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LOWER JURASSIC AMMONITES IN THE ROMANIAN CARPATHIANS

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Abstract: The present review of zonal Lower Jurassic stratigraphy of the Romanian Carpathians is based on a new paleontological material studied by the authors and contained partly in archives reports. The condensed stratigraphic interval of Adnetian limestones ranges from the Liasicus to the Jamesoni Zone. The rocks of the Gresten facies have yielded rich assemblages of ammonites from the Bucklandi to the Levesquei zones.

1. INTRODUCTION

On the occasion of the International Colloquium on Mediterranean Jurassic Stratigraphy (Budapest, 1969), the authors of this study presented a paper on Lower and Middle Jurassic Ammonite zones known at that time. During the following two decades a great number of data on Lower Jurassic zone stratigraphy have been obtained, being associated with the elaboration of biostratigraphic synthesis studies of different Carpathian areas (East Carpathians - Patrulius et al., 1980, 1981; Apuseni Mountains - Patrulius et al., 1982; South Carpathians - Popa et al., 1977), the discovery of new fossiliferous sites, the revised determination of Ammonites belonging to old collections of the Geological Institute of Romania in Bucharest (Popa, 1969 b), the collection and determination in known sites. The aim of the present study is to systematize and synthesize the information contained by different published and archives reports.

The Ammonites presented and partly figured in this study come from the collections of Jekelius, Macovei, Kräutner, Preda, Răileanu, Motaş, Patrulius, Popa, Mantea to be found at the museum of the Geological Institute of Romania in Bucharest. In fact, only the specimens from the above mentioned collections are figured in the present study; as regards other citations, references to the published studies are made.

Special attention is paid to the Ammonites from Lower Jurassic deposits in Gresten facies, widely developed in the Carpathian area, in which I have taken personal interest since 1967, with respect to different Carpathian sectors (Popa, 1967, 1969 a, 1970, 1971, 1981; Popa in Popa et al., 1977; Popa in Mantea et al., 1982; Popa et al., 1985).

It should be mentioned that the chapter of the present study on Lower Jurassic in Adnet facies presents the Ammonite assemblages which I revised or specified mostly in co-operation with Patrulius (Patrulius, Popa in Patrulius et al., reports: 1980, 1981).

The Ammonite fauna has been analysed by means of the zonal scale of Dean et al. (1961), slightly adapted to other schemes (Mouterde et al., 1971) for the Lower Sinemurian-Lower Domerian interval.

The standard chronostratigraphic scale after Dean, Donovan and Howarth, adopted by the international subcommission on Jurassic stratigraphy in 1984, is very appropriate and all researchers agree on it.

2. LOWER JURASSIC FACIES

In the Romanian Carpathian area, the Lower Jurassic deposits occur in extreme facies, on the one hand (1) the Adnet facies, to be recognized only in the East Carpathians, and on the other hand (2) the Gresten facies, largely developed in all the Carpathian areas (Apuseni Mountains, South Carpathians, East Carpathians).

2.1. The Adnet Facies

In accordance with the initial definition (Hauer, 1853 and Wendt, 1969) the Adnet Beds *s.str.*

are represented by red nodular limestones bearing Cephalopods of small thickness (2-15m), developed in the Sinemurian-Lower Pliensbachian interval. They overlie discontinuously the Rhaetian reef limestones; the gap corresponds at least to the Lower Hettangian (Planorbis Zone) and the End Rhaetian. In the Adnet area (Salzburg, Austria) the sedimentation of red limestones ended during the Pliensbachian, while in other areas it went on till the Upper Aalenian (Murchisonae Zone).

The deposits in Adnet facies exhibit the following lithological types: (1) red nodular limestones with argillaceous or marly matrix (ammonitico rosso); (2) limestones of Flaserkalk type, and (3) dense limestones and decimetric to submetric layered ones.

The fauna contained by the Adnet Beds, concentrated on highly stratigraphically condensed layers, is dominated by Ammonoids; the characteristic feature consists in the abundance of phylloceratids; sparse echinoids, gastropods, bivalves, brachiopods, belemnites occur subordinately. This faunal assemblage is exclusively of Mediterranean type.

As regards the Romanian Carpathians, the Lower Jurassic rocks in Adnet facies occur in the Olt Nappe of the Transylvanian Nappe System from the East Carpathians (1. Perşani Mts; 2. Hăghimaş Mts and 3. Rarău Mts).

The Adnet limestones are represented mostly by two types: a) nodular limestones with marly matrix and b) more or less marly, partly subnodular, plate and slab stratified limestones.

The microfacies type of these limestones consists of micrites with disseminated entroques, calcareous foraminifers, bivalve fragments, echinoids, brachiopods and belemnites. Ammonites are the prevailing group in these limestones.

2.1.1. The Perşani Mountains

In the Perşani Mts the rocks in Adnet facies constitute small olistoliths, which originate in the division into fragments of the Olt Nappe, subsequently included in the Barremian-Aptian Wildflysch Formation. The stratigraphic interval of the Liassic deposits in Adnet facies from the Perşani Mts is Middle Hettangian (Liasicus Zone)-Lower Carixian (Jamesoni Zone). In the northern Perşani Mts only, within the middle scale of the Meghieş klippen (Table 1/34) the limestones of Adnet type (Lower Sinemurian) overlie discontinuously the Hallstatt Limestones (Upper Norian), which means that the Jurassic sedimentation is resumed there after a gap corresponding to the Rhaetian-Hettangian interval.

The Adnet limestone olistoliths were noticed mainly in the central Perşani Mts, on the two sides of the Olt Gorges. On their southern slope, along the Tepei Valley (Table 1/31), 2 km upstream its confluence with the Olt river, one encounters the main fossiliferous site, explored by Herbich (1878), Vadasz (1906, 1907, 1915), Jekelius (1915 - collection of the Geological Institute of Romania in Bucharest), Preda, Răileanu (1953), Popa (in Patrulius et al., 1966). The Ammonite collections were revised by Popa (1969 b, report) and Patrulius, Popa (1969). This is a stratigraphically condensed layer belonging to the Middle Hettangian-Lower Sinemurian interval.

An alignment of small olistoliths can be traced in the right slope of the Tepei Valley along its east-side tributaries (Table 1/31) and in Dealul Negru (Table 1/35), at an altitude of about 125 m from the main river bed. North of the Olt Gorges, the Adnet limestone olistoliths occur in a small valley beneath Pietrele Albe (Table 1/33), on the southern slope of Tepea Racoşului and on a small, right tributary of the Olt river, east of the Tepei Valley.

In the southern Perşani Mts a single Adnet limestone olistolith was reported (Patrulius et al., 1966) from the Stanciului Valley (Table 1/32).

The Ammonite fauna is often concentrated in the highly stratigraphically condensed beds.

The zonal inventory (Patrulius and Popa in the report by Patrulius et al., 1980) of the fossiliferous deposits occurring in the Perşani Mts area, south and north of the Olt Gorges, is the following (after revision and determinations by Patrulius, Popa of the collections belonging to Jekelius, Preda, Răileanu, Patrulius, Popa):

Liassicus Zone

Waehneroceras toxophorum (WAEHNER), *W.* sp. ex gr. *W. portlocki* (WRIGHT), *W.* sp. ex gr. *W. anisophyllum* (WAEHNER), *Franziceras* sp. aff. *F. ruidum* BUCKMAN, in Tepeul Ormeniş Valley (Pl. XV, Fig. 1 and Table 2).

Angulata Zone

Schlotheimia montana (WAEHNER), *S. pachygaster* (SUTTNER), *S. exechoptycha* WAEHNER n. ssp., *S.* sp. aff. *S. extranodosa* (WAEHNER), *S.* sp. ex gr. *S. stenorhyncha* LANGE, *Charmasseiceras marmoreum* (OPPEL), *Ectocentrites petersi* (HAUER), *Aegolytoceras* sp. in the Tepei and Stanciului Valleys (Pl. XV, Figs. 2-7).

The olistolith in the Stanciului Valley (Comana de Sus) partly consisting of red nodular limestones with abundant marly matrix contains, in its lower part, species (identified by Patrulius and Popa) assigned to Uppermost Hettangian and to the Lower Sinemurian (Pl. XV, Figs. 2, 4, 5, 8) such as: *Calliphylloceras sylvestre* (HERBICH), *Geyeroceras cylindricum* (J. SOWERBY), *Juraphyllites gigas* (FUCINI), *Ectocentrites petersi* (HAUER), *Aegolytoceras* sp., *Arnioceras*

sp., *Schlotheimia* sp., *Charmasseiceras marmoreum* (OPPEL).

Bucklandi, Semicostatum and Turneri Zones

Paracaloceras centauroides (SAVI and MENEG.), *Metophioceras* spp., *Arnioceras* spp., in Tepeul Ormenişului Valley (Pl. XIX, Fig. 1), *Metophioceras* sp., *Coroniceras lyra* HYATT, *Euagassiceras* sp., *Arnioceras* spp. in the Dealul Negru-south deposits (Pl. XV, Fig. 9; Pl. XVIII, Fig. 2). The isolated blocks occurring in the thalweg of the Tepei Valley have yielded several specimens of the species pertaining to the genera: *Arietites, Coroniceras, Paracoroniceras, Caenisites, Arnioceras, Euagassiceras.* Vadasz (1915) mentioned the species *Agassiceras scipionianum* (ORB.) from the Semicostatum Zone.

Among the numerous Phylloceratidae, Juraphillitidae and Lytoceratidae belonging to the Middle Hettangian-Lower Sinemurian interval, which occur in the Tepei Valley within a stratigraphically condensed layer, the following species are presented (Pl. XV, Fig. 8; Pl. XVI, Pl. XVII, Pl. XVIII, Figs. 1, 3): *Juraphyllites transilvanicus* (HAUER), *J. gigas* (FUCINI), *Geyeroceras cylindricum* (SOW.), *G. leptophyllum* (HAUER), *G. persanense* (HERBICH), *G. oenotrium* (FUCINI), *G. szadeczkyi* (VADASZ), *G. hungaricum* (VADASZ), *G. prinzi* (VADASZ), *Ectocentrites alutae* (HERBICH), *Dasyceras rakosense* (HERBICH), *Paradasyceras uermoesense* (HERBICH), *P. tenuilobata* RĂILEANU, *P. lunense* (DE STEF.), *Tragolytoceras herbichi* (BON.), *T. altecinctum* (HAUER), *T.* ? *simplex* (VADASZ), *Pleuroacanthites biformis* (SOW.), *Analytoceras* sp., *Phylloceras lipoldi* (HAUER), *Calliphylloceras sylvestre* (HERB.), *C. dubium* (FUCINI).

The limestones of Adnet type which overlie discontinuously the Norian limestones in the Meghieş Hill contain a Lower Sinemurian fauna (identified by Patrulius), namely: *Paradasyceras uermoesense* (HERBICH), *Ectocentrites (Cosmolytoceras) canavarii* (BONARELLI), *Charmasseiceras* sp., *Epammonites* (?) sp., *Arnioceras* sp.

Obtusum Zone

Several *Asteroceras* species, *A.* cf. *suevicum* (QUENST.) included, were reported from the Adnet limestone blocks occurring in the Tepei Valley. It should be noted that the specimen described by Vadasz as *Asteroceras obtusum* SOW. var. *vulgaris* belongs (acc. to Patrulius) to the genus *Euagassiceras.*

Oxynotum (?) Zone

No species characteristic of the Oxynotum Zone has been identified so far in the Perşani Mts. However, as far as the whole Upper Sinemurian to Lower Carixian inclusively interval, in Adnet facies, shows no lithological change typical of discontinuity, it is highly probable that this zone is also represented.

Raricostatum Zone

An assemblage characteristic of this zone is reported from the Pietrele Albe olistolith (collected by Patrulius). The following species (Pl. XIX, Figs. 3, 4, 6; Pl. XX, XXI) have been identified by Patrulius and Popa: *Echioceras* aff. *rhodanicum* (DUM.), *E. raricostatum* (ZIETEN), *Paltechioceras* sp. aff. *P. aplanatum* (HYATT), *Leptechioceras* sp., *Epideroceras* sp. aff. *E. lorioli* (HUG.), *Zettoceras bonarelli* (BETTONI), *Partschiceras* cf. *tenuistriatum* (MENEG.), *Phylloceras meneghinii* GEMM., *Calliphylloceras anatolicum* MEISTER, *C. bicicolae* (MENEG.), *C.* cf. *emeryi* (BETTONI), *Paradasyceras planispira* (REYNES), *Meneghiniceras libertus* (GEMM.).

It is also to note here the Upper Sinemurian specimens of *Adneticeras* (?) sp. aff. *A. adnethicum* ? HAUER, identified (Pl. XVIII, Fig. 4) within an olistolith occurring on the fourth right-slope tributary of the Tepei Valley.

Jamesoni Zone

An *Uptonia jamesoni* (J de C. SOWERBY) specimen (collected by Patrulius) has been reported from the first right-slope tributary of the Tepei Valley in the thalweg. Richer fauna belonging to this zone has been found by Ileana Popescu within an olistolith lying on the third right-slope tributary of the same valley. The assemblage includes, besides *Uptonia* specimens, such as *Uptonia* sp. aff. *U. jamesoni* (J. de C. SOW.) (Pl. XIX, Fig. 5), several Phylloceratidae.

Several other Ammonite species have been described or cited by Vadasz (1908) from the Olt Gorges. It is to note the abundant *Arnioceras* species assigned to the interval of Bucklandi, Semicostatum, Turneri and Obtusum Zones, such as: *Arnioceras semicostatum propinquum* FUCINI, *A. ceras* HYATT, *A.* cf. *obliquecostatus* (ZIETEN), *A. hartmanni* (OPPEL), *A.* cf. *dimorphum* PARONA, *A. speciosum* FUCINI, *A. subrejectum* (VADASZ), *A. pseudospiralis* (VADASZ), *A. carenatus antiquus* (VADASZ), *A. semilaeva* HAUER. The species *Metarnioceras althii* (HERBICH) (described by Herbich, 1878, as *Aegoceras*) is also worth mentioning.

2.1.2. The Hăghimaş Massif

The only Adnet Beds occurring in the Hăghimaş Nappe (Săndulescu, 1967, 1975) lie at the springs of Pârâul Sec (Table 1/36) in the Curmătura saddle, between Piatra Unică and Muntele Fratele, as an olistolith hosted by the Barremian-Albian Wildflysch formation. This olistolith consists of red and green argillaceous-marly shales, marls and micrite limestones, scarcely sandy, of red colour, as well as greenish thin-bedded limestones. The macrofauna inventoried by Herbich (1878), Vadasz (1915) and Grasu

(1970) consists mainly of Ammonites, out of which the following (the taxonomic nomenclature revised by Patrulius, Popa in report by Patrulius et al., 1981) are particularly relevant for the chronostratigraphic correlation:

Lower Hettangian (Planorbis Zone) - *Caloceras johnstoni* (SOW.),

Middle Hettangian (Liasicus Zone) - *Waehneroceras (Megastomoceras)* cf. *megastoma* (GUMBEL), *W.(M.) anisophyllum* (WAEHNER).

Upper Hettangian (Angulata Zone) - *Schlotheimia angulata* (SCHLOTH.), *S.* cf. *donar* WAEHNER, *S. trapezoidalis* (SOW.), *Ectocentrites petersi* (HAUER).

Lower Sinemurian (Rotiforme, Bucklandi, Semicostatum, Turneri Zones - *Metophioceras longidomus* (QUENST.), *Charmasseiceras charmassei* (ORB.), *C. marmoreum* (OPPEL), *Paracaloceras* cf. *coregonense* (SOW.), *Arietites bisulcatus* (BRUG.), *Tmaegoceras crassiceps* POM., *Arnioceras mendex rareplicatus* FUCINI, *Euagassiceras sauseanum* (ORB.), *Promicroceras planicosta* (SOW.), *Caenisites turneri* (J. de C. SOW.).

Upper Sinemurian (Obtusum and Raricostatum Zones) - *Asteroceras* cf. *stellare* (SOW.), *Echioceras raricostatoides* VADASZ, *Paradasyceras uermoesense* (HERB.), *Juraphyllites transylvanicus* (HAUER), *Schistophylloceras lunense* (DI STEF.), *S. aulonotum* (HERB.), *Geyeroceras cylindricum complanatum* FUC., *G. cylindricum bielzii* (HERB.), *G. persanense* HERB., *G. leptophyllum* (HAUER), *Partschiceras* cf. *tenuistriatum* (MENEGH.), *Calliphylloceras dubium* (FUC.), *C. sylvestre* (HERB.), Nautilods and Coleiods.

Thus, the Curmătura sequence of red shales and limestones represents the entire Hettangian (except for its bottom) and the entire Sinemurian. Besides Cephalopods, these limestones contain sparse Gastropods, Echinoderms and Brachiopods.

2.1.3. The Rarău Massif

The Lower Jurassic deposits of Adnet type, the most typical of the Transylvanian sedimentation area, are represented in the Rarău Syncline (in the Olt Series, acc. to Patrulius et al., 1981) by isolated blocks or small olistoliths included in the Barremian-Albian Wildflysch. The largest olistolith, reported for the first time by Uhlig (1900), lies in Dealul Praşca, on its slope facing Valea Seacă. It is about 50 m long and only a few meters wide. The lithological composition of this olistolith consists of red, partly argillaceous-marly, nodular or subnodular limestones. The rich Ammonite fauna, inventoried by Uhlig (1900), includes the following species (the taxonomic nomenclature revised by Patrulius and Popa in Patrulius et al., 1981): *Partschiceras partschi* (STUR.) (as *Phylloceras), Geyeroceras persanense* (HERBICH) (as *Phylloceras), Paradasyceras planispira* (REYNES) (as *Phylloceras), Harpophylloceras bucovinicus* (UHLIG) (as *Rhacophyllites), Meneghiniceras nardii* (MENEGH.) (as *Rhacophyllites), Lytoceras* aff. *secernendum* DI STEF., *Microderoceras keindli* (EMMR.) (as *Aegoceras*), *Gleviceras* sp. aff. *G. subguibalianum* PIA (as *Oxynoticeras*), *Arnioceras* n. sp. ex gr. *A. semicostatum* (as *Arietites), Paltechioceras romanicus* (UHLIG) (as *Arietites*), *P. waehneri* (UHLIG), (as *Arietites*), *P. herbichi* (UHLIG) (as *Arietites*), *P. boesei* (UHLIG) (as *Arietites*), *P. charpentieri* (SCHAF.) (as *Arietites*), *P.* n. sp. ind. (as *Arietites*), *"Arietites"* cf. *resurgens* DUM., *"Arietites"* cf. *pluricosta* (MGH.) FUCINI, *Echioceras raricostatum* (ZIET.) (as *Arietites).* The inventory presented by Uhlig (1900) also contains: *Atractites* sp., *Spiriferina aequilobata* UHLIG.

From the same fossiliferous site, Trauth (1906) (see Patrulius, Popa, 1969; Turculeţ, 1970) reported the following assemblage (taxonomic nomenclature revised by Patrulius, 1981): *"Phylloceras"* cf. *lunense* MENEG., *"Phylloceras"* cf. *leptophyllum* HAU., *Zetoceras zetes* (ORB.), *Geyeroceras cylindricum* SOW. (as *Phylloceras*), *Oxynoticeras* cf. *oxynotum* (QUENST.), *Microderoceras* aff. *nothum* MENEG., *Tmaegophioceras laevis* (GEYER) [as *Arietites saemilevis* (HAUER) in Geyer], *Paltechioceras boesei* (UHL.), *"Arietites" falcaries* var. *ceratitoides* (QN.).

A big Ammonite, yielded by the same limestones, has been identified by Răileanu as belonging to the *Asteroceras genus* (collections of the Bucharest University).

In 1980 several Ammonite specimens have been collected and identified (Patrulius, Popa in Patrulius et al., 1981) from the limestone olistolith of Adnet type in Dealul Praşca. The following are worth mentioning: *Adnethiceras* sp. aff. *A. adnethicum* (HAUER), *Tragolytoceras* sp., *Echioceras* sp. ex gr. *E. regulare* (TRUE-W.), *Paltechioceras* sp., *Pseudasteroceras* sp., *Juraphyllites* sp. (Pl. XIX, Fig. 2).

The Ammonite assemblages identified so far show that the Adnet limestones occurring in Dealul Praşca include the entire Upper Sinemurian (Obtusum, Oxynotum, Raricostatum Zones), possibly the upper part of the Lower Sinemurian (*Arnioceras* species reported by previous authors).

Turculeţ (1970) added to the above cited inventory assemblages of Brachiopods, Foraminifers, Bivalves, Gastropods, Echinoderms, fishes.

Based on varied benthonic faunas, Turculeţ (1970) assigned the limestones in Dealul Praşca to an intermediate facies between the Adnet facies and the Hierlatz one.

The Foraminifers listed by Turculeţ in 1970 are completed with a study (Patrulius et al., 1981) of the Adnet limestones occurring in Dealul Praşca.

2.2. The Gresten Facies

The initial definition of the Gresten Beds (Hauer, 1853 in Trauth, 1909) was associated with both the Lower Jurassic formation and the Lunz Sandstone from the northern Alpine area. Later, Stur (in Trauth, 1909) limited the Gresten Beds to the Liassic deposits in littoral facies from the Austrian Prealpine area.

At Gresten, the Lower Jurassic sequence consists of (Trauth, 1909): (1) a lower complex formed of arkoses, carbonaceous and middle- and coarse-grained bituminous sandstones, and of black sandy shales with coal interlayerings (7-16 layers). Both the upper part and the bottom of the coal layers have yielded plant remnants. Spherosiderites occur subordinately. These layers belong to the lower part of Lower Jurassic (probably Planorbis Zone, possibly Rhaetian-Hettangian boundary deposits); (2) the Gresten shales, of black or black-grey colour, fossil-bearing (Pleuromya Stur beds) assigned to the Upper Hettangian (Angulata Zone)-Lower Sinemurian (lower half of Bucklandi Zone); (3) the Gresten limestones, dark-coloured, associated with quartzose and with calcareous and schistous sandstones, fossil-bearing (beds containing Terebratulas, Rhynchonelas and Pectens) - Lower Sinemurian (upper half of Bucklandi Zone)-Pliensbachian.

The Gresten facies is generally characteristic of a littoral area abounding in detrital supply, while the coal occurrences point to humid temperate climate.

The Lower Jurassic coal-bearing formation is widespread in the northern hemisphere; it occurs approximately along the 45^0N parallel, from the Alps to Crimea region (the Gresten Formation) and from the Northern Caucasus to Central Asia (the Shemshak Formation) (Dercourt et al., 1986).

The fauna yielded by the Gresten Beds consists of neritic assemblages dominated by Brachiopods, Bivalves and Cephalopods (Celtic-Suabian or Submediterranean fauna). The Phylloceratids are extremely rare.

In the Romanian Carpathians, the Lower Jurassic deposits in Gresten facies occur in (1) the northern Apuseni Mts, (2) the South Carpathians, and (3) the East Carpathians. In all these areas, the field work carried out in order to draw the geological maps, scale 1:50.000, and the biostratigraphic studies (Popa, 1967, 1969 a, 1970, 1971, 1981; Popa et al., 1977, 1985; Mantea, 1985; Mantea et al., 1982; Năstăseanu, 1979) have contributed with new data to the zonal stratigraphy based on Lower Jurassic Ammonites, from the Sinemurian onwards.

The following Ammonite Zones have been recognized:

Bucklandi Zone

A small size *Arietites bucklandi* (Sow.) specimen has been identified by Răileanu (1953) in the Cuţilor Valley, on the southern part of Pădurea Craiului Mts. This Ammonite comes from fine micaceous sandstones assigned to the Poniţa Formation (Patrulius et al., 1982) and is to be found in the collection of the Bucharest University.

From the "Moneasa black limestones" assigned to the Finiş Nappe (Codru Mts - Moneasa sector), Nedelcu (1958) has reported the species *Arietites bisulcatus* Brug., encountered in the neighbourhood of Moneasa locality. The same Moneasa limestones have yielded a *Coroniceras species* (Patrulius et al., 1972).

Semicostatum and Turneri Zones

The Semicostatum Zone has been recognized by Tomescu and Bordea (1976) based on Ammonite fauna collected from the Următ Unit (Finiş Nappe - Bihor Mts). The authors mentioned above have reported the assemblage *Arnioceras* sp. ex gr. *A. semicostatum* (Y. & B.) and *Agassiceras* sp. aff. *scipionianum* (Orb.), yielded by the black limestones occurring in the Următ Complex of the Valea Mare profile.

An Ammonite from Jekelius' collection (stored at the collections of the Geological Institute of Romania in Bucharest), which has been reported from the marine sequences synchronous with the "coal-bearing complex that contains refractory clays" at Cristian-Braşov, belongs to (rev. Popa, 1969 b) the species *Angulaticeras lacunatum* (Buckman) (Pl. I, Fig. 1) (as *"Schlotheimia" lacunata* Buchman in Jekelius' collection). This species is known from the upper part of the Lower Sinemurian (it is supposed to point to the Semicostatum or Turneri Zone).

Obtusum Zone

The organogenous detrital limestones of red and grey colour, Brachiopod-bearing oolitic ones, occurring in the Lower Jurassic sequence from Munteana-Banat (south-western Carpathians) have yielded, according to Răileanu (1953) the species *Promicroceras* cf. *planicosta* (Sow.) [as *Aegoceras (Amblycoceras)* cf. *planicosta* Sow.] (revised Popa, 1977).

Jamesoni Zone

The Jamesoni Zone has yielded large specimens of *Uptonia jamesoni* (Sow.) in the Pădurea Craiului Mts (Apuseni Mts) as follows: (a) one specimen has been yielded from the middle of the "Gryphaea-bearing limestone subformation" occurring at Poniţa, southwest of the Cuţilor Gorges (Patrulius, in Ianovici et al., 1976); (b) another specimen of *Uptonia jamesoni* (Sow.) has been reported from the western slope of Boiului Valley, from the sandy limestones assigned to the same subformation (Popa, 1981), and (c) a third

specimen of the same species has been collected by Diaconu (Patrulius et al., 1982) from the yellow limestones occurring in the Peştireului Valley (north of Dealul Crucii).

A specimen of *Acanthopleuroceras rursicosta* (BUCKMAN) assigned to the Jamesoni Zone has been reported from the top of the grey and red oolitic limestones, occurring at Munteana-Banat (from the last three meters overlying the Brachiopod-bearing lumachelle) (Popa et al., 1977).

In the western South Carpathians, the Lower Jurassic deposits in Presacina facies, more precisely the base of the Ohaba Beds occurring in the Belareca Valley, have yielded (Iliescu, 1963) the species *Platypleuroceras* cf. *brevispina* (SOW.) characteristic of the lowermost Carixian (fide Mouterde in Mouterde et al., 1971).

In Northern Dobrogea (foreland of the Carpathians), at Poşta, the Lower Jurassic sandstones have yielded a small assemblage which consists of *Uptonia* cf. *jamesoni* (SOW.) and *Tropidoceras masseanum* (ORB.) assigned to Jamesoni and Ibex Zones (Macovei' collection, see Patrulius, Popa, 1969).

Ibex Zone

The Ammonites belonging to this zone, identified so far in the Romanian Carpathians, are the following: (1) *Liparoceras* sp., specimen collected from the neighbouring area of the Braşov town and figured by Jekelius (1916); (2) *Androgynoceras* sp. aff. *hybrida* (ORB.), specimen identified by Patrulius in the Hăghimaş Massif (Patrulius, Popa, 1969); (3) *Tropidoceras masseanum* (ORB.), specimen (Pl. I, Fig. 5) yielded by the Carixian calcareous sandstones occurring at Munteana-Banat (calcareous-sandy facies) (Popa in Popa et al., 1977). Another specimen assigned to the same species (Pl. II, Fig. 1) has been collected by Bleahu and Mantea from the calcareous sandstone occurrences in the Gârda Seacă Valley (Bihor Mts).

The bioclastic sparry limestones, exhibiting yellowish, reddish or violaceous alteration, of the Vălani Unit (Northern Apuseni Mts), have yielded (Preda, 1962) a *Tropidoceras* species collected from the Dealul Tabla Buşii (Câmpani- Căbeşti window); (4) the grey sparry limestones occurring on the southern tributary of the Leşului Valley (Remeţi Graben) in the Northern Apuseni Mts have yielded (Popa, 1981) the species *Beaniceras luridum* (SIMPS.) (Pl. I, Figs. 6-9) in association with various Brachiopod species.

Davoei Zone

Some small specimens of *Aegoceras* sp. (Pl. I, Fig. 4) with simple capricorn ribbing have been found (Patrulius in Patrulius, Popa, 1969) at Vadu Crişului in the Pădurea Craiului Mts (Apuseni Mts). An *Androgynoceras* sp. ex gr. *A. hibridiforme* SPATH specimen has been identified (Popa, 1981) in the Bisericii Valley from the Remeţi Graben (Northern Apuseni), in association with *Gryphaea mccullochii mccullochii* SOW. and *G. gigantea* (SOW.) species.

From the sandy limestone outcrops in the Pârâul Suhardu and at Bâtca lui Cioflec (East Carpathians), Grasu (1971) has reported the species *Aegoceras capricornum* (SCHLOTH.). This species was mentioned by Tietze in 1872 (*Ammonites capricornus* according to Tietze) and by Popa (in Popa et al., 1977) from the sandy limestone occurrences (Munteana, Southwesthern Carpathians) (Pl. II, Fig. 2). From the same site Răileanu (1960) reported the species *Liparoceras (Becheiceras) bechei* (SOW.). The same species has been reported (Grasu and Turculeţ, 1978) from the southern part of the Hăghimaş Syncline (East Carpathians), namely from the Trotuş Valley, upstream its confluence with the Strâmba Valley (Table 1/12).

Stokesi Zone

Typical specimens of *Amaltheus stokesi* (SOW.) have been found by Jekelius (Pl. II, Fig. 3) in the grey, slightly micaceous sandy siltstones occurring in the Fabricii Valley (Schneebrich), at Cristian-Braşov (as *Amaltheus margaritatus* MONTF. according to Jekelius, in collections; rev. Popa, 1969 b), by Patrulius (in Patrulius, Popa, 1969) (Pl. II, Fig. 1) and by Popa (Pl. II, Fig. 5) in the marly layers at the bottom of the horizon bearing silexites nodules assigned to Vadu Crişului (Apuseni Mts) Domerian occurrences (Popa in Patrulius et al., 1982), as well as in the grey-greenish organogenous-sandy detrital limestone occurrences at the bottom of the Munteana (Pl. II, Fig. 4) Domerian deposits (western South Carpathians) (Popa in Popa et al., 1977).

Margaritatus Zone

This zone has been identified in the surroundings of Braşov town (East Carpathians), in Pădurea Craiului (Apuseni Mts) and at Munteana (western South Carpathians).

The identified Ammonites of the Margaritatus Zone are: (1) *Amaltheus gloriosus* HYATT from Munteana, figured and described by Tietze (1872) as *Ammonites margaritatus* var. *muntjanae*; (2) *Protogrammoceras* sp. from Munteana (*Ammonites normanianus* D'ORB. according to Tietze, rev. by Patrulius and Popa, 1969); (3) *Amaltheus margaritatus* (MONTF.) identified (Pl. III, Fig. 1) at Munteana from grey-greenish calcareous sandstones and (4) *Pseudoamaltheus* sp. reported from the same site (Popa in Popa et al., 1977). The species *Amaltheus margaritatus* (MONTF.) has also been identified in the Domerian occurrences in the Remeţi Graben (Northern Apuseni) by Kräutner

(1939) and Pauliuc (1958) (Table 1/17).

Kräutner has also reported scarce *A. margaritatus* (MONTF.) specimens (Pl. III, Fig. 3) from the Lower Jurassic deposits at Vadu Crişului (Pădurea Craiului, where Patrulius (Patrulius et al., 1982) has also cited this species. This one has been identified by Diaconu (Diaconu, Ionescu, 1970) in the grey or yellow-rusty Valea Neagră marly limestones which exhibit silex lenses of Domerian age. Besides the above cited species, the Domerian fauna in the Pădurea Craiului Mts includes the species *Phylloceras frondosum* (REYNES), represented by a unique specimen found by Popa (1981) in the western slope of Boiului Valley. According to Szontagh, the fauna yielded by this formation (in Kräutner, 1939) seems to contain the species *Meneghiniceras lariense* (MENEGHINI) (rev. Popa, 1981), too.

The Domerian occurrences at Cristian-Braşov have also yielded a *Paltarpites* sp. (Pl. II, Fig. 6), belonging to Jekelius' collection (fide Popa, 1969 b).

Spinatum Zone

The most common species of this zone is *Pleuroceras solare* (PHYLL.) which has been identified in all the Carpathian sectors.

In the Perşani Mts (Sărăţii and Cascadelor Valleys) this species (Pl. III, Figs. 5, 6) has been yielded by the yellowish and reddish, in places ooidal limestones. These limestones crop out in the middle course of the Sărăţii Valley, up- and downstream its confluence with the Măguri Brook, as well as in two sites along the upper course of the Sărăţii Valley, on its slopes and in the thalweg, 30 m upstream the Toarcian fossiliferous site and 60 m downstream the latter (Table 1/9).

In the Cascadelor Valley, the Domerian limestones were identified in 1965 (Patrulius et al., 1966) in the river bed and on its eastern slope as far as the ridge, as the filling material of a crevasse in the Triassic dolomites. The limestones are no longer seen in the river bed, as they have been covered by a newly built road.

Other specimens of *Pleuroceras solare* (Pl. III, Fig. 4) have been supplied by the sparry sandstone complex at Cristian-Braşov (collected by Săndulescu) and by the grey encrinite limestones at Munteana (Western South Carpathians) assigned to the top of the Domerian (Pl. III, Fig. 7).

The specimen of *Pleuroceras solare* (PHILLIPS) (revised by Popa) mentioned by Codarcea [as *Pleuroceras costatus nudus* (QUENST)] in 1940 (see Năstăseanu, 1979) has been yielded by the Domerian deposits assigned to the Danubian Autochthon (Western South Carpathians). This specimen was collected by Codarcea from "the Ohaba Beds" (Presacina facies) which occur on the road that links the villages of Bogâltin and Presacina across Poiana Lungă (the springs of the Bolvaşniţa Valley). This specimen, determined initially by Jekelius ,is preserved in the G.I.R. collection, no 408.

Another species which occurs frequently in the Spinatum Zone is *Pleuroceras spinatum* (BRUG.). Specimens assigned to this species have been identified by Grasu (1971) in the Domerian occurrences in Pârâul Ghilcoş (Hăghimaş) (Table 1/40).

The richest assemblages of the Spinatum Zone have been reported from the Apuseni Mts. In the Remeţi Graben (the Fruntea Crest and Leşului Valley) (acc. to Thalmann in Kräutner, 1939; Pauliuc, 1958; Popa, 1981); in the Pădurea Craiului Mts (Vadu Crişului and Cuţilor Valley) (Patrulius in Patrulius et al., 1982); in the Someşul Cald Graben (Mantea et al., 1982); in the east of the Borod Basin (Diaconu, Ionescu, 1970); in the Crişanului Valley and Gârda Seacă Valley (Bihor Mts) (Popa in Popa et al., 1985) have been identified assemblages which contain the following species: *Pleuroceras solare* (PHILLIPS), *P. spinatum* (BRUG.), *P. hawskerense* (Y. et B.), *P. gigas* HOWARTH, *Aegoceras nautiliforme* (YOK.), *Arieticeras* spp. (Pl. III, Figs. 8-15).

Tenuicostatum Zone

This zone has been identified in several sites from the Pădurea Craiului Mts (Remeţi Graben, Coasta Cailor, Poniciori, Mnierei Valley), in the Someşul Cald Graben, at Cristian-Braşov and in the Zamoniţa Valley (Banat). The following species have been recorded: *Dactylioceras tenuicostatum* (Y. et B.) (Pl. IV, Fig. 1), *D. semicelatum* (SIMP.), *D. helianthoides* (YOK.) (western slope of the Boiului Valley, fide Popa, 1981), *Dactylioceras tenuicostatum* (Y. et B.) (Pl. IV, Fig. 2) (Mnierei Valley, Patrulius in Patrulius et al., 1982), *Dactylioceras semicelatum* (SIMP.) in Dealul Crucii (Coasta Cailor) (Patrulius, 1982) as well as in the Someşul Cald Graben (Mantea et al., 1982), *Dactylioceras* sp. aff. *D. acanthus* ORB. (in the Remeţi Graben, Popa, 1981).

The assemblage of *Dactylioceras tenuicostatum* (Y. et B.), *D.* cf. *semicelatum* SIMP., *D.* cf. *helianthoides* (YOK.) and *D.* aff. *crassulosum* SIMP. has been identified (Popa, 1970) in the Căldării Valley, at Cristian (Pl. IV, Figs. 3, 4). The species *Dactylioceras (Orthodactylites) semicelatum* (SIMPSON) (Pl. IV, Figs. 5, 6) has been identified at the bottom of the rock sequence assigned to the Toarcian in the Bigăr area (Banat), along the Zamoniţa Valley (Popa et al., 1977).

Falcifer Zone

Rich assemblages of this zone have been reported from the Apuseni Mts and the Banat region (Danubian Autochthon). In the East Carpathians has been found a single Ammonite specimen assigned to this

zone, represented by the species *Harpoceras mulgravium* Y. et B. (Pl. V, Fig. 4); it has been reported, together with *Hildoceras sublevisoni*, by I. Motaş (personal commun.) from blocks of the Miocene conglomerates occurring in the Teleajen Valley (Table 1/11).

The following species have been reported from the Pădurea Craiului Mts: *Harpoceras falciferum* (Sow.) (Remeţi Graben, Popa, 1981), *Harpoceras* sp. ex gr. *H. falciferum* Sow. and *Harpoceratoides alternatus* (Simp.) (Mnierei Valley, Patrulius, 1982) (Pl. V, Fig. 3), *Nodicoeloceras crassoides* (Simp.) (Boiului Valley, Popa, 1981) (Pl. IV, Fig. 7), *Harpoceras mulgravium* (Y. et B.) (Mnierei Valley and Vadu Crişului, Patrulius in Patrulius et al., 1982).

The following Ammonites belong to the Falcifer Zone of the Danubian Autochthon: *Harpoceras mulgravium* Y. et B., *H.* cf. *falciferum* (Sow.), *H. exaratum* Y. et B., *Hildaites* sp. aff. *H. serpentiniformis urkutensis* Geczy (recognized at Munteana, Popa in Popa et al., 1977) (Pl. IV, Figs. 8, 9; Pl.V, Figs. 1, 2); *Whitbiceras* sp. (Nievrei Valley, Popa in Popa et al., 1977); *Harpoceras* sp. (Zoina Valley, east of Bogâltin, Schafarzik, 1897, in Năstăseanu, 1979).

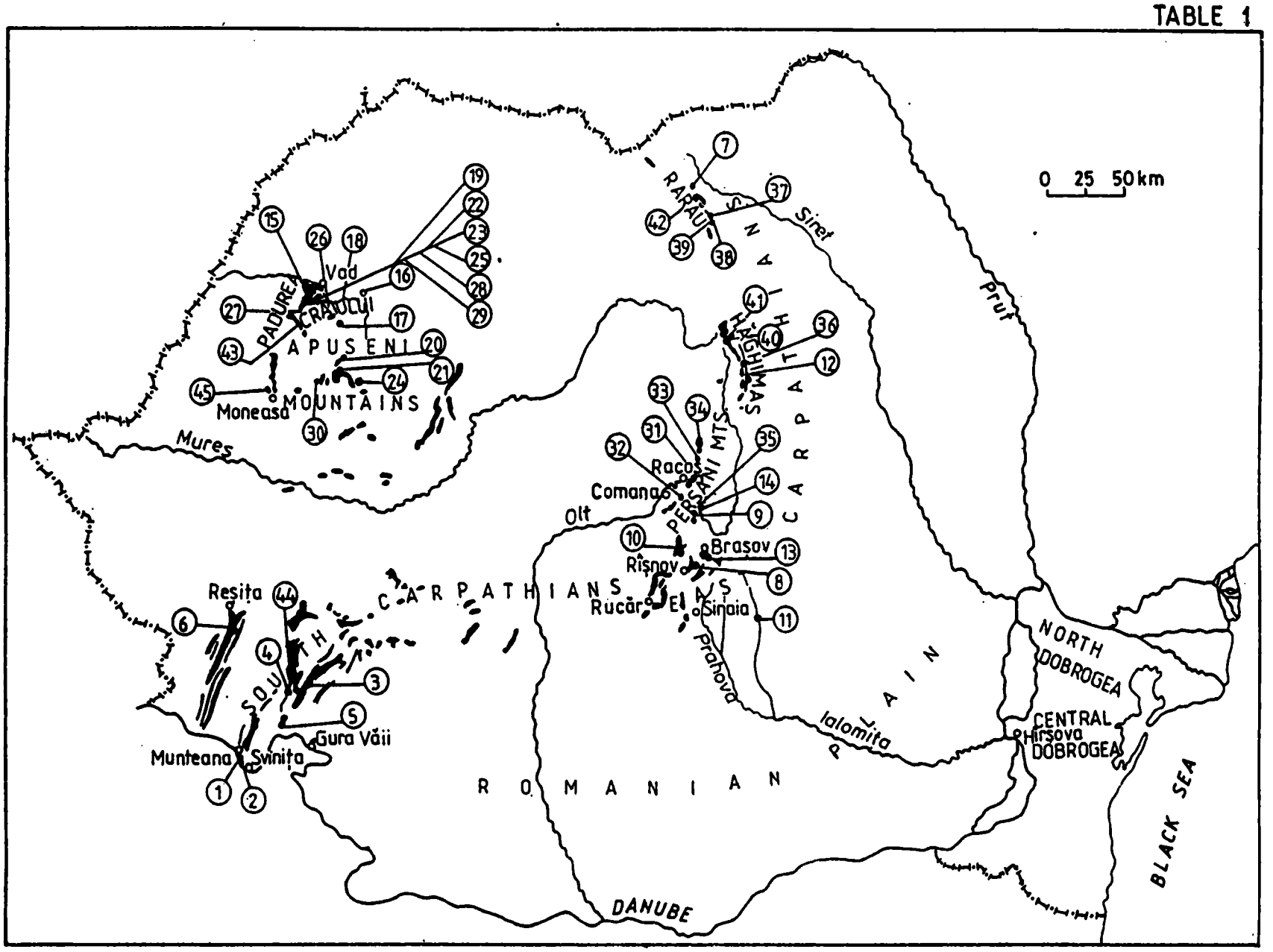
Bifrons Zone, to which are assigned: *Hildoceras bifrons* (Brug.), *H. lusitanicum* (Meister), *H. sublevisoni* (Fucini), *H. semicosta* (Buckman), *Lytoceras* sp. ex gr. *L. rhodanicum* (Monestier), *Porpoceras* sp. ex gr. *P. vortex* (Simpson), *Phymatoceras* sp. ex gr. *P. lillii* (Hauer), *Catacoeloceras* sp. ex gr. *C. jordani* (Guex) (Munteana, Pl. VII, Figs. 8, 9, 10; Pl. VIII, Figs. 1-5) (Popa in Popa et al., 1977); *Dactylioceras commune* (Sow.) and *Hildoceras* sp. (Cristian-Căldării and Cristianului Valleys) (Jekelius, 1915 and Popa, 1970), *Hildoceras sublevisoni* (Fucini) (found in blocks included in Miocene conglomerates occurring in the Teleajen Valley, collected by Motaş) (Pl. V, Fig. 6); *Hildoceras semipolitum* Buck. [as *Hildoceras bifrons* (Brug.) in Năstăseanu and Solcan, 1963, revised Patrulius, 1981] (Strâmba Valley, southernmost part of the Hăghimaş Syncline), *Peronoceras* sp. ex gr. *P. subarmatum* (Y. et B.) (Pl. V, Fig. 7) [as *Coeloceras subarmatum* (Y. et B.) in Jekelius, 1938], reported from the neighbouring areas of the Braşov town (revised Popa, 1969 b) and *Hildoceras* sp. (from Cristian, Popa, 1970); *Hildoceras sublevisoni* (Fucini), *H. bifrons* (Brug.) *H. semipolitum* Buck., *Polyplectus apenninicus* (Haas) (Remeţi Graben, Popa, 1981) (Pl. VI, Figs. 2, 3, 5, 7; Pl. VIII, Figs. 2, 3); *Hildoceras* cf. *semipolitum* Buck., *Catacoeloceras broilii* (Mitzopoulos), *Hildoceras sublevisoni* (Fucini) (Boiului Valley, Popa, 1981) (Pl. VI, Figs. 1, 6; Pl. VII, Fig. 4); *Hildoceras sublevisoni* (Fucini), *Harpoceras* sp. ex gr. *H. falciferum* (Sow.), *Dactylioceras atlethicum* (Simp.) (Mnierei Valley-Pădurea Craiului Mts, Patrulius in Patrulius et al., 1982), *H. Lusitanicum* (Meister), *Dactylioceras* sp. ex gr. *D. commune* (Sow.), *Phymatoceras* sp. (Someşul Cald Graben - Bihor Mts, Mantea et al., 1982) (Pl. VI, Figs. 10, 11; Pl. IX, Figs. 2–4); *Hildoceras lusitanicum* (Meister), *Dactylioceras atlethicum* (Simp.), *Zugodactylites* sp., *Nodicoeloceras* (?) sp. (Piatra Bulzului- Bihor Mts, Popa et al., 1985) (Pl. VII, Fig. 5; Pl. VIII, Fig. 6); *Hildoceras bifrons* (Bruguiere) (Pregusului Valley - Pădurea Craiului, Patrulius in Patrulius et al., 1982) (Pl. VI, Fig. 4); *Hildoceras sublevisoni* (Fucini), *Dactylioceras atlethicum* (Simp.), *Zugodactylites* sp., *Nodicoeloceras* sp. (Crişanului Valley - Bihor Mts, Popa et al., 1985) (Pl. VII, Figs. 6, 7), *Hildoceras semipolitum* Buck., *H. bifrons* (Brug.), *Peronoceras* sp. ex gr. *P. fibulatum* (Sow.), *Zugodactylites* sp. ex gr. *Z. braunianus* (Orb.) (Coasta Cailor - Pădurea Craiului, Patrulius in Patrulius et al., 1982) (Table 1).

Variabilis Zone to which are assigned: *Brodieia* sp. aff. *clausum* Merla (Boiului Valley - Pădurea Craiului, Popa, 1981) (Pl. IX, Fig. 5); *Haugia illustris* (Denckmann) and *Pseudolioceras* cf. *gradatum* Buck. (Piatra Arsă Peak and Alunul Mare Valley - Someşul Cald Graben, Mantea et al., 1982) (Pl. IX, Figs. 8, 9); *Pseudomercaticeras* aff. *frantzi* (Reynes) and *Denckmannia* ? sp. (Piatra Bulzului - Bihor Mts, Popa et al., 1985); *Brodieia* cf. *bayani* Dum. (Poniciori - Pădurea Craiului, Patrulius in Patrulius et al., 1982); *Phymatoceras narbonense* (Buck.) and *Catacoeloceras* sp. ex gr. *C. crassum* Phill. (Vălăul Rece and Vălăul Preguzului - Pădurea Craiului, Patrulius in Patrulius et al., 1982); *Haugia (Haugia)* sp. (Crişanului Valley, Bihor Mts, Popa et al., 1985) (Pl. IX, Figs. 6, 7); *Pachylytoceras jurense* (Ziet.) (Munteana - Banat, Răileanu, 1960).

Thouarsense Zone to which are assigned: *Grammoceras thouarsense thouarsense* (d'Orb.), *Pseudogrammoceras fallaciosum* (Bayle), *P. latescens* (Simpson), *Pseudolioceras compactile* (Simpson), *Polyplectus pluricostatus* (Haas), *Polyplectus discoides* (Zieten), *Lobolytoceras* aff. *siemensi* (Denckmann), *Denckmannia* sp. (Sărăţii Valley - Perşani Mts, Popa, 1967) (Pl. X, Figs. 1, 2, 7; Pl. XI, Figs. 1-7; Pl. XII, Figs. 1-4); *Grammoceras thouarsense thouarsense* (d'Orb.), *Pseudogrammoceras fallaciosum* (Bayle), *Phymatoceras comensis* (v. Buch) (Lucava Valley - Rarău, Stănoiu, 1967; Patrulius et al., 1982); *Pseudogrammoceras struckmanni* (Denk.) (Codlea - collection Vâlceanu rev. Patrulius); *Pseudogrammoceras fallaciosum* (Bayle) (as *P. cotteswoldiae* Buckm.) (Izvoru Malului Valley - Rarău, Turculeţ, 1971 in Patrulius et al., 1981); *Pseudogrammoceras fallaciosum* (Bayle) (Munteana - Banat, Popa et al., 1977) (Pl.

LOCATION OF MAIN FOSSILIFEROUS SITES YIELDING LOWER JURASSIC AMMONITES IN THE ROMANIAN CARPATHIANS

TABLE 1



1 Munteana (South Carpathians)
2 Zamonița Valley
3 Nievra Valley
4 Poiana Lungă
5 Belareca Valley
6 Reșița
7 Lucava Valley (Rarău Massif)
8 Cristian
9 Sărății Valley (Perșani Mountains)
10 Codlea
11 Teleajen Valley
12 Strîmba Valley, Trotuș Valley (Hăghimaș Massif)
13 Brașov
14 Cascade Valley (Persani)
15 Plaiul Marcheș (Pădurea Craiului)
16 Borod Basin
17 Remeti Graben
18 Boiu Valley (Pădurea Craiului)
19 Mnierei Valley (Pădurea Craiului)
20 Someșul Cald Graben (Bihor Mountains)
21 Piatra Bulzului (Bihor Mountains)
22 Poniciori (Pădurea Craiului)
23 Vâlăul Preguzului-Vâlăul Rece (Pădurea Craiului)
24 Crișanului Valley-Gîrda Valley (Bihor Mountains)
25 Coasta Cailor (Pădurea Craiului)
26 Vadu Crișului (Pădurea Craiului)
27 Cuților Valley (Pădurea Craiului)
28 Peștireului Valley (Pădurea Craiului)
29 Ponița (Pădurea Craiului)
30 Valea Mare (Bihor Mountains)
31 Tepei Valley and its tributaries (Perșani Mountains)
32 Stanciului Valley (Perșani Mountains)
33 Pietrele Albe (Perșani Mountains)
34 Dealul Meghieș (Perșani Mountains)
35 Dealul Negru (Perșani Mountains)
36 Curmătura (Hăghimaș Massif)
37 Dealul Prașca (Rarău Massif)
38 Valea Izvoru Malului (Rarău Massif)
39 Piatra Zimbrului (Rarău Massif)
40 Pârâul Ghilcoș (Hăghimaș Massif)
41 Pârâul Suhardu (Hăghimaș Massif)
42 Pojorâta anticline (Rarău Massif)
43 Dealul Tabla Bușii (Pădurea Craiului)
44 Culmea Mica (A slope of the Zoina Valley-Bogîltin)
45 Surroundings of Moneasa (Codru Mountains)

LOWER JURASSIC AMMONITES IN ADNET FACIES

ELENA POPA and D. PATRULIUS Lower Jurassic Ammonites in the Romanian Carpathians

TABLE 2

		STANDARD ZONES	EAST CARPATHIANS — TRANSYLVANIAN NAPPE SYSTEM — PERŞANI MOUNTAINS				HAGHIMAŞ SYNCLINE	RARĂU SYNCLINE
PLIENSBACHIAN	CARIXIAN	Jamesoni	*Uptonia jamesoni* (J. de C. Sow.) (31)					
SINEMURIAN	UPPER	Raricostatum	*Echioceras aff. rhodanicum* (Dum.) *Echioceras raricostatum* (Ziethen) *Paltechioceras sp. aff. P. aplanatum* (Hyatt) (39) *Leptechioceras sp.* *Epideroceras sp. aff. E. loriali* (Hug.) *Zetoceras banarelli* (Bettoni)	*Partschiceras meneghinii* Gemm *Calliphylloceras anatolicum* Meister *Calliphylloceras bicicolae* (Menegh.) *Calliphylloceras cf. emeryi* (Betoni) *Paradasyceras planispira* (Reynès) *Meneghiniceras libertus* (Gemm) (33)			*Echioceras raricostatoides* (Vadasz) *Asteroceras stellare* (Sow.) *Paradasyceras uermoesense* (Herb.) *Juraphyllites transylvanicus* (Hauer) *Schistophylloceras lunense* (Di Stef.) *Schistophylloceras aulonotum* (Herb.) *Geyercceras cylindricum breizii* (Herb.) *Geyeroceras personense* (Herb.) *Geyeroceras leptophylium* (Hauer) *Geyeroceras cylindricum complanatum* Fuc. *Partschiceras cf. tenuistriatum* (Menegh.) *Calliphylloceras dubium* (Fuc.) *Calliphylloceras silvestre* (Herb.) (38)	*Partschiceras parischi* (Stur.) *Geyeroceras personense* (Herbich) *Paradasyceras planispira* (Reynès) *Harpophylloceras bucovnicus* (Uhlig) *Meneghiniceras gardi* (Menegh.) *Lytoceras aff. scernendum* Di Stef. *Microderoceras keindli* (Emmr.) *Gleviceras subguibalianum* Pia *Paltechioceras ramanicus* (Uhlig) *Paltechioceras spp.* *Echioceras raricostatum* (Ziet.) *Zetoceras zetes* Orb. *Oxynoticeras cf. oxynotum* (Quenst.) (37)
		Oxynotum	Se presupune că există continuitate					
		Obtusum	*Asteroceras cf. suevicum* (Quenst.) *Asteroceras spp.* (31)	*Arnioceras semicostatum propinquum* Fucini *Arnioceras ceras* Hyatt *Arnioceras cf. obliquecostatum* (Ziethen) *Arnioceras hortmanni* (Oppel) *Arnioceras cf. dimorphum* Parona *?Arnioceras speciosum* Fucini *Arnioceras rejectum* Fucini *Arnioceras subrejectum* (Vadasz) *Arnioceras pseudospirolis* (Vadasz) *Arnioceras carenatus antiquus* (Vadasz) *Arnioceras semilaeve* Hauer *Arnioceras sp. cf. ceratitoides* (Quenst.) *Futamioceras althi* (Herbich) (37)	*Adnethiceras sp. aff. A. adnethicum* Hauer (31)			
	LOWER	Turneri Semicostatum Bucklandi	*Paracoloceras centauroides* (Savi et Meneg.) *Caenisites sp., Arietites sp.* *Metophioceras spp.* *Coroniceras sp.; Paracoroniceras sp.* *Arnioceras spp.; Euagassiceras sp.* *Agassiceras scipionianum* (Orb.) *Metophioceras sp.* *Coroniceras lyra* Hyatt *Euagassiceras sp.* *Arnioceras spp.* (31) (35)	*Juraphyllites transylvanicus* (Hauer) *Juraphyllites gigas* (Fucini) *Geyeroceras cylindricum* (Sow.) *Geyeroceras leptophyllum* (Hauer) *Geyeroceras personense* (Herbich) *Geyeroceras oenotrium* (Fucini) *Geyeroceras szadeczkyi* (Vadasz) *Geyeroceras hungaricum* (Vadasz) *Geyeroceras prinzi* (Vadasz) *Ectocentrites alutae* (Herbich) *Dasyceras rakosense* (Herbich) *Paradasyceras uermoesense* (Herbich) *Paradasyceras tenuilobata* Râileanu *Paradasyceras lunense* (Di Stef.) *Tragolytoceras herbichi* (Bon.) *Tragolytoceras uitecinctum* (Hauer) *Tragolytoceras (?) simplex* (Vadasz) *Pleuroacanthites biformis* (Sow.) *Anolytoceras sp.* *Phylloceras lipoldi* (Hauer) *Calliphylloceras sylvestre* (Herb.) *Calliphylloceras dubium* (Fucini) (31)	*Calliphylloceras sylvestre* (Herbich) *Geyeroceras cylindricum* (J. Sow.) *Juraphyllites gigas* (Fucini) *Ectocentrites petersi* (Hauer) *Aegolyloceras sp.* *Arnioceras sp.* *Schlotheimia sp.* *Charmasseiceras marmoreum* (Oppel) (32)	*Paradasyceras uermoesense* (Herbich) *Ectocentrites (Cosmolytoceras) canavari* (Bonarelli) *Charmasseiceras sp.* *Epammonites (?) sp.* *Arnioceras spp.* (34)	*Caenisites furreri* (J. de C. Sow.) *Promicroceras planicosta* (Sow.) *Euagassiceras sauzeanum* (Orb.) *Arnioceras mendax rarepicatus* Fucini *Tmaegoceras crassiceps* Pom. *Arietites bisulcatus* (Brug.) *Paracoloceras cf. coregonense* (Sow.) *Charmasseiceras marmoreum* (Oppel) *Charmasseiceras charmassei* (Orb.) *Metophioceras longidomus* (Quenst.) (36)	*Euagassiceras sauzeanum* (d'Orb.) (38)
HETTANGIAN	UPPER	Angulata	*Schlotheimia montana* Wähner *Schlotheimia pachygaster* (Suttner) *Schlotheimia exechoptycha* Wähner n. spp. *Schlotheimia sp. aff. extranodosa* (Wähner) *Schlotheimia sp. ex gr. stenorhyncha* Longe *Charmasseiceras marmoreum* (Oppel) (31) (32)				*Schlotheimia angulata* (Schloth.) *Schlotheimia cf. donar* Wähner *Schlotheimia trapezoidalis* (Sow.) *Ectocentrites petersi* (Hauer) (36)	*Schlotheimia sp.* (39)
	MIDDLE	Liasicus	*Waehneroceras toxophorum* (Wähner) *Waehneroceras sp. ex. gr. W. portlocki* (Wright) *Waehneroceras sp. ex. gr. W. anisophyllum* (Wähner) *Franziceras sp. aff. F. ruidum* Buckman (31)				*Waehneroceras (Negastomoceras) cf. megastoma* (Gümbel) *Waehneroceras (Negastomoceras) cf. anisophyllum* (Waehner) (36)	
	LOWER	Planorbis					*Coloceras johnstoni* Sow. (36)	

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LOWER JURASSIC AMMONITES IN GRESTEN FACIES

		STANDARD ZONATION WITH AMMONITES	LOCAL AMMONITE ZONATION — CARPATHIAN AREA — SOUTH-WESTERN CARPATHIANS — DANUBIAN REALM	GETIC REALM	EAST CARPATHIANS	APUSENI MOUNTAINS — BIHOR AUTOCHTHON	CODRU NAPPE SYSTEM — FINIŞ NAPPE	CODRU NAPPE SYSTEM — VALANI NAPPE
TOARCIAN								
		Levesquei			*Pleydellia aalensis* (Zieten) ③ *Dumortieria levesquei* (d'Orb.) *Hammatoceras cf. insigne* (Zieten) ⑩ *Hammatoceras sp.* ⑨	*Pleydellia costulata* (Ziet) *Pleydellia subcompta* (Branco) *Pleydellia cf. aalensis* (Ziet) *Pleydellia cf. distans* (Buck) *Dumortieria cf. exacta* Buck *Dumortieria sp. ex gr. D. diphyes* Buck *Dumortieria sp. ex gr. D. costula* (Rein) *Dumortieria sp. ex gr. D radians* (Rein) *Pleydellia sp. Dumortieria sp.* ⑭ ⑮		
		Thouarsense	*Pseudogrammoceras fallaciosum* (Bayle) ① *Grammoceras aff striatulum* (Sow.) ③		*Pseudogrammoceras fallaciosum* (Bayle) ⑨ ⑦ ⑤ *Pseudogrammoceras struckmanni* (Denk.) ⑥ *Pseudogrammoceras latescens* (Simpson) ⑨ *Grammoceras thouarsense thouarsense* (d'Orb) ⑨ ⑦ *Pseudolioceras compactile* (Simpson) ⑨ *Polyplectus pluricostatus* (Haas) ⑨ *Polyplectus discoides* (Zieten) ⑨ *Phymatoceras comensis* (V Buch.) ⑦ *Lobolytoceras aff siemensi* (Denckmann) ⑨ *Denckmannia sp* ⑨	*Pseudogrammoceras fallaciosum* (Bayle) ⑰ ⑱ *Pseudogrammoceras doerntense* (Denck) ⑰ ⑫ *Pseudogrammoceras struckmanni* (Denck) ⑰ ㉑ ㉔ *Pseudogrammoceras quadratum* Quenst ⑭ *Catacoeloceras dumortieri* Maubeuge ⑮ *Pseudogrammoceras cf saemanni* (Dum.) ⑭ *Pseudogrammoceras cf latescens* (Simp.) ㉓ *Polyplectus pluricostatus* (Haas.) ㉕ *Grammoceras striatulum* (Sow.) ㉒ *Grammoceras thouarsense thouarsense* (d'Orb.) ⑳ ⑰ ㉖ *Osperlioceras bicarinatum* (Zieten) ㉘ *Subcollina yeovilensis* Spath. ㉗		
		Variabilis	*Pachylytoceras jurense* (Ziet) ①			*Brodieia sp aff clausum* Merla ⑯ *Brodieia cf. bayani* Dum. ⑫ *Catacoeloceras sp. ex gr. C. crassum* Phill. ⑬ *Haugia illustris* (Denckmann) ⑭ *Phymatoceras narbonense* (Buck.) ⑫ *Pseudomercaliceras aff frantzi* (Reynes) ⑳ *Pseudolioceras cf. gradatum* (Buck.) ⑫ *Denckmannia ? sp.* ⑳ *Haugia (Haugia) sp.* ㉒		
		Bifrons	*Hildoceras bifrons* (Brug) *Hildoceras lusitanicum* (Meister) *Hildoceras sublevisoni* (Fucini) *Hildoceras semicosta* (Buckman) *Lytoceras sp ex gr. L. rhodanicum* (Monestier) *Porpoceras sp. ex gr. P. vortex* (Simpson) *Phymatoceras sp. ex gr P. lilii* (Hauer) *Catacoeloceras sp. ex gr. C. jordani* (Guex) ①	*Hildoceras bifrons* (Brug) ⑥	*Hildoceras sublevisoni* (Fucini) ⑪ *Hildoceras semipolitum* Buck ⑫ *Dactylioceras commune* (Sow.) ⑧ *Peronoceras sp. ex. gr. P. subarmatum* (Yet B.) ⑬ *Hildoceras sp* ⑨	*Polyplectus apenninicus* (Haas) ⑰ *Hildoceras semipolitum* Buck. ⑨ ⑰ ⑫ *Catacoeloceras cf broilii* (Mitzopoulos) ⑨ *Hildoceras bifrons* (Brug.) ⑰ ㉑ ㉔ *Hildoceras sublevisoni* (Fucini) ⑰ ⑨ ⑫ ㉔ *Hildoceras lusitanicum* (Meister.) ㉑ ㉔ *Dactylioceras athleticum* (Simp) ⑪ ⑭ ⑯ *Dactylioceras sp. ex gr. D. commune* (Sow) *Phymatoceras sp.* ⑳ *Peronoceras sp ex gr P fibulatum* (Sow.) ⑫ *Zugodactylites sp gr Z. braunianus* (Orb.) ⑫ *Zugodactylites sp. Nodicoeloceras (?) sp.* ㉑ ㉒		
		Falcifer	*Harpoceras mulgravium* Young et Bird. *Harpoceras cf. falciferum* (Sow.) *Harpoceras exaratum* Young et Bird. *Hildaites sp aff H serpentiniformis urcutensis* Geczy ① *Whitbiceras sp.* ③ *Harpoceras sp.* ⑫		*Harpoceras mulgravium* Yet B. ⑩	*Nodicoeloceras crassoides* (Simp.) ⑨ *Nodicoeloceras sp.* ⑫ *Harpoceras mulgravium* (Yet B) ⑨ ⑭ *Harpoceratoides alternatus* (Simp.) ⑨ *Harpoceras falcifer* (Sow.) ⑰ *Harpoceras sp. ex gr. H. falcifer* (Sow) ⑫		
		Tenuicostatum	*Dactylioceras (Orthodactylites) semicelatum* (Simpson) ②		*Dactylioceras tenuicostatum* (Yet B) *Dactylioceras cf. semicelatum* Simp. *Dactylioceras cf. helianthoides* Yok *D. aff crassulosum* Simp. ⑧	*Dactylioceras tenuicostatum* (Yet B) ⑭ ⑮ *Dactylioceras semicelatum* (Simp) ⑮ ⑭ ⑭ *Dactylioceras helianthoides* (Yok.) ⑭ *Dactylioceras' sp. aff. D acanthus* Orb. ⑰		
PLIENSBACHIAN	DOMERIAN	Spinatum	*Pleuroceras solare* (Phyll) ① *Pleuroceras solare* (Phyll) [*sub Pleuroceras costatus nudus* (Quenst] ④		*Pleuroceras solare* (Phillips) ⑨ ⑧ *Pleuroceras spinatum* (Brug.) ④	*Pleuroceras hawskerense* (Yet B) ㉔ *Pleuroceras gigas* Howarth ㉔ *Pleuroceras solare* (Phillips) ⑰ ㉔ ㉔ ㉔ ㉔ *Pleuroceras spinatum* (Brug.) ⑰ ⑰ ㉔ *Aegoceras nautiliforme* (Buck) ㉔ *Arieticeras sp.*		
		Margaritatus	*Amaltheus margaritatus* De Montfort *Amaltheus gloriosus* Hyatt *Protogrammoceras sp.* *Pseudamaltheus sp.* ①		*Amaltheus margaritatus* (Montf.) ⑧ *Paltarpites sp.* ⑧	*Amaltheus margaritatus* Montf ⑰ ㉔ ㉔ *Phylloceras frondosm* (Reynes) ㉔		
		Stokesi	*Amaltheus stokesi* (Sow) ①		*Amaltheus stokesi* (Sow.) ⑩	*Amaltheus stokesi* (Sow.) ㉔		
	CARIXIAN	Davoei	*Aegoceras capricornu* (Schlatheim) *Liparoceras (Becheiceras) bechei* (Sow.) ①		*Aegoceras capricornu* (Schlotheim) ⑭ *Liparoceras (Becheiceras) cf. bechei* (Sow.) ⑫	*Androgynoceras sp ex gr A hybridiforme* Spath ⑰ *Aegoceras sp* ㉔		*Tropidoceras sp.*
		Ibex	*Tropidoceras masseanum* (Orb.)		*Liparoceras sp.* ⑬ *Androgynoceras sp. aff. hybrida* (d'Orb.) ⑫	*Beaniceras luridum* (Simp.) ⑰ *Tropidoceras masseanum* (Orb.) ㉒		
		Jamesoni	*Acanthopleuroceras rursicosta* (Buckman) ① *Platypleuroceras cf. brevispina* (Sow.) ⑤			*Uptonia jamesoni* (Sow) ㉔ ㉔ ㉔		
SINEMURIAN	UPPER	Raricostatum Oxynotum Obtusum	*Promicroceras cf. planicosta* (Sow) ④					
	LOWER	Turneri Semicostatum Bucklandi			*Angulaticeras lacunatum* (Buckman) ⑧	*Arietites bucklandi* (Sow) ㉓	*Arnioceras sp ex gr A. semicostatum* (Yet B) ⑭ *Agassiceras sp. aff. Ascipionianum* (Orb.) ⑭ *Arietites bisulcatus* Brug ⑭ *Coroniceras sp.* ⑭	
HETTANGIAN		Angulata Liasicus Planorbis						

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XIII, Fig. 5); *Grammoceras* aff. *striatulum* (Sow.) (Bogâltin Beds, Nievrei Valley - Banat, Năstăseanu, 1979); *Grammoceras* sp. ex gr. *G. thouarsense thouarsense* (d'Orb.), *Pseudogrammoceras fallaciosum* Bayle, *P.* cf. *doerntense* (Denck.) (Remeţi Graben - Pădurea Craiului, Popa, 1981) (Pl. X, Fig. 4; Pl. XII, Fig. 8; Pl. XIII, Figs. 1, 4); *Pseudogrammoceras fallaciosum* (Bayle), *P. quadratum* Quenst., *P.* cf. *saemanni* (Dum.), *Polyplectus pluricostatus* (Haas) (Boiului Valley, Pădurea Craiului, Popa, 1981) (Pl. X, Fig. 6; Pl. XIII, Figs. 1, 4; Pl. XIV, Fig. 4); *Pseudogrammoceras fallaciosum* Bayle (Birtinului Valley - Pădurea Craiului, and the east of the Borod Basin, col. Popa) (Pl. XII, Fig. 7; Pl. XIV, Fig. 2); *Pseudogrammoceras struckmanni* (Denck.), *Catacoeloceras dumortieri* Maubeuge, *Subcollina yeovilensis* Spath. (Mnierei Valley - Pădurea Craiului, Patrulius in Patrulius et al., 1982); *Pseudogrammoceras struckmanni* (Denck.), *Grammoceras thouarsense thouarsense* (d'Orb.) (Someşul Cald Graben - Bihor Mts, Mantea et al., 1982) (Pl. XIII, Figs. 2, 3); *Pseudogrammoceras struckmanni* (Denck.), *Grammoceras thouarsense thouarsense* (d'Orb.), *Osperlioceras bicarinatum* (Zieten); *Pseudogrammoceras* cf. *latescens* (Simp.) (Piatra Bulzului, Bihor Mts, Popa et al., 1985) (Pl. IX, Fig. 10; Pl. X, Fig. 5; Pl. XIII, Fig. 6; Pl. XIV, Fig. 1); *Pseudogrammoceras doerntense* (Denck), *Grammoceras striatulum* (Sow.) (Poniciori, Pădurea Craiului, Patrulius in Patrulius et al., 1982).

Levesquei Zone to which are assigned: *Dumortieria levesquei* (d'Orb.) and *Hammatoceras insigne* (Zieten) (Cristian - Braşov, Jekelius, 1915; see Popa, 1970); *Pleydellia aalensis* (Zieten) (north-eastern slope of the Pojorâta Anticline - Rarău, Turculeţ, 1971); *Hammatoceras* sp. (Sărăţii Valley - Perşani Mts, Popa, 1967).

In the Bihor Autochthon (Plaiul Marcheş) are reported (Patrulius, in Patrulius et al., 1982) the zones Pseudoradiosa and Aalensis (corresponding to the Levesquei Zone on zonal diagram elaborated by Dean et al. (1961) for the north-west European province) to which the following assemblage is assigned: *Pleydellia costulata* (Ziet.), *P. subcompta* (Branco), *P.* cf. *aalensis* (Ziet.), *P.* cf. *distans* (Buck.), *Dumortieria* cf. *exacta* Buck., *D.* sp. ex gr. *D. diphyes* Buck., *D.* sp. ex gr. *D. costula* (Rein.), *D.* sp. ex gr. *D. radians* (Rein.).

Pleydellia sp., *Dumortieria* sp. and *Hammatoceras* sp. specimens belonging to the Levesquei Zone (Popa, 1967, 1981) have been identified in the Boiului Valley (Pădurea Craiului), in the Sărăţii Valley (Perşani Mts) and in the eastern area of the Borod Basin (Pl. XIV, Figs. 5-7).

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Plate I

Fig. 1 — *Angulaticeras lacunatum* (BUCKMAN), Lower Sinemurian, Cristian - Braşov. Col. E. Jekelius. Rev. Elena Popa (x 2)

Fig. 2 — *Uptonia jamesoni* (J. de C. SOW.), Carixian, Jamesoni Zone. Boiului Valley, Pădurea Craiului. Col. Elena Popa (x 0,6)

Fig. 3 — *Acanthopleuroceras rursicosta* BUCKMAN, Carixian, Jamesoni Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

Fig. 4 — *Aegoceras* sp., Carixian. Vadu Crişului, Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 5 — *Tropidoceras masseanum* (ORB.), Carixian, Ibex Zone. Munteana - Banat. Col. Elena Popa (x 1)

Figs. 6–9 — *Beaniceras luridum* (SIMPS.), Carixian, Ibex Zone. Leşului Valley - Pădurea Craiului. Col. Elena Popa. Figs. 6 and 7 (x 1); figs. 8 and 9 (x 1,8)


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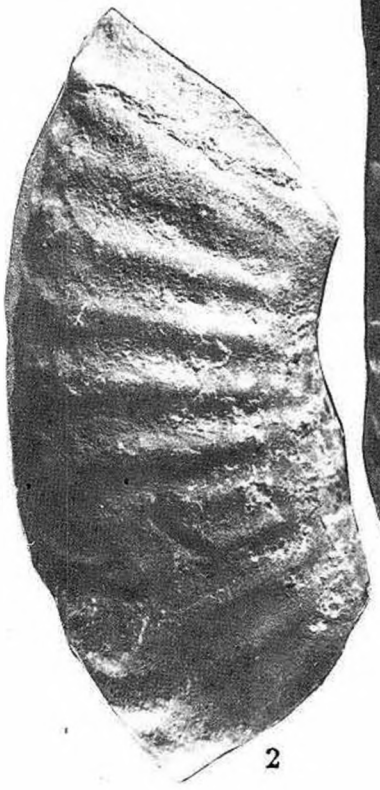
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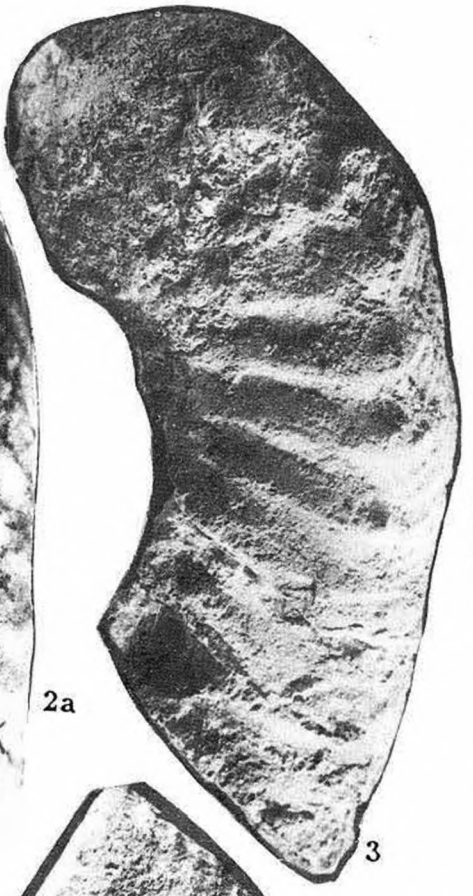
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Plate II

Fig. 1 — *Tropidoceras masseanum* (ORB.), Carixian, Ibex Zone. Gârda Seacă - Bihor Mts. Col. G. Mantea. Det. Elena Popa (x 1)

Fig. 2 — *Aegoceras capricornu* (SCHLOTHEIM), Carixian, Davoei Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

Fig. 3 — *Amaltheus stokesi* (SOWERBY), Domerian, Stokesi Zone. Braşov. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 4 — *Amaltheus stokesi* (SOWERBY), Domerian, Stokesi Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

Fig. 5 — *Amaltheus stokesi* (SOWERBY), Domerian, Stokesi Zone. Vadu Crişului - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 6 — *Paltarpites* sp., Domerian. Braşov. Col. E. Jekelius. Det. D. Patrulius & Elena Popa (x 0,3)

Fig. 7 — *Amaltheus margaritatus* (MONTF.), Domerian, Margaritatus Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

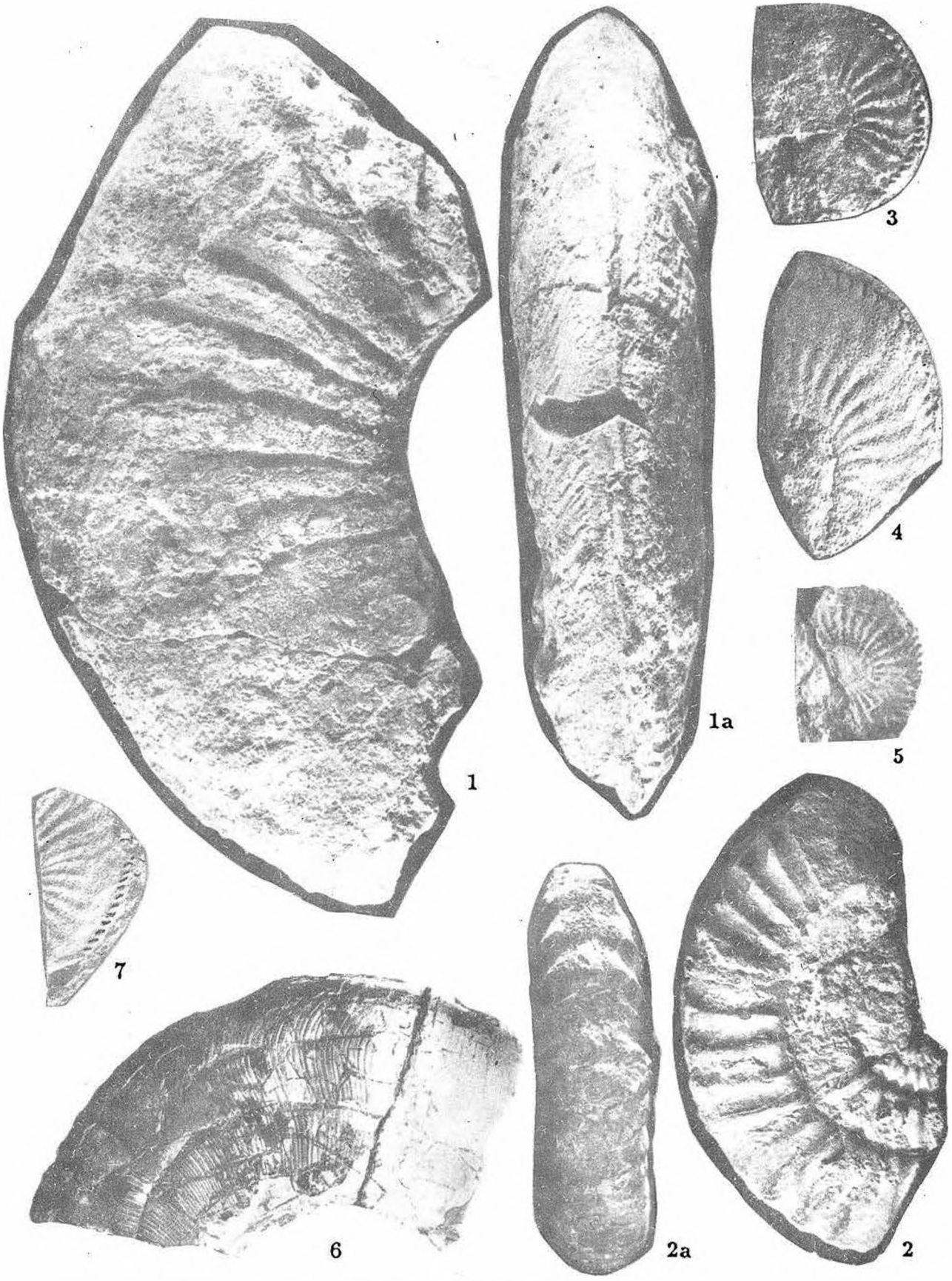
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Plate III

Fig. 1 — *Amaltheus margaritatus* (MONTF.), Domerian, Margaritatus Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

Fig. 2 — *Phylloceras frondosum* (REYNES), Domerian, Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 3 — *Amaltheus margaritatus* (MONTF.), Domerian, Margaritatus Zone. Vadu Crişului - Pădurea Craiului. Col. Th. Kräutner (x 1)

Fig. 4 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Cristian - Braşov. Rec. M. Săndulescu. Col. and det. Elena Popa (x 1)

Fig. 5 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa (x 1)

Fig. 6 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Cascadelor Valley - Perşani Mts. Col. Elena Popa (x 1)

Fig. 7 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Munteana - Banat. Col. Elena Popa (x 1)

Figs. 8 and 9 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Leşului Valley - Pădurea Craiului. Col. Elena Popa. Fig. 8 (x 2); fig. 9 (x 1)

Fig. 10 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Vadu Crişului - Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 11 — *Pleuroceras spinatum* (BRUGUIÈRE), Domerian, Spinatum Zone. Vadu Crişului - Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 12 — *Pleuroceras spinatum* (BRUGUIÈRE), Domerian, Spinatum Zone. Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 13 — *Pleuroceras hawskerense* (YOUNG et BIRD), Domerian, Spinatum Zone. Ponor Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

Fig. 14 — *Pleuroceras solare* (PHILLIPS), Domerian, Spinatum Zone. Ruginii Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

Fig. 15 — *Pleuroceras gigas* HOWARTH, Domerian, Spinatum Zone. Onceasa Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

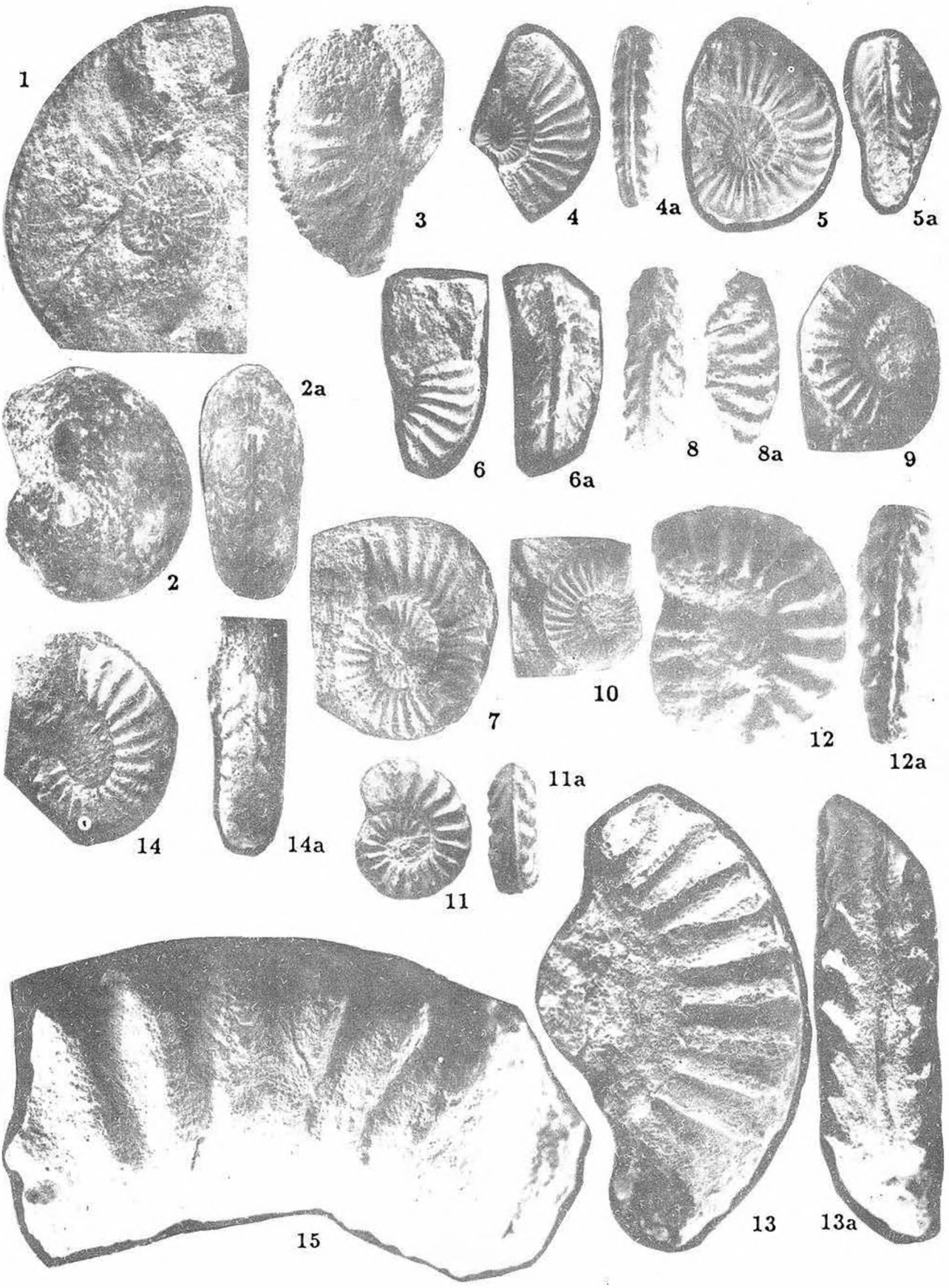
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Plate IV

Fig. 1 — *Dactylioceras tenuicostatum* (Y. et B.), Toarcian, Tenuicostatum Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 2 — *Dactylioceras tenuicostatum* (Y. et B.), Toarcian, Tenuicostatum Zone. Mnierei Valley - Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 3 — *Dactylioceras tenuicostatum* (Y. et B.), Toarcian, Tenuicostatum Zone. Căldării Valley - Cristian, Braşov. Col. Elena Popa (x 1)

Fig. 4 — *Dactylioceras* cf. *semicelatum* (SIMPSON), Toarcian, Tenuicostatum Zone. Căldării Valley - Cristian, Braşov. Col. Elena Popa (x 1)

Fig. 5 — *Dactylioceras semicelatum* (SIMPSON), Toarcian, Tenuicostatum Zone. Zamoniţa Valley - Banat. Col. Elena Popa (x 1,2)

Fig. 6 — *Dactylioceras* cf. *semicelatum* (SIMPSON), Toarcian, Tenuicostatum Zone. Zamoniţa Valley - Banat. Col. Elena Popa (x 1,2)

Fig. 7 — *Nodicoeloceras crassoides* (SIMPSON), Toarcian, Falcifer Zone, Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 8 — *Hildaites* sp., aff. *H. serpentiniformis urkutensis* GÉCZY, Toarcian, Falcifer Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 9 — *Harpoceras mulgravium* YOUNG et BIRD, Toarcian, Falcifer Zone. Munteana - Banat. Col. Elena Popa (x 0,6)

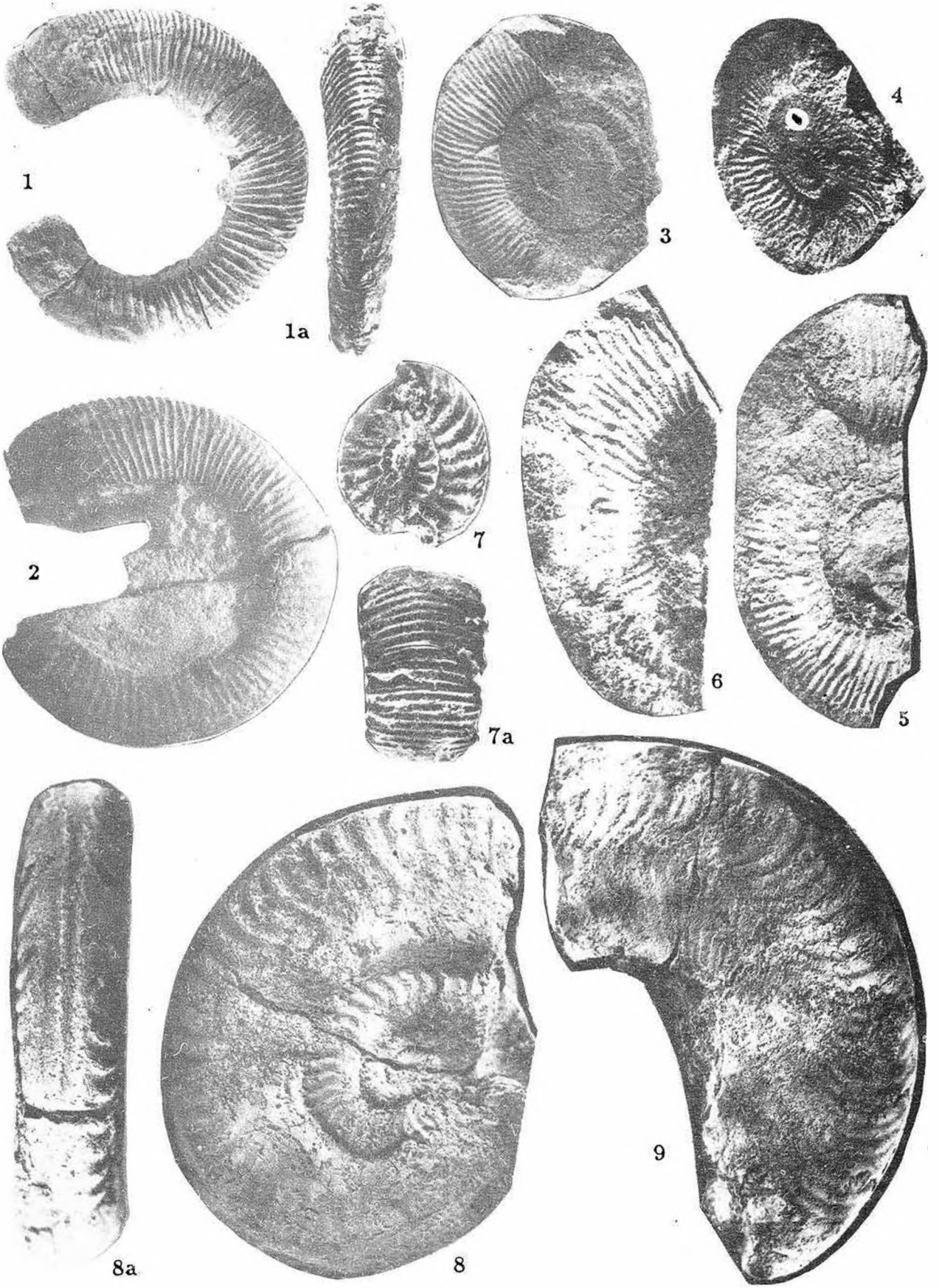
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Plate V

Fig. 1 — *Harpoceras exaratum* (YOUNG et BIRD), Toarcian, Falcifer Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 2 — *Harpoceras* cf. *falciferum* (SOWERBY), Toarcian, Falcifer Zone. Munteana - Banat. Col. Elena Popa (x 0,6)

Fig. 3 — *Harpoceras* sp., ex gr. *H. falciferum* (SOWERBY), Toarcian, Falcifer Zone. Mnierei Valley - Pădurea Craiului. Col. D. Patrulius (x 1)

Fig. 4 — *Harpoceras mulgravium* YOUNG et BIRD, Toarcian, Falcifer Zone. Teleajenului Valley. Col. I. Motaş (x 1)

Fig. 5 — *Hildoceras sublevisoni* FUCINI, Toarcian, Bifrons Zone. Mnierei Valley - Pădurea Craiului. Col. Th. Kräutner. Det. Elena Popa (x 1)

Fig. 6 — *Hildoceras sublevisoni* FUCINI, Toarcian, Bifrons Zone. Teleajenului Valley. Col. I. Motaş (x 1)

Fig. 7 — *Peronoceras* sp., ex gr. *P. subarmatum* (YOUNG et BIRD), Toarcian, Bifrons Zone. Braşov (Hinter der Graft). Col. E. Jekelius (x 1)


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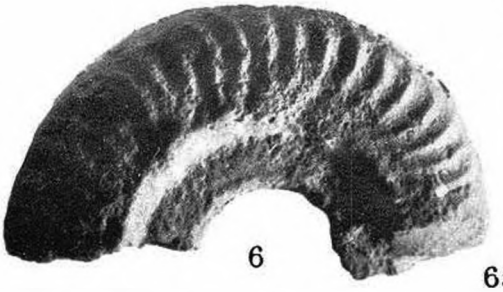
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Plate VI

Fig. 1 — *Catacoeloceras* cf. *broilii* (MITZOPOULOS), Toarcian, Bifrons Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Figs. 2 and 3 — *Hildoceras bifrons* (BRUGUIÈRE), Toarcian, Bifrons Zone. Bisericii Valley - Remeţi Graben. Col. Elena Popa (x 1)

Fig. 4 — *Hildoceras bifrons* (BRUGUIÈRE), Toarcian, Bifrons Zone. Pregusului Valley - Pădurea Craiului. Col. S. & J. Bordea. Det. D. Patrulius (x 1)

Fig. 5 — *Polyplectus appeninicus* (HAAS), Toarcian, Bifrons Zone. Bisericii Valley - Remeţi Graben. Col. Elena Popa (x 0,4)

Figs. 6 and 7 — *Hildoceras* cf. *semipolitum* BUCKMAN, Toarcian, Bifrons Zone. Fig. 6 - Boiului Valley, Pădurea Craiului; fig. 7 - Bisericii Valley, Remeţi Graben. Col. Elena Popa (x 1)

Fig. 8 — *Hildoceras lusitanicum* (MEISTER, Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 9 — *Hildoceras lusitanicum* (MEISTER), Toarcian, Bifrons Zone. Onceasa Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1,08)

Fig. 10 — *Hildoceras lusitanicum* (MEISTER), Toarcian, Bifrons Zone. Alunul Mic Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1,2)

Fig. 11 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Pârâul Ars - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1,2)

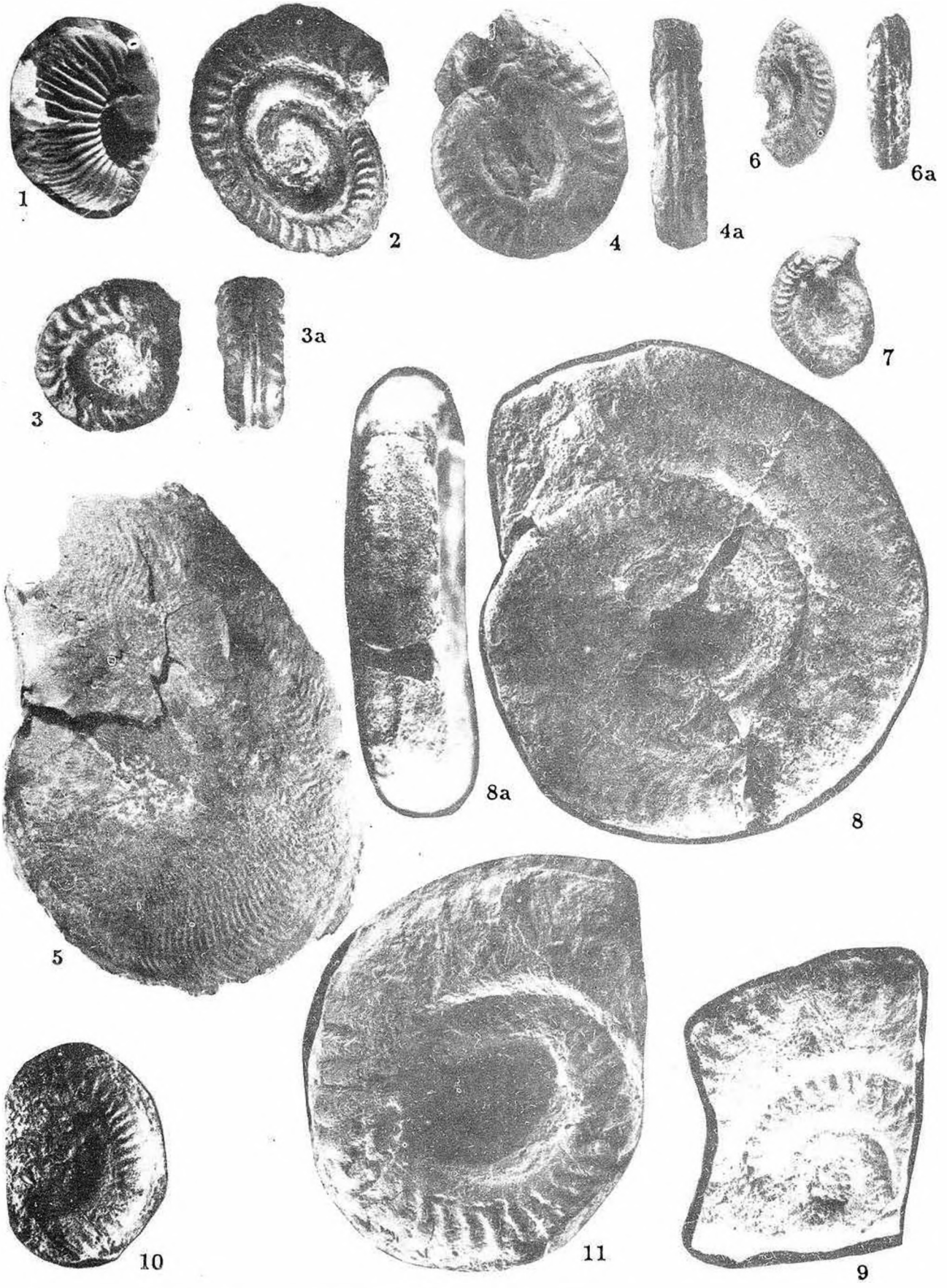
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Plate VII

Fig. 1 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Onceasa Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

Figs. 2 and 3 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Bisericii Valley - Remeţi Graben. Col. Elena Popa (x 1)

Fig. 4 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 5 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1)

Figs. 6 and 7 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Crişanului Valley - Bihor Mts. Col. Elena Popa (x 1)

Figs. 8 and 9 — *Hildoceras sublevisoni* (FUCINI), Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 10 — *Porpoceras* sp., ex gr. *P. vortex* (SIMPSON), Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

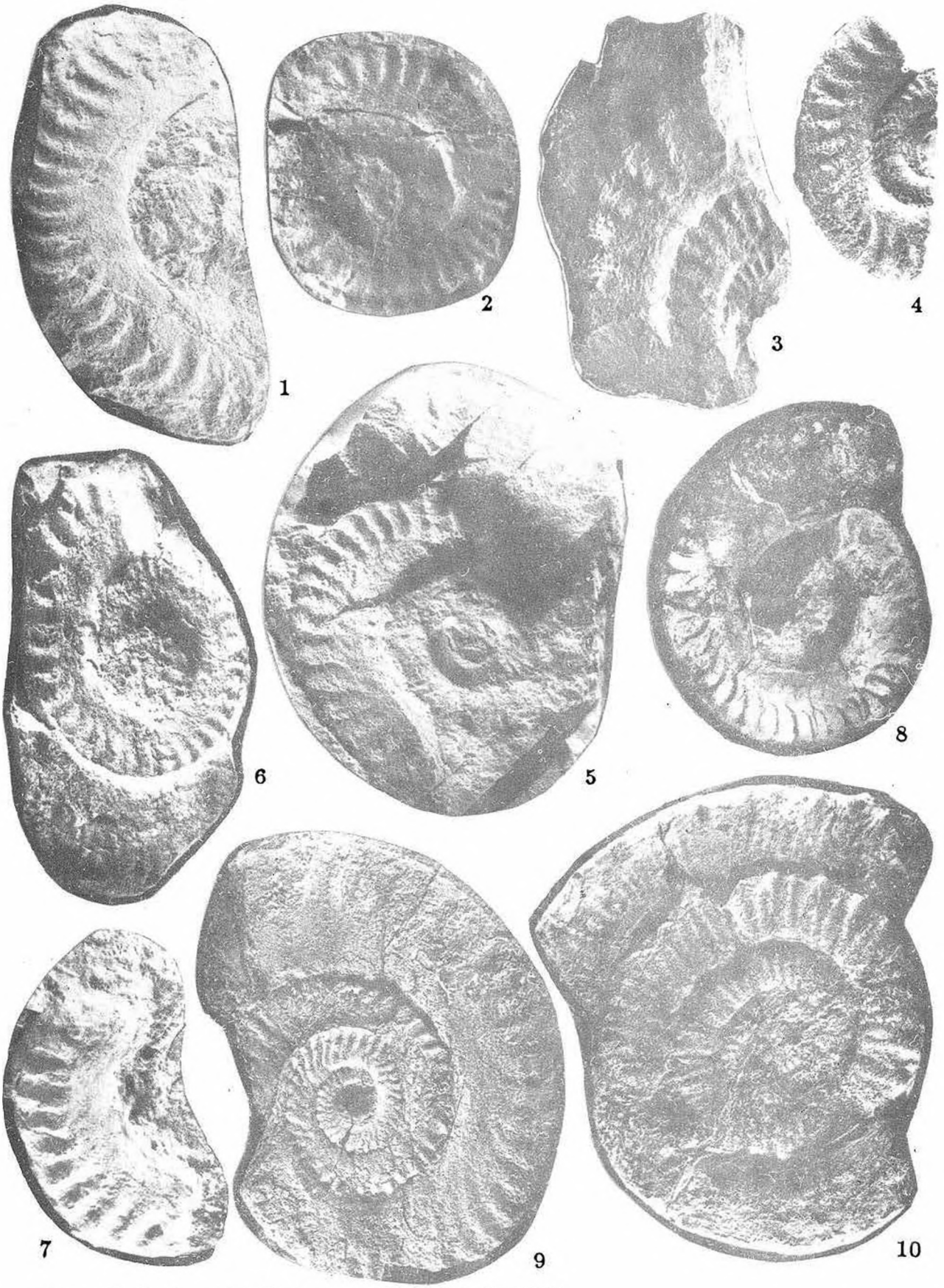
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Plate VIII

Fig. 1 — *Porpoceras* sp., ex gr. *P. vortex* (SIMPSON), Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1); 1a - detail

Fig. 2 — *Phymatoceras* sp., ex gr. *P. lilli* (HAUER), Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 0,6)

Figs. 3 and 4 — *Hildoceras semicosta* BUCKMAN, Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 5 — *Catacoeloceras* sp., ex gr. *C. jordani* GUEX., Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 6 — *Zugodáctylites* sp., Toarcian, Bifrons Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1,2)

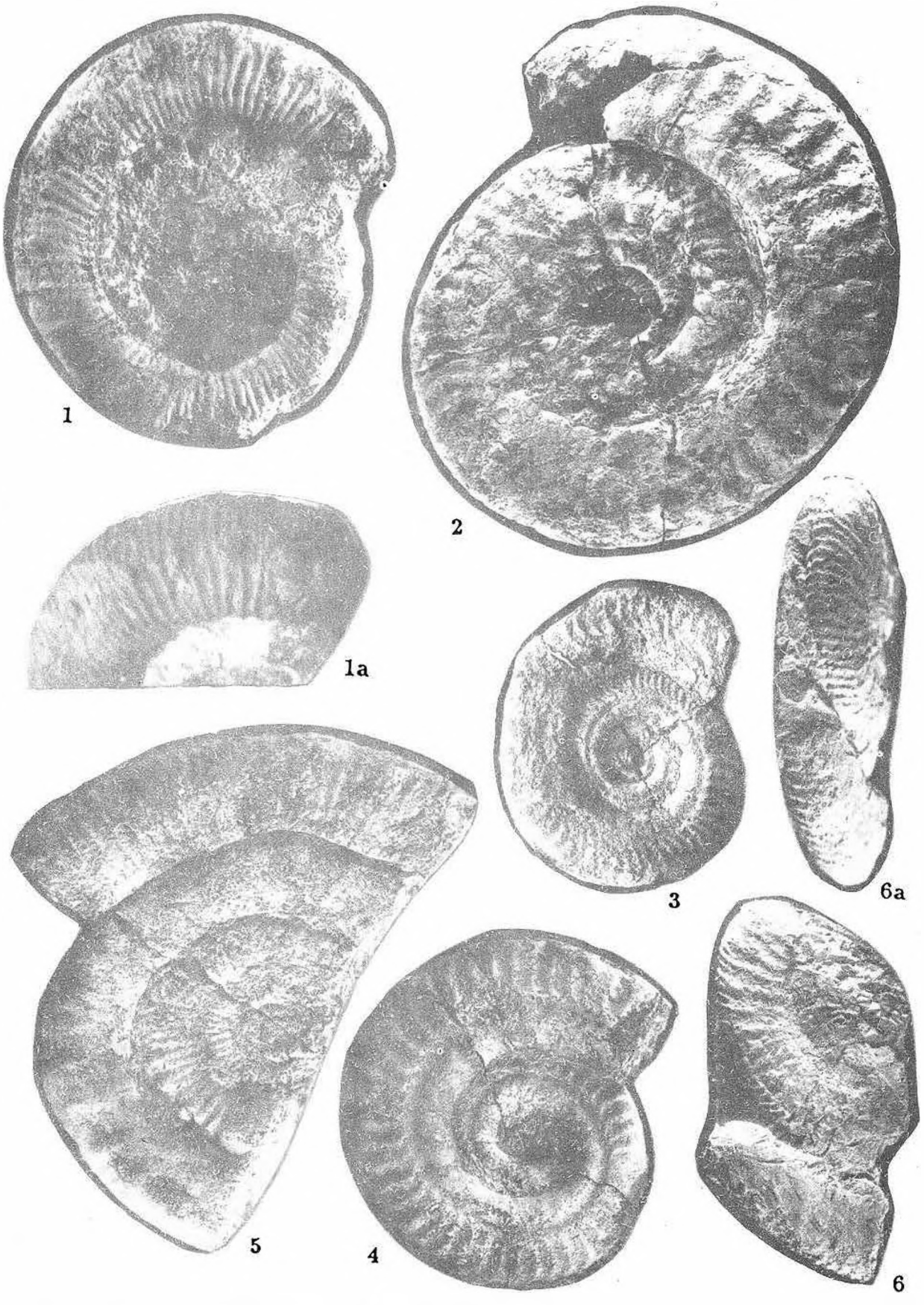
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Plate IX

Fig. 1 — *Lytoceras* sp., ex gr. *L. rhodanicus* (MONESTIER), Toarcian, Bifrons Zone. Munteana - Banat. Col. Elena Popa (x 1)

Fig. 2 — *Phymatoceras* sp., Toarcian, Bifrons Zone. Pârâul Ars - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

Figs. 3 and 4 — *Phymatoceras* sp., Toarcian, Bifrons Zone. Onceasa Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa. Fig. 3 (x 1); fig. 4 (x 0,7)

Fig. 5 — *Brodieia* sp., aff. *B. clausum* MERLA, Toarcian, Variabilis Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Figs. 6 and 7 — *Haugia (Haugia)* sp., Toarcian, Variabilis Zone. Crişanului Valley - Bihor Mts. Col. Elena Popa (x 1)

Fig. 8 — *Haugia illustris* (DENCKMANN), Toarcian, Variabilis Zone. Piatra Arsă - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 0,8)

Fig. 9 — *Pseudolioceras* cf. *gradatum* BUCKMAN, Toarcian, Variabilis Zone. Alunul Mare Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 1)

Fig. 10 — *Pseudogrammoceras* cf. *latescens* (SIMPSON), Toarcian, Thouarsense Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1)

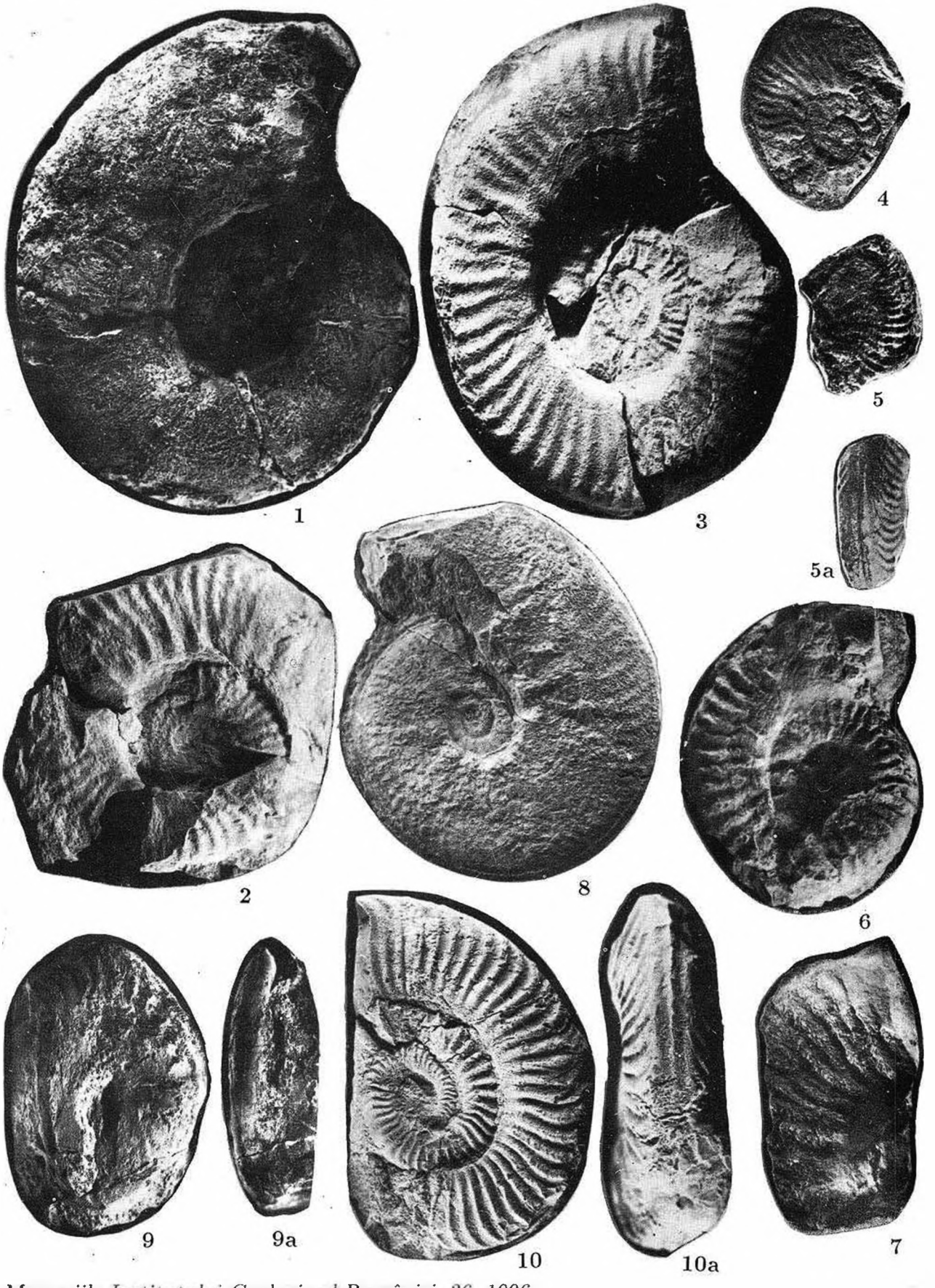
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Plate X

Figs. 1 and 2 — *Grammoceras thouarsense thouarsense* (ORB.), Toarcian, Thouarsense Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa (x 1)

Fig. 3 — *Grammoceras thouarsense thouarsense* (ORB.), Toarcian, Thouarsense Zone. Lucava Valley - Rarău Massif. Col. Elena Popa (x 1)

Fig. 4 — *Grammoceras* sp., ex gr. *G. thouarsense thouarsense* (ORB.), Toarcian, Thouarsense Zone. Fruntea Crest - Remeţi Graben. Col. Elena Popa (x 1)

Fig. 5 — *Grammoceras thouarsense thouarsense* (ORB.), Toarcian, Thouarsense Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1)

Fig. 6 — *Polyplectus pluricostatus* (HAAS), Toarcian, Thouarsense Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 7 — *Pseudogrammoceras latescens* (SIMPSON), Toarcian, Thouarsense Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa (x 1)

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Plate XI

Fig. 1 — *Pseudogrammoceras latescens* (SIMPSON) (x 1)

Fig. 2 — *Denckmannia* sp. (x 1,2)

Fig. 3 — *Polyplectus discoides* (ZIETEN) (x 1)

Fig. 4 — *Pseudolioceras compactile* (SIMPSON) (x 1,1)

Fig. 5 — *Polyplectus pluricostatus* (HAAS) (x 1)

Figs. 6 and 7 — *Pseudogrammoceras fallaciosum* (BAYLE). Fig. 6 (x 1); fig. 7 (x 0,7)

Figs. 1-7 — Toarcian, Thouarsense Zone, Sărăţii Valley - Perşani Mts. Col. Elena Popa

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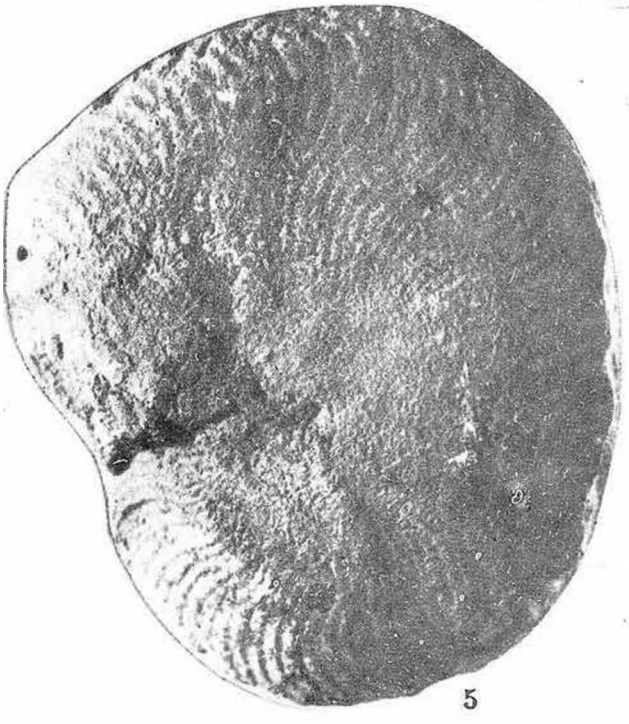

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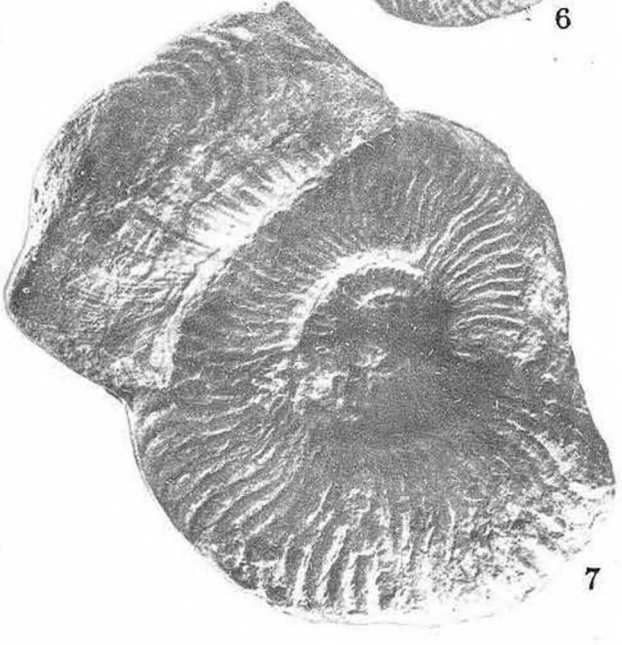

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Plate XII

Fig. 1–4 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa. Figs. 1, 3 and 4 (x 1); fig. 2 (x 0,7)

Fig. 5 and 6 — *Pseudogrammoceras* cf. *doerntense* (DENCKMANN), Toarcian, Thouarsense Zone. Fruntea Crest - Remeţi Graben. Col. Elena Popa (x 1)

Fig. 7 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. Birtinului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 8 — *Pseudogrammoceras fallaciosum*, (BAYLE), Toarcian, Thouarsense Zone. Bisericii Valley - Remeţi Graben. Col. Elena Popa (x 1)

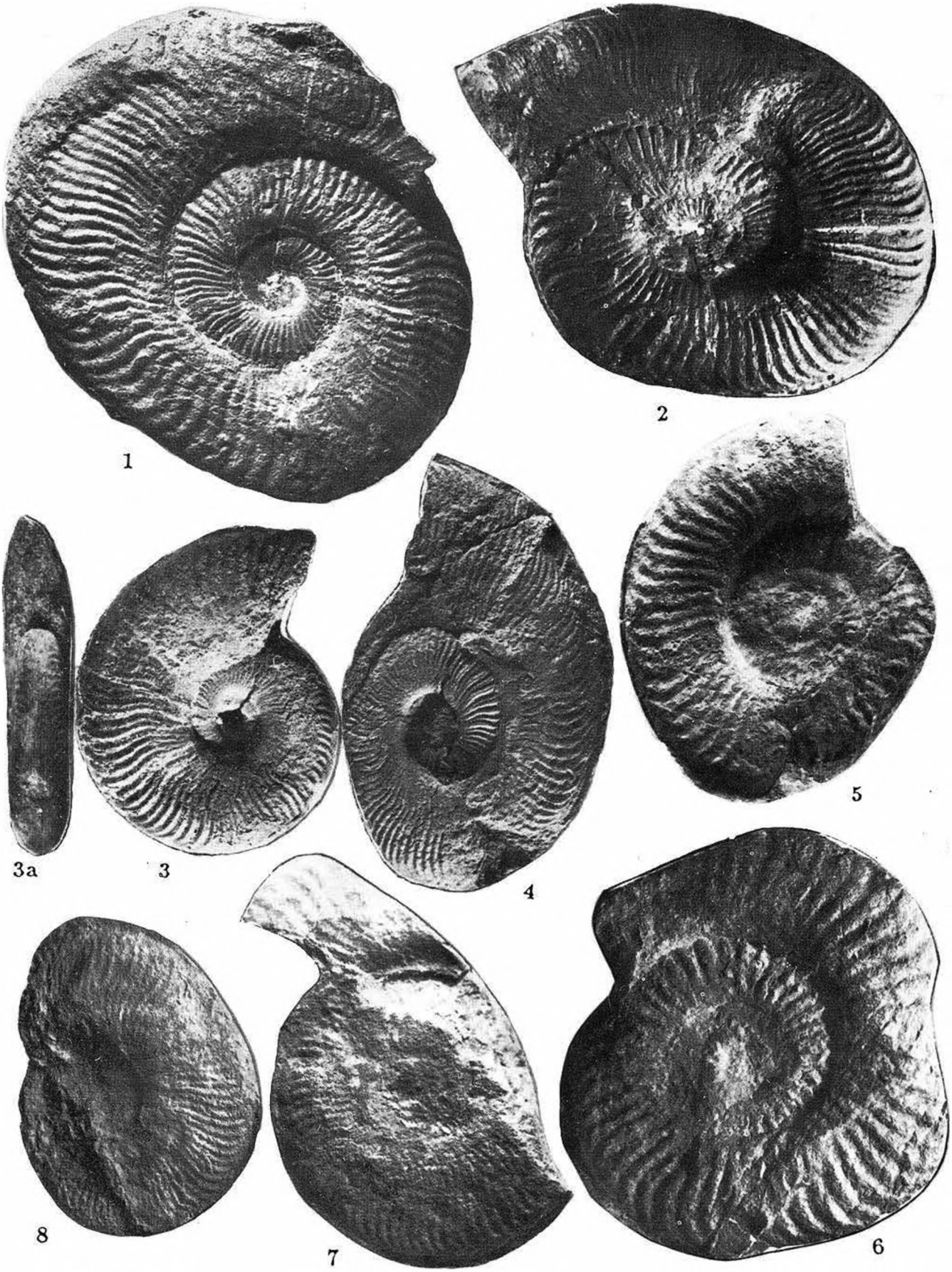
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Plate XIII

Figs. 1 and 4 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig.2 — *Pseudogrammoceras struckmanni* (DENCKMANN), Toarcian, Thouarsense Zone. Onceasa Valley - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 0,7)

Fig. 3 — *Pseudogrammoceras struckmanni* (DENCKMANN), Toarcian, Thouarsense Zone. Piatra Arsă - Someşul Cald Graben. Col. G. Mantea. Det. Elena Popa (x 0,9)

Fig. 5 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. Munteana - Banat. Col. Elena Popa (x 1,1)

Fig. 6 — *Pseudogrammoceras* cf. *latescens* (SIMPSON), Toarcian, Thouarsense Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1)

1

5

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6

4

Plate XIV

Fig. 1 — *Osperlioceras bicarinatum* (ZIETEN), Toarcian, the bottom of the Thouarsense Zone. Piatra Bulzului - Bihor Mts. Col. Elena Popa (x 1)

Fig. 2 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. East of the Borod Basin. Col. Elena Popa (x 1)

Fig. 3 — *Lobolytoceras* aff. *siemensi* (DENCKMANN), Toarcian, Thouarsense Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa (x 0,6)

Fig. 4 — *Pseudogrammoceras fallaciosum* (BAYLE), Toarcian, Thouarsense Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

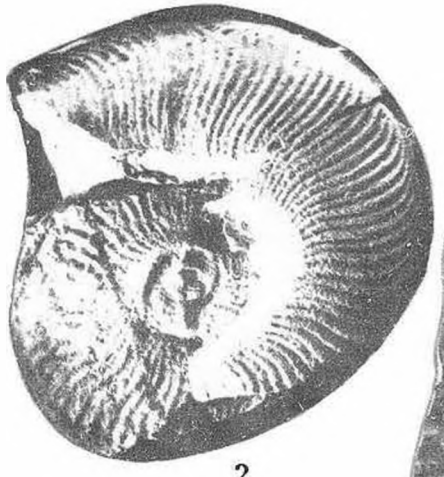
Fig. 5 — *Hammatoceras* sp., Toarcian, Levesquei Zone. Sărăţii Valley - Perşani Mts. Col. Elena Popa (x 1)

Fig. 6 — *Pleydellia* sp., Toarcian, Levesquei Zone. Boiului Valley - Pădurea Craiului. Col. Elena Popa (x 1)

Fig. 7 — *Dumortieria* sp., Toarcian, Levesquei Zone. East of the Borod Basin. Col. Elena Popa (x 1)

1

3



2

5

5a

4

7

7a

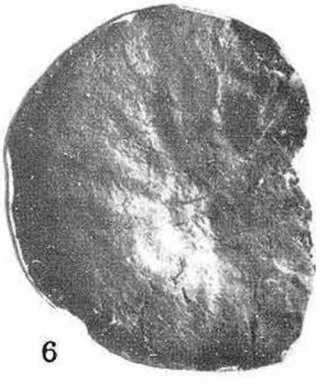


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Plate XV

Fig. 1 — *Wachneroceras toxophorum* (WAEHNER), Middle Hettangian, Liasicus Zone. Tepei Valley - Perşani Mts. Col. D.M.Preda. Det. Gr. Răileanu. Rev. Elena Popa (x 1)

Fig. 2 — *Ectocentrites petersi* (HAUER), Upper Hettangian, Angulata Zone. Stanciului Valley - Perşani Mts. Col. D. Patrulius, Elena Popa, Ileana Popescu (x 1)

Fig. 3 — *Ectocentrites petersi* (HAUER), Upper Hettangian, Angulata Zone. Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 4 — *Aegolytoceras* sp., Upper Hettangian. Stanciului Valley - Perşani Mts. Col. D. Patrulius, Elena Popa, Ileana Popescu (x 1)

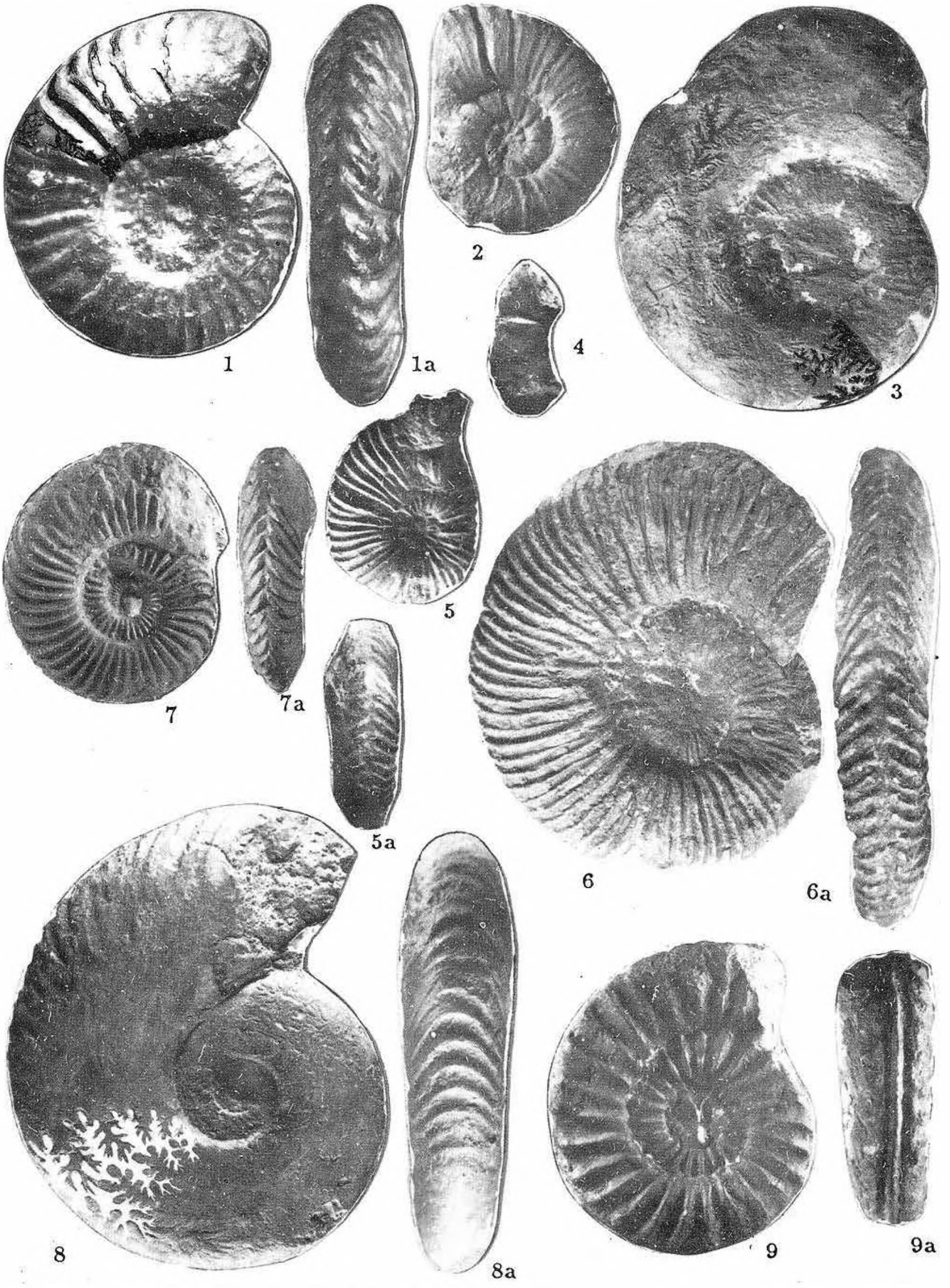
Fig. 5 — *Charmasseiceras marmoreum* (OPPEL), Upper Hettangian, Angulata Zone. Stanciului Valley - Perşani Mts. Col. D. Patrulius, Elena Popa, Ileana Popescu (x 1)

Fig. 6 — *Charmasseiceras marmoreum* (OPPEL), Upper Hettangian, Angulata Zone. Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 7 — *Schlotheimia montana* (WAEHNER), Upper Hettangian, Angulata Zone. Tepei Valley - Perşani Mts. Col. D. Patrulius (x 1)

Fig. 8 — *Juraphyllites* sp., Hettangian-Lower Sinemurian (condensed beds). Stanciului Valley - Perşani Mts. Col. D. Patrulius, Elena Popa, Ileana Popescu (x 1)

Fig. 9 — *Coroniceras lyra* (HYATT), Lower Sinemurian, Bucklandi Zone. Dealu Negru - Perşani Mts. Col. D. Patrulius (x 1)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1a
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7a
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6a
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8a
9
9a

Plate XVI

Fig. 1 — *Paradasyceras uermoesense* HERBICH.. Col. D. Patrulius, Elena Popa (x 1)

Fig. 2 — *Paradasyceras tenuilobata* RĂILEANU. Col. D. Patrulius, Elena Popa (x 1)

Fig. 3 — *Geyeroceras cylindricum* (SOWERBY). Col. D. Patrulius, Elena Popa (x 1)

Fig. 4 — *Arietites* sp. Sinemurian. Stanciului Valley - Perşani Mts. Col. D. Patrulius, Elena Popa, Ileana Popescu (x 1)

Fig. 5 — *Geyeroceras szadeczkyi* (VADASZ). Col. D. Patrulius (x 1)

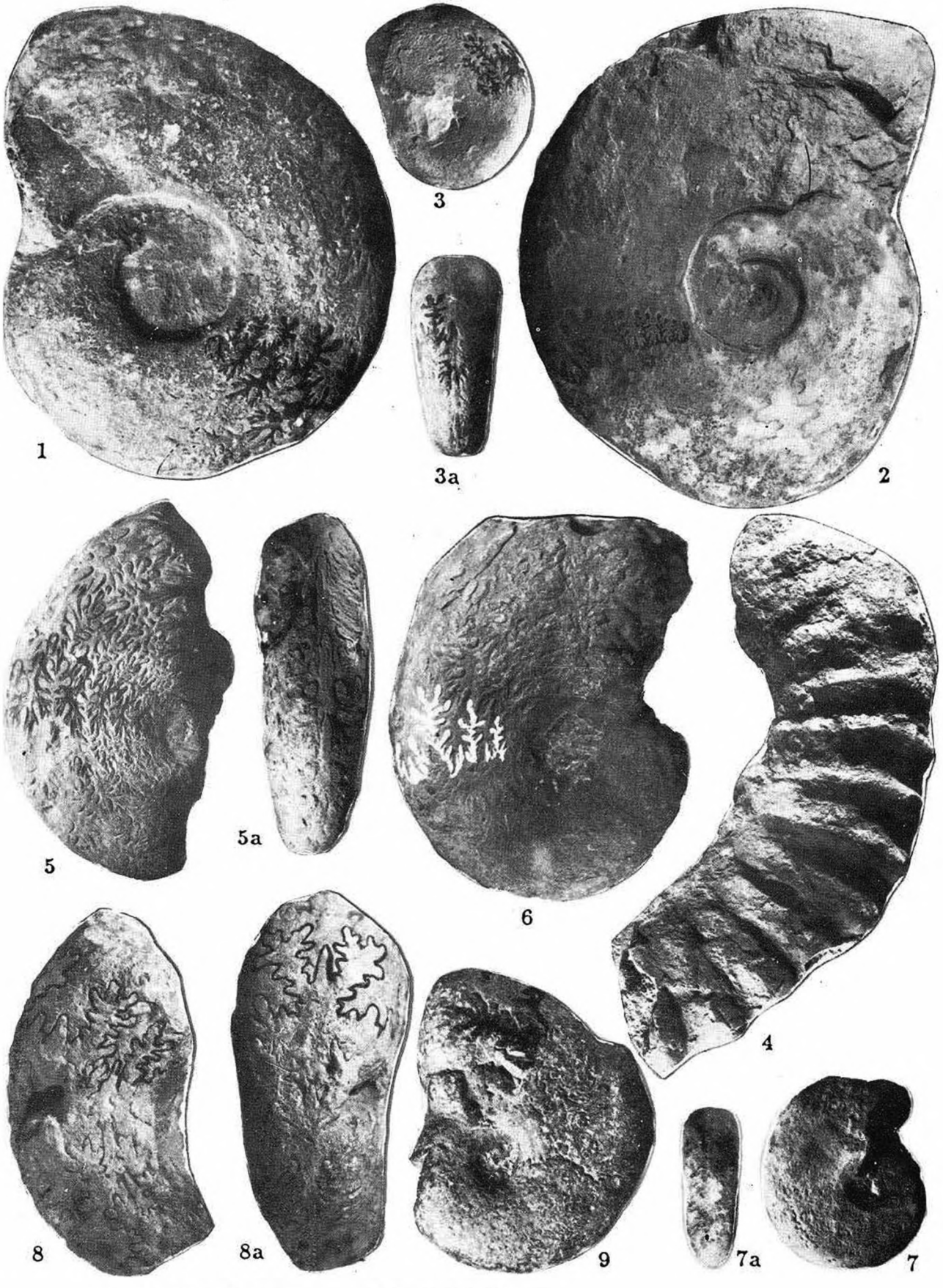
Fig. 6 — *Calliphylloceras* sp., aff. *C. sylvestre* (HERBICH). Col. D. Patrulius, Elena Popa (x 1)

Fig. 7 — *Geyeroceras cylindricum compressum* (FUCINI). Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 8 — *Geyeroceras leptophyllum* (HAUER). Col. D. Patrulius, Elena Popa (x 1)

Fig. 9 — *Geyeroceras leptophyllum* (HAUER). Col. E. Jekelius. Rev. Elena Popa (x 1)

Figs. 1-3, 5, 6 and 8 — Hettangian-Lower Sinemurian (condensed beds). Tepei Valley - Perşani Mts
Figs. 7 and 9 - Hettangian-Lower Sinemurian (condensed beds). Racoşul de Jos - Perşani Mts


1
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3a
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5a
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8a
9
7a
7

Plate XVII

Fig. 1 — *Geyeroceras cylindricum bielzii* HERBICH. Col. E. Jekelius (x 1)

Fig. 2 — *Paradasyceras uermoesense* (HERBICH). Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 3 — *Geyeroceras persanense* (HERBICH). Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 4 — *Geyeroceras cylindricum* (SOWERBY). Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 5 — *Juraphyllites* sp. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 6 — *Geyeroceras persanense* (HERBICH). Col. D.M.Preda. Rev. Elena Popa (x 1)

Fig. 7 — *Paradasiceras lunense* (DE STEF.). Col. E. Jekelius (x 1)

Figs. 1–7 — Hettangian-Lower Sinemurian (condensed beds). Racoşul de Jos - Perşani Mts


1


2


3


4


4a


5


5a


3a


6


7


7a

Plate XVIII

Fig. 1 — *Juraphyllites transilvanicus dorsoplanatus* FUCINI, Hettangian-Lower Sinemurian (condensed beds). Racoşul de Jos - Perşani Mts. Col. D.M.Preda. Det. Gr. Răileanu (x 1)

Fig. 2 — *Euagassiceras* sp., Lower Sinemurian. Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

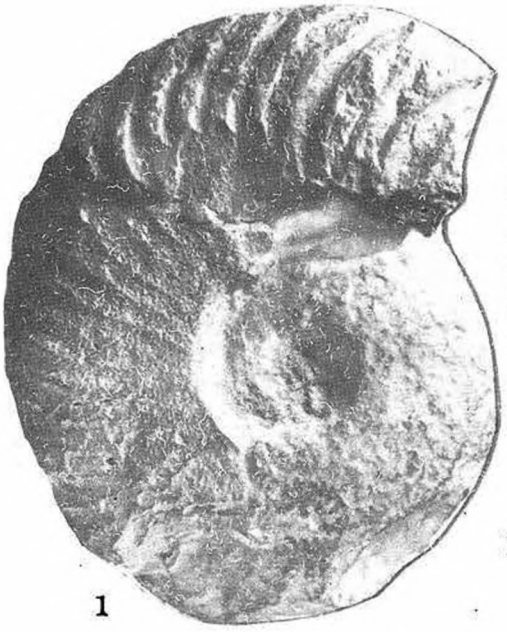
Fig. 3 — *Paradasyceras uermoesense* (HERBICH), Hettangian-Lower Sinemurian (condensed beds). Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 4 — ? *Adnethiceras* sp., aff. *A. adnethicum* (HAUER), Upper Sinemurian. Tepei Valley - Perşani Mts. Col. D. Patrulius, Elena Popa (x 1)

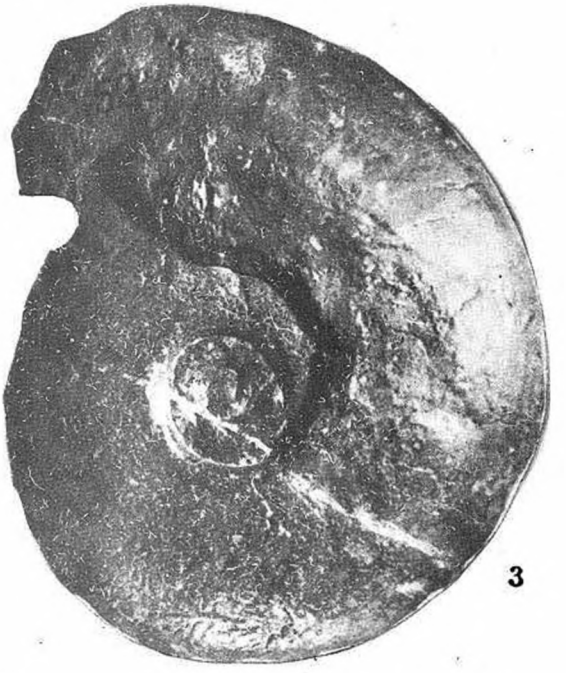
Fig. 5 — *Partschiceras* sp., Upper Sinemurian. Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 6 — *Asteroceras obtusum* (SOWERBY), Upper Sinemurian. Racoşul de Jos - Perşani Mts. Col. E. Jekelius. Rev. Elena Popa (x 1)

Fig. 7 — *Epideroceras* sp., Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius (x 1)


1


1a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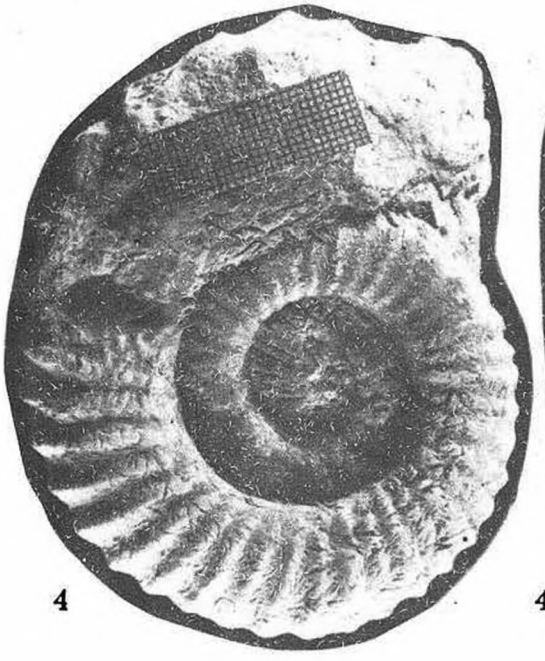
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4a

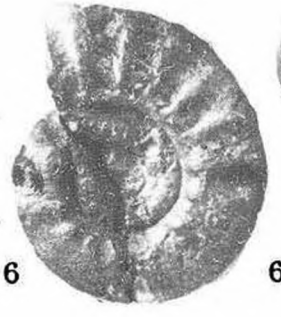

2


2a


5


7


7a


6


6a

Plate XIX

Fig. 1 — *Arnioceras* sp., Lower Sinemurian. Racoşul de Jos - Perşani Mts. Col. E. Jekelius (x 1)

Fig. 2 — *Paltechioceras* sp., Upper Sinemurian. Dealul Praşca - Rarău Massif. Col. D. Patrulius, Elena Popa (x 1)

Fig. 3 — *Echioceras* sp., aff. *E. rhodanicum* (DUM.), Upper Sinemurian, Raricostatum Zone. Pietrele Albe - Perşani Mts. Col. D. Patrulius (x 1)

Fig. 4 — *Epideroceras* sp., aff. *E. lorioli* (HUG.), Upper Sinemurian, Raricostatum Zone. Pietrele Albe - Perşani Mts. Col. D. Patrulius (x 1)

Fig. 5 – *Uptonia* sp., aff. *U. jamesoni* (SOWERBY), Carixian. Dealul Negru – Perşani Mts. Col. D. Patrulius (X 1)

Fig. 6 – *Lytoceras* sp., Upper Sinemurian. Pietrele Albe – Perşani Mts. Col. D. Patrulius (X 1)

1a

1

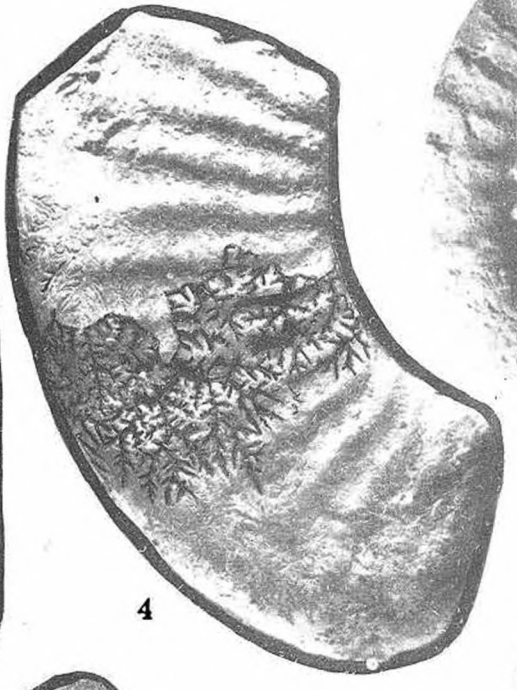
2

2a

3

3a

4a



4

3b

5

6a

6

Plate XX

Fig. 1 — *Phylloceras meneghinii* GEMM., Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius, Elena Popa. Figs. 1 and 1a (x 1); fig. 1b (x 3)

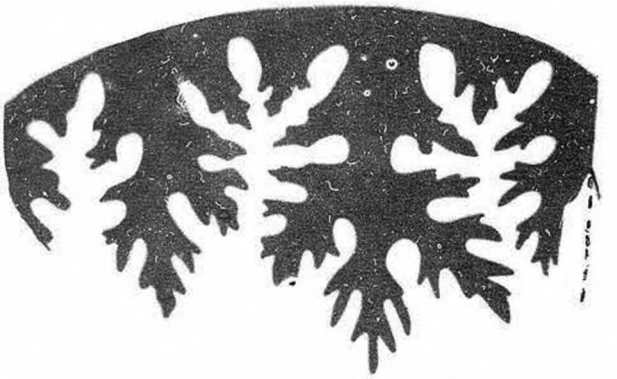
Fig. 2 — *Partschiceras* cf. *P. tenuistriatum* (MENEGHINI), Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius, Elena Popa. Figs. 2 and 2a (x 2); fig. 2b x 5,5)

Fig. 3 — *Zetoceras bonarelli* OSETT, Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius, Elena Popa. Figs. 3 and 3a (x 1); fig. 3b (x 3)

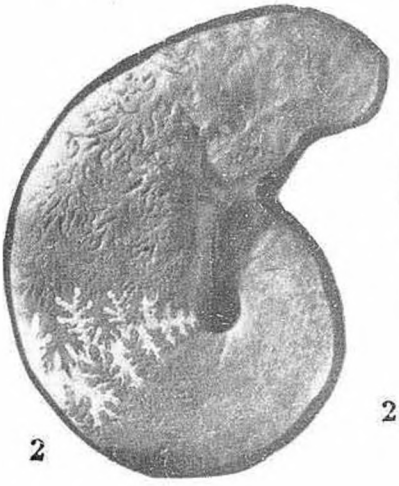
Fig. 4 — *Calliphylloceras bicicolae* (MENEGHINI), Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius, Elena Popa. Figs. 4 and 4a (x 1); fig 4b (x 4)

1

1a

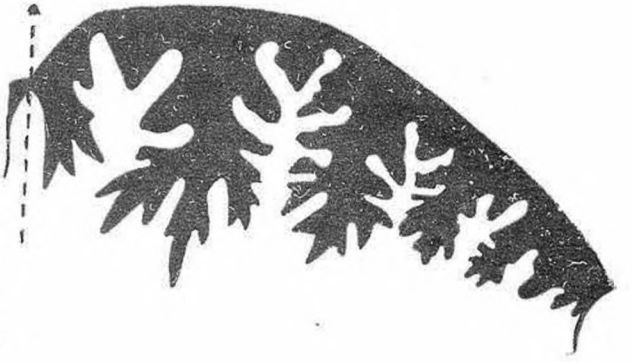


1b



2

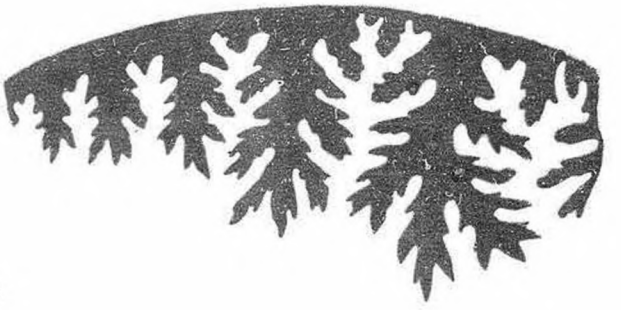
2a



2b

3

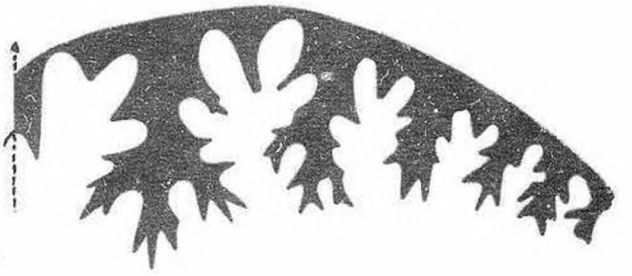
3a



3b

4

4a



4b

Plate XXI

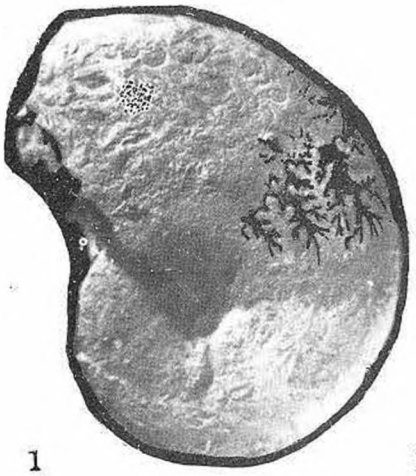
Fig. 1 — *Calliphylloceras anatolicum* MEIST. Figs. 1 and 1a (x 1); fig. 1b (x 3)

Fig. 2 — *Calliphylloceras* cf. *C. emeryi* (BETTONI). Figs. 2 and 2a (x 1); fig. 2b (x 3)

Fig. 3 — *Meneghiniceras libertus* GEMM. Figs 3 and 3a (x 2); fig. 3b (x 3,5)

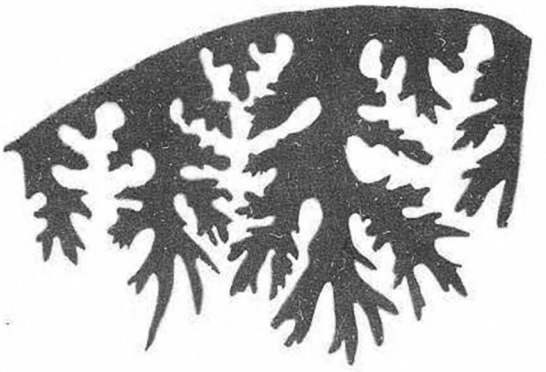
Fig. 4 — *Paradasyceras planispira* (REYNÈS). Figs. 4 and 4a (x 1); fig. 4b (x 5,5)

Figs. 1-4 — Upper Sinemurian. Pietrele Albe - Perşani Mts. Col. D. Patrulius, Elena Popa



1

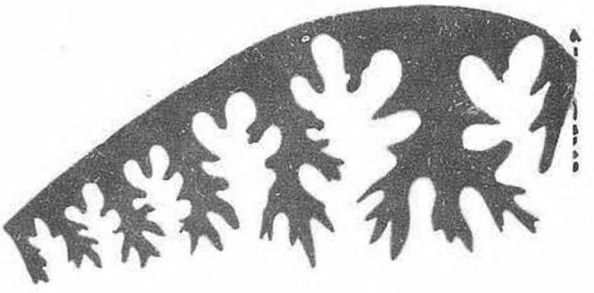
1a



1b

2

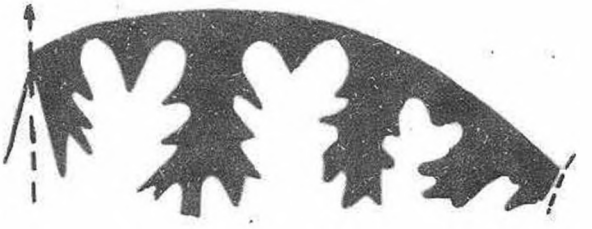
2a



2b

3

3a



3b

4

4a

4b