu et al., 1977) and the Dimbovicioara area (work in progress), which need further checkings.

From a biostratigraphic viewpoint the four Romanian species may be considered as potential time markers: *Matheronia dacica* sp. nov. appears as an index of the Lower Barremian, *Matheronia nerae* sp. nov. and *Matheronia carinata* sp. nov. are localized in the Upper Barremian-Lower Aptian, *Matheronia silvaeregis* sp. nov. been restricted to the Lower Aptian.

The study Romanian species but one conforms to the matheroniform morphotype defined earlier. Hence, they pertain to the clinger eco-morphotype (Skelton & Gili, 2002) with a limited bioconstructional potential. They tend to be associated with requieniid dominated rudist assemblages in which they have a significant physiognomic role.

Change in size is the prominent evolutionary character. The bivariate scatter plots of Dap versus Ddv (Fig. 8), two dimensional parameters of size, illustrates a size increase through time. This pattern known as Cope's rule, is quite common in many rudist lineages (e.g. Fenerci-Masse et al., 2011). Contemporaneous *Matheronia* species from SE France tend to be larger and the shell more lamellar.

The Romanian taxa are interpreted as chronospecies included in a lineage rooted in the Lower Barremian, hence derived from *Matheronia dacica* nov. sp. This interpretation does not discard a possible phyletic relationship with the Caucasian, Valanginian, *Matheronia baksanensis* belonging to the same biome.

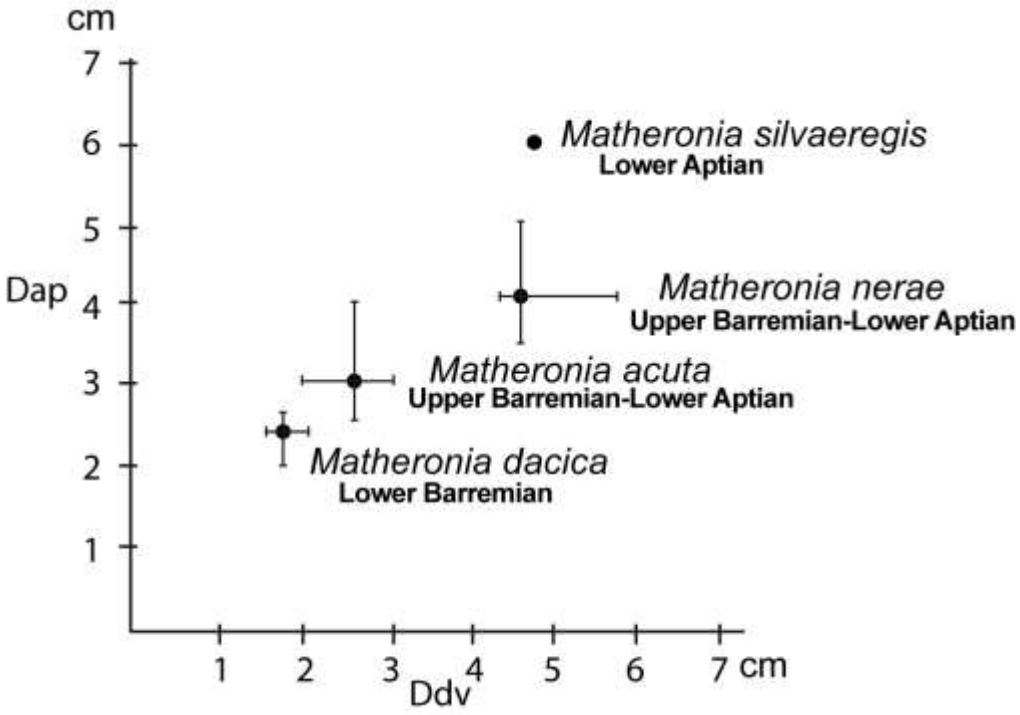

Fig. 8. Bivariate scatter plot of Dap versus Ddv of the new Romanian species of *Matheronia*, showing shell size increase through time.

PALAEOBIOGEOGRAPHY

The genus *Matheronia* is not known from the New World. It was mentioned from Algeria as *Matheronia gryphoides* by Coquand (1880), in fact this form belongs to *Requienia* (see above). The generic position of problematic requieniid sections recorded in the Hauterivian Avvantaggio Member of the Calcari di Bari Formation (Apulian Platform, Southern Italy), i.e. their assignement to *Matheronia* or *Requienia*, cannot be ascertained (Luperto-Sinni & Masse, 1982). Hence the presence of *Matheronia* on the Southern Tethyan Mediterranean margin, is dubious. Consequently, the genus appears strictly European and represents a critical endemic component of the Northern Tethyan Mediterranean margin. The presence in Romania of four species distinct from their three subcontemporaneous West European counterparts show that the two faunal assemblages belong to two distinct paleobiogeographical entities i.e. the West European and Carpatho-Cimmerian rudist bioprovinces defined earlier (see Masse et al., 2023), hence the specificity of the two bioprovinces is enhanced. But the pre-Barremian evolutionary history of the genus in Eastern Europe remains unknown and the timing of its last occurrence as well.

CONCLUSIONS

The study of requieniid rudists from the Barremian-Lower Aptian from the Southern Carpathians and the Apuseni Mountains, in Romania, documents the presence of four new species of the genus *Matheronia*: *Matheronia dacica*, *Matheronia nerae, Matheronia carinata* and *Matheronia silvaeregis*. The four species are characterized by a short beak, the absence of radial bands on the left valve and the absence of coiling of the right valve. The right valve has a myophoral organisation which consists of an anterior bulge and a posterior cross-sectional crest, typical of the Urgonian *Matheronia* species (e.g. *Matheronia aptiensis*) of SE France. Specific characters include size, shape and lamellar shell habit, significantly different from the West European *Matheronia*. Their evolution through time is essentially characterized by shell size increase. The different species possess a potential biostratigraphic value: *Matheronia dacica* being a Lower Barremian index, *Matheronia nerae* and *Matheronia carinata* are Upper Barremian-Lower Aptian forms whereas *Matheronia silvaeregis* appears to be restricted to the Lower Aptian. *Matheronia* looks confined to the North Mediterranean Tethyan margin; the new Romanian species are interpreted as markers of the Carpatho-Cimmerian rudist province, and their specificity tend to enhance the palaeobiogeographic splitting of the two North Mediterranean bioprovinces defined earlier.

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