Rivista Italiana di Paleontologia e Stratigrafia
(*Research in Paleontology and Stratigraphy*)
vol. 123(1): 79-148. **March 2017**

EARLY JURASSIC (SINEMURIAN TO BASAL TOARCIAN) AMMONITES OF THE BRESCIAN PREALPS (SOUTHERN ALPS, ITALY)

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To cite this article: Meister C., Schirolli P. & Dommergues J.-L. (2017) - Early Jurassic (Sinemurian to basal Toarcian) ammonites of the Brescian Prealps (Southern Alps, Italy). *Riv. It. Paleontol. Strat.,* 123(1): 79-148.

Key words: Early Jurassic; Ammonites; Systematics; Biostratigraphy; Southern Alps; Italy.

Abstract. This work provides a more precise up-to-date biostratigraphical framework of the Early Jurassic ammonite succession of the Brescian Prealps with more than seventy taxa for the Sinemurian, Pliensbachian and basal Toarcian corresponding to a about 30 horizons or faunal assemblages rather well correlable with the NW European standard zonation. These results are supported with already published data, new data from recent field investigations, revised contributions of different authors and with the study of the historical collection of the Museum of Natural Sciences of Brescia (Northern Italy).

The biohorizons are referred to the Lower Jurassic carbonate series of the Brescian Prealps, cropping out between the eastern surroundings of Brescia (Botticino-Serle), to the East, and the Lake Iseo, to the West. This area was located in the eastern border of the wide Lombardian Basin, a part of the southern continental passive margin subjected to the Jurassic rifting, preceding the Neo-Tethys opening.

Introduction

This paper reports the outcomes of a work that is part of a long-term research programme aimed at supplying a stratigraphic and palaeontologic framework for the Lower Jurassic succession of the Prealps of Brescia (Lombardy, Northern Italy), in the region where the type-locality of the «Domerian» substage occurs (Bonarelli 1894). In fact, the famous fossiliferous site of Mt. Domaro (Cita et al. 1961; Cita 1964; Fantini Sestini 1962; Ferretti 1967; Montanari 1974; Schirolli 1990, 2002a) is located close to Gardone Val Trompia (Fig. 1). This study will contribute to put the well-known Late Pliensbachian ammonite fauna, which was not collected in place, into a precise regional stratigraphic context.

Data on the stratigraphy of this part of the Brescian Prealps are the result both of a great number of stratigraphic sections described in the area (Schirolli 1990, 1994, 1997 and Dommergues et al. 1997b) and of a new mapping of the region (ISPRA 2011). New data come both from recent investigations in the field and from the study of the historical collection of Brescian Early Jurassic ammonites, preserved in the Museum of Natural Sciences of Brescia. In the latter case, ammonites were at first selected on the basis of the completeness and reliability of the data concerning the site and the level of finding, carrying out new field stratigraphic surveys where necessary. The subsequent step has been the attribution of the ammonites to a precise biostratigraphic horizon and/or faunal assemblage, also placing the specimens into a more or less accurate lithostratigraphic range within the sedimentary succession. The revision of the specimens illustrated by Meneghini (1867-81), Parona (1897), Bettoni (1900), Cantaluppi (1966), Cassinis & Cantaluppi (1967), Cantaluppi & Cassinis (1970) and Castelli (1980) referred to the surroundings of Brescia complete this work.

Received: July 14, 2016; accepted: November 23, 2016

Geographic and geologic outline

This contribution focuses on the Sinemurian to Lowermost Toarcian ammonite biohorizons occurring in the Mesozoic carbonate succession of the central-western Brescian Prealps, facing the Po Plain to the South. The fossiliferous localities are

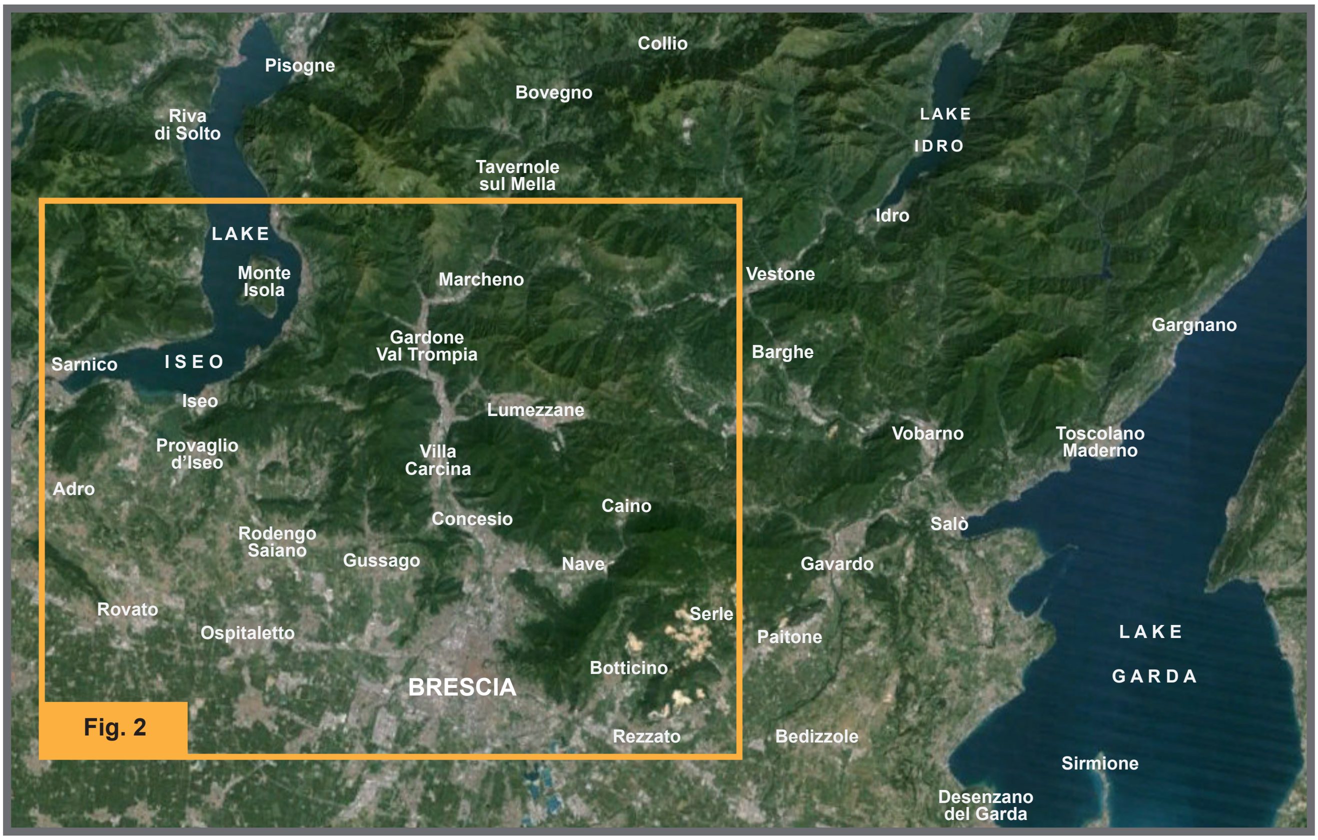
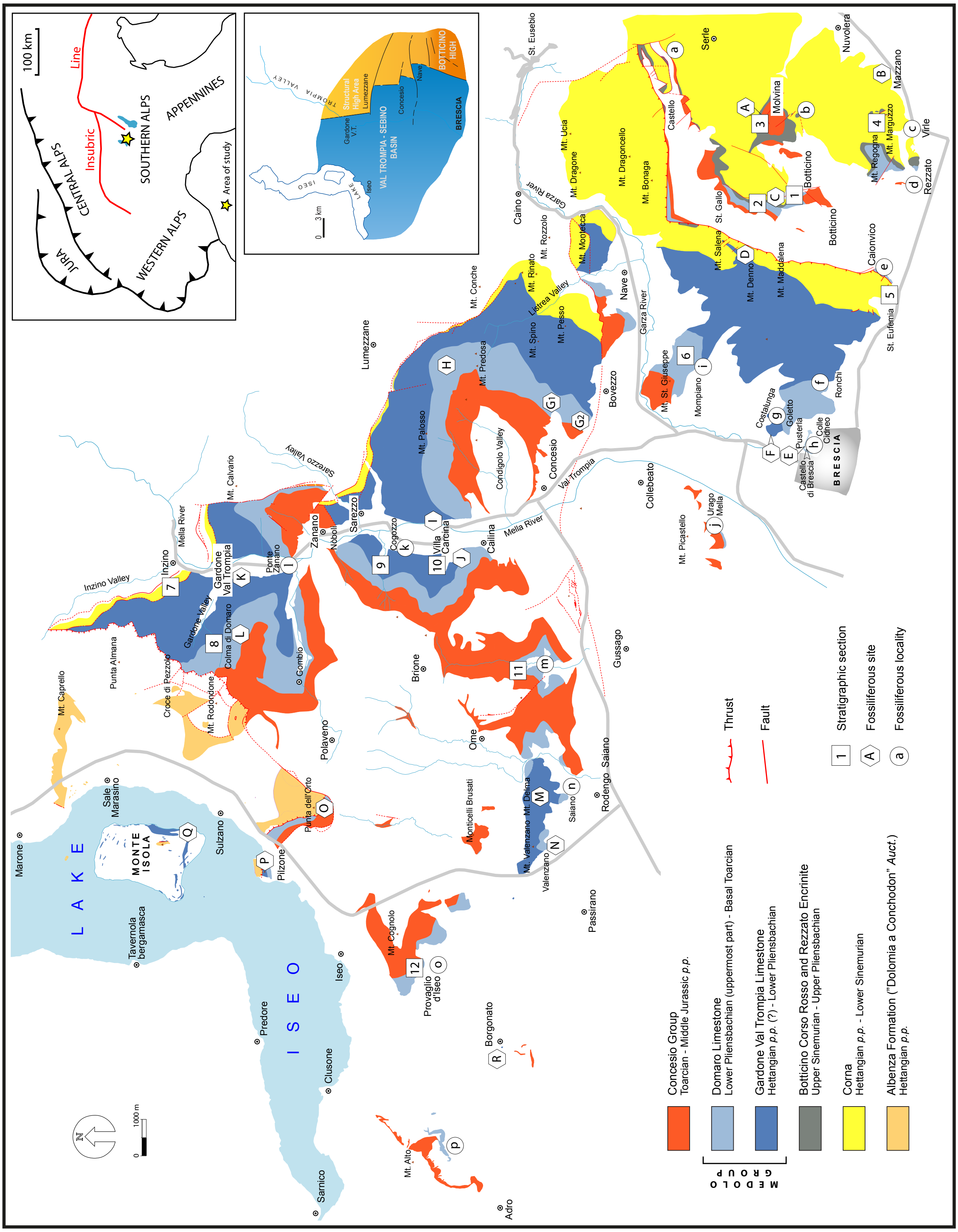


Fig. 1 - Geographic overview. The rectangle points out the area of study detailed in the next figure.

referred to an area streching from the eastern surroundings of the city of Brescia to the Lake Iseo, to the West. Serle is the most eastern locality whereas Montisola, the wide isle within the Lake Iseo, and Adro, immediately South of the lake, are the most western sites (Fig. 2). These deposits belong to the sedimentary cover of the Southalpine domaine of the Alps (Fig. 3). Presumably since the Hettangian this region, likewise the whole of the Southern Alps, was involved in the paroxismal phase of Early Jurassic rifting, following the Norian crustal streching stage and preceding the upcoming opening of Neo-Tethys during the Jurassic. The East-West direction of the rifting extension produced a block-faulting pattern giving rise to approximately North-South oriented basins and submarine highs (Bosellini 1973; Gaetani 1975; Bernoulli et al. 1979; Winterer & Bosellini 1981; Sarti et al. 1992; Bertotti et al. 1993) that fortunately the Alpine shortening during the Tertiary did not obliterate at all. In the Early Jurassic, the Brescian area was located on the eastern border of the wide Lombardian Basin, bounded by the wide Trento Platform to the East (Castellarin 1972; Castellarin & Picotti 1990). Moreover, inside the Lombardian Basin, Brescia was near a transitional zone of fault-induced slope between the high area of Botticino and the basin that regionally extended westward from the city (Cassinis 1968, 1978; Cassinis & Schirolli 1995; Schirolli 1997).

Fig. 2 - Geologic framework of the Lower Jurassic lithostratigraphic units cropping out in the Prealps around Brescia, between the Lake Iseo and the eastern surroundings of the city, and Lower Jurassic paleogeographic units described in the text (inset on the right). Numbers, capital and small letters are referred respectively to the location of the investigated stratigraphic sections, fossiliferous sites and localities of collecting for the ammonites cited in this work.
Stratigraphic sections: Botticino Mattina (1), Lassa (2), Molvina (3), Mt. Marguzzo (4), St. Eufemia (5), Mompiano (6), Inzino (7), Mt. Domaro (8), Cogozzo (9), Villa (10), Caricatore Val Navezze (Gussago) (11), Provaglio d'Iseo (12). Fossiliferous sites: Molvina (Mt. Sapone) (A), Mazzano (B), Lassa QRQ (C), Mt. Denno (D), North face of «Colle Cidneo» (E), Costalunga (Ponte Alto) (F), Concesio (G1, G2), Poffe di Lumezzane (H), Pregno (I), Mt. Zoadello (J), Gardone Val Trompia (K), Mt. Domaro (L), Mt. Delma (M), Valenzano (N), Punta dell'Orto (O), Montecolo di Pilzone (P), Montisola (Q), Borgonato (R). Fossiliferous localities: Serle (a), Gazzolo (Nuvolera) (b), Virle (c), Rezzato (d), Caionvico (e), Ronchi di Brescia (f), Costalunga (g), «Colle Cidneo» (h), Mompiano (i), Urago Mella (j), Cogozzo (k), Ponte Zanano (l), Gussago (Val Navezze) (m), Saiano (n), Provaglio d'Iseo (o), Adro (p).



100 km
Insubric Line
CENTRAL ALPS
SOUTHERN ALPS
APPENNINES
WESTERN ALPS
JURA
Area of study
TROMPIA VALLEY
Structural High Area
Lumezzane
Gardone V.T.
Concesio
Nave
BOTTICINO HIGH
VAL TROMPIA - SEBINO BASIN
BRESCIA
ISEO
LAKE
Iseo
3 km
L A K E
I S E O
MONTE ISOLA
1000 m
Marone
Sale Marasino
Sulzano
Tavernola bergamasca
Predore
Clusone
Sarnico
Pilzone
Iseo
Mt. Caprello
Punta Almana
Croce di Pezzolo
Mt. Rodondone
Punta dell'Orto
Polaveno
Inzino Valley
Inzino
Mella River
Mt. Calvario
Gardone Val Trompia
Gardone Valley
Colma di Domaro
Gombio
Ponte Zanano
Zanano
Noboli
Sarezzo
Sarezzo Valley
Lumezzane
Cogozzo
Villa Carcina
Cailina
Mella River
Brione
Ome
Monticelli Brusati
Mt. Valenzano
Mt. Delma
Valenzano
Saiano
Rodengo Saiano
Gussago
Passirano
Mt. Cognolo
Provaglio d'Iseo
Borgonato
Mt. Alto
Adro
Mt. Palosso
Condigolo Valley
Concesio
Val Trompia
Mt. Predosa
Mt. Spino
Mt. Pesso
Listrea Valley
Mt. Rinato
Mt. Conche
Mt. Rozzolo
Caino
Garza River
St. Eusebio
Mt. Montecca
Nave
Garza River
Bovezzo
Mt. St. Giuseppe
Mompiano
Collebeato
Mt. Picastello
Urago Mella
Costalunga
Goletto
Pusterla
Colle Cidneo
Castello di Brescia
BRESCIA
Ronchi
St. Eufemia
Caionvico
Botticino
Mt. Maddalena
Mt. Denno
Mt. Salena
St. Gallo
Mt. Ucia
Mt. Dragone
Mt. Dragoncello
Mt. Bonaga
Castello
Serle
Molvina
Botticino
Mt. Regogna
Mt. Marguzzo
Mazzano
Nuvolera
Virle
Rezzato
Thrust
Fault
Stratigraphic section
Fossiliferous site
Fossiliferous locality
Concesio Group
Toarcian - Middle Jurassic p.p.
Domaro Limestone
Lower Pliensbachian (uppermost part) - Basal Toarcian
Gardone Val Trompia Limestone
Hettangian p.p. (?) - Lower Pliensbachian
Botticino Corso Rosso and Rezzato Encrinite
Upper Sinemurian - Upper Pliensbachian
Corna
Hettangian p.p. - Lower Sinemurian
Albenza Formation ("Dolomia a Conchodon" Auct.)
Hettangian p.p.
MEDOLO GROUP

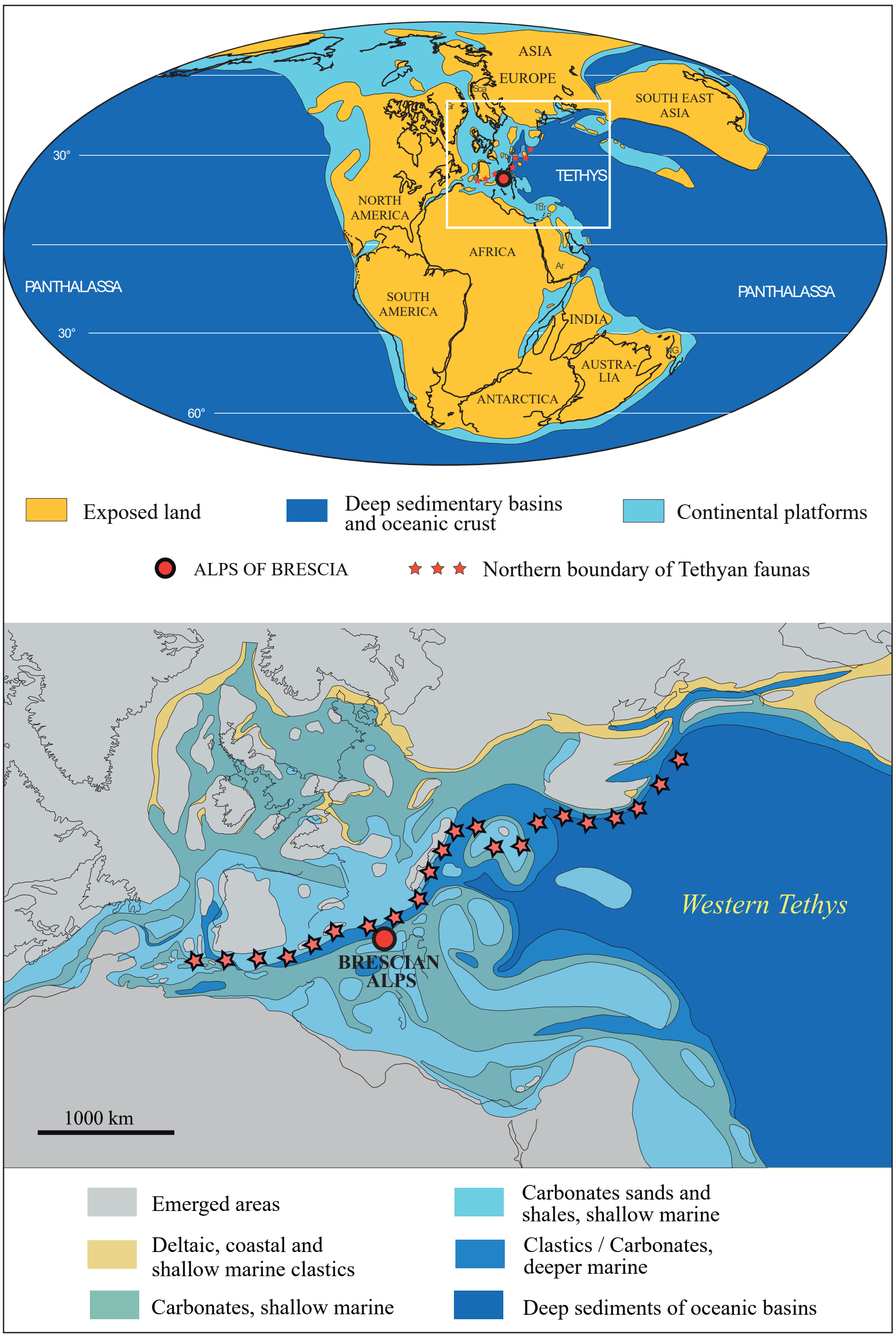


Fig. 3 - Paleogeographical framework for the Sinemurian to basal Toarcian on the scale of the globe and of the western Tethys (modified from Thierry et al. 2000) and location of the studied area.

At the beginning of the Jurassic, an articulated fault-system, composed of West-dipping North-South master faults and West-East transfer faults, trending from Brescia to the North, separated a growing western basinal area (Val Trompia-Sebino Basin) to the eastern Botticino structural high (Picotti 1991; Cassinis & Schirolli 1995; Schirolli 1997; Picotti et al. 1997). Between the Hettangian (?) and the onset of Toarcian, almost 1000 m of well-stratified cherty marly limestones of the Medolo Group (Gardone Val Trompia Limestone and Domaro Limestone formations) represent the synrift deposition of the Val Trompia-Sebino Basin, following the drowning of the Hettangian Corna platform (Schirolli 2007a; Cassinis & Schirolli 2008). In the Botticino High, after the Early Sinemurian a nearly coeval reduced sequence, 50 m thick, composed of the calcarenites/siltites of the Rezzato Encrinite (Upper Sinemurian to upper part of Lower Pliensbachian) and the overlying thinly-bedded and sometimes nodular ammonitic marly limestones of the Botticino Corso Rosso (upper part of Lower Pliensbachian and Upper Pliensbachian), covered the Corna Platform (Fig. 4).

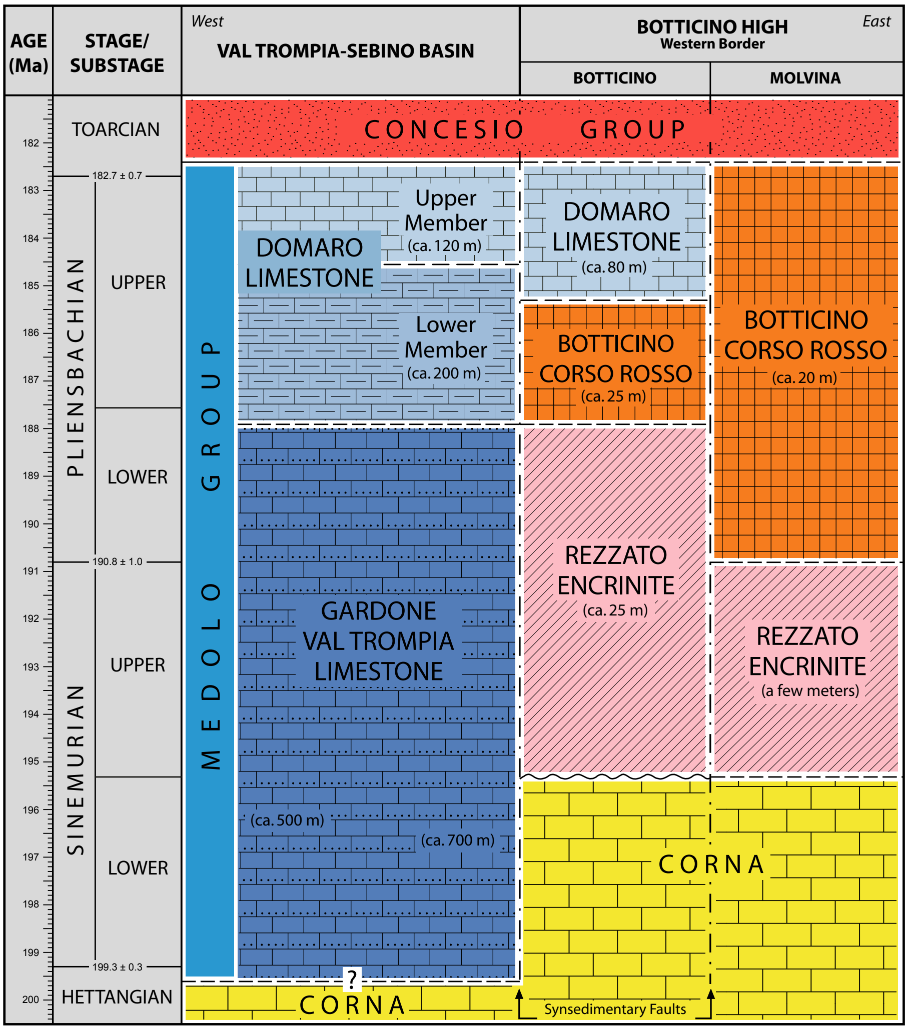


Fig. 4 - Lithostratigraphic setting for the Lower Jurassic in the Prealps of Brescia. Time scale after Cohen et al. (2013; updated 2016). Unit boundaries follow the interpolated numerical ages for ammonite zones outlined in GTS2012 (Gradstein et al. 2012).

Abridged stratigraphic framework of the Lower Jurassic succession

Val Trompia-Sebino Basin

Presumably since the Hettangian, a thick (900-1000 m) basinal succession accumulated above the Corna formation in the Val Trompia-Sebino Basin. The Medolo Group represents the first synrift deepening-upward sequence, showing well-bedded cherty limestones and marly limestones, rich in sponge spicules and radiolarians, interbedded with thin layers of marls and argillaceous marls (Schirolli 2007b).

Two formations are distinguished in the Medolo Group: the Gardone Val Trompia Limestone (Hettangian? to upper part of Lower Pliensbachian), appearing as regularly-bedded fine- and medium-grained spongolitic-peloidal calciturbidites to hemipelagites, and the Domaro Limestone (uppermost part of Lower Pliensbachian to basal Toarcian), showing well-stratified pelagic sediments, bearing the classical «Domerian» fauna of Mt. Domaro. Moreover, two members are recognized in the Domaro Limestone: a «lower member», composed both of pelagic calciturbidites and pelagites, and an «upper member», mainly due to a pelagic settling (Schirolli 2002c). A thick transitional lithofacies characterizes the passage between the two formations of the Medolo Group in the Brescia block during the Lower Pliensbachian with respect to the succession cropping out in Val Trompia. Platform-derived megabreccias occur in the basal part of the Gardone Val Trompia Limestone, close to the tectonic lineaments activated by the Jurassic rifting. Other breccias and slump deposits locally appear in several levels of the Medolo Group.

The thick- and coarse-grained calciturbidites of the lowermost part of Concesio Group (Schirolli & Cassinis 2002), rich in crinoids, overlie the micritic limestones of the Medolo in the basinal area. Commonly a lithozone of variegated marlstones, bearing basal Toarcian ammonites, concordantly

Fig. 5 - Arnioceras bed (hammer is above) overlying the lithostratigraphic boundary between Corna and Rezzato Encrinite in the Botticino Mattina section.

Fig. 6 - Nodular thin-bedded micrites of the Botticino Corso Rosso in the Molvina section, including the faunal «Assemblage b» referred to the Lower Pliensbachian (Jamesoni Chronozone).

occurs at the base of the Concesio Group (Schirolli 1994, 1997; Bersezio et al. 1996).

Botticino High

In the Botticino area, immediately to the East of Brescia, a reduced deepening sequence (50 m thick) in respect of the Medolo succession of the subsiding western region, characterizes the stepwise drowning of the platform massive limestones of the Corna, subsequent to the Early Sinemurian (Cassinis 1968; Cassinis & Schirolli 1995). The first step of drowning is marked by the deposition of the Rezzato Encrinite (Schirolli 2002d) above the Corna formation. A 25 m-thick sequence of crinoidal calcarenites, passing upwards to crinoidal-spongolitic calcisiltites, occured on the drawned plateau. A rich Sinemurian ammonite assemblage is known just above the top of the Corna limestone (Cassinis & Cantaluppi 1967; Cassinis 1968; Schirolli 1997; Dommergues et al. 1997b).

Near the end of the Lower Pliensbachian the Rezzato Encrinite passes transitionally into the condensed Botticino Corso Rosso, 20-25 m thick, showing the second step of drowning of the plateau towards a submarine pelagic high (Schirolli 2002b). Thinly-bedded pink calcilutites and red nodular marly limestones, bearing ammonites of the beginning of Upper Pliensbachian, occur in the unit (Dommergues et al. 1997b; Schirolli 1997). Only the western edge of the Botticino High shows a three-stage drawning evolution, inferred by the existence of the upper member of the Domaro Limestone above the Botticino Corso Rosso. On this marginal block, plenty of mass movement deposits occur on the upper part of the Botticino Corso Rosso. The Domaro Limestone abruptly desappears eastward (Molvina block).

At the beginning of Toarcian the variegated fossiliferous marlstones of the Molvina unit (local lower formation of the Concesio Group) drape the entire Botticino High.

Stratigraphical sections, fossiliferous sites and localities

The stratigraphic framework of the most important fossiliferous localities considered in this study is briefly described below. The examined ammonites are collected in stratigraphical sections and fossiliferous sites or come from the collections of the Natural Sciences Museum of Brescia. Also the localities cited for the revised specimens from Meneghini (1867-81), Parona (1897), Bettoni (1900), Cantaluppi (1966), Cassinis & Cantaluppi (1967), Cantaluppi & Cassinis (1970) and Castelli (1980) are included.

Numbers, capital and small letters are referred respectively to the examined stratigraphical sections, fossiliferous sites and localities (Fig. 2). Both in the stratigraphical sections and in the fossiliferous sites, ammonites have been collected from well-known beds, whereas the fossiliferous locality indicates limited knowledge of the precise collection point of the ammonites within a source area, placed into a certain stratigraphical framework.

The palaeontologic descriptions of some of the specimens considered also in this work are given by Dommergues et al. (1997b). Some illustrations and a preliminary biostratigraphical framework are presented in Meister et al. (2009). More details about the stratigraphical and sedimentological features of the Jurassic carbonate succession of the area of study occur in Schirolli (1990, 1992, 1997, 2002bcd, 2007ab) and Cassinis et al. (2011).

For a detailed description of the geologic and stratigraphic outline of sections, fossiliferous sites and localities already published only the reference will be provided.

Botticino High

Stratigraphical sections.

Botticino Mattina (1) (Fig. 5), Lassa (2), Molvina (3) (Fig. 6), Mt. Marguzzo (4), St. Eufemia (5) from Schirolli (1997) and Dommergues et al. (1997b). Specimens from «Botticino» included in the museum's collections are coming mainly from the Sinemurian to Pliensbachian formations (Rezzato Encrinite, Botticino Corso Rosso, Medolo) cropping out in the abandoned quarries on the eastern side of the Botticino hill (Botticino Mattina), where the stratigraphic sections of Botticino Mattina and Lassa were described (Cassinis 1968; Schirolli 1997; Dommergues et al. 1997b).

Fossiliferous sites.

Molvina (Mt. Sapone) (A) from Schirolli (1997) and Dommergues et al. (1997b). Mazzano (B) from Cantaluppi & Cassinis (1970).

Lassa QRQ (C). In an active quarry of «Botticino Limestone» near «Lassa» have been observed plenty of ammonite's whorl sections (impossible to extract) in a layer stratigraphically 16 m below the top of the Corna formation. The layer seems to be attributed by the faunal assemblage to the middle-upper part of the Lower Sinemurian. The massive shallow-water limestones of the Corna are overlain by the well-stratified cherty limestones of the Rezzato Encrinite (see also the Lassa stratigraphic section from Schirolli 1997 and Dommergues et al. 1997b).

Fossiliferous localities.

Serle (a). Scattered outcrops of Medolo and Concesio Group are present along both the sides of a narrow roughly East-West trending syncline, located immediately to the North of Serle. Pliensbachian and Lower Toarcian ammonites are recorded from these layers.

Gazzolo (Nuvolera) (b). A Sinemurian ammonite was collected in the Rezzato Encrinite overlying the limestones of the Corna platform in Gazzolo locality, on the hill between Botticino Mattina to the West and the Nuvolera Valley to the East. The specimen is also cited by Parona (1897: 17-18).

Virle (c) - Rezzato (d). Hills facing these two neighbouring villages highlight the entire succession typical of the Jurassic Botticino structural high, ranging from Sinemurian to Toarcian beds. In fact, specimens are representative of all the lithostratigraphic units outcropping in this area. They are coming from the Sinemurian Rezzato Encrinite, the Pliensbachian Botticino Corso Rosso and the overlying Medolo, and finally from the basal Toarcian variegated marlstones of the Concesio Group.

Caionvico (e). A Late Pliensbachian specimen from this locality was likely collected in a small Medolo tectonic block outcropping at the base of the Mt. Maddalena overthrust, just below the Lowermost Jurassic massive limestones of the Corna formation.

Botticino. From Botticino mainly Sinemurian ammonites coming from the Rezzato Encrinite formation were selected from the collections of museum (Fig. 5). Late Pliensbachian specimens from the overlying «Corso» Auct. formation are illustrated by Bettoni (1900). The lithostratigraphy of this locality is supported by the published sections of Botticino Mattina and Lassa (Schirolli 1997; Dommergues et al. 1997b).

Val Trompia-Sebino Basin

Stratigraphical sections.

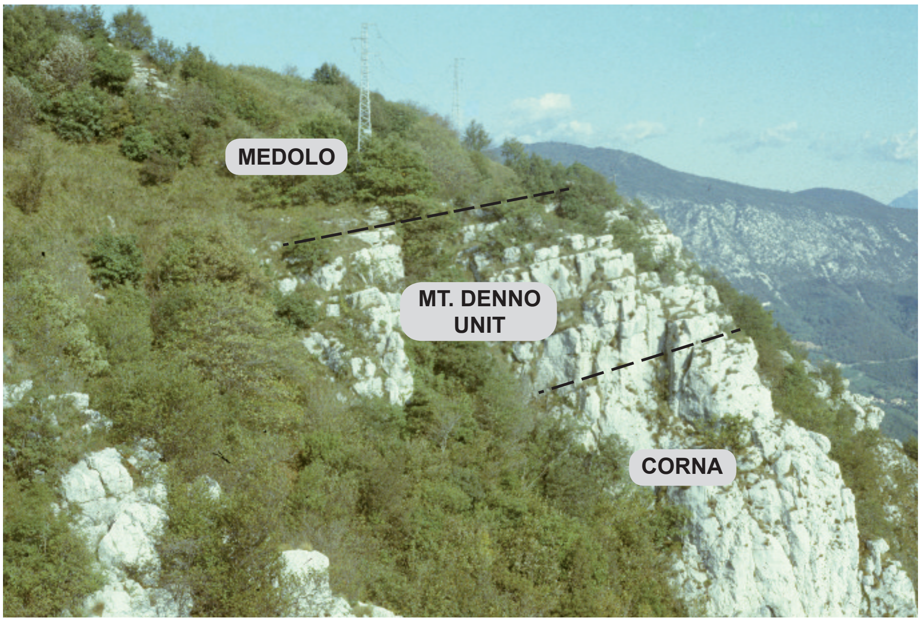


Fig. 7 - Well-stratified limestones of the Mt. Denno unit between the platform limestones of the Corna formation and the basinal cherty limestones of the Medolo Group typically outcropping along the Mt. Maddalena - Mt. Salena ridge. A Sinemurian faunal assemblage is recorded in the uppermost bed of this unit, just below the onset of Medolo succession.

Mompiano (6), Inzino (7), Mt. Domaro (8), Cogozzo (9), Villa (10), Caricatore Val Navezze (Gussago) (11), Provaglio d'Iseo (12) from Cantaluppi & Cassinis (1984), Schirolli (1990, 1997) and Dommergues et al. (1997b).

Fossiliferous sites.

Pregno (I), Poffe di Lumezzane (H), Mt. Zoadello (J), Mt. Delma (M), Punta dell'Orto (O), Montecolo di Pilzone (P), Montisola (Q) from Schirolli (1997) and Dommergues et al. (1997b).

Mt. Denno (D). A Sinemurian faunal assemblage is recorded in a bioclastic bed at the uppermost part of the informal Mt. Denno unit (Schirolli 1997), just below the onset of Medolo Group. The transitional unit between the platform limestones of the Corna formation and the basinal cherty limestones of the Gardone Val Trompia Limestone typically occurs along the Mt. Maddalena - Mt. Salena ridge (Fig. 7).

North face of «Colle Cidneo» (Cidneo Hill) (E). A well-stratified rock wall of Domaro Limestone, approximately 15 m high, occurring to the north side of the Cidneo Hill, has released plenty of ammonites of the lower part of Upper Pliensbachian (Stokesi to base Gibbosus Subchronozone) (Fig. 8).

Costalunga (Ponte Alto) (F). In the well-stratified cherty limestones of the Gardone Val Trompia Limestone outcropping in a today-disused quarry overlooking «Piazzale Golgi» («Ponte Alto» is the oldest name) in Brescia, about 1 Km to the North of the historical centre of the city, were collected ammonites of the middle part of Lower Pliensbachian. This site is included in the wider Costalunga locality.

Concesio (G). Under the name of the village Concesio two nearby sites are considered. (A1) The abandoned quarry in «Roncaglie» site shows the marly limestones of the lower member of the Domaro Limestone bearing ammonites of the middle-lower part of Upper Pliensbachian. (A2) In the neighbouring «Artignago» site were collected ammonites of the middle part of Upper Pliensbachian from a stratigraphic interval starting from beds just above those cropping out in Roncaglie and including both the members of the Domaro Limestone.

Gardone Val Trompia (K). The site named «Convento», in Gardone Val Trompia, is located at the eastern foot of Mt. Domaro. It highlights a sinemurian part of the Gardone Val Trompia Limestone stratigraphically just below the lotharingian beginning of Mt. Domaro section (Schirolli 1990) and over the top of the underlying Inzino section (Schirolli 1997) including an Arnioceras bed at the boundary between Lower and Upper Sinemurian (Semicostatum to base Obtusum Chronozones) (Dommergues et al. 1997b).

Mt. Domaro (L). This is the historical fossiliferous site in the Domaro Limestone cropping out at the foot of the «Colma di Domaro» mountaintop (Cita et al. 1961; Cita 1964; Fantini Sestini 1962; Ferretti 1967; Schirolli 1990, 1997, 2002a).

Valenzano (N). Close to the village of Valenzano, at the southern foot of the namesake

Fig. 8 - Well-stratified rock wall of Domaro Limestone of the middle-lower part of Upper Pliensbachian occurring to the north side of the Cidneo Hill. Beds pointed out by the blue bar released plenty of ammonites of the top Subnodosus-base Gibbosus Subzones.

mountain, plenty of ammonites of the middle part of the Upper Pliensbachian were collected in the outcropping marly limestones of the Domaro Limestone, around the boundary between the two members.

Montecolo di Pilzone (P). From the Gardone Val Trompia Limestone in the eastern side of Montecolo di Pilzone and in Pilzone are known the Early Pliensbachian specimens illustrated by Parona (1897, pl. IX, fig. 2 and pl. XI, fig. 2). In the overlying Domaro Limestone seems to be recorded also the middle-lower part of Upper Pliensbachian from Meneghini (1867-1881, pl. VI, figs 1, 2) and the middle-upper part of Upper Pliensbachian with specimens illustrated by Bettoni (1900) and cited by Parona (1894).

Montisola (Q). Two different Upper Sinemurian fossiliferous horizons occur in the well-stratified dark cherty limestones of the Gardone Val Trompia Limestone, making up the rock wall facing the lake in the eastern side of Montisola (Fig. 9). These new data confirm the presence of the Lotharingian in the Gardone Val Trompia Limestone of the south-eastern side of Montisola as cited (but not illustrated) by Vecchia (1946).

Borgonato (R). Early Pliensbachian ammonites collected in the late 19th century in marls and limestones of the Gardone Val Trompia Limestone underlying the alluvial deposits of an old quarry in Borgonato are recorded in the historical collection of the Natural Sciences Museum in Brescia. Also Parona (1897, pl. IX, fig. 3) illustrated the same specimens from Borgonato.

Fossiliferous localities.

Ronchi di Brescia (f). The so-called «Ronchi di Brescia» are the hills overlooking the city of Brescia from East. Along the succession outcropping in this locality ammonites range from the Lower Pliensbachian beds of the Gardone Val Trompia Limestone to the Upper Pliensbachian beds of the Domaro Limestone.

Costalunga (g). This locality is represented by the northern foothills of a rilief immediately to the North of the Cidneo Hill in Brescia. Its backbone is given by the stratified limestones of the Pliensbachian part of Medolo Group, including both its formations (Gardone Val Trompia Limestone and Domaro Limestone), although almost all the ammonites of the museum's collections from this locality are to be referred to the Upper Pliensbachian Domaro Limestone. Otherwise some specimens illustrated by Parona (1897) belong to the Early Pliensbachian, probably coming from the western side of Costalunga rilief, where is located the old quarry above mentioned as fossiliferous site of «Ponte Alto» (F). «Goletto» is a pass close to the top of the hill.

«Colle Cidneo» (Cidneo Hill) (h). The Cidneo Hill is located in the northeastern quadrant of the historic centre of Brescia. From a geological point of view this relief is connected to the eastern «Ronchi di Brescia», i.e. the latest southern offshoot of the Brescian Prealps in front of the Po Plain,

Fig. 9 - Lotharingian well-stratified dark cherty limestones of the Gardone Val Trompia Limestone, making up the rock wall facing the lake in the eastern side of Montisola.

which the ridge of Mt. Maddalena is also part of. The backbone of the hill is given by the basinal succession of Medolo Group, mainly by the Pliensbachian Domaro Limestone, although in the 19th century layers of underlying Gardone Val Trompia Limestone had to crop out.

On the top of the hill is located the medieval «Castello di Brescia» (Brescia Castle), built above the Pliensbachian Domaro Limestone succession ranging from the uppermost Lower Pliensbachian to the Upper Pliensbachian. Some specimens from the Brescia Castle have been revised from Bettoni (1900).

The collections of the Natural Sciences Museum of Brescia include also Late Pliensbachian ammonites labelled as collected in the Medolo limestone of «Pusterla», an area to the northern side of the Cidneo Hill. The above-mentioned site, named north face of Cidneo Hill (E), represents a restricted lithostratigraphic range included in this locality (Fig. 8).

Mompiano (i). This locality is located about 3 Km to the North-East of the centre of Brescia. The lithostratigraphy of this locality is supported by the studied geological cross-section of the Mompiano hill, cutting the entire succession of the Medolo Group, over 1000 m thick (Schirolli 1997; Dommergues et al. 1997b). The Mompiano hill stretches in a South-East to North-West direction from the Mt. Maddalena to the Mt. St. Giuseppe. Early Pliensbachian ammonites belonging to the museum's collections were collected in the upper part of the Gardone Val Trompia Limestone. Late Pliensbachian specimens are coming from the middle part of the overlying Domaro Limestone.

Brescia. Under the name «Brescia» are labelled that specimens collected in the Medolo Group outcropping in the city and referred to the Upper Pliensbachian beds. Locations already individually described are within the limits of this area. Most of Brescia ammonites are likely recorded from the Cidneo Hill.

Urago Mella (j). Early Toarcian ammonites included in the museum's collections were collected in the basal part of Concesio Group cropping out in the southern foothills of the Mt. Picastello, near the village of Urago Mella, immediately to the North-West of the Brescia's Old Town.

Cogozzo (k). Near the end of Lower Pliensbachian is recorded in emipelagites included in the succession of the uppermost part of the Gardone Val Trompia Limestone outcropping in the Cogozzo locality. Specimens from the middle part of Upper Pliensbachian were also collected in the

Fig. 10 - Rock walls of well-stratified Upper Pliensbachian Domaro Limestone in front of Provaglio d'Iseo and the next Iseo peat-bog. The orange hexagone near to the Madonna del Corno Church highlights the location of the Pliensbachian-Toarcian boundary in the uppermost part of Domaro Limestone (Schirolli 1997; Dommergues et al. 1997b).

upper member of the Domaro Limestone in the Cogozzo Valley section (Dommergues et al. 1997b; Schirolli 1997).

Ponte Zanano (l). This village, immediately to the South of Gardone Val Trompia, is located at the south-eastern foot of Mt. Domaro. An ammonite was collected in a dark marly level probably in the uppermost part of the Gardone Val Trompia Limestone.

Gussago (Val Navezze) (m). From this valley to the North of the Gussago village many Late Pliensbachian ammonites were collected in the Domaro Limestone. The «Caricatore» old quarry of stone, already site of published stratigraphic sections (Cantaluppi & Cassinis 1984; Schirolli 1997), cutting the boundary between the Domaro Limestone and the overlying Toarcian marly basal unit of the Concesio Group, is also located in this valley, supporting the stratigraphic framework of this locality.

Saiano (n). A specimen of the middle-late part of Late Pliensbachian is coming from the Domaro Limestone cropping out at the southern foothill of Mt. Valenzano - Mt. Delma relief, near Rodengo Saiano. This specimen can be added to the ammonites collected in two other nearby sites named «Mt. Delma» (M) and «Valenzano» (N), allowing a good reconstruction of the stratigraphic range of the Medolo Group building up this hill. In fact, a bed of the middle part of Lower Pliensbachian was recorded in the Gardone Val Trompia Limestone along the path that from Calvario goes to the Mt. Delma top (Schirolli 1997; Dommergues et al. 1997b) and at the foot of the Mt. Valenzano a new site has highlighted well-preserved specimens in the local Upper Pliensbachian Domaro Limestone.

Provaglio d'Iseo (o). This locality is characterized by rock walls of well-stratified Domaro Limestone in front of Provaglio d'Iseo and the next Iseo peat-bog (Fig. 10). A stratigraphic section near the top of the rock wall has highlighted the Pliensbachian-Toarcian boundary in the uppermost part of Domaro Limestone (Schirolli 1997; Dommergues et al. 1997b). An ammonite from the museum's historic collections, according to two specimens illustrated by Parona (1897, pl. X, fig. 3 and pl. XI, fig. 3), is recorded from Upper Sinemurian to Lower Pliensbachian beds in Provaglio, although no coeval outcrops of Medolo are known in this locality at present; only in the nearby places of Montecolo d'Iseo and Mt. Valenzano-Mt. Delma relief the Gardone Val Trompia Limestone is present.

Adro (p). To the east side of Mt. Alto near the village of Adro, the Domaro Limestone bearing Upper Pliensbachian ammonites occurs as lowermost stratigraphic unit of a pile of Jurassic formations with Maiolica at the top.

Brescia surroundings. Plenty of ammonites from the collection of the Brescia Natural Sciences Museum are labelled as found in the surroundings of Brescia. This generic name mainly includes ammonites collected in the fossiliferous Domaro Limestone certainly outcropping in aforementioned localities both within the city, i.e. Colle Cidneo, Ronchi di Brescia, Costalunga, Mompiano, and in Val Trompia, to the North of the city, in localities as Concesio and Mt. Domaro. Only a few ammonites are recorded from the underlying Lower Pliensbachian Gardone Val Trompia Limestone.

Systematics

Remark. This work is an exhaustive study of the Early Jurassic ammonites of the Brescian Alps, taking in account two preliminary studies (Dommergues et al. 1997b; Meister et al. 2009). Moreover, if possible, a revision of the regional faunas previously illustrated by Meneghini (1867-81), Parona (1897), Bettoni (1900), Cantaluppi (1966), Cassinis & Cantaluppi (1967), Cantaluppi & Cassinis (1970) and Castelli (1980) is proposed. Cassinis' and Cantaluppi's discussions mainly concern the Sinemurian whereas the fauna of Cantaluppi (1966) concerns the Sinemurian and the Late Pliensbachian. For Parona most part of the fauna seems to belong to the Earliest Pliensbachian and is coming from several localities of Brescian Alps (Brescia area, Costalunga, Provaglio, Montecolo di Pilzone, Borgonato). For Bettoni and Meneghini, the fauna is rather of Late Pliensbachian age and is coming also from several localites studied here. The work of Castelli covers the entire Pliensbachian. It is to note that the ammonites of the Mt. Domaro, the historical type-locality for the «Domerian» substage (Cita et al. 1961; Cita 1964), will be the subject of a specific paper and are not discussed here. The main part of the material is based on our collects and on the material of the Natural Sciences Museum of Brescia. For discussion and comparison we refer to our recent publications (Géczy & Meister 1998, 2007; Macchioni & Meister 2003; Mouterde et al. 2007; Blau & Meister 2011; Meister et al. 2011; Meister & Blau 2014). Therefore for some taxa rather well known, the comments are reduced to their minimum. Additionally we do not provide extensive synonymy lists but only refer to recent publications with exhaustive ones.

For the ammonites we use herein the geochronologic terminology because we refer to age or range (= ammonite living interval). The use of chronozone, subchronozone in brackets following the age is just to mark the corresponding chronostratigraphical unit. More generally, we use lower-middle-upper when we refer to litho-bio- and chronostratigraphic units, but early-middle-late when we refer to the corresponding age (geochronologic unit). This use is confirmed in the text, according with the International Stratigraphic Guide (Salvador 1994).

Class **Cephalopoda** Cuvier, 1798
Subclass **Ammonoidea** Zittel, 1884
Order **Phylloceratida** Arkell, 1950
Superfamily **Phylloceratoidea** Zittel, 1884
Family Phylloceratidae Zittel, 1884

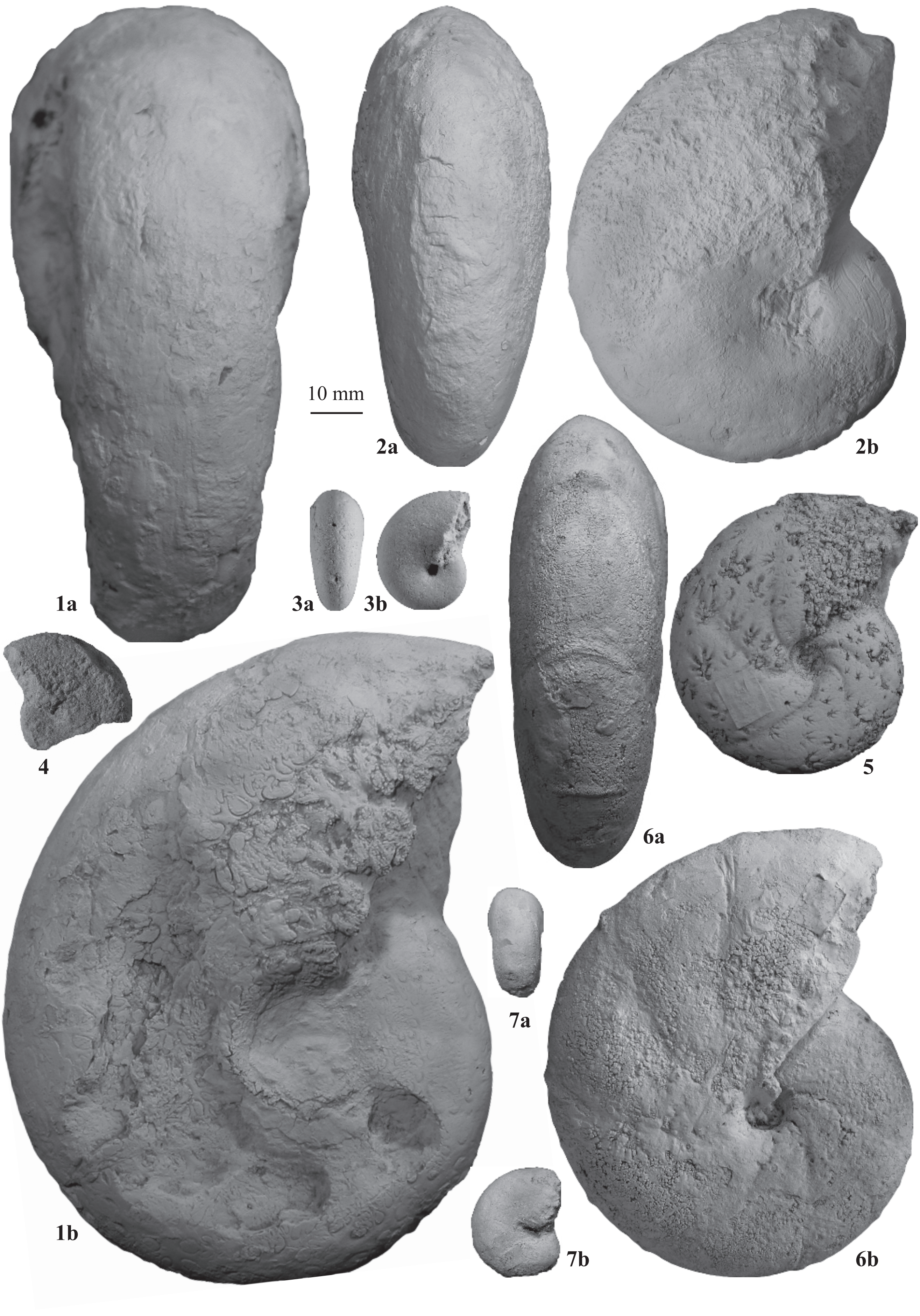
PLATE 1

Fig. 1, 7 - *Calaiceras calais* (Meneghini, 1874). Costalunga (no 2059), Colle Cidneo (Pusterla) (no 1539).

Fig. 2, 3 - *Phylloceras* gr. *frondosum* (Reynès, 1868) - *hebertinum* (Reynès, 1868). Gussago (Val Navezze) (no 294), Concesio (no 1540).

Fig. 4 - *Geyeroceras cylindricum* (Sowerby, 1831). Mt. Denno (no MMD2).

Fig. 5, 6 - *Calliphylloceras bicicolae* (Meneghini, 1874). Mt. Domaro (no 2007), Colle Cidneo (no 2014).


10 mm
1a
2a
2b
3a
3b
4
5
6a
1b
7a
7b
6b

Subfamily Phylloceratinae Zittel, 1884
Genus *Phylloceras* Suess, 1865
Type species: *Ammonites heterophyllus* Sowerby, 1820

Phylloceras gr. ***frondosum*** (Reynès, 1868) - ***hebertinum*** (Reynès, 1868)

Pl. 1, figs 2, 3

*1868 *Ammonites Hebertinus* Reynès, pl. 2, fig. 3.
*1868 *Ammonites frondosus* Reynès, pl. 5, fig. 1.
1884 *Phylloceras Meneghinii* Gemmellaro, pl. 2, figs 13-17.
1966 *Phylloceras meneghinii* - Cantaluppi, pl. 17, fig. 1.
1966 *Phylloceras subfrondosum* Del Campana - Cantaluppi, pl. 17, fig. 2.
2007 *Phylloceras* gr. *frondosum-hebertinum* - Géczy & Meister, pl. 1, figs 4-6; pl. 2, fig. 1; pl. 11, fig. 4b with synonymy.
2009 *Phylloceras* gr. *frondosum-hebertinum* - Meister, Schirolli & Dommergues, pl. 1, fig. 10.
2011 *Phylloceras frondosum-hebertinum* - Meister et al., p. 117.e8, fig. 5.1 with synonymy.

Classic *Phylloceras* of the group *P. frondosum* (Reynès) - *hebertinum* (Reynès) with smooth suboxycone to suboppelicone shell shape.

Local record. Concesio, Gussago (Val Navezze) and Provaglio d'Iseo, Lassa (Dommergues et al. 1997b), Molvina (Cantaluppi 1966).

Age and distribution. Common in the Tethyan regions, this species is also known in southern part of the Euroboreal domain, Central and South America and Asia. It ranges from at least, the Late Sinemurian to the Early Toarcian.

Genus *Geyeroceras* Hyatt, 1900
Type species: *Ammonites cylindricum* Sowerby, 1831

Geyeroceras cylindricum (Sowerby, 1831)

Pl. 1 fig. 4

*1831 *Ammonites cylindricum* Sowerby *in* De La Beche, p. 318, fig. 54.
2011 *Geyeroceras cylindricum* - Meister et al., p. 29, figs 3a-f, 4c-d with synonymy.

This form is smooth and shows a subrectangular whorl section with flat subparallel flanks, a convex ventral part and a narrow umbilicus, almost occluded. These character are typical of a peculiar phylloceratid, *Geyeroceras cylindricum* (Sowerby).

Local record. Mt. Denno.

Age and distribution. The species ranges from the latest Hettangian to the Late Sinemurian (Raricostatum Chronozone). It is known in Mediterranean Tethys and in Asia (Indonesia).

Genus *Calliphylloceras* Spath, 1927
Type species: *Phylloceras disputabile* Zittel, 1869

Calliphylloceras bicicolae (Meneghini, 1874)

Pl. 1, figs 5, 6

*1874 *Phylloceras Bicicolae* Meneghini, p. 106.
? 1878 *Phylloceras sylvestre* Herbich, pl. 20G, fig. 1.
1884 *Phylloceras alontinum* Gemmellaro, pl.1, fig. 7; pl. 2, figs 18-20.
1895 *Phylloceras Geyeri* Bonarelli, p. 333.
1900 *Phylloceras Emeryi* Bettoni, pl. 4, figs 2-4.
1900 *Phylloceras bettonii* Del Campana, pl. 7, fig. 30-32.
1910 *Phylloceras sylvestre* Herb. var. *retisulcata* Vadasz, pl. 2, fig. 3.
1920 *Phylloceras subcapitanei* Krumbeck, pl. 16, fig. 7.
1966 *Calliphylloceras emeryi* - Cantaluppi, pl. 17, fig. 3.
1967 *Calliphylloceras liasicum* Géczy, pl. 8, fig. 1, 2.
1967 *Calliphylloceras liasicum transdanubicum* Géczy, pl. 8, fig. 5.
1980 *Calliphylloceras bicicolae* - Castelli, pl. 1, fig. 7.
1997b *Calliphylloceras bicicolae* - Dommergues, Meister & Schirolli, pl. 1, fig. 1.
2007 *Calliphylloceras bicicolae* - Géczy & Meister, pl. 1, fig. 7 with synonymy.

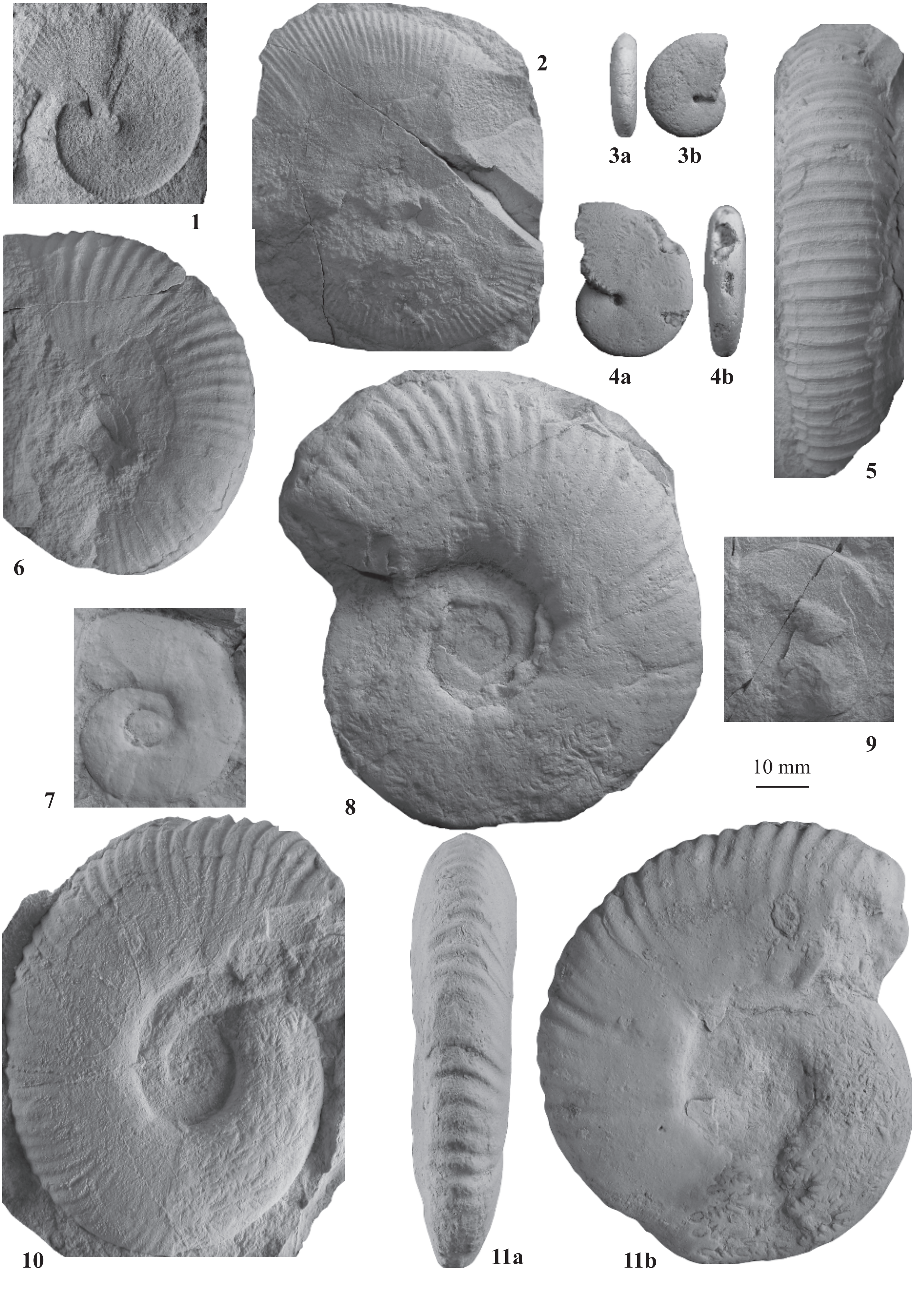
After the *Partschiceras*, this taxon seems to be the most representative Phylloceratinae in the Sinemurian-Pliensbachian in the Brescia Alps. A platycone involute shell shape associated with periodic constrictions characterize this taxon. The constriction is rursiradiate on the periumbilical part then curving and becoming prorsiradiate.

Local record. Colle Cidneo, Concesio, Mt. Domaro, and from Lassa, Molvina (Dommergues et al. 1997b; Cantaluppi 1966).

Age and distribution. *C. bicicolae* (Meneghini) is recorded from theTethyan regions except the westernmost region like Morocco, from part of the Euroboreal domain and from Asia. It ranges from Late (Early?) Sinemurian to Late Pliensbachian (Early Toarcian ?).

PLATE 2

Fig. 1, 2 - *Partschiceras tenuistriatum* (Meneghini, 1868). Colle Cidneo (North face) (no Castello 3), Colle Cidneo (Castello di Brescia) (no 283a).
Fig. 3, 4 - *Zetoceras zetes* (Orbigny, 1850). Brescia surroundings (no 1541a, no 1541b).
Fig. 5, 6 - *Partschiceras* gr. *striatocostatum* (Meneghini, 1853). Colle Cidneo (no 1994), Provaglio d'Iseo (no 600).
Fig. 7 - *Juraphyllites* aff. *limatus* (Rosenberg, 1909). Costalunga (Goletto) (no 2766a).
Fig. 8, 11 - *Juraphyllites libertus* (Gemmellaro 1884). Costalunga (no 5009), Botticino Mattina-Lassa (no 383).
Fig. 9 - *J.* (*Harpophylloceras*) *eximius* (Hauer, 1854). Colle Cidneo (North face) (no 5026).
Fig. 10 - *Juraphyllites* gr. *diopsis* (Gemmellaro 1884). Costalunga (no 175).


1
2
3a
3b
4a
4b
5
6
7
8
9
10 mm
10
11a
11b

Genus *Calaiceras* Kovacs, 1939
Type species: *Phylloceras calais* Meneghini, 1874

Calaiceras calais (Meneghini, 1874)
Pl. 1, figs 1, 7

1867-1881 *A.* (*Phylloceras) calais* Meneghini, pl. 3, figs 1, 2.
? 1900 *Phylloceras calais* - Bettoni, pl. 9, fig. 3.
2007 *Calaiceras calais* - Géczy & Meister, pl. 43, fig. 9 with synonymy.

Our specimens are characterized by a quite open umbilicus for the subfamily, quite massive subrectangular whorl section and a marked umbilical edge. The presence of some constrictions distinguishes them from the genus *Hantkeniceras*.

Local record. Costalunga, Colle Cidneo (Pusterla) and from Botticino (Bettoni 1900).

Age and distribution. Known in the whole Mediterranean Tethys excepted High Atlas, its range corresponds to the Pliensbachian (? already Sinenurian) and basal Toarcian.

Genus *Zetoceras* Kovacs, 1939
Type species: *Ammonites zetes* Orbigny, 1850

Zetoceras zetes (Orbigny, 1850)
Pl. 2, figs 3, 4

1845-1849 *Ammonites heterophyllus amalthei* Quenstedt, pl. 6, fig. 1.
*1850 *Ammonites zetes* Orbigny, p. 247.
1900 *Phylloceras zetes* - Bettoni, pl. 9, fig. 2.
? 1908 *Phylloceras pseudozetes* Fucini, p. 12.
2007 *Zetoceras zetes* - Géczy & Meister, pl. 2, figs 3, 7 with synonymy.
2011 *Zetoceras zetes* - Meister et al., p. 117e10, fig. 6.1 with synonymy.

With high compressed whorls, these Phylloceratinae belong to the genus *Zetoceras*. Their subparallel flanks and a very narrow umbilicus characterize the *Z. zetes* (Orbigny).

Local record. Brescia surroundings and Botticino (Bettoni 1900).

Age and distribution. This species ranges from Early Sinemurian to Late Pliensbachian, maybe to Early Toarcian. It is recorded in the western Tethys (southern margin includin Morocco, High Atlas and northern margin until Pontides) and in some part of the Euroboreal domain (France, UK, Germany).

Genus *Partschiceras* Fucini, 1923
Type species: *Ammonites Partschi* Stur, 1851

Partschiceras gr. ***striatocostatum*** (Meneghini, 1853)
Pl. 2, figs 5, 6

1851 *Ammonites Partschi* Stur, p. 26 (*nom. nudum*).
1853 *Ammonites striatocostatus* Meneghini, p. 28.
1868 *Ammonites Sturi* Reynès, pl. 3, fig. 1.
1913 *Phylloceras anonymum* Haas, pl. 1, fig. 5.
1942 *Partschiceras trauthi* Kovacs, pl. 1, fig. 3.
1980 *Partschiceras anonymum* - Castelli, pl. 1, fig. 6.
2007 *Partschiceras* gr. *striatocostatum* - Géczy & Meister, pl. 3, figs 3-6, 8; pl. 4, fig. 1 with synonymy.

P. gr. *striatocostatum* (Meneghini) is very well represented in the Brescian Alps. With a suboxycone shape, it is characterized by regular ribs telatively spaced for the genus, thickened on the outer part and associated with striae, both crossing the venter.

Local record. Gussago, Colle Cidneo, Provaglio d'Iseo, Botticino.

Age and distribution. The species ranges from ?Late Sinemurian to basal Toarcian. It is known in the western tethys including Pontides and Taurides and southern Europe like the Causses Basin. The genus is also known in Morocco (High Atlas) and In Algeria (Kabylie).

Partschiceras tenuistriatum (Meneghini, 1868)
Pl. 2, fig. 1, 2

1868 *Ammonites tenuistriatus* Meneghini, p. 321.
1879 *Ammonites tenuistriatus* - Reynès, pl. 44, fig. 16 (lectotype).
1886 *Phylloceras costatoradiatum* Geyer, pl. 1, fig. 10.
? 1936 *Partschiceras catanense* Gugenberger, pl. 13, figs 21, 22; pl. 14, figs. 6, 7.
1942 *Partschiceras tenuistriatum* var. *acuticostata* Kovacs, pl. 1, fig. 4.
2007 *Partschiceras* gr. *tenuistriatum* - Géczy & Meister, pl. 3, fig. 7; pl. 4, figs 2, 3 with synonymy.
2009 *Partschiceras* gr. *striatocostatum* - Meister, Schirolli & Dommergues, pl. 1, fig. 11.

These *Partschiceras* are characterized by a fine dense, slightly proradiate ribbing that distinguish them from *P. striatocostatum* (Meneghini).

Local record. Colle Cidneo.

Age and distribution. Its range correspond

PLATE 3

Fig. 1 - *Lytoceras fimbriatoides* Gemmellaro, 1884. Provaglio d'Iseo (no 161).
Fig. 2 - *Lytoceras* aff. *villae* Meneghini, 1874. Colle Cidneo (no 5011).

1a

1b

10 mm

2

to the Late Sinemurian - Late Pliensbachian. Its distribution is more restricted than *P.* gr. *striatocostatum* (Meneghini), part of western Tethys (e.g. Austrian Upper Austroalpine units, Bakony, North Africa).

Remark. *Partschiceras* sp. is known in Provaglio d'Iseo and Mt. Domaro (Dommergues et al. 1997b, p. 8) and *P. retroplicatum* (Geyer) is present in Castello di Brescia, Bresciano and Gussago (see Bettoni 1900).

Family Juraphyllitidae Arkell, 1950
Genus *Juraphyllites* Muller, 1939
Type species: *Phylloceras diopsis* Gemmellaro, 1884

Juraphyllites nardii (Meneghini, 1853)

Pl. 16, fig. 5

*1853 *Ammonites Nardii* Meneghini, p. 27.
2007 *Juraphyllites nardii* - Géczy & Meister, pl. 6, figs 1-3 with synonymy.

This *Juraphyllites* is characterized by a well developed ribbing as well on the venter than on the flanks of the body chamber. The ribs start from the base of the flank, fine they become thicker on the outer part and cross the venter. This habitus distinguishes *J. nardii* (Meneghini) from the other species of the genus. Often contrictions are obvious as illustated by Fucini (1901, pl. 7, figs 1-7).

Local record. Montisola.

Age and distribution. Widespread in the MediterraneanTethys and in the Pacific domain, this species is known in the Late Sinemurian.

Juraphyllites libertus (Gemmellaro, 1884)

Pl. 2, figs 8, 11

*1884 *Phylloceras libertum* Gemmellaro, pl. 2, fig. 1-5.
1900 *Rhacophyllites libertus* - Bettoni, pl. 9, fig. 1.
? 1966 *Juraphyllites libertus* - Cantaluppi, pl. 17, fig. 4.
1980 *Juraphyllites libertus* - Castelli, pl. 2, fig. 1 (refigures here pl. 2, fig. 11).
1997b *Juraphyllites libertus* - Dommergues et al., p. 8.
2007 *Juraphyllites libertus* - Géczy & Meister, pl. 7, fig. 4 with synonymy.
2011 *Juraphyllites libertus* - Meister et al., p. 117.e8, figs 5.3, 9.

Characteristic constricted *Juraphyllites* with strong ribs, well developed on the outer part of the last whorl and forming chevrons (wrinkles) on the venter. The body chamber occupies the half part of the last whorl as remarkable on our specimens.

Local record. Botticino Mattina-Lassa (see also Dommergues et al. 1997b), Molvina (Cantaluppi 1966) and Costalunga.

Age and distribution. Recorded from the western Tethys, the southern part of the Euroboreal domain, Pontides and Caucasus, the species ranges from the Late Sinemurian to the basal Toarcian.

Juraphyllites gr. ***diopsis*** (Gemmellaro, 1884)

Pl. 2, fig. 10

1884 *Phylloceras diopsis* Gemmellaro, pl. 2, figs 6-8; pl. 6, fig. 1, 2.
2003 *Juraphyllites* gr. *diopsis* - Meister & Friebe, pl. 3, fig. 1 with synonymy.

Without clearly constriction and with a rather dense ribbing developed on the upper half part of the last whorl, this *Juraphyllites* is attributed to *J. diopsis* (Gemmellaro). The absence of ribs on the lower part of the flank distinguishes Gemmellaro's specimen from *J. nardii* (Meneghini). The lack of constrictions distinguishes it from *J. libertus* (Gemmellaro).

Local record. Costalunga.

Age and distribution. *J. diopsis* (Gemmellaro) is known in the western Tethys and ranges from Late Sinemurian (Raricostatum Chronozone) to Early Pliensbachian (Jamesoni Chronozone).

Juraphyllites aff. ***limatus*** (Rosenberg, 1909)

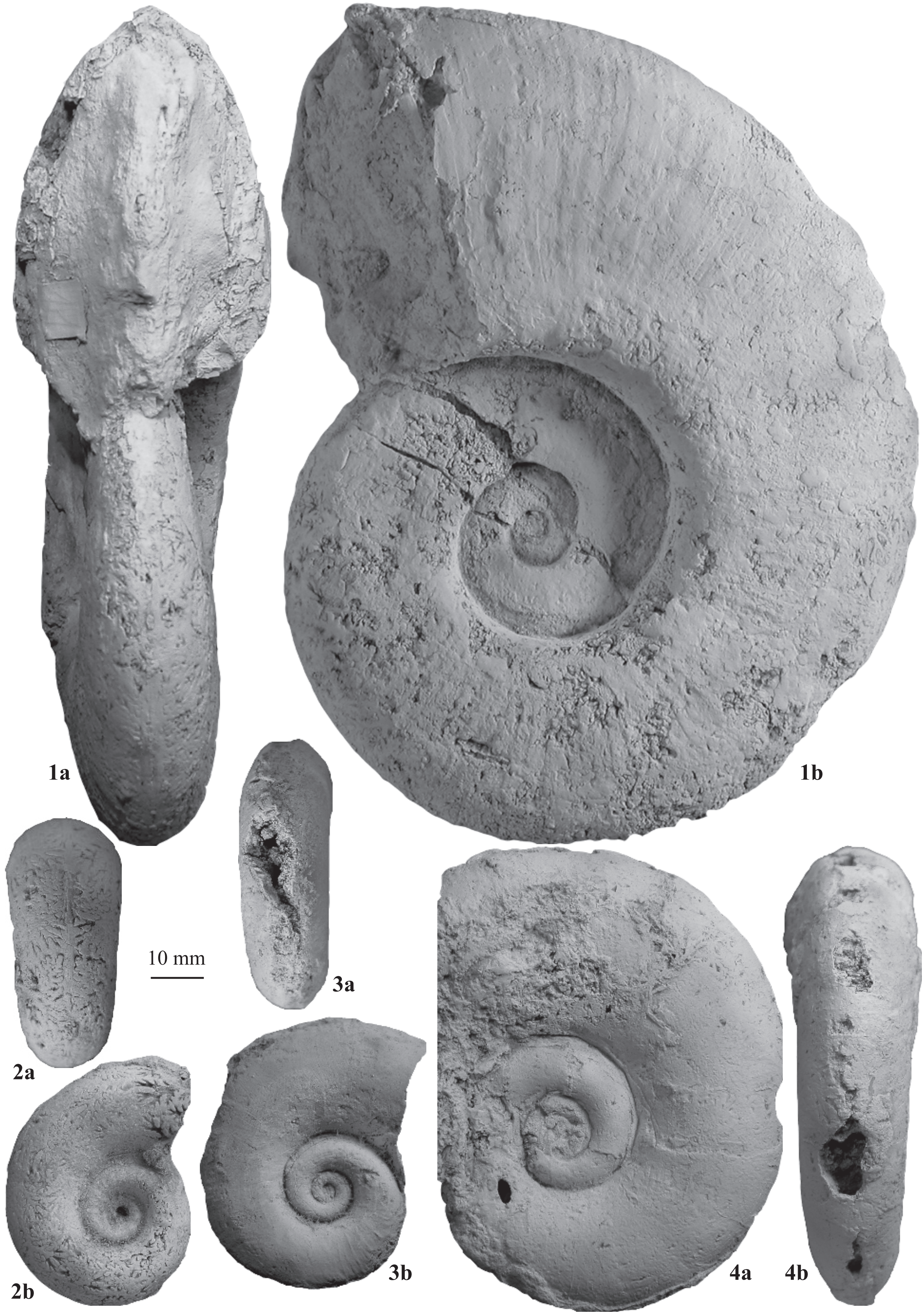
Pl. 2, fig. 7

aff. 1909 *Rhacophyllites limatus* Rosenberg, pl. 2, fig. 10ab, 11.
aff. 1913 *Rhacophyllites limatus* Rosenberg var. *asiatica* Pia, pl. 13, fig. 2.
aff. 2007 *Juraphyllites* gr. *limatus* - Géczy & Meister, pl. 7, figs 1-3 with synonymy.
2011 *Juraphyllites* cf. *limatus* - Meister et al., p. 117.e8, fig. 5.8.

A small smooth *Juraphyllites* is attributed to this species. It well corresponds to the illustrations of Wiedenmayer (1977, pl. 3, fig. 4 and pl. 8, fig. 12).

PLATE 4

Fig. 1, 4 - *Lytoceras ovimontanum* Geyer, 1893. Brescia surroundings (no 1533), Concesio (no 1526).
Fig. 2, 3 - *Lytoceras* sp. Concesio (no 1535a, no 1535b).


1a
1b
2a
10 mm
3a
2b
3b
4a
4b

Local record. Costalunga (Goletto).

Age and distribution. Its range is not well known (Early-Late Pliensbachian). It is recorded from the Alps (Southern Calcareous Alps, Upper Austroalpine units), Morocco and Pontides.

Genus *Harpophylloceras* Spath, 1927

Type species: *Ammonites eximius* Hauer, 1854

J. (*Harpophylloceras*) *eximius* (Hauer, 1854)

Pl. 2, fig. 9

1854 *Ammonites eximius* Hauer, pl. 2, figs 1-4.
1900 *Rhacophyllites eximius* - Bettoni, pl. 3, fig. 6.
2007 *J. (Harpophylloceras) eximius* - Géczy & Meister, pl. 8, fig. 1 with synonymy.
2011 *J. (Harpophylloceras) eximius* - Meister et al., p. 117.e8, figs 5.2, 7.

The association of a fine and dense ribbing on the outer part of the whorls and a minute keel at the end of the growth characterize this *Juraphyllites*.

Local record. Colle Cidneo (North face), Rezzato and from Castello di Brescia (Bettoni 1900).

Age and distribution. It is known in western Tethys and southern Euroboreal domain. Its ranges from Middle maybe Early Pliensbachian to basal Toarcian.

Remark. Note that *Meneghiniceras lariense* (Meneghini) is present in Molvina and in Cava Mompiano (Dommergues et al. 1997b, pl. 1, fig. 2).

Order **Psiloceratida** Housa, 1965
Superfamily **Lytoceratoidea** Neumayr, 1875
Family Pleuroacanthitidae Hyatt, 1900
(= Analytoceratidae Spath, 1927)
Subfamily Ectocentritinae Spath, 1926
Genus *Ectocentrites* Canavari, 1888

Type species: *Ammonites petersi* Hauer, 1856

Ectocentrites aff. ***altiformis*** Bonarelli, 1899

Pl. 6, fig. 4

aff. 1899 *Ectocentrites* (?) *altiformis* Bonarelli, pl. 2, figs 4-6.
aff. 2007 *Ectocentrites* gr. *altiformis* - Géczy & Meister, pl. 9, figs 3, 6; pl. 10, fig. 2 with synonymy.

One specimen (323d) shows affinites with *E. altiformis* Bonarelli with the platycone involute shell shape, the subelliptical whorl section associated with a moderatly embracing whorl overlap and the sigmoidal irregular ribbing. In the inner whorls, periodic sigmoidal constrictions are present with densely, finely and sigmoid ribs.

Local record. Virle, Botticino and the genus is also known from Molvina with an Early Pliensbachian age (Dommergues et al. 1997b, p. 8). The bad preserved specimen from Gazzolo (Nuvolera) discussed by Parona (1897, p. 17) with the name *Cycloceras masseanum* (Orbigny) could also belong to the group of the Sinemurian *Ectocentrites* (?).

Age and distribution. This species is recorded from Italy (Central Apennine, Liguria, Southern Calcareous Alps) and from Hungary (Bakony). It ranges without precision from the Semicostatum Chronozone to Oxynotum maybe Raricostatum Chronozones.

Family Lytoceratidae Neumayr, 1875
Genus *Lytoceras* Suess, 1865
(syn. *Kallilytoceras* Buckman, 1921)

Type species: *Ammonites fimbriatus* Sowerby, 1817

Lytoceras fimbriatoides Gemmellaro, 1884

Pl. 3, fig. 1

1884 *Lytoceras fimbriatoides* Gemmellaro, pl. 3, figs 20-23.
1997b *Lytoceras* aff. *fimbriatoides* - Dommergues et al., p. 9.
2007 *Lytoceras fimbriatoides* - Géczy & Meister, pl. 12, fig. 7 with synonymy.
2011 *Lytoceras fimbriatoides* - Meister et al., p. e9, figs 5(10), 7(2) with synonymy.

With simple annular slightly rursiradiate ribs on the external part and constriction of annular plan, this *Lytoceras* is distinguishable from *L. fimbriatum* (Sowerby).

Local record. Provaglio d'Iseo and Mt. Domaro (Dommergues et al. 1997b).

PLATE 5

Fig. 1, 5 - *Lytoceras ovimontanum* Geyer, 1893. Gussago (Val Navezze) (no u01), Brescia surroundings (no 1532).
Fig. 2 - *Asteroceras* gr. *varians* Fucini, 1903. Montisola (no 507).
Fig. 3 - *Epophioceras* sp. indet. Colle Cidneo (no 283b).
Fig. 4 - *Lytoceras altum* Vadász, 1910. Colle Cidneo (Pusterla) (no 1996a).
Fig. 6 - *A.* (*Boucaulticeras*) sp. Mt. Denno (no MMD3).

1
2
3
4a
4b
5a
5b
6
10 mm

Age and distribution. This species is present in western Tethys [Central Apennine, Sicilia, Albania (Ionian zone), Upper Austroalpine (Austria and Hungaria) and High Atlas]. It ranges from the Late Sinemurian to the Early Pliensbachian without precision.

Lytoceras altum Vadasz, 1910

Pl. 5, fig. 4

1910 *Lytoceras fimbriatum* var. *alta* Vadasz, p. 72, fig. 21.
? 1972 *Lytoceras altum* - Géczy, pl. 2, fig. 1.
2007 *Lytoceras altum* - Géczy & Meister, pl. 12, figs 1, 4.

Almost advolute *Lytoceras* with a peculiar coiling characterized by a very rapid whorl height encreasing.

L. altum Vadasz has rather rounded to subelliptic whorls, rather similar to our specimen.

Two Sinemurian species, *L. tuba* De Stefani and *L. siemensis* (Denckman) have the same coiling but they have a rib pattern close to that one of the group of *L. fuggeri* Geyer or *L. fimbriatoides* Gemmellaro.

L. victoriae Bettoni from the Brescian Alps is a more compressed form with (it seems) divergent flanks.

Local record. Colle Cidneo (Pusterla).

Age and distribution. This species is present in the Bakony (Upper Austroalpine unit) and in Brescia (Southern Calcareous Alps) only. Its age is not well kown, most probably Early, maybe Late Pliensbachian.

Lytoceras* aff. *villae Meneghini, 1874

Pl. 3, fig. 2

aff. 1874 *Lytoceras villae* Meneghini, p. 107.
aff. 1997b *Lytoceras villae* - Dommergues et al., p. 9.
aff. 2011 *Lytoceras* gr. *villae* - Meister et al., p. e9, fig. 8(4) with synonymy.

A rounded whorl section associated with bi or polyfurcate ribs near the median of the flank characterize this *Lytoceras* (no 5011).

Local record. Colle Cidneo and Lassa (Dommergues et al. 1997b).

Age and distribution. Its age corresponds to the middle (maybe the earliest) part of the Early Pliensbachian to middle part of the Late Pliensbachian. It is present in Western Tethys and in southern Euroboreal domain.

Lytoceras ovimontanum Geyer, 1893

Pl. 4, fig. 1, 4; pl. 5, figs 1, 5

1893 *Lytoceras ovimontanum* Geyer, pl. 8, fig. 1.
1900 *Lytoceras ovimontanum* - Bettoni, pl. 2 fig. 4.
1980 *Lytoceras ovimontanum* - Castelli, pl. 3 fig. 1 (refigured here pl. 5, fig. 1).
1980 *Lytoceras nothum* Meneghini - Castelli, pl. 2 fig. 6 (refigured here pl. 4, fig. 4).
1998 *Lytoceras ovimontanum* - Géczy & Meister, pl. 5 figs 1, 6, 7 with synonymy.
2002 *Lytoceras ovimontanum* - Wilmsem et al., pl. 1, fig. 1a-c.
2003 *Lytoceras ovimontanum* - Meister & Friebe, pl. 3, fig. 14; pl. 4, fig. 1.
2011 *Lytoceras ovimontanum* - Meister et al., p. e13, figs 8 (1, 2).

With a rather compressed ovoid whorl section and polyfurcate ribbing, these Brescian *Lytoceras* belong to *L. ovimontanum* Geyer.

Local record. Concesio, Gussago (Val Navezze) and Brescia surroundings.

Age and distribution. The species is known in the western Tethys (High Atlas, Southern Calcareous Alps, Upper Austroalpine units, Sicilia and Djebel Nador in Algeria) and in southern part of the Euroboreal domain. Its age corresponds to the Late Pliensbachian.

Lytoceras baconicum Vadász, 1910

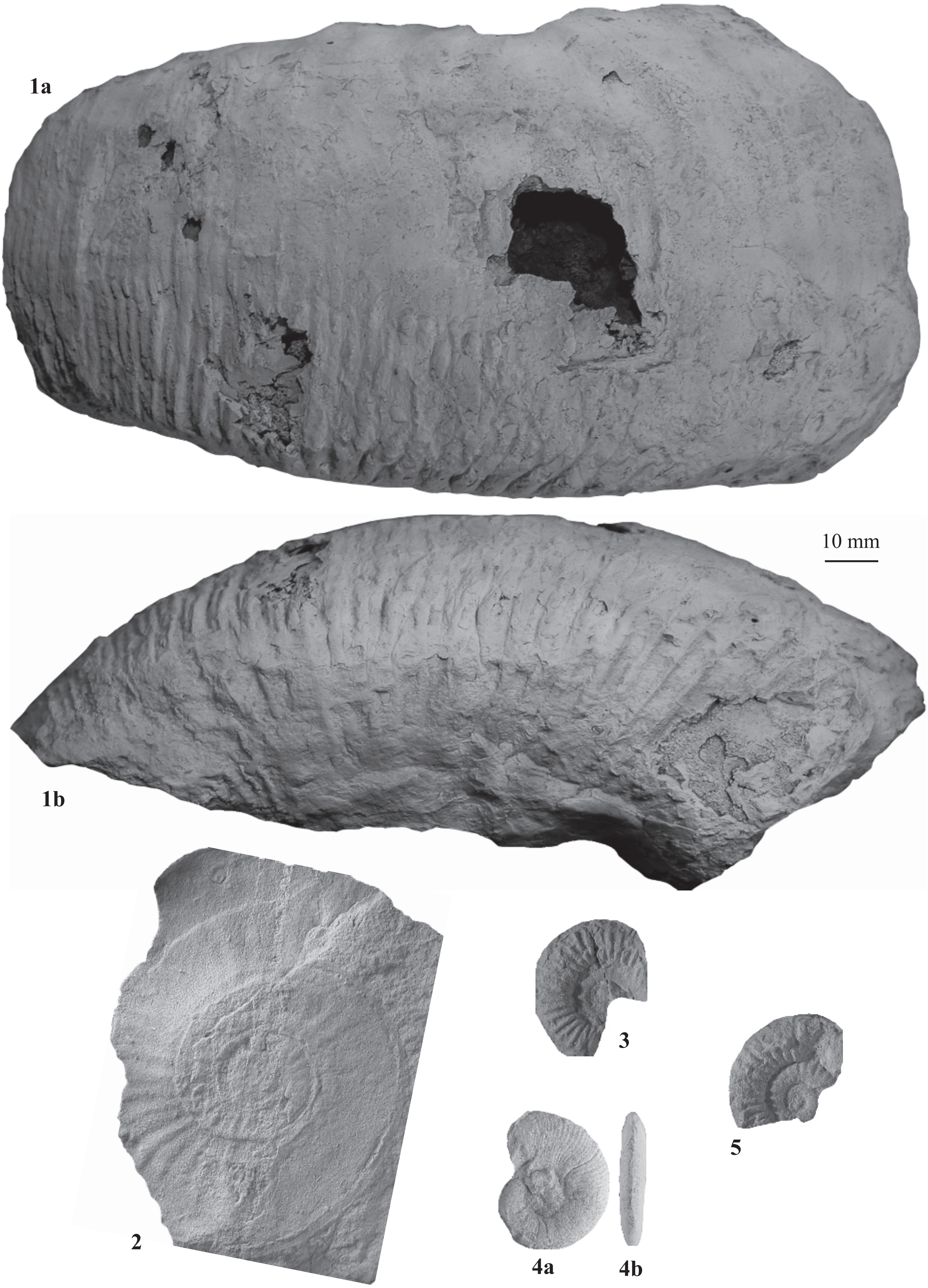
Pl. 6, fig. 1

1910 *Lytoceras baconicum* Vadász, p. 75, p. 24, 25.
2011 *Lytoceras* gr. *baconicum* - Meister et al., p. e13, fig. 8(3) with synonymy.

L. baconicum Vadász is characterized by very broard slightly depressed whorls and relatively coarse polyfurcate ribbing. It is to note that *L. villae* Meneghini, *L. baconicum* Vadász, *L. ovimontanum* Geyer form a population of *Lytoceras* with the same ornamented pattern and only distinguishable by the morphology ot their whorl section. Maybe the expression of a high variability inside an unique species ?

PLATE 6

Fig. 1 - *Lytoceras baconicum* Vadász, 1910. Gussago (Val Navezze) (no 656).
Fig. 2 - *Hypasteroceras* aff. *montii* (Meneghini, 1877). Virle (no 323a)
Fig. 3, 5 - *Arnioceras* sp. Mt. Denno (no MMD1a, no MMD1b).
Fig. 4 - *Ectocentrites* aff. *altiformis* Bonarelli, 1899. Virle (no 323d).


1a
10 mm
1b
2
3
5
4a
4b

Local record. Gussago (Val Navezze).

Age and distribution. It is present in Western Tethys from the Alps (Southern Calcareous Alps, Upper Austroalpine units) to Morocco (High Atlas) and its age corresponds to the early and middle part of the Late Pliensbachian (Margaritatus Chronozone).

Remarks. In Mt. Marguzzo, *L.* aff. *fuggeri* Geyer is present and recorded from the Raricostatum Chronozone (Dommergues et al. 1997b, pl. 1, fig. 3). The genus is also present in St. Eufemia (Dommergues et al. 1997b, p. 9) and cited by Bettoni (1900) in Castello di Brescia, Bresciano, Navezze, Gussago, Sarezzo, Mt. Domaro, Mompiano and Concesio.

Among the Lytoceratidae, the genus *Audaxlytoceras* is present in Botticino (Castelli 1980, pl. 3, fig. 2) and more doubtfuly in Molvina (Cantaluppi 1966, 17, fig. 8 formerly described as *Asaphoceras* sp.). The presence of the genus *Derolytoceras* is more doubtful but the ammonite illustrated by Cantaluppi (1966, pl. 16, fig. 5) could belong to this genus.

Superfamily **Psiloceratoidea** Hyatt, 1867
Family Schlotheimiidae Spath, 1923
Genus *Angulaticeras* Quenstedt, 1883
Type species: *Ammonites lacunatus* J. Buckman, 1844 SD by Lange (1924) (ICZN Opinion 324)

Remark. For extensive discussion on the use of *Angulaticeras* see Meister et al. (2011).

Subgenus *Boucaulticeras* Spath, 1924
Type species: *Ammonites boucaultianus* Orbigny, 1844

A. (*Boucaulticeras*) sp.

Pl. 5, fig. 6

One small Schlotheimiidae (D = 20 mm) from Mt. Denno is characterized by a suboxycone shape and a rather fine ornamentation with ribs splitting rather low on the flanks. These characters well correspond to those of the subgenus *Boucaulticeras* as defined by Meister et al. (2011, p. 67).

Age and local distribution. It is associated with *Arnioceras* sp. in Mt. Denno and its age corresponds to an indistinct period from Semicostatum to Obtusum Chronozones. Another *Angulaticeras* is known in Botticino with probably a similar age. Note that in Mt. Marguzzo an *Angulaticeras* sp. (Dommergues et al. 1997b, pl. 1, fig. 5) is present in the Raricostatum Chronozone.

Family Arietitidae Hyatt, 1875
Subfamily Arietitinae Hyatt, 1875
Genus *Arnioceras* Hyatt, 1867
Type species: *Arnioceras cuneiforme* Hyatt, 1867

Arnioceras aff. gr. ***paucicostum*** Fucini *sensu* Ferretti, 1975

Pl. 7, figs 1, 3

non 1901-05 *Arnioceras ceratitoides* var. *paucicosta* Fucini, pl. 18, figs 9, 10, 12-14.
aff. 1975 *Arnioceras ceratoides paucicosta* - Ferretti, pl. 22, figs 1-3.
2007 *Arnioceras* aff. gr. *paucicostum* Fucini *sensu* Ferretti - Géczy & Meister, pl. 16, fig. 2 with synonymy.
2009 *Arnioceras* sp. - Meister et al., pl. 1, fig. 1.

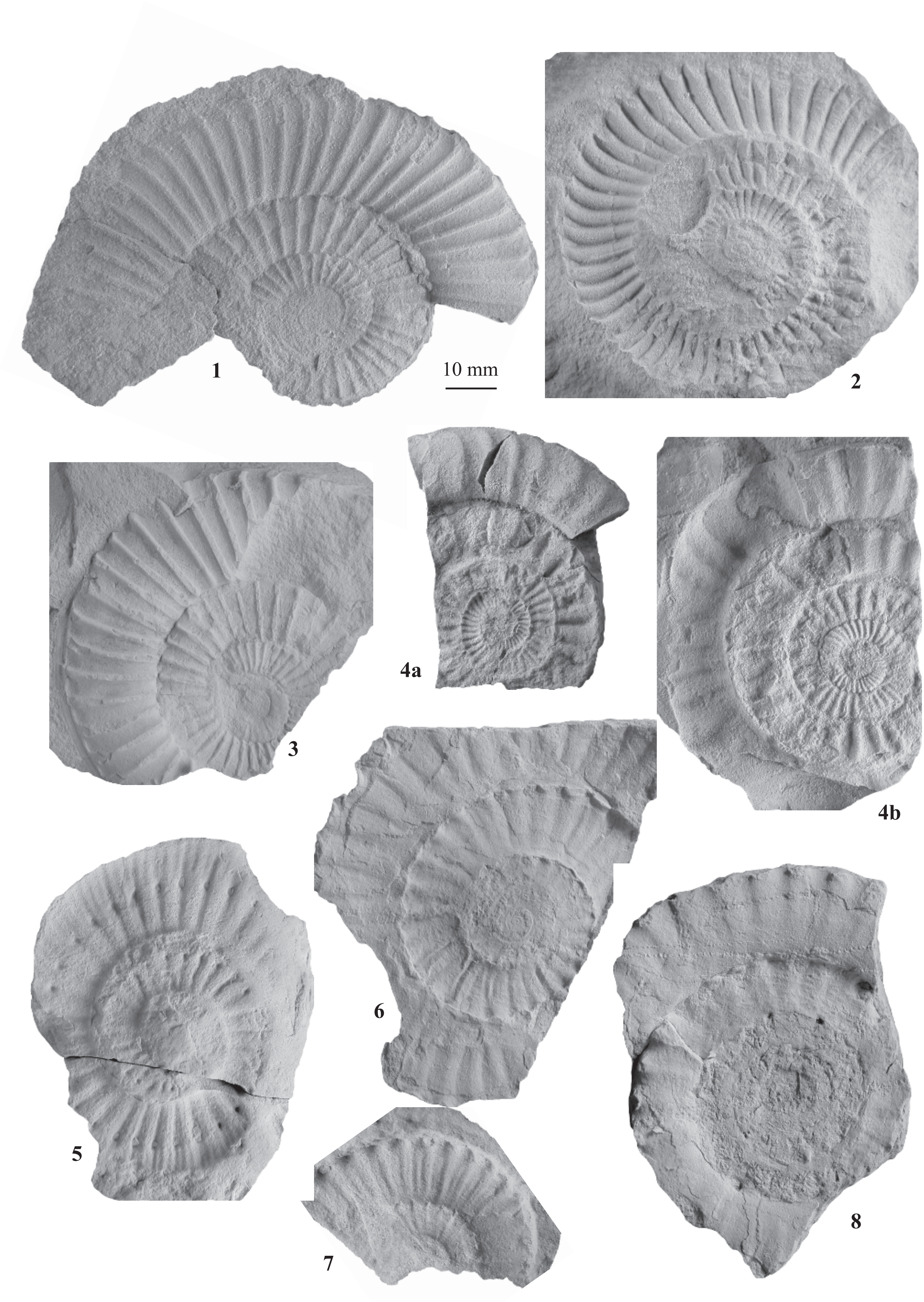
With a long smooth stage and quite spaced ribbing, these *Arnioceras* belong to *A.* gr. *paucicostum* Fucini *sensu* Ferretti (see discussion in Dommergues et al. 1994; Meister & Friebe 2003; Géczy & Meister 2007).

Local record. Rezzato and Colle Cidneo.

Age and distribution. This species known in the Tethys realm (Apeninnes, Austrian and Hungarian upper Austrolapine units, Southern Calcareous Alps) characterizes the Semicostatum Chronozone (Early Sinemurian). Maybe it ranges to the base of the Late Sinemurian (Obtusum Subchronozone).

PLATE 7

Fig. 1, 3 - *Arnioceras* aff. gr. *paucicostum* Fucini *sensu* Ferretti, 1975. Colle Cidneo (no 189), Rezzato (no 1560).
Fig. 2 - *Arnioceras rejectum* Fucini, 1902. Colle Cidneo (no 1411).
Fig. 4 a-b - *Echioceras quenstedti* Schafhäutl, 1847. Gardone Val Trompia (no 1524) (a is the counterpart of b).
Fig. 5 - *Miltoceras sellae* (Gemmellaro, 1884). Brescia surroundings (no 413).
Fig. 6, 7, 8 - *Metaderoceras* gr. *gemmellaroi* (Levi, 1896). Costalunga (Ponte Alto) (no 1544), Colle Cidneo (no 1408), Ronchi di Brescia (no 398).


1
10 mm
2
3
4a
4b
5
6
7
8

Arnioceras rejectum Fucini, 1902
Pl. 7, fig. 2

1902 *Arnioceras rejectum* Fucini, pl. 17, fig. 14; pl. 19, figs 1-6.
2007 *Arnioceras rejectum* - Géczy & Meister, pl. 17, figs 1, 2 (aff.), 3, 5 with synonymy.

A short smooth stage and a closer ribbing characterize our specimen and correspond to *Arnioceras rejectum* Fucini (see discussion in Dommergues et al. 1994; Meister & Friebe 2003; Géczy & Meister 2007).

Local record. Colle Cidneo.

Age and distribution. Like the previous species, it is recorded from the Tethys realm (High Atlas, Apeninnes, Austrian and Hungarian upper Austrolapine units, Southern Calcareous Alps). Maybe it occurs also in South America. It is present in the Obtusum Chronozone, probably Stellare Subchronozone (Late Sinemurian).

Arnioceras sp.
Pl. 6, figs 3, 5

Two small *Arnioceras* from Mt. Denno are characterized by a rather long juvenile smooth stage (about 15 mm of diameter) following by a rather close ribbed ornamental stage. The high density of the ribbing distinguishes these specimens from *Arnioceras* aff. gr. *paucicostum* Fucini *sensu* Ferretti.

Other *Arnioceras* sp. are coming from Inzino, St. Eufemia and Botticino Mattina (Cassinis & Cantaluppi 1967, pl. 7, figs 2-10; Dommergues et al. 1997b, p. 9).

Age. Their ranges correspond to a not precise period to be situated in the Semicostatum – Obtusum Chronozones. Most probably in the Prealps of Brescia, there are several beds with *Arnioceras*, but for the moment, it is not possible to determine and to correlate them precisely.

Subfamily Asteroceratinae Spath, 1946
Genus *Asteroceras* Hyatt, 1867
Type species: *Ammonites stellaris* Sowerby, 1815

Asteroceras gr. ***varians*** Fucini, 1903
Pl. 5, fig. 2

1903 *Asteroceras varians* Fucini, pl. 31, figs 1-5.
2007 *Asteroceras varians* - Géczy & Meister, pl. 20, figs 1, 2 with synonymy.

This specimen shows a platycone coiling with a rather small umbilicus. The ribs are smoothing on the upper part of the flanks evoking the group of *A. varians* var. *intermedia* Fucini and *A. varians* Fucini s.s. The impossibility to see the ventral part does not allow to distinguish between these two taxa.

Local record. Montisola.

Age and distribution. Fucini's species characterize the Stellare Subchronozone and is known in Tethyan realm (High Atlas, Apeninnes, Upper Austrolapine units, Southern Calcareous Alps) and maybe in (?) North America.

Remarks. An *Asteroceras* sp. is recorded from St. Eufemia (Cantaluppi 1966, pl. 16, fig. 3) and its age corresponds to the Obtusum Chronozone without precision.

The Oxynoticeratidae in Brescian Alps are very rare and only a *Gleviceras* aff. *guibalianum* (Orbigny) is recorded from St. Eufemia (Dommergues et al. 1997b, p. 10).

Genus *Epophioceras* Spath, 1924
Type species: *Ammonites landrioti* Orbigny, 1850

Epophioceras sp. indet.
Pl. 5, fig. 3

A rather small serpenticone specimen shows blunt and regular spaced ribs. Its ventral part is not visible. So it is attributated without more precision to the genus *Epophioceras*. Indeed this genus groups hyperoxycone regularly ribbed forms.

PLATE 8

Fig. 1-4 - *Metaderoceras* gr. *gemmellaroi* (Levi, 1896). Borgonato (no 164), Costalunga (Ponte Alto) (no 519), Borgonato (no 166), Colle Cidneo (no 1430).
Fig. 5 - *Reynesocoeloceras fallax* (Fucini, 1905). Ronchi di Brescia (no 2076).
Fig. 6 - *Cetonoceras psiloceroides* (Fucini, 1905). Costalunga (no 5005).
Fig. 7 - *Dubariceras dubari* Dommergues, Mouterde & Rivas, 1984. Borgonato (no u35).

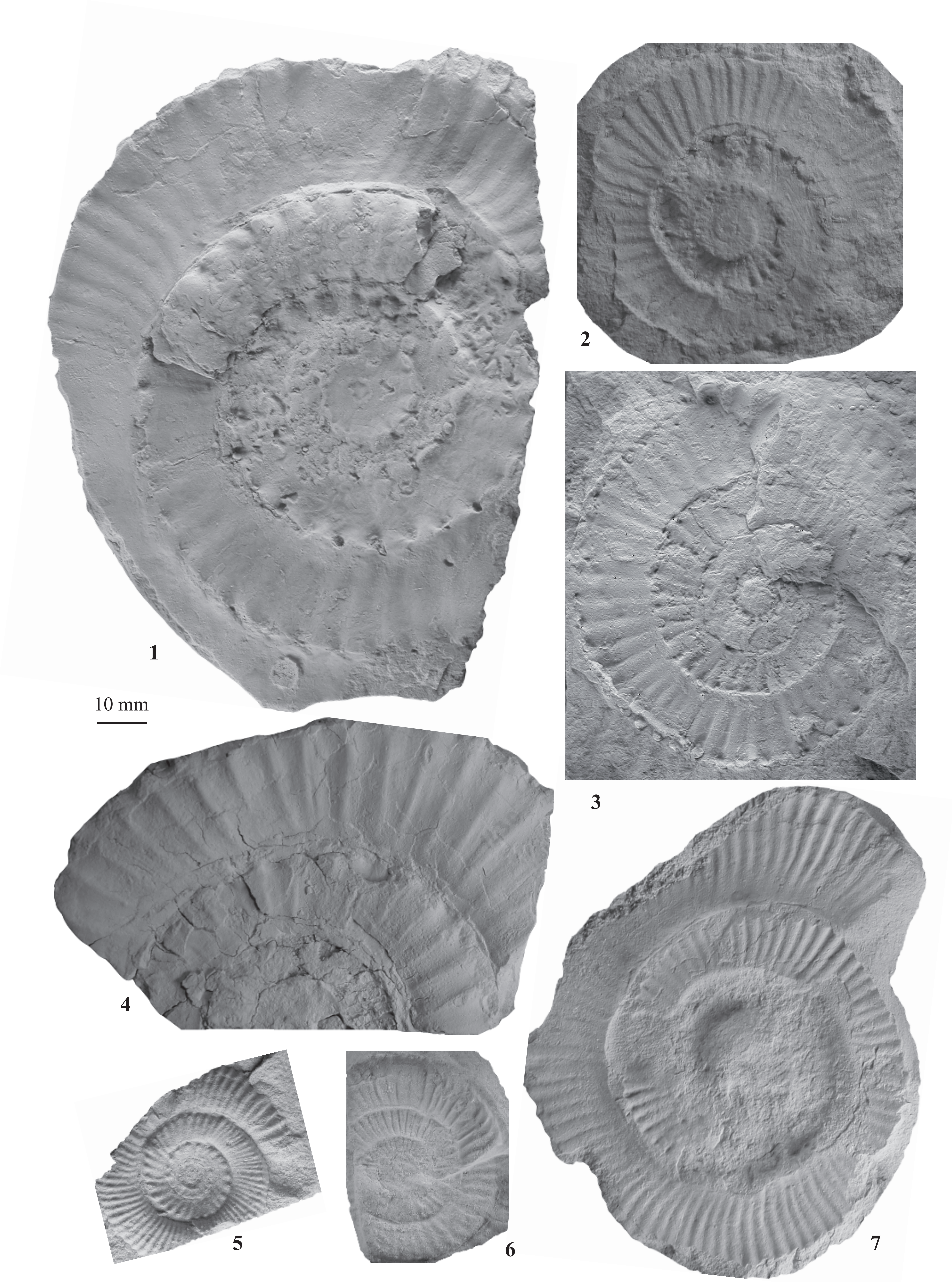

1
10 mm
2
3
4
5
6
7

Fig. 11 - *Bakonyceras* aff. *evolutum* (Géczy, 1976) s.l. was illustrated by Parona (1897, pl. 10, fig. 3) under the name *Aegoceras* (*Platypleuroceras*) *brevispina* (Sowerby).

Local record. Colle Cidneo.

Age and distribution. The genus is known in the Euroboreal domain, Tethyan realm and Pacific areas. It ranges from maybe already from Turneri Chronozone to Obtusum Chronozone.

Family Echioceratidae Buckman, 1913
Genus *Echioceras* Bayle, 1878
Type species: *Ammonites raricostatum* Zieten, 1831

Echioceras quenstedti Schafhäutl, 1847
Pl. 7, figs. 4ab

1847 *Ammonites quenstedti* Schafhäutl, pl. 8. fig. 1; pl. 15, fig 9.
2003 *Echioceras quenstedti* - Meister & Friebe, pl. 10, figs 6-8; pl. 11, figs 1, 2 with synonymy.
2012 *Echioceras* cf. *quenstedti* - Dommergues, Meister & Manatschal, p. 47, figs 1a-c.

One specimen is attributed to this species. These subserpenticone form is characterized by a fine densely ribbed stage in the inner whorls following by subradiate, spaced blunt ribs in the adult morphology; they are smoothing on the ventral margin. The ventral part is weakly keeled but no sulci are evident.

Local record. Gardone Val Trompia.

Age and distribution. This species is the index species of the *E. quenstedti*. Horizon from the Raricostatum Chronozone (Late Sinemurian). Only known from the Alps (Subbriaçonnais units, Upper Austroalpine units, Middle Pennic units), *Echioceras quenstedti* Schafhäutl is recorded for the first time from the Southern Calcareous Alps.

Superfamily **Eoderoceratoidea** Spath, 1929
Family Eoderoceratidae Spath, 1929
(emended Dommergues & Meister, 1999)

Genus *Bakonyceras* Meister & Géczy, 2007
Type species: *Tetraspidoceras quadrarmatum evolutum* Géczy, 1976

Bakonyceras aff. ***evolutum*** (Géczy, 1976) s.l.
Fig. 11

aff. 1897 *Aegoceras* (*Platypleuroceras*) *brevispina* (Sowerby) - Parona, pl. 10, fig. 3.
aff. 1976 *Tetraspidoceras quadrarmatun evolutum* Géczy, pl. 7, fig. 1.
aff. 2007 *Bakonyceras evolutum* - Géczy & Meister, pl. 34, figs 1, 3; pl. 35, figs 1, 2; pl. 36, figs 1, 2; pl. 37, fig. 1.

The large specimen illustrated by Parona (1897, pl. 10, fig. 3) is recorded from Provaglio d'Iseo. The inner whorls are corroded following Parona (1897, p. 10) but ribs seem present.

It is characterized with rather strong spaced subradiate bituberculate ribs. They become stronger and acute on the last fourth part of the last whorl (? part of the body chamber) associated with a smoothing of the tuberculation. On the last whorl, the inner tuberculate row become more and more offsetted and occupes a high position on the flank.

All these characters evokes two genera the first one is *Platypleuroceras* as determinated by Parona (1897). Giant *Platypleuroceras* are published by Cassel (1997, pl. 17, fig. 1) with the same ontogeny where the ribbing is fine, enforcing near the aperture. The second is *Bakonyceras*, a large sized taxon, that shows the same ontogeny for the coiling and the ornamentation, especially with *B. evolutum* (Géczy 1976, pl. 7, fig. 1). As the ventral part is not visible, the determination remains difficult. The main difference between these two genera lays on the inner whorl coiling, more serpenticone in *Platypleuroceras* than in *Bakonyceras*. Only for this reason our specimen is included in *Bakonyceras* aff. *evolutum* (Géczy).

Apoderoceras dunrobinense Spath develops strong outer ventro-lateral tubercles and its ribbing is less expressed on the outer whorls.

Age and distribution. Only recorded from Bakony (Hungary) until now, this taxon ranges from the middle part of the Raricostatum Chronozone to the base of the Jamesoni Chronozone.

Remark. In St. Eufemia, some *Microderoceras* sp. from the Raricostatum Chronozone are present (Dommergues et al. 1997b, pl. 1, fig. 8).

Genus *Callomoniceras* Meister & Dommergues, 2011
Type species: *Paramicroderoceras kisnyergesarokensis* Géczy & Meister, 2007, pl. 32, fig. 2

Callomoniceras salmojraghii (Parona, 1894)
Fig. 12

1894 *Platypleuroceras salmojraghii* Parona, p. 2.
1897 *Aegoceras* (*Platypleuroceras*) *salmojraghii* - Parona, pl. 9, fig. 2.
2002 *Foetterleiceras salmojraghii* - Rakus & Guex, pl. 18, fig. 1.

An original large sized (D = 165 mm) specimen from Montecolo di Pilzone (Parona 1897, pl. 9, fig. 2) shows a rather serpenticone coiling with weakly embracing whorls and a suboval compressed whorl section. The ornamentation is composed of subradiate, blunt and almost erased primary ribs completely obliterated by a secondary fine and dense ribbing throughout out the ontogeny and of tubercles. Secondary ribs show several patterns either simple, either fasciculate from the inner tubercles and/or sometimes bifurcate-trifurcate from the upper part of the flanks. They cross the ventral part. The tubercles form an inner row of small and spiny nodes situated at the lower part of the flanks. A second set of tubercles is only visible at the end of the last whorl. The umbilical and ventro-lateral parts have no clearly materialized edges. This kind of morphology is close to that one of the genus *Callomoniceras* including *C. kisnyergesarokensis* Géczy et Meister (2007, pl. 32, fig. 2; pl. 37, fig. 3) *Callomoniceras* type 3 (Dommergues et al. 2000, fig. 7.2) and *C. parahungaricum* Géczy et Meister (2007, pl. 31, fig. 5). A specimen from Tunisia illustrated by Rakus & Guex (2002, p. 18, fig. 1) under the name *Foetterleiceras salmojraghii* (Parona) is attributed without doubt to the genus *Callomoniceras*. Indeed, the genus *Foetterleiceras* is based on *Ammonites Foetterlei* Hauer that clearly belongs to Epideroceratidae because of a platycone coiling and the disappearance of the ornament in the adult stage.

The Brescian and the Tunisian forms belong to the Early Pliensbachian Eoderoceratidae of which the variability remains not well understood.

Age and distribution. This species is only recorded from the Brescian Alps and the Tunisian ridge. Its age remains imprecise, maybe the early part of the Early Pliensbachian as suggested by Parona (1897, p. 12).

Family Coeloceratidae Haug, 1910
(emended Dommergues & Meister, 1999)
Subfamily Coeloceratinae Haug, 1910
(emended Dommergues, 1994)

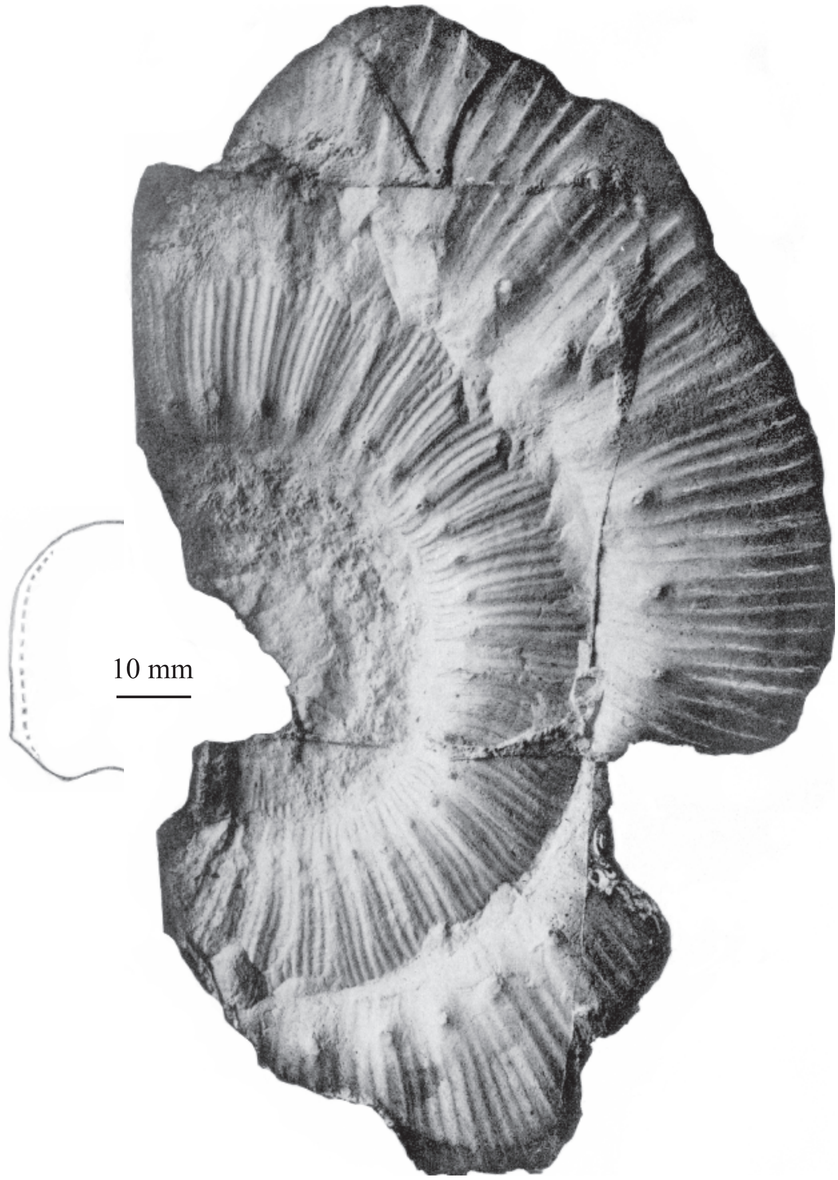


Fig. 12 - *Callomoniceras salmojraghii* (Parona, 1894) was illustrated by Parona (1897, pl. 9, fig. 2) under the name *Aegoceras* (*Platypleuroceras*) *salmojraghii* Parona.

Genus *Miltoceras* Wiedenmayer, 1980

Type species: *Aegoceras sellae* Gemmellaro, 1884

Miltoceras sellae (Gemmellaro, 1884)

Pl. 7, fig. 5

1884 *Aegoceras sellae* Gemmellaro, pl. 3, figs 1-5.
1980 *Coeloderoceras sellae* - Castelli, p. 3, fig. 4 (refigured here).
2007 *Miltoceras sellae* - Géczy & Meister, pl. 38, figs 1, 6, 7, 9 with synonymy.
2009 *Miltoceras sellae* - Meister et al., pl. 1, fig. 6.
2011 *Miltoceras sellae* - Meister et al., p. 117.e20, figs 12 (2, 4, 9).

It is the *Miltoceras sellae* (Gemmellaro) illustrated by Castelli (1980, pl. 3, fig. 4). This specimen is middle sized (D = ~60 mm) equivalent to the size of the type. Its shape (subplatycone evolute) and its ornamental habitus (primary proradiate rigid ribs ending with a fine tubercles and then biplicate or triplicate crossing the venter) are similar to the specimen illustrated by Gemmellaro (1884, pl. 3, figs 1, 2) except a more spaced lateral ribbing. *M. deficiens* (Wiedenmayer) shows a coarser ornamentation with still more spaced ribs.

Local record. Brescia surroundings.

Age and distribution: The species is mainly known from Tethyan areas (Upper Austroalpine units, Apennine, North Africa) and from east Pacific regions. They characterize the upper part, maybe already the middle part of the Jamesoni Chronozone (Early Pliensbachian).

Remark. Note the presence in Pregno of *Capreoliceras* sp. from the Jamesoni Chronozone (Dommergues et al. 1997b, pl. 1, fig. 4).

Family Polymorphitidae Haug, 1887
(emended Dommergues & Meister, 1999)

Remark. The presence of classic Euroboreal Polymorphitidae (*Platypleuroceras* and *Uptonia*) sensu Dommergues & Meister is known in Tethys realm. In Southern Calcareous Alps they are rare but already recorded from Arzo and Breggia in Ticino (Parona 1897; Wiedenmayer 1980), in opposite they are very common in the Upper Austroalpine units of Austria. In Brescia three specimens can be attributed to this family: two from Borgonato are coming from the museum's collections and one specimen from Pilzone is illustrated by Parona (1897, pl. 11, fig. 2).

Genus *Platypleuroceras* Hyatt, 1867
Type species: *Ammonites brevispina* Sowerby, 1827

Platypleuroceras amplinatrix (Quensted, 1885) - ***tenuilobus*** (Quenstedt, 1885)
Pl. 10, figs 1, 6

1885 *Ammonites amplinatrix* Quenstedt, pl. 32, fig. 7.
1885 *Ammonites Jamesoni tenuilobus* Quenstedt, pl. 32, fig. 6.
1986 *Platypleuroceras tenuilobus* - Meister, pl. 5, fig. 1 with synonymy.
2002 *Platypleuroceras tenuilobus* - Fauré, pl. 4, fig. 1ab.
2003 *Platypleuroceras amplinatrix* - Meister & Friebe, pl. 14, fig. 5 with synonymy.
2008 *Platypleuroceras* (?) gr. *tenuilobus-amplinatrix* - Dommergues & Meister, p. 214, figs 10-12.

It is a transitional form between *Platypleuroceras* and *Uptonia* still with a quite wide umbilicus and a bituberculation like in *Platypleuroceras* and with a quite irregular denser ribbing like for the *Uptonia* rib habitus.

Note that some stries appear in the last half whorl like in *U. jamesoni* (Sowerby) (see Dean et al. 1961, pl. 68, fig. 3 or Wright 1880, pl. 51, fig. 1).

Because of its still open umbilicus with a ration U/D = 0.56, our forms are put in *Platypleuroceras*. Indeed our specimen is very close to *P. amplinatrix* (Quensted) with a ration U/D = 0.57 (holotype) and also to *P. tenuilobus* (Quenstedt) (U/D = 0.53 for the holotype. In *P. tenuilobus* (Quenstedt), the reduction of the umbilicus size is obvious as shown for the specimen of Futterer (1893, pl. 9, fig. 2) with a ratio U/D = 0.50 and of Meister (1986, pl. 5, fig. 1) with U/D = 0.48.

A second specimen from Borgonato (no 1342) also is attributed to this species even if its ornamental habitus is closer to that of *Uptonia*.

Local record. Borgonato.

Remark. «*Dumortieria jamesoni*» of Parona (1897, pl. 9, fig. 1) from Ticino also could correspond to the *Platypleuroceras amplinatrix* (Quenstedt) - *tenuilobus* (Quenstedt) group and *Platypleuroceras variscoi* Parona (1897, pl. 11, fig. 1) from Val Cavallina (Bergamo) is rather a *Platypleuroceras brevispina* (Sowerby).

Age and distribution. This taxon is known in Southern Germany, South France including the western Alps, Italian, Swiss and Austrian Alps, Spain (Ibericas). It characterizes the uppermost part of the Brevispina Subchronozone.

Remark. In Mt. Domaro *Uptonia* cf. *jamesoni* (Sowerby) is recorded from the eponym Chronozone (Dommergues et al. 1997b, pl. 1, fig. 9).

Family Acanthopleuroceratidae Arkell, 1950
(emended Dommergues & Meister, 1999)
Genus *Catriceras* Venturi, 1978
(emended Géczy & Meister, 2007)
Type species: *Catriceras catriense* Venturi, 1978

Remark. This genus is discussed in detail by Géczy & Meister (2007, p. 194).

Catriceras sp.
Fig. 13

1897 *Harpoceras normanianum* (d'Orbigny) - Parona, pl. 9, fig. 4a, b.

This specimen from Costalunga is characterized by a platycone evolute coiling with narrow and rather high subrectangular whorls and a pinched ventral part with an acute, fine and elevated keel. The ribs are strong, rather spaced and sigmoid with a rather rigid lower segment. On the upper part they curve and are projected forward. Our specimen rather evokes *C. campiliense* (Fucini) that also presents a sinuosity of the rib and a very acute ventral part including a high keel. *C. catriense* Venturi shows a wider ventral part and a more angular projection of the ribs on the ventro-lateral part. *C. pannonicum* Meister & Géczy has a thicker and blunt ribbing and a keel bodered with two oblique bands.

Age and distribution. *Catriceras* is known in the Mediterranean Tethys [Apennine, Southern Calcareous Alps, Albania (Ionian zone)], most pro-

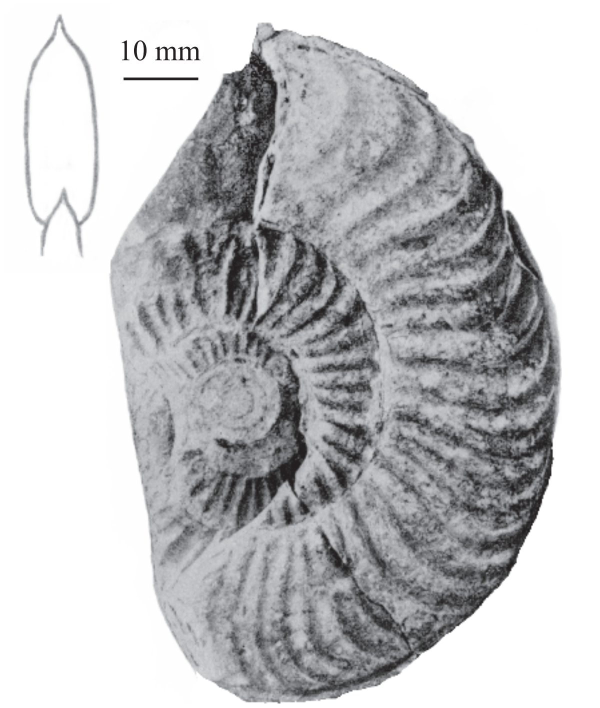


Fig. 13 - *Catriceras* sp. was illustrated by Parona (1897, pl. 9, fig. 4a, b) under the name *Harpoceras normanianum* (d'Orbigny).

bably in Euroboreal domain (France) and maybe (?) in South America. Its age corresponds to a period to be situated in the lower part of the Jamesoni Chronozone.

Genus *Tropidoceras* Hyatt, 1867

Type species: *Ammonites Masseanum* Orbigny, 1844

Tropidoceras flandrini (Dumortier, 1869)

Pl. 9, figs 1, 2

1869 *Ammonites flandrini* Dumortier, pl. 14, figs 1-2.
2007 *Tropidoceras flandrini* - Géczy & Meister, pl. 40, fig. 11; pl. 43, fig. 3.
2008 *Tropidoceras flandrini* - Dommergues et al., p. 563, fig. 8F.
2009 *Tropidoceras flandrini* - Meister et al., pl. 1, fig. 14.

Developed latero-ventral small tubercles, small discret periumbilical tubercles, rather rigidstraight lateral ribs and more or less irregular ventro-lateral secondaries are typical characters for *T. flandrini* (Dumortier).

Local record. Mompiano and Brescia surroundings.

Age and distribution. This cosmopolitan species (Europe, North Africa, Pacific areas) ranges from the upper part of the Jamesoni Subchronozone to the middle part of the Valdani Subchronozone.

Tropidoceras gr. *mediterraneum* (Gemmellaro, 1884)

Pl. 9, fig. 3

1884 *Harpoceras Masseanum* (Orbigny) var. *mediterranea* Gemmellaro, pl. 5, figs 1-4.
1936 *Tropidoceras* (*Cycloceras*) *masseanum* (Orbigny) var. *mediterranea* - Termier, pl. 20, fig. 1.
1963 *Tropidoceras masseanum* (Orbigny) var. *mediterraneum* - Du Dresnay, pl. 2, fig. 6.
1966 *Tropidoceras masseanum* - Kollarova-Andrusova, pl. 14, fig. 3.
1977 *Tropidoceras masseanum* - Wiedenmayer, pl. 12, fig. 13; pl. 13, fig. 8.
1978 *Tropidoceras masseanum* var. *mediterraneum* - Faugères, pl. 42, figs 11, 12.
1985 *Tropidoceras mediterraneum* - Braga & Rivas, pl. 3, figs 1, 4, 7.
aff. 1995 *Tropidoceras* gr. *mediterraneum* - Alkaya & Meister, pl. 10, fig. 4, pl. 11, fig. 6.
1994 *Tropidoceras mediterraneum* - Faraoni et al., pl. 7, figs 5-8.
1996 *Tropidoceras mediterraneum* - Faraoni et al., pl. 1, fig. 8.
1998 *Tropidoceras mediterraneum* - El Hariri, pl. 9, figs 1, 2, 4, 5.
? 2002 *Tropidoceras mediterraneum* - Rakus & Guex, pl. 31, fig. 6.
? 2006 *Tropidoceras* cf. *mediterraneum* - Hillebrandt, pl. 18, fig. 17.
2008 *Tropidoceras mediterraneum* - Dommergues et al., p. 567, fig. 9A.

No obvious latero-ventral tubercles and a sigmoid ribbing associated with ventro-lateral secondaries reaching the keel characterize this species. This specimen is similar with the Tethyan forms illustrated for Morocco by Faugères (1978, pl. 42, fig. 12) or for Southern Calcareous Alps by Wiedenmayer (1977, pl. 13, fig. 8).

Local record. Ronchi di Brescia.

Age and distribution. Well distributes in the Mediterranean Tethys, this species characterizes the Masseanum Subchronozone. Doubtfully it is recorded from South America.

Remark. An Acanthopleuroceratidae (probably a *Tropidoceras* sp.) from Tavernola is illustrated by Parona (1897, pl. 10, fig. 5).

PLATE 9

Fig. 1, 2 - *Tropidoceras flandrini* (Dumortier, 1869). Mompiano (no 2765), Brescia surroundings (no 1663).
Fig. 3 - *Tropidoceras* gr. *mediterraneum* (Gemmellaro, 1884). Ronchi di Brescia (no 1434).
Fig. 4, 5 - *Dubariceras dubari* Dommergues, Mouterde & Rivas, 1984. Eastern surroundings of Brescia (no 317), Brescia surroundings (no 847).


1
2
3
10 mm
4
5

Family Dubariceratidae
Dommergues & Meister, 1999
Genus *Metaderoceras* Spath, 1925
(synonymy: *Farinaccites* Faraoni, Marini, Pallini & Venturi, 1996)
Type species: *Ammonites muticus* Orbigny, 1844

Metaderoceras gr**. *gemmellaroi*** (Levi, 1896)

Pl. 7, figs 6, 7, 8; Pl. 8, figs 1-4

1896 *Aegoceras gemmellaroi* Levi, pl. 8, figs 3, 6.
1997b *Metaderoceras* cf. *gemmellaroi* - Dommergues et al., p. 10.
2007 *Metaderoceras gemmellaroi* - Géczy & Meister, pl. 39, figs 1, 2a-c, 5 with synonymy.
2011 *Metaderoceras gemmellaroi* - Meister et al., p. e24, figs 14(4, 5, 7), 15(5).

All these *Metaderoceras* belong to the *M. gemmellaroi* (Levi) s. l. The adult size exceeds 160 mm of the diameter. Among these *Metaderoceras* the coarse stage (spaced ribbed with a strong ventro-lateral tubercle) is more or less persistent during the ontogeny. Some paedomorphic forms (e.g. pl. 7, fig. 8) evoke *M. gemmellaroi evolutum* (Fucini) with their more serpenticone coilig, keeping coarse ornament and a smooth ventral part throughout the ontogeny. But the most part of these forms express a middle ornemental morphology between fine and coarse specimen. In the adult, the ribbing is more developed and tends to cross the venter when the ventro-lateral tubercle diminuishes in intensity. The whorl section is subrectangular to slightly trapezoidal compressed in the inner whorls. The preserved margino-ventral spines reach 7 mm of lenght (e.g. no 164) at a diameter of 120 mm. A related Euroboreal form is *M. venarense* (Oppel).

Local record. Costalunga (Ponte Alto), Colle Cidneo, Ronchi di Brescia, Borgonato and Mt. Delma (Dommergues et al. 1997b). The specimen from Borgonato illustrated by Parona (1897, pl. 9, fig. 3) also could belong to the genus *Metaderoceras*.

Age and distribution. This species characterizes the middle to upper part of the Ibex Chronozone. It is recorded from the Mediterranean Tethys including Taurides (Turkey) and from South America.

Genus *Dubariceras* Dommergues,
Mouterde & Rivas, 1984
Type species: *Dubariceras dubari* Dommergues, Mouterde & Rivas, 1984

Dubariceras dubari Dommergues, Mouterde & Rivas, 1984

Pl. 8, fig. 7; pl. 9, figs 4, 5

1984 *Dubariceras dubari* Dommergues, Mouterde & Rivas, pl. 1, figs 1-18 avec synonymie.
1997b *Dubariceras* cf. *dubari* - Dommergues et al., p. 10.
2007 *Dubariceras dubari* - Géczy & Meister, pl. 41, figs 5, 6 with synonymy.
2009 *Dubariceras dubari* - Meister et al., pl. 1, fig. 7.
2011 *Dubariceras dubari* - Meister et al., p. e28, fig. 17(4).

Three evolute specimens can be attributed to *Dubariceras*, a derived form of the *Metaderoceras*. They are finely, densely and regurlarly ribbed. Ribs are subradiate to slightly prorsiradiate and hardly sinuous. Although the ventral part is not visible, a light rib thickening on the ventro-lateral part is visible. These characteritics well correspond to *D. dubari* Dommergues, Mouterde & Rivas.

Local record. Surroundings of Brescia, Borgonato and from Mt. Domaro (Dommergues et al. 1997b).

Age and distribution. This species characterizes the upper part of the Ibex Chronozone. It is a Tethyan species recorded from Italy, Albania, Hungary, Beticas, Tunisia and Morocco.

Subfamily Reynesocoeloceratinae
Dommergues, 1986
Genus *Reynesocoeloceras* Géczy, 1976
Type species: *Coeloceras crassum* var. *indunense* Meneghini, 1881

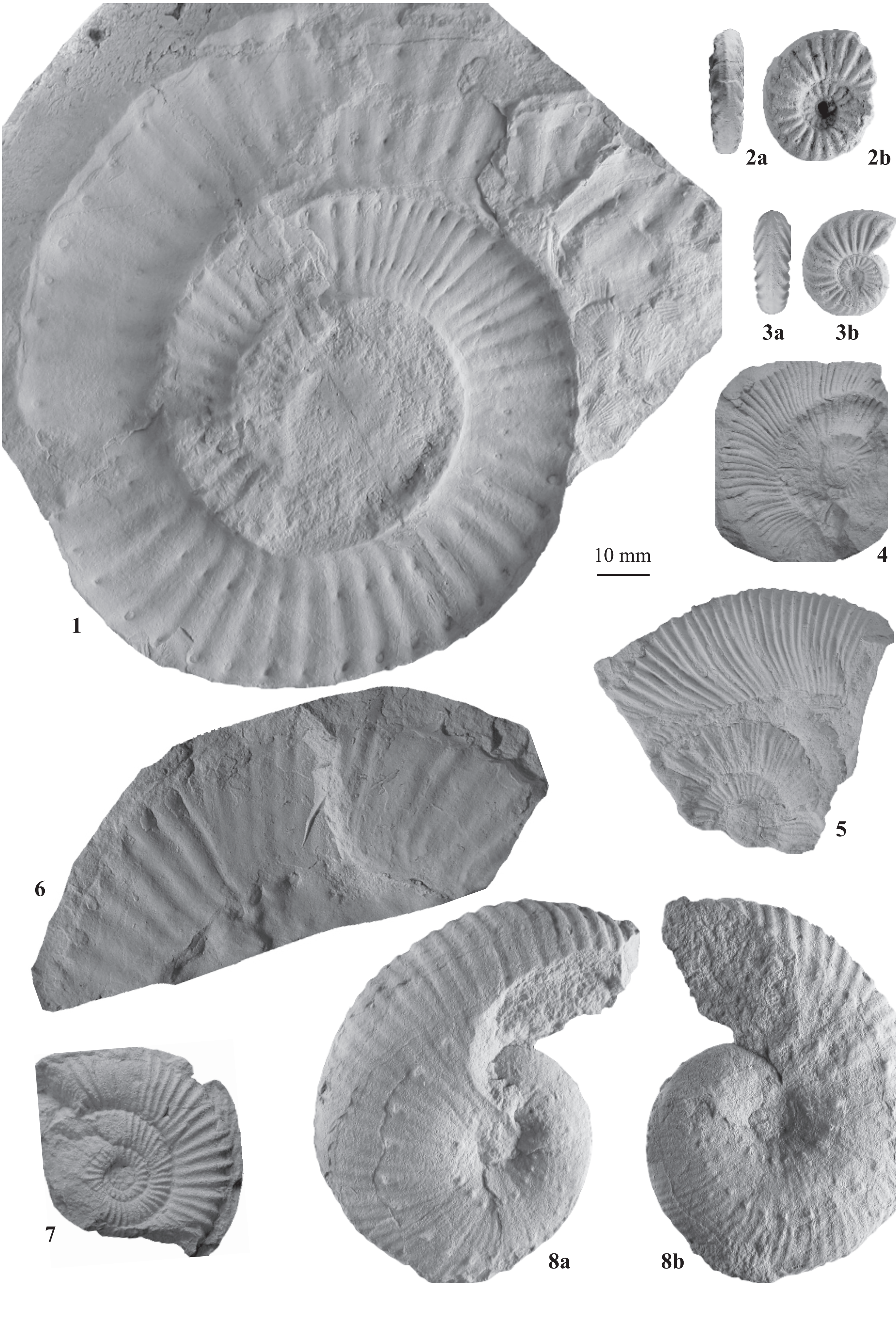
Reynesocoeloceras fallax (Fucini, 1905)

Pl. 8, fig. 5

1905 *Coeloceras fallax* Fucini, pl. 8, figs 14-16; pl. 9, figs 1, 2, 4, 5, ? 7.
1905 *Coeloceras fallax* var. *semiplicata* Fucini, pl. 9, figs 3.
1905 *Coeloceras fallax* var. *irregularis* Fucini, pl. 9, fig. 6.

PLATE 10

Fig. 1, 6 - *Platypleuroceras amplinatrix* (Quensted, 1885) - *tenuilobus* (Quenstedt, 1885). Borgonato (no 162, no 1342).
Fig. 2, 3 - *Pleuroceras* gr. *solare* (Phillips, 1829). Brescia surroundings (no 388), Caionvico (no 338).
Fig. 4, 5 - *Prodactylioceras inaequiornatum* (Bettoni, 1900). Brescia surroundings (no u07), Brescia (no u11).
Fig. 7 - *Prodactylioceras colubriforme* (Bettoni, 1900) *sensu* Fucini (1905). Colle Cidneo (no 403).
Fig. 8 - *Liparoceras* (*Becheiceras*) aff. *bechei* (Sowerby, 1821). Ponte Zanano (no 1523).


1
2a
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3a
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8a
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1980 *Reynesoceras fallax* - Castelli, pl. 4, fig. 2 (refigured here).
2011 *Reynesoceras fallax* - Blau & Meister, p. 267, figs 3j, m, o, 4a-e, g with synonymy.
2011 *Reynesoceras fallax* - Meister et al. fig. 15(7) with synonymy.

A cadicone coiling in the inner whorls followed in the outer whorls by a serpenticone one characterize the *Reynesocoeloceras*. Our specimen is close to *R. fallax* Fucini (1905, pl. 8, fig. 14) with a short cadicone stage associated with a coarse ornament (mainly a strong ventro-lateral tubercle) and a long serpenticone finely and densely ribbed, not tuberculate stage. It also characterized by a less deep and open umbilicus.

Local record. Ronchi di Brescia.

Age and distribution. Its range corresponds to an interval from the upper part of the Ibex Chronozone to the lower part of the Davoei Chronozone (Blau & Meister 2011). The species is known in Central Apennine, Southern Calcareous Alps, High Atlas and in upper Austroalpine units (Hungary).

Remark. *R.* aff. *simulans subplanata* (Fucini) is present in Villa (Dommergues et al. 1997b, pl. 1, fig. 11). Its range corresponds to the uppermost part of the Ibex Chronozone - lowermost part of the Davoei Chronozone.

Genus *Prodactylioceras* Spath, 1923

Type species: *Ammonites Davoei* Sowerby, 1822

Prodactylioceras ausonicum (Fucini, 1900)

Pl. 11, figs 1, 3, 4

1900 *Coeloceras ausonicum* Fucini pl. 13, figs 8, 9.
1972 *Prodactylioceras ausonicum* - Ferretti, pl. 14, fig. 1.
1980 *Aveyroniceras ausonicum* - Wiedenmayer, pl. 7, figs 11, 12 with synonymy.

Rather inflated *Prodactylioceras* characterized by a high rib density with sporadically associated ribs forming bundles on the lower part of the flanks. This gives a swelling aspect to the conch. Three of our specimens are close to this type of morphology.

Local record. Colle Cidneo and Brescia surroundings.

Age and distribution. The total range of this species remains uncertain, it probably corresponds to the Subnodosus – Gibbosus Subchronozones, doubfully to the Hawskerense Subchronozone. It is restricted to the Southern Calcareous Alps and the Central Apennine.

Prodactylioceras italicum (Fucini, 1900)

Pl. 11, figs 2, 8, 16

1900 *Coeloceras italicum* Meneghini *in* Fucini, pl. 13, fig. 4.
? 1980 *Reynesoceras* (?) *medolense* (Hauer) - Castelli, pl. 3, fig. 5 (refigured here pl. 11, fig. 8).
1998 *Prodactylioceras italicum* - Géczy & Meister, pl. 6, figs 9, 12 with synonymy.
2011 *Prodactylioceras italicum italicum* - Blau & Meister, p. 269, figs 5k, l with synonymy.
2011 *Prodactylioceras italicum* - Meister et al., p. e28, fig. 17(3) with synonymy.

P. italicum (Fucini) corresponds to *Prodactylioceras* with regular, particularly fine and close ribbing and subcircular whorl section. It does not develop bundles and it has a more serpenticone coiling than *P. ausonicum* (Fucini).

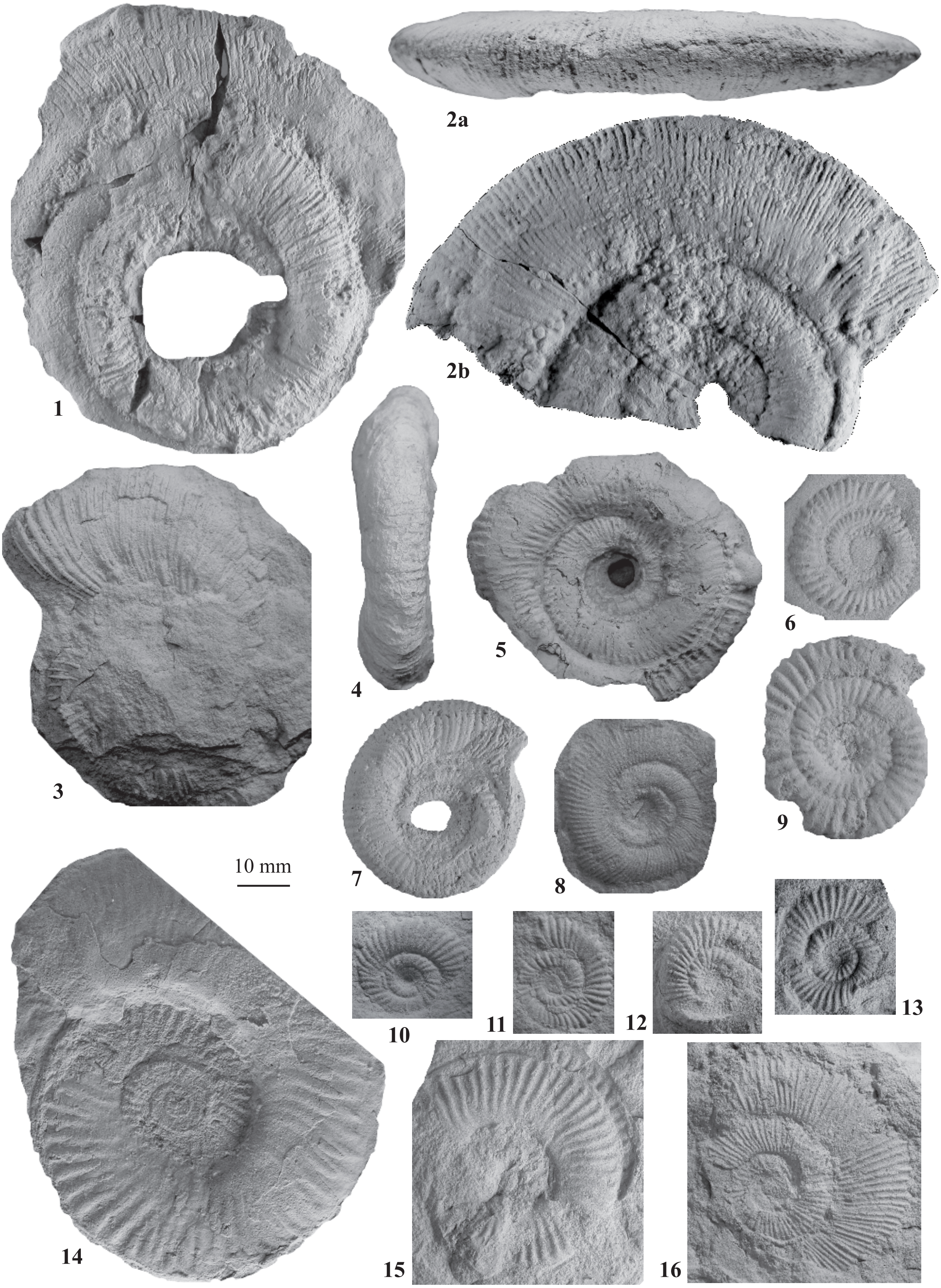
Local record. Colle Cidneo, Brescia and Gussago (Val Navezze).

Age and distribution. Well represented in the Mediterranean Tethys, this species also is recorded doubtfully from Japan and North America. It ranges from the Maculatum Subchronozone to the Stokesi Subchronozone.

Remarks. «*Dumortieria Bettonii*» Parona (1897, pl. 10, fig. 1) from Costalunga and «*Coeloceras lorioli*» Bettoni (1900, pl. 7, fig. 12, 13) from Castello di Brescia characterized by a fine and closely spaced ribbing are here assigned to «*Reynesoceras*» aff. *mortilleti* (Meneghini).

PLATE 11

Fig. 1, 3, 4 - *Prodactylioceras ausonicum* (Fucini, 1900). Brescia surroundings (no 836), Colle Cidneo (no 1578, no 412); 4 is a crushed ventral part.
Fig. 2, 8, 16 - *Prodactylioceras italicum* (Fucini, 1900). Gussago (Val Navezze) (no 557), Brescia (no 444), Colle Cidneo (Castello di Brescia) (no 367).
Fig. 5, 7, 10-13 - *Reynesoceras ragazzoni* (Hauer, 1861) - *acanthoides* (Reynès, 1868). Brescia surroundings (no u09, no u10), Brescia (no 493a, no 313), Colle Cidneo (Castello di Brescia) (no 387, no 523b).
Fig. 6, 9 - *Reynesoceras subanguinum* (Meneghini, 1867-81). Costalunga (no 5004c), Ronchi di Brescia (no 1384).
Fig. 14, 15 - *Fuciniceras* gr. *costicillatum* (Fucini, 1900) - *detractum* (Fucini, 1900). Serle (no u19), Colle Cidneo (no 417a).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Prodactylioceras cf. ***colubriforme*** (Bettoni, 1900) *sensu* Fucini, 1905

Pl. 10, fig. 7

non 1900 *Coeloceras colubriforme* Bettoni, pl. 7, fig. 10.
cf. 1905 *Coeloceras colubriforme* - Fucini, p. 122, pl. 7, figs 13a-c, 14.
cf. 2011 *Prodactylioceras colubriforme* (Bettoni) *sensu* Fucini - Blau & Meister, p. 268, figs 5g, i, j.

One specimen can be refered to *P. colubriforme* (Bettoni) and following the opinions of Blau & Meister (2011, p. 272) and Meister et al. (2011, p. 117.e30) its designation is *P.* cf. *colubriforme* (Bettoni) *sensu* Fucini. It is characterized by stronger and more spaced ribbing than *P. italicum* (Fucini). Moreover the ribs enforce on the outer part. The rib habitus of the outer whorls is similar to that one of the form illustrated by Fischer (1971, pl. 2, fig. 10).

Local record. Colle Cidneo.

Age and distribution. The species ranges from the uppermost part of the Ibex Chronozone to the lower part of the Davoei Chronozone. It is recorded from the Mediterranean Tethys (Southern Calcareous Alps, Central Apennines and High Atlas).

Prodactylioceras inaequiornatum (Bettoni, 1900)

Pl. 10, figs 4, 5

1900 *Coeloceras inaequiornatum* Bettoni, pl. 7, fig. 11.
1980 *Bettoniceras inaequiornatum* - Wiedenmayer, pl. 5, fig. 11 with synonymy.

Two specimens show a very irregular, rather fine and dense ribbing developing some kinds of ventro-lateral nodosities. They are close to the inner-intermediate whorls of the specimen illustrated by Wiedenmayer (1980, pl. 5, fig. 1). *P. inaequiornatum* (Bettoni) is of the same group than P. *colubriforme* (Bettoni) *sensu* Fucini but with a more irregular ribbing. «*P. colubriforme*» (Bettoni) in Schröder (1927, pl. 4, fig. 11) herein refigured (pl. 16, fig. 3), shows an intermediate morphology between *P. inaequiornatum* (Bettoni) and P. *colubriforme* (Bettoni) *sensu* Fucini.

Local record. Brescia.

Age and distribution. Known in the Southern Calcareous Alps and very doubtfully from North America, this species is present in the Stokesi Subchronozone (early Late Pliensbachian).

Genus *Cetonoceras* Wiedenmayer, 1977

Type species: *Coeloceras psiloceroides* Fucini, 1905

Cetonoceras psiloceroides (Fucini, 1905)

Pl. 8, fig. 6

1905 *Coeloceras psiloceroides* Fucini, pl. 47, figs 1, 5-12; pl. 46, figs 6-9.
1997b *Cetonoceras psiloceroides* - Dommergues et al., pl. 1, fig. 7.
1998 *Cetonoceras psiloceroides* - Géczy & Meister, pl. 6, fig. 8 with synonymy.
2014 *Cetonoceras psiloceroides* - Meister & Blau, p. 259, fig. 4i with synonymy.

A serpenticone shell shape with rather compressed whorls and a rigid ribbing characterize this Reynesocoeloceratinae.

Local record. Costalunga and Botticino Mattina (Dommergues et al. 1997b).

Age and distribution. This species characterizes the base of the Late Pliensbachian (lowermost part of the Stokesi Subchronozone) throughout the Mediterranean Tethys (Meister 2010, fig. 13).

Family Liparoceratidae Hyatt, 1867
(emended Dommergues & Meister, 1999)
Genus *Liparoceras* Hyatt, 1867

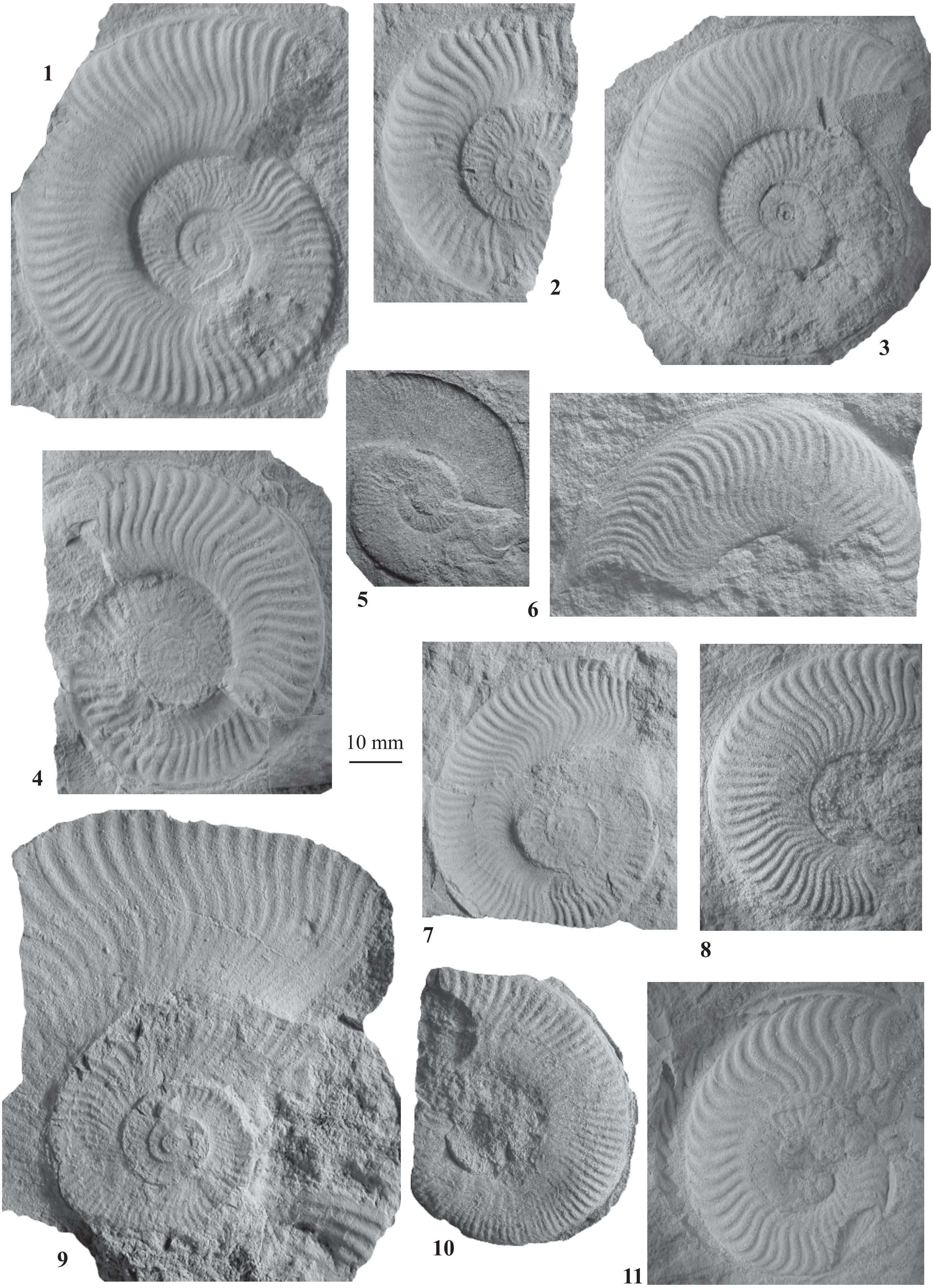
Type species: *Liparoceras bronni* Spath, 1938 (ICZN 308)

Subgenus *Becheiceras* Trueman, 1918

Type species: *Ammonites bechei* Sowerby, 1821 (see Donovan & Forsey 1973, p. 13)

PLATE 12

Fig. 1-4, 9, 10 - *Fuciniceras* gr. *costicillatum* (Fucini, 1900) - *detractum* (Fucini, 1900). Colle Cidneo (Castello di Brescia) (no u12), Colle Cidneo (no u14), Ronchi di Brescia (no u15), Mompiano (no 1711), Cogozzo (no 510), Brescia surroundings (no u20).
Fig. 5 - *Fuciniceras* cf. *costicillatum* (Fucini, 1900) - *detractum* (Fucini, 1900). Colle Cidneo (Castello di Brescia) (no 391).
Fig. 6 - *Fuciniceras celebratum* (Fucini, 1900). Colle Cidneo (North face) (no Castello 4).
Fig. 7 - *Fuciniceras* gr. *isseli* (Fucini, 1900) - *brevispiratum* (Fucini, 1900). Colle Cidneo (Castello di Brescia) (no 868).
Fig. 8 - *Fuciniceras marianii* (Fucini, 1904) - *Fuciniceras celebratum* (Fucini, 1900). Colle Cidneo (no u18).
Fig. 11 - *Fuciniceras marianii* (Fucini, 1904). Colle Cidneo (no u17).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Liparoceras (*Becheiceras*) aff. *bechei* (Sowerby, 1821)

Pl. 10, fig. 8

aff. *1821 *Ammonites bechei* Sowerby, pl. 280.
non 1897 *Aegoceras* (*Liparoceras*) *bechei* - Parona, pl. 11, fig. 3 [= *L.* (*B.*) *gallicum* Spath].
aff. 1973 *Liparoceras* (*Becheiceras*) *bechei* - Donovan & Forsey, pl. 2, fig. 4 (neotype).
aff. 2007 *Liparoceras* (*Becheiceras*) *bechei* - Géczy & Meister, pl. 41, fig. 10 with synonymy.
2009 *Becheiceras* sp. - Meister et al., pl. 1, fig. 8.
aff. 2011 *Liparoceras* (*Becheiceras*) *bechei* - Meister et al., pe28, fig. 17(7) with synonymy.

This *Becheiceras* is characterized by a rather strong and coarse ornamentation and so evokes an intermediate morphology between *L.* (*B.*) *bechei* (Sowerby) in Donovan & Forsey (1973) and *L.* (*B.*) *gallicum* Spath (1938, pl. 11, fig. 3). It corresponds to the second not illustrated specimen discussed by Parona (1897, p. 16). On the other hand the specimen from Provaglio illustrated by Parona (1897, pl. 11, fig. 3) is coarser ribbed and attributed to *L.* (*B.*) *gallicum* Spath.

Local record. Ponte Zanano and Provaglio d'Iseo. Note that the first specimen is the same ammonite cited by Parona (1897, p. 16) as *Aegoceras* (*Liparoceras*) *bechei* (Sowerby), not figured but sent by Bettoni who collected it in the Pliensbachian of Ponte Zanano (Gardone Val Trompia).

Age and distribution. If Spath's species is well distributed in the NW Europe (Euroboreal domain) and rare in the Tethyan domain (Southern Calcareous Alps), in opposite *L.* (*B.*) *bechei* (Sowerby) is a more cosmopolitan species as well present in Euroboreal and Tethyan domains as in Pacific areas. This one ranges from the middle part of the Ibex Chronozone (uppermost Valdani Subchronozone) to the middle-upper part of Margaritatus Chronozone (Gibbosus Subchronozone). *L.* (*B.*) *gallicum* Spath seems to be restricted to the Early Plienbachian and the Parona's specimen could be a rather old form, maybe already from the (?) Jamesoni Chronozone as suggested with the association proposed by Parona (1897, p. 16).

Subfamily Amaltheinae Hyatt, 1867
Genus *Pleuroceras* Hyatt, 1867
[Synonymy: *Paltopleuroceras* S.S. Buckman, 1898 (obj.)]
Type species: *Ammonites spinatus* Bruguière, 1789, selection by Fischer (1882)

Pleuroceras gr. *solare* (Phillips, 1829)

Pl. 10, figs 2, 3

1829 *Ammonites solaris* Phillips, pl. 4, fig. 29.
1900 *Paltopleuroceras spinatum* (Bruguière) - Bettoni, pl. 1, fig. 5.
1958 *Pleuroceras solare* - Howarth, pl. 5, figs 1 (neotype), 2-7.
2003 *Pleuroceras* gr. *solare* - Meister & Friebe, pl. 16, figs 10, 11 with synonymy.
2008 *Pleuroceras solare* - Dommergues et al., pl. 10, figs 5, 6.
2009 *Pleuroceras* gr. *solare* - Meister et al., pl. 1, fig. 5.
2013 *Pleuroceras solare* - Bardin et al., p. 327, figs B-E.
2013 *Pleuroceras solare trapezoidiforme* (Maubeuge) - Bardin et al., p. 327, figs F, G.

They are typical *Pleuroceras* with platycone evolute shell shape and with regular, subradiate, simple, rather rigid and acute ribbing strongly arched forward on the latero-ventral part until the finely well individualized crenulate keel. The whorl section is subrectangular, weakly compressed with rather flat flanks and with moderatly embracing whorl overlap. The smallest specimen (338) is characterized by fine and dense ribbing similar to the topotype illustrated by Howarth (1958, pl. 5, fig. 2). In opposite the second one (388) shows coarser spaced ribs closer with the specimen illustrated Howarth (1958, pl. 5, fig. 10) under the name *P. solare* var. *solitarium* (Simpson). More discussion is given by Meister (1988).

Local record. Caionvico and the surroundings of Brescia. Also a specimen is coming from Castello di Brescia (Bettoni 1900).

Age and distribution. This species characterizes the upper part of the Apyrenum Subchronozone. It is well distributed in NW Europe and in the Mediterranean Tethys (Upper austroalpine units in Austria, western Carpathians and Fatra in Slovakia, eastern Carpathians and Bihor in Romania, Southern Calcareous Alps, Apennines and Sicily in Italy, Beticas in Spain, High Atlas in Morocco and in western Algeria).

Family Dactylioceratidae Hyatt, 1867
sensu Dommergues, 1986
Subfamily Dactylioceratidae Hyatt, 1867
Genus *Reynesoceras* Spath, 1936
Type species: *Ammonites ragazzoni* Hauer, 1861

«*Reynesoceras*» aff. *mortilleti* (Meneghini, 1867-81)

Fig. 14

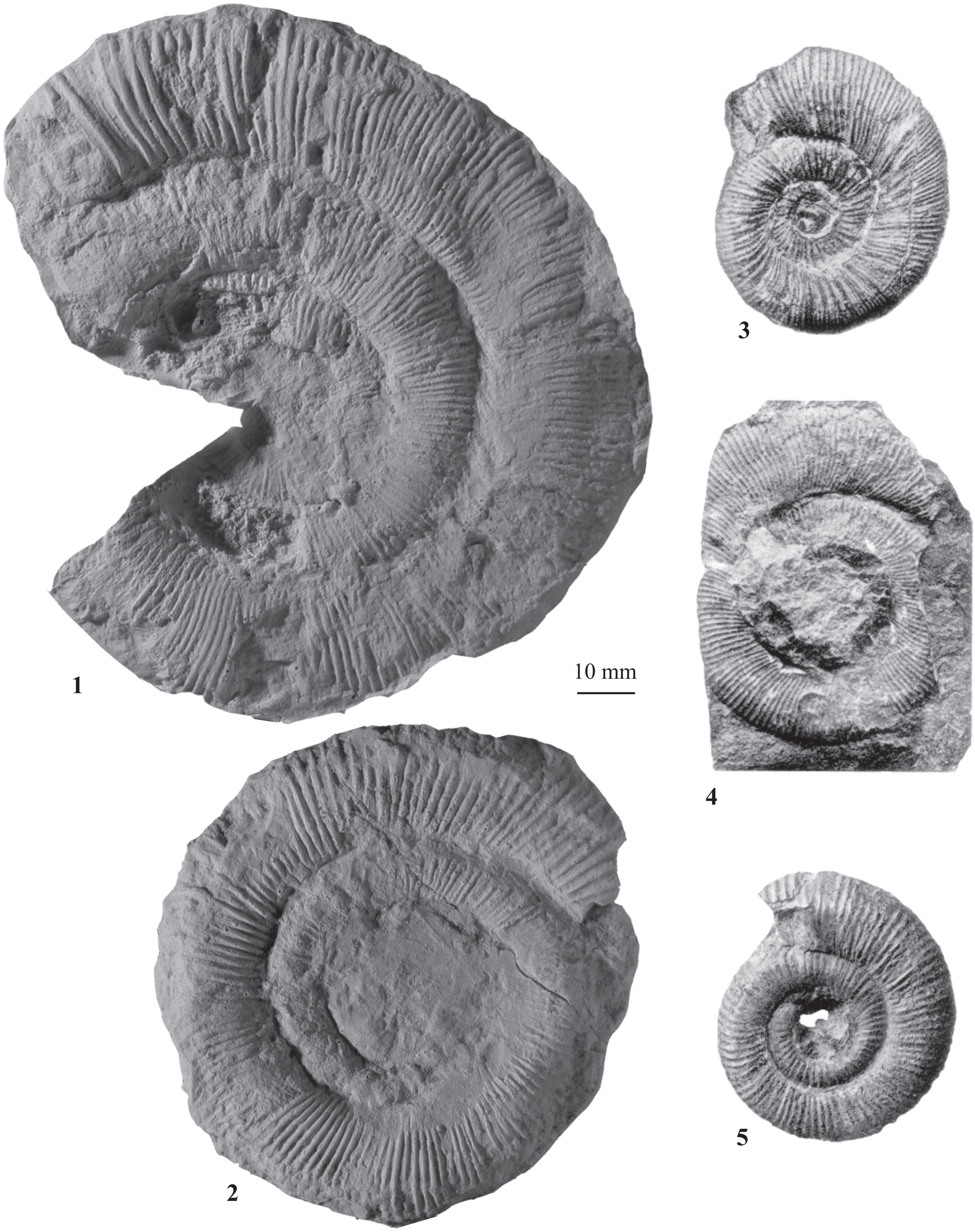


Fig. 14 - «*Reynesoceras*» aff. *mortilleti* (Meneghini, 1867-81). Illustration of two specimens (1 and 2) illustrated by Meneghini (1867-81, pl. 6, figs 1, 2 = lectotype) and three specimens (3, 4, 5) of Bettoni (1900) belonging to the same species and given respectively under the name *Coeloceras lorioli* Bettoni (3, 4) and *Coeloceras mortilleti* (Meneghini) (5).

1867-81 *Stephanoceras Mortilleti* Meneghini, pl. 4, fig. 7; pl. 6, figs 1, 2 (refigured here).
aff. 1900 *Coeloceras mortilleti* - Bettoni, pl. 7, fig. 9 (refigured here).
1900 *Coeloceras lorioli* Bettoni, pl. 7, figs 12, 13.
1998 «*Reynesoceras*» aff. *mortilleti* - Géczy & Meister p. 106 with synonymy.
aff. 2011 *Reynesoceras* cf. *mortilleti* - Meister et al. p. e34, fig. 18(1) with synonymy.

In Brescia Museum we have not found this species but it is important to discuss it because one specimen from Concesio was illustated by Bettoni (1900, pl. 7, fig. 9) and here refigured. Moreover Bettoni (1900) illustrated under the species name *R. lorioli* Bettoni specimens from Castello di Brescia that fit very well with *R. mortilleti* (Meneghini); therefore they are considered here as synonym of Meneghini's species. In the same time we illustrated again the lectotype and a syntype of *R. mortilleti* (Meneghini). This large *Reynesoceras* (until 135 mm of diameter) is characterized by rather broad whorls associated with a rather regular and close ribbing. If we follow the interpretation of Meneghini (1967-81) there are some nodosities in the inner whorls that evokes the *Prodactylioceras italicum* (Fucini) and the macroconch of the *R. ragazzonii* (Hauer) - *acanthoides* (Reynès) couple. But, on the cast of the type, the inner whorls are not visible and nodosities are hardly visible if they are. The less high rib density in our specimen distinguishes it from *P. italicum* (Fucini). With *R. acanthoides* (Reynès) similarities are high and without the inner whorls, only massiver whorls in Meneghini's species makes the difference. Note that Pinna & Levi Setti (1971) consider *R. mortilleti* as synonymy of *R. acanthoides*.

Taking in account the broard morphology of the whorls we consider this taxon as a distinct species. Partly co-occuring with the last *P. italicum* (Fucini) in the Stokesi Subchronozone and the *R. ragazzonii* (Hauer) - *acanthoides* (Reynès) in the lower part of the Gibbosus Subchronozone, *R. mortilleti* (Meneghini) enforces the idea of an intermediate morphology between *Prodactylioceras* and *Reynesoceras*. Besides *P. ausonicum* (Fucini) clearly is a more inflated forms with moderatly depressed whorls and more finely and densely ribbed.

Local record. Concesio and Castello di Brescia for Bettoni (1900) and also Pilzone for Meneghini (1867-81).

Age and distribution. This species ranges from the Stokesi Subchronozone to the base of Gibbosus Subchronozone. It is present in the Apennines, Southern Alps, Subbeticas, High Atlas, Lusitanian Basin and most probably in Bakony (Hungary).

Reynesoceras subanguinum
(Meneghini, 1867-81)
Pl. 11, figs 6, 9

1867-81 *Ammonites* (*Coeloceras*) *subanguinum* Meneghini, pl. 16, fig. 9.
1900 *Coeloceras subanguinum* - Bettoni, pl. 6, fig. 14; pl. 7, figs 1-3.
? 1900 *Coeloceras subanguinum* - Del Campana, pl. 8, figs 42, 43.
non 1962 *Reynesoceras subanguinum* - Fantini Sestini, pl. 38, fig. 14.
1975 *Reynesoceras subanguinum* - Fantini Sestini, pl. 52 figs 7, 9.
1980 *Reynesoceras subanguinum* - Wiedenmayer, pl. 6, figs 11-15.
1980 *Reynesoceras angulosum* Wiedenmayer, pl. 5, figs 12-15.
2009 *Reynesoceras ragazzonii* (Hauer) - Meister et al., pl. 1, fig. 4.

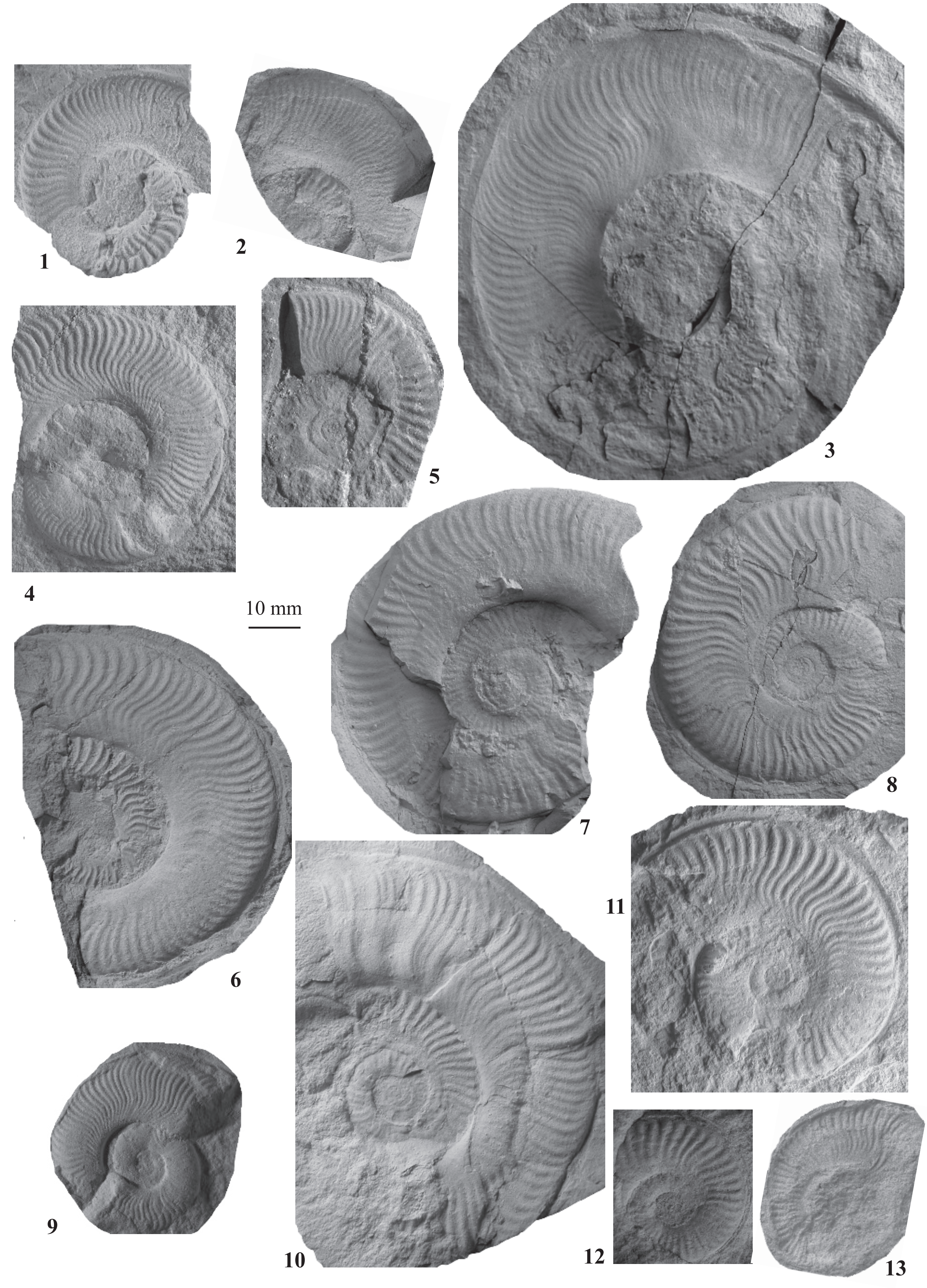
This species is characterized by a particularly serpenticone coiling, a less deep umbilicus and regular rather spaced, strong, subradiate to proradiate and annular ribs. The whorl section is subcircular to slightly depressed. *R. morosum* (Bettoni) differs with coarser and more spaced ribs, subdivided on the venter. *R. angulosum* Wiedenmayer is similar to *R. subanguinum* (Meneghini) and so considered as a junior synonym.

Local record. Ronchi di Brescia and Costalunga.

Age and distribution. This species seems to be restricted to the North of Italy (Southern Calcareous Alps). Wiedenmayer gives the more precise indication for the age: Subnodosus Subchronozone.

PLATE 13

Fig. 1, 2, 4, 13 - *Fuciniceras* gr. *isseli* (Fucini, 1900) - *brevispiratum* (Fucini, 1900). Colle Cidneo (no 1429), Colle Cidneo (North face) (no 5053), Colle Cidneo (Pusterla) (no u13), Colle Cidneo (North face) (no 5048).
Fig. 3, 5-8, 10-12 - *Fuciniceras* gr. *cornacaldense* (Tausch, 1890) - *bicicolae* (Bonarelli, 1895). Colle Cidneo (North face) (no 5029, no 5022), Concesio (no 1433), Colle Cidneo (North face) (no 5023), Gussago (Val Navezze) (no 1694), Colle Cidneo (no u16), Val Trompia (no 1915), Colle Cidneo (North face) (no 5039).
Fig. 9 - *Fuciniceras* (*Paltarpites*) aff. *kurrianus* (Oppel, 1862). Brescia surroundings (no PA11116/1).


1
2
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10 mm
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Reynesoceras ragazzonii (Hauer, 1861) - ***acanthoides*** (Reynès, 1868)

Pl. 11, figs. 5, 7, 10-13

1861 *Ammonites ragazzonii* Hauer, pl. 1, figs 16, 17.
1868 *Ammonites acanthoides* Reynès, pl. 1, fig. 3.
? 1900 *Coeloceras ragazzonii* mut. *tardevoluta* Bettoni, pl. 9, fig. 11.
1980 *Reynesoceras ragazzonii* - Castelli, pl. 4, fig. 1 (refigured here).
1980 *Aveyroniceras* cf. *acanthoides* - Castelli, pl. 4, fig. 5.
1997b *Reynesoceras ragazzonii* - Dommergues et al., pl. 1, fig. 10.
1998 *Reynesoceras ragazzonii-acanthoides* - Géczy et Meister, p. 105 with synonymy.
2011 *Reynesoceras ragazzonii-acanthoides* - Meister et al., p. e28, figs 17(6, 8) with synonymy.

Recent taxonomic interpretations (Fantini Sestini 1975; Meister 1989) consider the small sized adult *R. ragazzonii* (Hauer) as microconch and the largest *Reynesoceras acanthoides* (Reynès) as macroconch.

The microconch has a cadicone coiling with simple lateral ribs ending with a ventro-lateral tubercle and with ventral fine secondaries crossing the venter. In the adult stage the umbilicus is more open, the whorls more circular and simple coarser and annular ribs, sometimes splitting on the venter, are developed. The size does not exceed 25 mm. The ontogeny of the macroconch is similar in the inner whorls then the coiling becomes serpenticone with the development of a fine, dense, proradiate ribbing, often subdivided on the venter and crossing it. The adult diameter can exceed 100 mm.

Remark. «*P.*» *medolense* (Hauer) of uncertain age is a small form with a serpenticone coiling (not cadicone following Hauer's drawing) in the inner whorls and looks very close to *P. italicum* (Fucini). On the other hand, the interpretation of Wiedenmayer (1980), including several subspecies, better corresponds to a rather inflated *Reynesoceras* with cadicone inner whorls.

Local record. Brescia and surroundings, Colle Cidneo (Castello di Brescia), Gussago (Caricatore) (Castelli 1980) and from Mt. Domaro, Mt. Zoadello (Dommergues et al. 1997b) and Botticino (Bettoni 1900).

Age and distribution. This dimorphic couple is very well known in the Mediterranean Tethys and in the southern part of the Euroboreal domain. It is also recorded from North America. It characterizes the lower part of the Gibbosus Subchronozone (upper part of the Margaritatus Chronozone).

Remarks. *Reynesoceras* is also present in Punta dell'Orto in the upper part of the Margaritatus Chronozone (Dommergues et al. 1997b, pl. 1, fig. 12) and in Concesio (Bettoni 1900).

In Molvina other Dactylioceratidae are present with *Dactylioceras mirabile* (Fucini) that indicates the Early Toarcian (Dommergues et al. 1997b, pl. 1, fig. 13). In Provaglio d'Iseo an acme of *Dactylioceras* sp. possibly determined the Pliensbachian - Toarcian boundary (*ibidem*, p. 19).

Superfamily **Hildoceratoidea** Hyatt, 1867
Family Hildoceratidae Hyatt, 1867
Subfamily Harpoceratinae Neumayr, 1875
Genus *Fuciniceras* Haas, 1913
sensu Dommergues et al. (2002)

Type species: *Hildoceras lavinianum* Meneghini *in* Fucini, 1900

The usage of *Fuciniceras* (including *Protogrammoceras* Spath, 1913) reflects the opinion of Dommergues et al. (2002, p 459). A detailled morphological analysis of most part of the species listed below was recently discussed by Meister at al. (2011, fig. 27), mainly for the discrimination of the rib patterns.

Remark. Note that *Fuciniceras* gr. *mellahense* Dubar - *praecurionii* Géczy is recorded in Mt. Domaro from the Ibex Chronozone (Dommergues et al. 1997b, p. 12, pl. 2, fig. 15).

Fuciniceras gr. ***costicillatum*** (Fucini, 1900) - ***detractum*** (Fucini, 1900)

Pl. 11, figs 14, 15; pl. 12, figs 1-4, 9, 10

1900 *Grammoceras normanianum* (d'Orbigny) var. *costicillata* Fucini, pl. 7, fig. 10; pl. 8, fig. 1.
1900 *Grammoceras normanianum* (d'Orbigny) var. *costicillata* forme *detracta* Fucini, pl. 8, figs 2, 3.
1980 *Fuciniceras bicicolae* (Bonarelli) - Castelli pl. 5, fig. 5 (refigured here pl. 12, fig. 1).
1980 *Fuciniceras coniungens* Cantaluppi - Castelli pl. 6, figs 1, 2 (refigured here pl. 12, fig. 3, 4).
2007 *Protogrammoceras* gr. *costicillatum-detractum* - Géczy et Meister, p. 212 with synonymy.
2011 *Fuciniceras* gr. *costicillatum-detractum* - Meister et al., p. e37, figs 18(12-16), 19(1, 3-10) with synonymy.

Rather evolute *Fuciniceras* are grouped herein. They are characterized by sinuous ribs tending to become clearly rursiradiate and hardly curved forwards on the ventro-lateral part. The coarse spaced ribbed forms correspond to *F. costicillatum*

(Fucini) and the finer close ribbed ones to *F. detractum* (Fucini). The ventral part becomes more flat and broard, developing tricarenation. In comparison with the overlying *F.* gr. *lavinianum* (Fucini) - *portisi* (Fucini), the ventral part remains more pinched and the ribbing less angustirursiradiate.

Local record. Mompiano, Colle Cidneo, Colle Cidneo (Castello di Brescia), Ronchi di Brescia, Brescia surroundings, Cogozzo, Botticino and Serle.

Age and distribution. It is the index species of the *F. costicillatum - detractum* Horizon that corresponds to the upper part of the Maculatum Subchronozone to the Figulinum Subchronozone. This taxon is present in the Mediterranean Tethys and its adjacent areas (Apennines, Southern Calcareous Alps, Austrian and Hungarian Upper Austroalpine, High Atlas and Causses Basin).

Fuciniceras cf. ***costicillatum*** (Fucini, 1900) - ***detractum*** (Fucini, 1900)

Pl. 12, fig. 5

A particularly fine close and regularly ribbed specimen does not exactly well corresponds to *F. costicillatum* (Fucini) - *detractum* (Fucini) group. It evokes the forms illustrated by Meister et al. (2011, p. 117.e36, fig. 19.8), Fucini (1905, pl. 5, fig. 9) or a Hungarian specimen (Géczy 1976, pl. 34, fig. 5), but its ribbing still remains finer and more regular. In *F. giennense* Braga & Rivas (1980, pl. 1, fig. 1-4) of the Davoei Chronozone, the ribbing is dense too but remains more irregular during the ontogeny; moreover the rib plan is more sinuous with a stronger angle on the flanks.

Local record. Colle Cidneo (Castello di Brescia).

Age. Same age as *F. costicillatum* (Fucini) - *detractum* (Fucini).

Fuciniceras gr. ***lavinianum*** (Fucini, 1900) - ***portisi*** (Fucini, 1900)

1900 *Hildoceras lavinianum* Meneghini *in* Fucini, pl. 11, figs 6, 7.
1900 *Hildoceras lavinianum* Meneghini *retroflexa* Fucini, pl. 12, fig. 1.
1900 *Hildoceras lavinianum* Meneghini var. *coniungens* Fucini, pl. 12, figs 2, 3.
1900 *Hildoceras inclytum* Fucini, pl. 13, figs 1, 2.
1900 *Grammoceras portisi* Fucini, pl. 9, figs 1-3.
1900 *Grammoceras portisi* Fucini var. *Zitteliana* Fucini, pl. 9, fig. 4.
1900 *Grammoceras normanianum* d'Orbigny var. *inseparabilis* Fucini, pl. 8, fig. 5.
1900 *Hildoceras intumescens* Fucini, pl. 13, fig. 3.
1905 *Hildoceras lavinianum* var. *dissimilis* Fucini, pl. 43, figs 13, 14.
1997b *Fuciniceras lavinianum* - Dommergues et al., pl. 2, figs 4, 29.
2011 *Fuciniceras* gr. *lavinianum-portisi* - Meister et al., p. 117.e40, figs. 21(1-14) et 22(1-7) with synonymy.
2014 *Fuciniceras* gr. *lavinianum-portisi* - Meister & Blau, p. 259, figs. 4n-v, 5a-u with synonymy.

They are present in Mompiano and were already illustated by Dommergues et al. (1997b). Their main characters are a flat tricarenate venter, rather broad whorls and angustirursiradiate ribs. The variability in rib density is very high in this species. The coarse spaced ribbed forms are represented by *F. lavinianum* (Fucini) and the fine closely ribbed ones by *F. portisi* (Fucini).

Local record. Mompiano, Villa, Mt. Domaro.

Age and distribution. This index species of the *F. lavinianum - portisi* Horizon characterizes the base of the Late Pliensbachian (lowermost part of the Stokesi Subchronozone) in the Mediterranean Tethys (see Meister 2010, fig. 13).

Fuciniceras gr. ***isseli*** (Fucini, 1900) - ***brevispiratum*** (Fucini, 1900)

Pl. 12, fig. 7; pl. 13, figs 1, 2, 4, 13

1900 *Grammoceras isseli* Fucini, pl. 9, figs 6-8.
1900 *Hildoceras lavinianum* var. *brevispirata* Fucini, pl. 8, fig. 6.
1980 *Fuciniceras isseli* - Castelli, pl. 6, fig. 3 (refigured here pl. 13, fig. 4).
1997b *Fuciniceras isseli-brevispiratum* - Dommergues et al., p. 13.
2011 *Fuciniceras* gr. *isseli-brevispiratum* - Meister et al., p. e41, figs 22(8-14), 23(1, 2, 5, 10) with synonymy.
2014 *Fuciniceras* gr. *isseli-brevispiratum* - Meister & Blau, p. 264, figs. 5v-bb, 6a-g, l-o.

Again this taxon shows a variability in rib strength with rather finely closely ribbed form represented by *F. isseli* (Fucini) and with coarser spaced ribbed ones represented by *F. brevispiratum* (Fucini). They are characterized by sigmoid ribs clearly projected forwards on the ventro-lateral part and by a ventral part becoming narrower (tricarenate more rounded and pinched).

Local record. Colle Cidneo, Colle Cidneo (Castello di Brescia), Colle Cidneo (North face), Colle Cidneo (Pusterla), Botticino Mattina and Lassa (Dommergues et al. 1997b).

Age and distribution. It is the index species of the *F. isseli - brevispiratum* Horizon of the middle part of the Stokesi Subchronozone. It is well distributed in the Mediterranean Tethys and in its adjacent areas like the Ibericas (Spain).

Fuciniceras marianii (Fucini, 1904)
Pl. 12, fig. 11; pl. 16, figs 1, 2

* 1904 *Harpoceras marianii* Fucini, pl. 41, figs 1-3.
1997b *Fuciniceras* aff. *marianii* - Dommergues et al., pl. 2, fig. 10.
2003 *Protogrammoceras marianii* - Macchioni & Meister, pl. 2, figs 13, 14, 17, with synonymy.
2014 *Fuciniceras marianii* - Meister & Blau, p. 264, figs 6k, p-u.

The association of a subogival whorl section with relatively flat flanks, a keel bordered by two slightly depressed keel bands and rather falcoid and rather coarse ribs characterize this species. The distinction between *F. marianii* (Fucini) and *F. celebratum* (Fucini) essentially lies on the morphology of the ventral part, more shouldered in *F. marianii* (Fucini) and also on the ribbing, finer and closer in *F. celebratum* (Fucini). One specimen well shows the relative coarse ribbing and although crushed a still shouldered ventral area is visible. A second specimen rather evokes a transitional morphology and is named herein *F. marianii* (Fucini) - *celebratum* (Fucini) (see pl. 12, fig. 8 a refigured specimen of Castelli 1980, pl. 5, fig. 4).

Local record. Colle Cidneo, Botticino Mattina and Mt. Domaro (Dommergues et al. 1997b).

Age and distribution. This species characterizes the middle part of the Sokesi Subchronozone (*F. marianii* Horizon). It is recorded from the western Tethys and probably the southern part of the Euroboreal (Causses Basin).

Fuciniceras celebratum (Fucini, 1900)
Pl. 12, fig. 6

* 1900 *Grammoceras celebratum* Fucini, pl. 10, fig. 1, 2.
* 1900 *Grammoceras celebratum* var. *italica* Fucini, pl. 10, fig. 3.
1997b *Protogrammoceras celebratum* - Dommergues et al., pl. 2, figs 16, 21.
2003 *Protogrammoceras celebratum* - Macchioni & Meister, pl. 2, figs 18, 19, 21, 22 with synonymy.
2007 *P.* (*Protogrammoceras*) *celebratum* - Mouterde et al., pl. 4, figs 11, 16 with synonymy.
2009 *Fuciniceras* aff. *celebratum* - Meister et al., pl. 1, fig. 13.
2014 *Fuciniceras celebratum* - Meister & Blau, p. 264, figs 7o-r.

An ogival whorl section rounded until the acute keel and a dense, rather fine and falcate ribbing differenciate *F. celebratum* (Fucini) from the stratigraphically underlying *F. marianii* (Fucini). These characters make the difference to the older *F. marianii*.

Local record. Colle Cidneo (North face) and Botticino Mattina, Lassa (Dommergues et al. 1997b).

Age and distribution. *F. celebratum* (Fucini) ranges from the upper part of the Stokesi Subchronozone to the lower part of the Subnodosus Subchronozone. It is present in the Mediterranean Tethys and in the southern part of the Euroboreal domain.

Fuciniceras gr. ***cornacaldense*** (Tausch, 1890) - ***bicicolae*** (Bonarelli, 1895)
Pl. 13, figs 3, 5-8, 10-12; pl. 14, fig. 1

1890 *Harpoceras cornacaldense* Tausch, pl. 1, fig. 1.
1895 *Harpoceras* ? *cornacaldense* Tausch var. *bicicolae* Bonarelli, p. 339.
1900 *Hildoceras* (?) *cornacaldense* - Bettoni, pl. 6, fig. 1.
? 1900 *Hildoceras* (?) *boscense* (Reynès) - Bettoni, pl. 9, fig. 6.
1980 *Protogrammoceras varisostatum* (Fucini) - Castelli, pl. 6, fig 4 (refigured here).
2003 *Fuciniceras* gr. *cornacaldense* - Meister & Friebe, pl. 17, fig. 12 with synonymy.
2011 *Fuciniceras cornacaldense* - Meister et al., p. e43, fig. 23(6) with synonymy.

Without a visible ventral part (usually tricarenate) and a preserved whorl section (usually suquadrangular with flat flanks), the determination of our specimens is only based on the rib habitus. For the discrimination of the rib pattern we refer to Meister et al. (2011, fig. 27). Typical angulirursiradiate ribbing well corresponds to the types of *F. cornacaldense* (Tausch) and *F. bicicolae* (Bonarelli). This species, so understood, groups together forms with a rather

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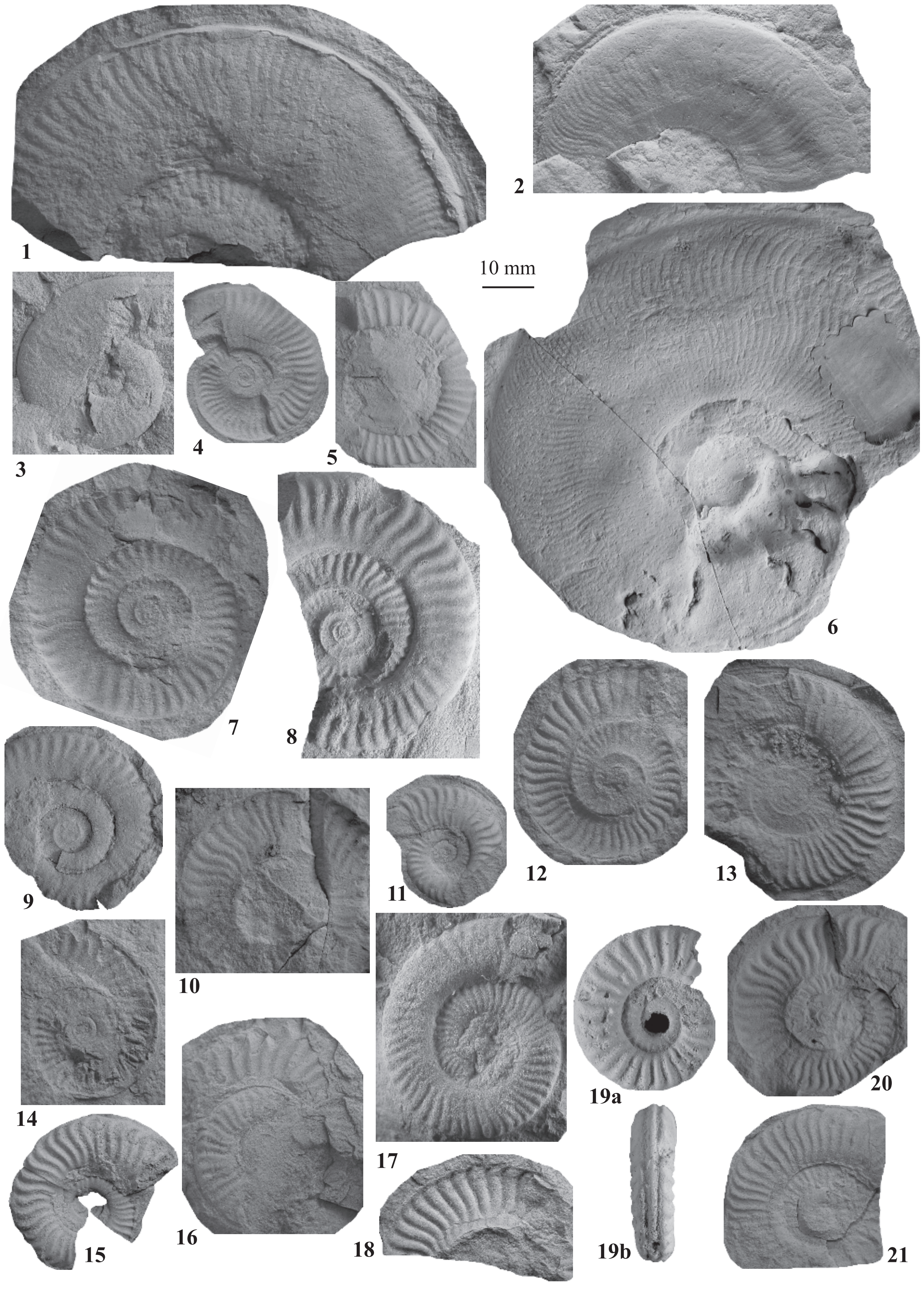
PLATE 14

Fig. 1 - *Fuciniceras* gr. *cornacaldense* (Tausch, 1890) - *bicicolae* (Bonarelli, 1895). Brescia (no 1232).
Fig. 2 - *Fuciniceras* (*Paltarpites*) sp. Costalunga (Goletto) (no 634).
Fig. 3 - *Lioceratoides lorioli* (Bettoni, 1900). Brescia (no 5013).
Fig. 4 - *Neolioceratoides* cf. *vergai* (Fucini, 1923). Colle Cidneo (Pusterla) (no 348).
Fig. 5, 7 - *Arieticeras* cf. *apertum* Monestier, 1934. Costalunga (no u03), Brescia (no 1569).
Fig. 6 - *Fuciniceras* (*Paltarpites*) *decoratum* (Fucini, 1924). Gussago (Val Navezze) (no 490).
Fig. 8, 9, 17 - *Arieticeras mirificum* (Fucini, 1900). Adro (no u41), Brescia (no 501b), Adro (?) (no u38).
Fig. 10, 11, 14-16, 18, 20 - *Arieticeras amalthei* (Oppel, 1853). Colle Cidneo (North face) (no 5045), Colle Cidneo (no 404), Colle Cidneo (North face) (no 5038, no Castello 2, no 5046), Brescia (no 559), Colle Cidneo (no u34).
Fig. 12, 13, 21 - *Arieticeras* cf. *expulsum* Fucini, 1931. Colle Cidneo (Castello di Brescia) (no 617), Colle Cidneo (no 1696a), Brescia surroundings (no u28).
Fig. 19 - *Arieticeras bertrandi* (Kilian, 1889). Brescia surroundings (no 1538).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open umbilicus and rather regularly ribbed corresponding to *F. cornacaldense* (Tausch) and forms with a smaller umbilicus and developing strong bullae-like on the lower part of the flanks of the body chamber that correspond to *F. bicicolae* (Bonarelli). Very often in the literature, Bonarelli's species is considered as a synonym of Tausch's species.

Local record. Brescia, Colle Cidneo, Colle Cidneo (North face), Concesio, Gussago (Val Navezze), Val Trompia, Lassa. Other specimens figured by Bettoni (1900) are coming from Castello di Brescia and Botticino.

Age and distribution. The age of *F. cornacaldense* (Tausch) corresponds to upper part of the Subnodosus Subchronozone. This species is known in the Mediterranean Tethys and probably in the southern part of the Euroboreal domain (Causses Basin). *F. boscense* (Reynès) probably is to the equivalent species in the Euroboreal realm.

Remark. Several specimens of Bettoni (1900) belong to the genus *Fuciniceras* and are recorded from Castello di Brescia, Montecolo di Pilzone and Botticino.

Subgenus *Paltarpites* Buckman, 1922
Type species: *Paltarpites paltus* Buckman, 1922

Remark. Involute platycone and compressed Harpoceratinae with a subfalciform ribbing characterize this subgenus.

Fuciniceras* (*Paltarpites*) aff. *kurrianus (Oppel, 1862)

Pl. 13, fig. 9

aff. *1862 *Ammonites Kurrianus* Oppel, p. 136, pl. 42, fig 3.
non 1900 *Harpoceras* (?) *kurrianum* - Bettoni, pl. 9, figs 8, 9.
aff. 1989 *P. (Paltarpites) kurrianus* - Meister, pl. 8, figs 1, 2 with synonymy.
aff. 1992 *P. (Protogrammoceras) kurrianus* - Howarth, pl. 3, figs 3, 4.

Our specimen is characterized by a little irregular ribbing with fine and close subfalciform ribs and a rather opened umbilicus at this size.

The Brescian specimen has most affinity with an Euroboreal species: *F.* (*Paltarpites*) *kurrianus* (Oppel) as well with the ribbing than with the umbilicus size. Only the rib-segment on the lower part of the flank is more proradiate in our specimen. It is the reason to put it *in affinis*. It is also closely related with *F.* (*Paltarpites*) *meneghini* (Bonarelli) but the diameter of the umbilicus is different. Indeed Bonarelli's species seems to have a more opened umbilicus (at least in the inner whorls) (see Wiedenmayer 1980, pl. 13, fig. 7 or Fantini Sestini 1977, pl. 33, fig. 4). Nevertheless Oppel's and Bonarelli's species have the same age and are morphologically very close as Braga (1983, 166) already indicated.

The specimen illustrated by Bettoni (1900, pl. 6, fig. 10) under the name *F.* (*P.*) *curionii* (Meneghini) is also rather close to the Brescian specimen. Among the *F.* (*Paltarpites*) with an open umbilicus, *F.* (*Paltarpites*) *vacekii* (Haas) is finer and more regularly ornamented with more sinuous ribs and *F.* (*P.*) *veliferum* (Gemmellaro), a younger species, is more involute seems to be more more densely ribbed.

Local record. Surroundings of Brescia; Corso of Botticino.

Age and distribution. Its age corresponds to the Gibbosus Subchronozone. In Brescia, this species is associated with *Arieticeras mirificum* (Fucini). *F.* (*Paltarpites*) *kurrianus* (Oppel) s.s. is only known in the Euroboreal domain and in the Southern Calcareous Alps (Italy and Switzerland).

Fuciniceras* (*Paltarpites*) *decoratum (Fucini, 1924)

Pl. 14, fig. 6

1924 *Harpoceras decoratum* Fucini, pl. 3, figs 4, 5 (lectotype).
1980 *Protogrammoceras percostatum* - Castelli, p. 64.
1980 *Paltarpites decoratus* - Wiedenmayer, pl. 29, figs 1, 2.
1983 *Protogrammoceras decoratum* - Braga, pl. 6, fig. 2; pl. 7, fig. 1.

This *F.* (*Paltarpites*) is characterized by a rather fine, sinuous and dense ribbing and a rather narrow umbilicus. This habitus evokes *F.* (*P.*) *decoratum* (Fucini), a similar sized form (see lectotype). Among the fine closely ribbed *F.* (*Paltarpites*), *F.* (*P.*) *curionii* (Meneghini) *sensu* Ferretti shows a narrower umbilicus, *F.* (*P.*) *praeexaratum* (Fucini) has a finer ribbing, *F.* (*P.*) *meneghinii* (Bonarelli) shows a more falciform ribbing and *F.* (*P.*) *percostatum* (Fucini) a clearly coarser and more spaced ribbing.

Another specimen (no 634) is put closer to *F.* (*Paltarpites*) because of very sinuous rather irregular ribbing. Indeed in this partly preserved body chamber, ribs are grouped (two or three) on the lower part of the flanks sporadically alternating with simple ones. It is named *Fuciniceras* (*Paltarpites*) sp. and illustrated pl. 14, fig. 2.

Local record. Gussago (Val Navezze), Costalunga (Goletto).

Age and distribution. This species ranges from the upper part of the Gibbosus Subchronozone to the Apyrenum Subchronozone or base of Hawskerense Subchronozone (Late Pliensbachian). It is restricted to the Mediterranean Tethys (Southern Calcareous Alps, Sicily and Beticas).

Remark. *F.* (*P.*) cf. *meneghini* (Bonarelli) is recorded in Villa from the middle-upper part of the Margaritatus Chronozone (Dommergues et al. 1997b, pl. 2, fig. 1) and *F.* (*P.*) cf. *jucundus* (Fucini) is known in the topmost Pliensbachian (upper part of the Spinatum Chronozone) in Provaglio d'Iseo (*ibidem*, pl. 2, fig. 18).

Genus *Lioceratoides* Spath, 1919
Type species: *Lioceras* ? *grecoi* Fucini, 1900

Lioceratoides lorioli (Bettoni, 1900)
Pl. 14, fig. 3

1900 *Hildoceras* (?) *Lorioli* Bettoni, pl. 8, fig. 11(?), 12 (lectotype).
1908 *Hildoceras* (?) *Lorioli* - Fucini, pl. 3, figs 15, 16.
1983 *Lioceratoides lorioli* - Braga, pl. 8, figs 7-10 with synonymy.
2003 *Lioceratoides grecoi* (Fucini) - *lorioli* - Macchioni & Meister, pl. 5, figs 17, 18; pl. 6, figs 1-3, 7, 8.
2007 *Lioceratoides lorioli* - Fauré et al., p. 493, fig. 7(A-C).

This form is characterized with a platycone involute coiling associated with an irregular sigmoid more or less fasciculate ribbing. The ornament, strong in the inner whorls, becomes finer, subfalciform and evanescent in the last whorl where the sheel is suboxycone. The ventral area is narrow with two thin bands and a high keel. These characters are observed in the fauna discussed by Braga (1983) under the name *L. lorioli* (Bettoni).

For memory Bettoni discussed this species on the basis of only inner whorls and the lectotype is coming from Castello di Brescia.

Local record. Brescia city.

Age and distribution. *L. lorioli* (Bettoni) age corresponds to the Latest Pliensbachian (Spinatum Chronozone) and more precisely to a period from the upper part of the Apyrenum Subchronozone to the Hawskerense Subchronozone. It is known in the Mediterranean Tethys [(Southern Calcareous Alps, Apennines (Umbria-Marche), Sicily, Beticas and North Africa (Morocco, Tunisia)].

Remark. A rather small evolute specimen (D = 23 mm) from Rezzato is considered herein as inner whorls of *Lioceratoides* without more precision (*Lioceratoides* sp.). This genus is also present in Navezze (Bettoni 1900) and in Provaglio d'Iseo (Dommergues et al. 1997b, pl. 2, fig. 5). In this last locality and in Molvina *L.* cf. *grecoi* (Fucini) is also present (*ibidem*, p. 14).

Genus *Neolioceratoides* Cantaluppi, 1970
Type species: *Hildoceras* (*Lillia*) *Hoffmanni* Gemmellaro, 1885

Neolioceratoides cf. ***vergai*** (Fucini, 1923)
Pl. 14, fig. 4

cf. 1923 *Pseudolioceras vergai* Fucini, pl. 13, figs 1-5.
cf. 1975 «*Harpoceras*» *hoffmanni* (Gemmellaro) - Ferretti, pl. 25, fig. 7.
cf. 1980 *Fuciniceras bicicolae* (Bonarelli) - Castelli, p. 61.
cf. 1980 *Neolioceratoides vergai* - Wiedenmayer, pl. 16, figs 3, 4.
aff. 1983 *Neolioceratoides hoffmanni* (Gemmellaro) - Braga, pl. 9, fig. 3 (only).

This platycone ammonites is characterized by rather fine, close regular and slightly sigmoidal ribbing, not strongly projected forward on the ventral part. The ribs are thicker than their corresponding in between spaces. These characters are obvious in *N. vergai* (Fucini) mainly in pl. 13, figs 2-4 (*ibidem*, 1923). In comparison with *N. hoffmanni* (Gemmellaro) the rib density is higher, at least in the inner whorls. Nevertheless Braga (1983) includes *N. vergai* (Fucini) in the Gemmellaro's species. *Bassaniceras* shows a blunter ribbing.

Local record. Colle Cidneo (Pusterla).

Age and distribution. The species is present in the Calcareous Alps, Central Apennine, Sicily and possibly in Beticas. It characterizes the Hawskerense Subchronozone (upper part of the Spinatum Chronozone).

Remark. *Neolioceratoides* is also present in Castello di Brescia (Bettoni 1900, pl. 6, figs 4, 5) and in Molvina (Dommergues et al. 1997b, pl. 2, fig. 3). Moreover *N. schopeni* (Gemmellaro) is recorded from Molvina and Provaglio d'Iseo (*ibidem*, pl. 2, fig. 19).

Subfamily Arieticeratinae Howarth, 1955
Genus *Arieticeras* Seguenza, 1885
Type species: *Ammonites algovianus* Oppel, 1862

Fig. 15 - Bioturbation tracks in the body chamber of an *Arieticeras amalthei* (Oppel, 1853) from Oglio river, Roccafranca (Bs).

***Arieticeras* cf. *apertum* Monestier, 1934**

Pl. 14, figs 5, 7

cf. 1897 *Aegoceras* n. f. cf. *A. capricornu* (Schlotheim) - Parona, pl. 10, fig. 2.
cf. 1934 *Arieticeras apertum* Monestier, pl. l, figs 14-16,19.
pars 1900 *Hildoceras* (*Arieticeras*) *domarense* (Meneghini) - Bettoni pl. 9, fig. 4; pl. 5, fig. 1.
1997b *Arieticeras* aff. *apertum* sensu Meister - Dommergues et al., pl. 2, fig. 17.
2003 *Arieticeras* cf. *apertum* - Macchioni & Meister, pl. 7, figs 1, 3 with synonymy.

A. apertum Monestier regroups serpenticone *Arieticeras* and is taken in a wide sense. Following this idea, specimens with a rather serpenticone coiling (pl. 14, fig. 5) close to the population of Monestier (1934, pl. 1, figs 14-16, 19) and specimens with an umbilicus slightly but systematically narrower (pl. 14, fig. 7) evoking the forms of Braga et al. (1982), Braga (1983), Comas-Rengifo (1985) and Meister (1989) belong to this species. Our first specimen shows a rigider whereas at the second, the ribbing is sinuous. Because of their preservation, they are put in confer with Monestier's species.

A. domarense (Meneghini) also is an evolute form but with more flexuous ribs. However some *A. domarense* (Meneghini) illustrated by Bettoni (1900, pl. 9, fig. 4; pl. 5, fig. 1) and coming from Botticino and Castello di Brescia rather belongs to *A. apertum* Monestier group because of their rigid ribbing. Nevertheless both species are closely related. Note that the specimen illustrated in pl. 14, fig. 5 already was illustrated by Parona (1897, pl. 10, fig. 2).

Local record. Costalunga, Brescia and Mt. Zoadello (Dommergues et al. 1997b).

Age and distribution. *A. apertum* Monestier is the oldest species of the genus *Arieticeras*. Its range corresponds to the Subnodosus Subchronozone and it recorded from the Mediterranean Tethys and the southern part of the Euroboreal domain (Ibericas and Causses). There is a citation of the species in Japan (Toyora Group) also.

***Arieticeras amalthei* (Oppel, 1853)**

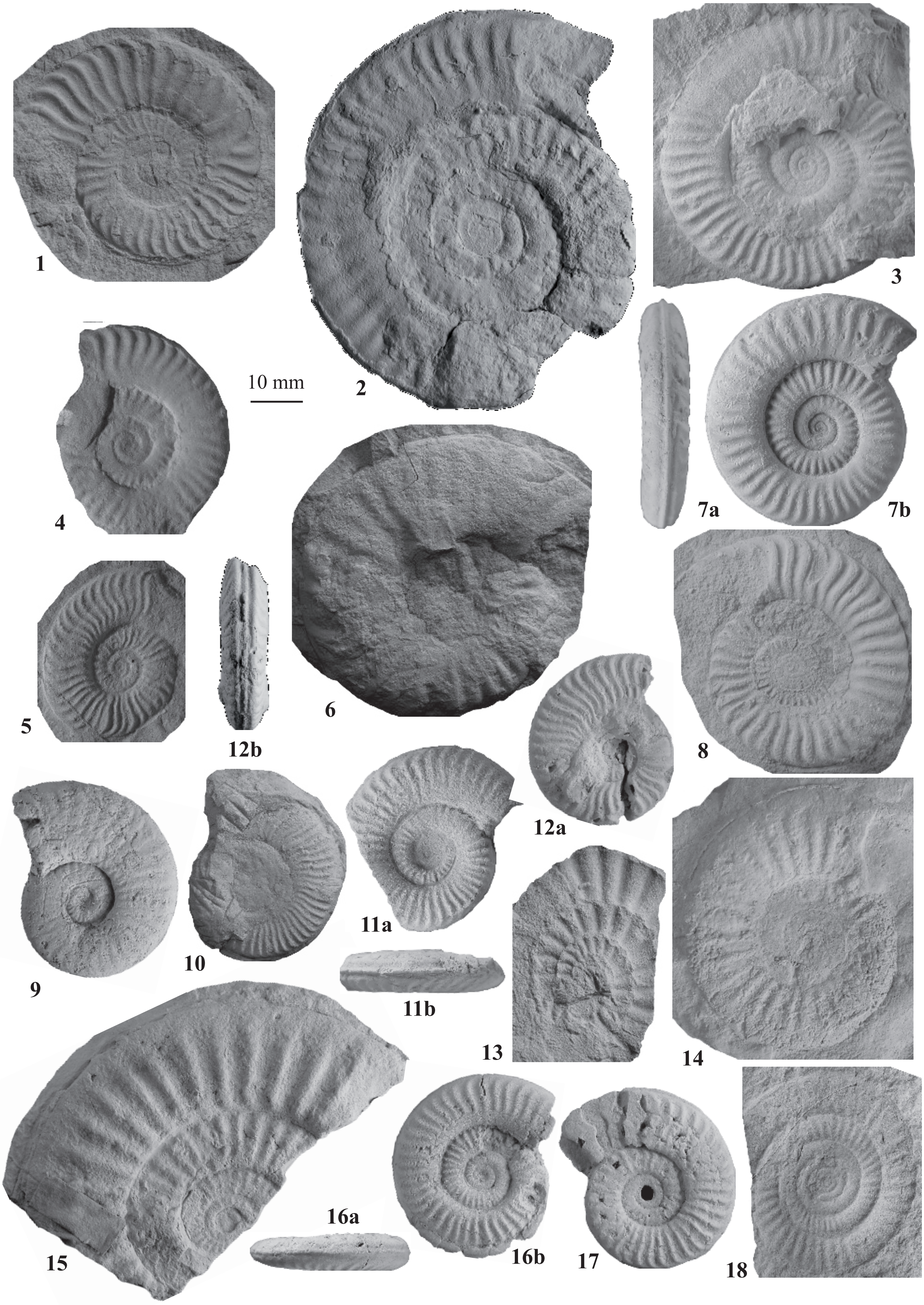
Pl. 14, figs 10, 11, 14-16, 18, 20; pl. 15, figs 1, 5; Fig. 15

1853 *Ammonites radians amaltlhei* Oppel, pl. 3, fig. 1 only.
1980 *Geczya gaetani* (?) - Castelli, pl. 6, fig. 5 (refigured here pl. 15, fig. 1).
2003 *Arieticeras amalthei* - Macchioni & Meister, pl. 7, figs 2, 6-8, 10, 11 with synonymy.
2007 *Arieticeras* gr. *amalthei* - Mouterde et al., pl. 6, fig. 3.
? 2008 *Arieticeras* cf. *amalthei* - Dommergues et al., pl. 3, fig. 2.

This *Arieticeras*, rather compressed and rather involute because of a consequent whorl height, is characterized by sigmoid, sometimes fasciculate ribbing varying from fine to rather coarse. This habitus distinguishes it from the other species here described. *A. gaetani* Fantini Sestini is included within Oppel's species.

PLATE 15

Fig. 1, 5 - *Arieticeras amalthei* (Oppel, 1853). Colle Cidneo (no u29), Valenzano (no LAV04).
Fig. 2 - *Arieticeras* gr. *algovianum* form *retrorsicosta* (Oppel, 1862). Colle Cidneo (no u39).
Fig. 3, 7, 8 - *Arieticeras* gr. *algovianum* (Oppel, 1862) s.s. Brescia surroundings (no 834), Costalunga (no 5008), Colle Cidneo (no u40).
Fig. 4 - *Arieticeras mirificum* (Fucini, 1900). Brescia surroundings (no PA11116/2).
Fig. 6, 17 - *Leptaleoceras* gr. *insigne* (Fucini, 1931). Brescia surroundings (no 844), Costalunga (no 5007).
Fig. 9 - *Leptaleoceras ugdulenai* (Gemmellaro, 1885). Concesio (no 1387a).
Fig. 10 - *Leptaleoceras accuratum preaccuratum* Braga, 1983. Concesio (no 1387b).
Fig. 11, 16 - *Leptaleoceras* gr. *accuratum* (Fucini, 1931). Brescia surroundings (no 1534a, no 1534b).
Fig. 12 - *Arieticeras ignarum* (Fucini, 1931). Virle (no 830).
Fig. 13 - *Fontanelliceras fontanellense* (Gemmellaro, 1885). Gussago (Val Navezze) (no 504).
Fig. 14, 15 - *Emaciaticeras* gr. *fervidum* Fucini, 1931. Ronchi di Brescia (no 1432), Gussago (Val Navezze) (no 396).
Fig. 18 - *Fontanelliceras* aff. *ultraspiratum* (Fucini, 1929-30). Colle Cidneo (no u36).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Local record. Brescia, Colle Cidneo, Colle Cidneo (North face), Valenzano.

Age and distribution. This species is well known in the western Tethys and in the Euroboreal domain (Causses Basin, South Germany). It characterizes a precise bioevent just below the *A. bertrandi* Horizon that corresponds to the lower-middle part of the Gibbosus Subchronozone.

Arieticeras mirificum (Fucini, 1900)

Pl. 14, figs 8, 9, 17 (aff.); pl. 15, fig. 4

1900 *Hildoceras mirificum* var. *semiradiata* Fucini, pl. l2, fig. 10.
1900 *Hildoceras mirificum* Fucini, pl. l2, fig. 9.
? non 1934 *Arieticeras* cf. *mirificum* - Monestier, pl. 10, figs 27, 28.
1977 *Geczya mirificum* - Fantini Sestini, pl. 34, figs 4-6.
1980 *Arieticeras mirificum* - Wiedenmayer, pl. 19, figs 17, 18.

This *Arieticeras* is characterized by rursiradiate, sigmoidal more or less coarse spaced ribs and by an open umbilicus. For comparison with a related species, *A.* gr. *apertum* Monestier and specially the Brescian specimens do not exhibit such rursiradiate and sinuous ribbing. With its closer and finer ribbing the specimen illustrated in pl. 14, fig. 17 is only put *in affinis* with Fucini's species.

Local record. Adro, Brescia and surroundings.

Age and distribution. This species is restricted to the Southern Calcareous Alps and to Central Apennine. Its age corresponds to the Gibbosus Subchronozone probably to its lower part as suggested by Braga (1983).

Arieticeras bertrandi (Kilian, 1889)

Pl. 14, fig. 19

1889 *Hildoceras bertrandi* Kilian, pl. 25, fig. 1 (lectotype).
1908 *Hildoceras reynesianum* Fucini, pl. 2, figs 19, 20.
1908 *Hildoceras reynesi* Fucini, pl. 2, figs 7-9.
1997b *Arieticeras* gr. *bertrandi* - Dommergues et al., pl. 2, fig. 12.
2011 *Arieticeras* cf. *bertrandi* - Meister et al., p. e46, fig. 25(1) with synonymy.

Classic *Arieticeras* of the Mediterranean Tethys that well corresponds to the interpretation of *A. bertrandi* (Kilian) group of Meister (1989, p. 7, fig. 38) based on the variability of the rib -density, -plan and -strenght and on the whorl thickness. With rather rigid and coarse ribs and a thick whorl section, our specimen corresponds to the *A. bertrandi* (Kilian) s.s.

Local record. Brescia surroundings and from Poffe di Lumezzane, Cogozzo, Villa (Dommergues et al. 1997b).

Age and distribution. Known in the Mediterranean Tethys and in the southern part of the Euroboreal domain, this species characterizes the *A. bertrandi* Horizon of the Gibbosus Subchronozone.

Arieticeras gr. ***algovianum*** (Oppel, 1862)

Pl. 15, figs 2, 3, 7, 8

1862 *Ammonites algovianum* Oppel, p. 137.
1862 *Ammonites retrosicosta* Oppel, p. 139.
1900 *Hildoceras (Arieticeras) algovianum* - Bettoni, pl. 4, figs 8, 9.
aff. 1900 *Hildoceras (Arieticeras) retrorsicosta* (Oppel) - Bettoni, pl. 9, fig. 5.
1931 *Arieticeras almoetianum* Fucini, pl. 8, fig. 1, non 2-4.
1980 *Arieticeras almoetianum* (?) - Castelli, pl. 5, fig. 1 (refigured here pl. 15, fig. 8).
1997b *Arieticeras* gr. *algovianum* - Dommergues et al., pl. 2, figs 6, 8, 9, 14.
2009 *Arieticeras* gr. *algovianum* - Meister et al., pl. 1, fig. 9.
2011 *Arieticeras* gr. *algovianum* - Meister et al., p. e46, figs 23(12, 14, 15); 25(4) with synonymy.

These forms are classic *Arieticeras* that also shows a variability in ribbing and in whorl thickness (Meister 1989). Here we have rather fine, dense, weakly sinuous ribbed specimens that correspond to *A. algovianum* (Oppel) s.s. and coarser, more spaced, rigid and rursiradiate specimens belonging to *A. algovianum* (Oppel) form *retrorsicosta* (Oppel). They have a more sinuous rib habitus that in the underlying *A. bertrandi* (Kilian), mainly with more forward arched ribs in the ventro-lateral part. In opposite they have less sinuous ribs in comparison with *A. amalthei* (Oppel), mainly in the lower part of the flanks where ribs are more straight and rigid, moereover no fasciculation is developed.

Local record. Costalunga, Colle Cidneo, Colle Cidneo (Castello di Brescia), Colle Cidneo (Pusterla), Brescia and surroundings, Saiano; from Cogozzo, Mt. Zoadello, Villa (Dommergues et al. 1997b); from Montecolo di Pilzone, Botticino and Castello di Brescia (Bettoni 1900).

Age and distribution. *A.* gr. *algovianum* (Oppel) is known from the Mediterranean Tethys, the southern part of the Euroboreal domain and the North Pacific areas. It is the index species of the eponym Horizon corresponding to the middle-upper part of the Gibbosus Subchronozone.

***Arieticeras* cf. *expulsum* Fucini, 1931**
Pl. 14, figs 12, 13, 21

cf. 1931. *Arieticeras expulsum* Fucini, pl. 8, fig. 9.
non 1986 *Arieticeras* (*Arieticeras*) *expulsum* - Gakovic, pl. 6, fig. 2.
pars 1977 *Arieticeras expulsum* - Fantini Sestini, pl. 37, fig. 5.
pars 1980 *Arieticeras expulsum* - Wiedenmayer, pl. 19, figs 2, 3, 6, 7, non 4, 5, 12, 13.
1980 *Arieticeras expulsum* - Castelli, pl. 5, fig. 2 (refigured here pl. 14, fig. 12).

This *Arieticeras* is characterized by thin ribs, hardly sinuous, almost tense on the flanks. Our specimens are crushed and therefore only put in confer with Fucini's species. *A. expulsum* Fucini shows rather a rigider ribbing in comparison with *A. algovianum* (Oppel) but it remains very close and maybe is only a variant inside the variability of Oppel's species. In *A. amalthei* (Oppel) the umbilicus is narrower and the ribs are more sinuous and sometimes fasciculate, mainly in the inner whorls.

Local record. Colle Cidneo, Colle Cidneo (Castello di Brescia), Brescia surroundings.

Age and distribution. This species is recorded only from Southern Calcareous Alps and Sicily. It is attributed without precision to the Gibbosus Subchronozone.

***Arieticeras ignarum* Fucini, 1931**
Pl. 15, fig. 12

1931 *Arieticeras algovianum* var. *ignara* Fucini, pl. 7, fig. 1.
cf. 1980 *Arieticeras scissum* (Fucini) - Wiedenmayer, pl. 21, figs 7, 8.

Under this name we include one peculiar moderatly evolute *Arieticeras* characterized by a sigmoidal ribbing like in *A. amalthei* (Oppel) associated with a wide tricarenate ventral part similar to those illustrated by Wiedenmayer (1980, pl. 21, fig.s 7, 8) under the name *A. scissum* (Fucini) or better by Fucini (1931) under the name *A. algovianum* var. *ignara*.

Local record. Virle.

Age and distribution. This rare species is known only from Southern Calcareous Alps and Sicily. Its age corresponds to the middle part of the Gibbosus Subchronozone.

Remark. Bettoni (1900) described under the name *Arieticeras domarense* (Meneghini) some specimens from Botticino and Castello di Brescia. *A.* gr. *disputabile* (Fucini) is present in Mt. Domaro (Dommergues et al. 1997b, pl. 2, fig. 13) and *A.* aff. *macrum* Monestier in Mompiano (*ibidem*, pl. 2, fig. 20). Moreover several specimens from the collection of the Museum of Brescia are put in *Arieticeras* sp. indet., mainly due to a poor preservation as also the specimen of Cantaluppi (1966, pl. 16, fig. 6).

Local record. Colle Cidneo, Colle Cidneo (Castello di Brescia), Colle Cidneo (Pusterla), Costalunga, Ronchi di Brescia, Mompiano, Brescia and surroundings, Rezzato, Concesio, Gussago (Val Navezze), Valenzano and Castello-Villa (Cantaluppi 1966).

Genus *Leptaleoceras* Buckman, 1918
Type species: *Leptaleoceras leptum* Buckman, 1918

Remark. *Leptaleoceras* groups more platycone compressed forms in comparison with *Arieticeras*. The whorl section is more pinched on the external part with a high keel bordered with hardly obvious sulci, often forming smooth bands. The ribs are particularly rigid on the lower part of the flanks.

***Leptaleoceras ugdulenai* (Gemmellaro, 1885)**
Pl. 15, fig. 9

1885 *Arieticeras (Grammoceras) ugdulenai* Gemmellaro, p. 6.
1929-30 *Seguentia ugdulenai* - Fucini, pl. 15, figs 1 (lectotype), 2-7.
1929-30 *Seguentia ugdulenai* (Gemmellaro) *dellseplicata* Fucini, pl. 15, figs 8, 9.
1929-30 *Seguentia ugdulenai* (Gemmellaro) *rareplicata* Fucini, pl. 15, figs 10-13.
1998 «*Leptaleoceras*» aff. *ugdulenai* - Géczy & Meister, pl. 15, figs 8,10 with synonymy.
2002 *Leptaleoceras ugdulenai* - Dommergues et al., p. 307, figs 6, 7.
2002 *Leptaleoceras ugdulenai* - Pavia & Cresta, p. 132, figs 78a (neotype), b, c
2003 *Leptaleoceras ugdulenai* - Macchioni & Meister, pl. 9, figs 1-9, 12.
2005 *Leptaleoceras* cf.*ugdulenai* - Dommergues et al., p. 426, fig. 11.
2007 *Leptaleoceras* gr. *ugdulenai* - Fauré et al., p. 485, figs 5.C1, C2, D, G1, G2.

This *Leptaleoceras* is characterized by a rather involute shell with high sub-elliptical compressed whorls. The keel is well differentiated bordered by two flat smooth bands. The ribs are subradiate and hardly sigmoid, sometimes fasciculate since the lower part of the flanks. Our specimen is close to the form illustrated by Ferretti (1991, pl. 13, fig. 4). *L. insigne* (Fucini) has a larger umbilicus.

Local record. Concesio and from Mt. Domaro (Dommergues et al. 1997b, p. 15).

Age and distribution. Well represented in the Western Tethys until the Taurides, this species also is represented in the southern part of the Euroboreal Domain. Its age corresponds to the middle-upper part of the Gibbosus Subchronozone.

Leptaleoceras gr. ***insigne*** (Fucini, 1931)

Pl. 15, figs 6, 17

1931 *Seguentia* ? *insignis* Fucini, pl. 9, figs 20, 21.
1998 *Leptaleoceras* gr. *insigne* - Géczy et Meister, pl. 15, figs 7, 9; pl. 16, figs 1-4, 6 with synonymy.
2011 *Leptaleoceras* gr. *insigne* - Meister et al., p. e46 with synonymy.

With rigid and rather spaced ribs, hardly projected forward on the ventro-lateral part, these *Leptaleoceras* are group within the *L. insigne* (Fucini). Besides in the adult stage, the ribbing becomes particularly coarse as we can observe in pl. 15, fig. 6 or in Braga (1983, pl. 11, fig. 4). These forms also well correspond to the Hungarian fauna recently described by Géczy & Meister (1998, pl. 15, figs 7, 9; pl. 16, fig. 1-4, 6). There are some allied species like *L. parodii* (Fucini) that has a more rursiradiate and rigider ribbing or *L. subtile* (Fucini) that shows a more pinched outer part with a high keel without flat bands. The Brescian specimens also show coarser and more spaced ribbing than *L. accuratum* (Fucini).

Local record. Costalunga and Brescia surroundings.

Age and distribution. This species is only recorded from the western Tethys and its range corresponds to the middle-upper part of the Gibbosus Subchronozone.

Leptaleoceras gr. ***accuratum*** (Fucini, 1931)

Pl. 15, figs 11, 16

1931 *Arieticeras* (?) *accuratum* Fucini, pl. 8, figs 7, 8.
1980 *Arieticeras disputabile* (Fucini) - Castelli, pl. 4, fig. 6 (refigured here pl. 15, fig. 16).
1997b *Leptaleoceras* gr. *accuratum* - Dommergues et al., pl. 2, figs 11, 25.
2011 *Leptaleoceras* gr. *accuratum* - Meister et al., p. e47, figs 23(7), 25(2, 3) with synonymy.

Our samples, corresponding to the inner and middle whorls, are quite close to the type of Fucini (1929-30, pl. 8, fig. 10) and to the fauna of Fantini Sestini (1977) and Braga (1983) with their rather fine, close, slightly sinuous, rarely fasciculate ribbing, their compressed whorl section and a rather opened umbilicus. The ventral part is keeld with 2 narrow sulci. *L. canavarii* (Fucini) is a related species but with a more irregular strongly fasciculate ribbing and *L. pseudoradians* (Reynès) has a finer and more dense ribbing.

Local record. Surroundings of Brescia, Cogozzo and Lassa (Dommergues et al. 1997b).

Age and distribution. This species is known in the Western tethys until the Taurides, in the southern part of the Euroboreal Domain and in North America. Its range corresponds to the upper part of the Gibbosus Subchronozone.

Leptaleoceras accuratum preaccuratum Braga, 1983

Pl. 15, fig. 10

1983 *Leptaleoceras accuratum preaccuratum* Braga, pl. 11, figs 27-30; pl. 12, figs 1, 2.
1998 *Leptaleoceras accuratum preaccuratum* - Géczy & Meister, pl. 15, fig. 15.

Smaller sized forms with denser and more flexuous ribbing than *L. accuratum* (Fucini) s.s. are grouped in Braga's subspecies.

Local record. Concesio.

Age and distribution. Only known from Beticas, Bakony and Southern Calcareous Alps, this taxon has the same age than *L. accuratum* (Fucini) s.s. (see above).

Genus *Fontanelliceras* Fucini, 1931

Type species: *Harpoceras fontanellense* Gemmellaro, 1885

Fontanelliceras fontanellense (Gemmellaro, 1885)

Pl. 15, fig. 13

1885 *Harpoceras Fontanellense* Gemmellaro, pl. 2, figs 1, 2.
1997b *Fontanelliceras fontanellense* - Dommergues et al., pl. 2, fig. 24.
2003 *Fontanelliceras fontanellense* - Macchioni & Meister, pl. 10, figs 1, 4 with synonymy.
2005 *Fontanelliceras fontanellense* - Dommergues et al., p. 427, figs 11(7, 10).

Our specimen is crushed but well corresponds to the *F. fontanellense* (Gemmellaro) illustrated by Fucini (1929-30, pl. 8, especially fig. 21, 23, 24). Indeed, it shows a quite serpenticone

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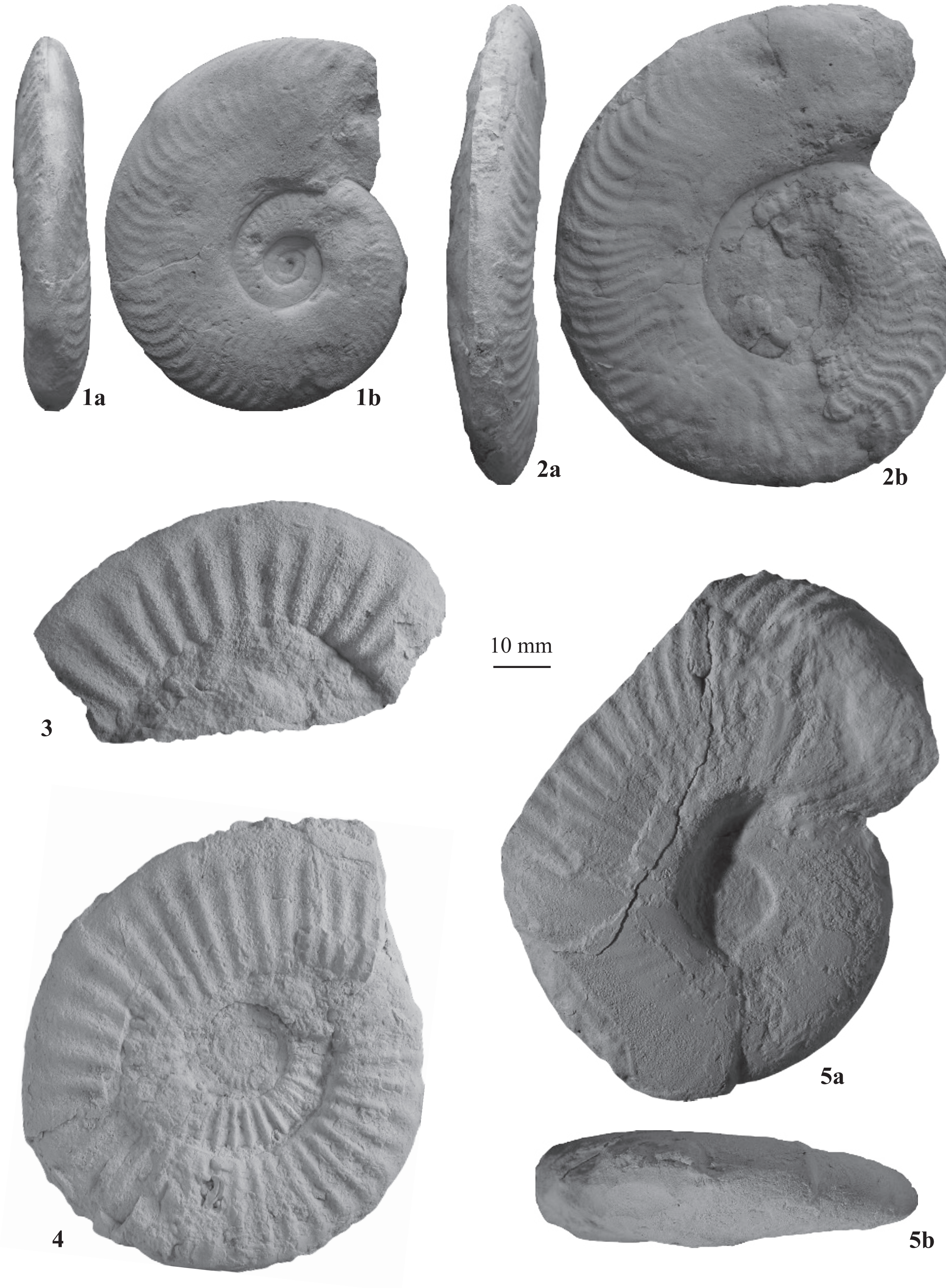
PLATE 16

Fig. 1, 2 - *Fuciniceras marianii* (Fucini, 1904). Botticino Mattina (no MAS02, MAS03).
Fig. 3 - *Emaciaticeras* gr. *fervidum* Fucini, 1931. Provaglio d'Iseo (no u44).
Fig. 4 - *Emaciaticeras emaciatum* (Catullo, 1853). Costalunga (no 5000).
Fig. 5 - *Juraphyllites nardii* (Meneghini, 1853). Montisola (no MoI01).


1a
1b
2a
2b
3
10 mm
5a
4
5b

coiling and a coarse rectiradiate to rursiradiate ribbing. *F. juliae* (Bonarelli) has a clear coarser ribbing and is often seen as a simple coarse variant of *F. fontanellense* (Gemmellaro). In this species the whorl section is subrectangular depressed with a bisulcate-tricarenate venter. In opposite «*F.*» *longispiratum* Fucini and «*F.*» *perspiratum* Fucini show a denser and finer ribbing. The taxonomic position of these two last species is still in discussion and they are doubfully attributed to the genus *Fontanelliceras*.

Local record. Gussago (Val Navezze), and from Provaglio d'Iseo and Molvina (Dommergues et al. 1997b).

Age and distribution. *F. fontanellense* (Gemmellaro) is well known in Mediterranean Tethys (Apennines, Southern Calcareous Alps, Sicily and northern Middle Atlas) and in Japan and North America. The total range of this species corresponds to the Latest Pliensbachian to the basal Toarcian (uppermost part of the Spinatum Chronozone to the lowermost Tenuicostatum Chronozone). The forms from Provaglio d'Iseo are of Toarcian age.

Remark. The lectotype proposed by Braga (1983) for *F. fontanellense* (Gemmellaro) is the specimen of Gemmellaro (1885) illlustrated pl. 2, fig. 2 and refigured by Fucini (1931, pl. 8, fig. 21). But in 2002 Pavia & Cresta chose another specimen (p. 146, fig. 88) as the lectotype that hardly and doubtfully corresponds to the figures of Gemmellaro and of Fucini.

Fontanelliceras aff. ***ultraspiratum*** (Fucini, 1931)

Pl. 15, fig. 18

aff. 1923-30 *Arieticeras perspiratum var. ultraspirata* Fucini, pl. 7, figs 7, 8.
1980 *Arieticeras perspiratum* (Fucini) - Castelli, pl. 4, fig. 7 (refigured here).

It is a serpenticone ammonite with a long smooth inner whorl stage for an Arieticeratinae (about 10 mm of diameter). Only the *Fontanelliceras* regroup such evolute morphologies and among this genus, *F. fontanellense* (Gemmellaro) and *F. juliae* (Bonarelli) regroup the coarse morphologies and «*F.*» *longispiratum* Fucini, «*F.*» *perspiratum* Fucini and *F. ultraspiratum* (Fucini) the finer and denser ones. The Brescian specimen without doubt belongs to the second group with its subradiate to prorsiradiate, rather fine and close ribs and especially to *F. ultraspiratum* (Fucini) that nevertheless is characterized by subradiate to rursiradiate ribs. Our specimen is put *in affinis* because of this difference and also because its long smooth stage is rather original. *A. apertum* Monestier one of very evolute *Arieticeras* is clearly less evolute than our specimen.

Local record. Colle Cidneo.

Age and distribution. The range of this species is not well known, most probably it corresponds to a part of the Spinatum Chronozone (Late Pliensbachian). It is only recorded from Sicily and Southern Calcareous Alps.

Genus *Emaciaticeras* Fucini, 1931

Type species: *Ammonites emaciatus* Catullo, 1853

Emaciaticeras emaciatum (Catullo, 1853)

Pl. 16, fig. 4

1853 *Ammonites emaciatus* Catullo, pl. 4, fig. 2.
1997b *Emaciaticeras emaciatum* - Dommergues et al., pl. 2, fig. 26.
2009 *Emaciaticeras* sp. - Meister et al., pl. 1, fig. 12.
2011 *Emaciaticeras emaciatum* - Meister et al., p. e47, figs 25(6, 7) with synonymy.

E. emaciatum (Catullo) and *E. fervidum* Fucini are close species as already discussed by Géczy & Meister (1998) and sometimes put in the same synonymy. Only the rib density distinguish them with more spaced, maybe coarser ribs in Fucini's species. *E. emaciatum* (Catullo) also shows a king of flexuosity ot the ribs and a persistence of the ribbing on the uppermost part of the flanks. In opposite the ribs clearly are smoothing on the outer part in *E. fervidum* Fucini.

Local record. Costalunga, Provaglio d'Iseo and Lassa (Dommergues et al. 1997b).

Age and distribution. Well known in the Mediterranean Tethys, this taxon also is present in the southern part of the Euroboreal domain (Ibericas, Lusitanian Basin). It characterizes the upper-middle part of the Spinatum Chronozone.

Emaciaticeras gr. ***fervidum*** Fucini, 1931

Pl. 15, figs 14, 15; pl. 16, fig. 3

1931 *Emaciaticeras fervidum* Fucini, pl. 13, figs 2, 3.
2011 *Emaciaticeras* gr. *fervidum* - Meister et al., p. e47, figs 25(5, 8-11), 26(1) with synonymy.

As discussed above, coarser *Emaciaticeras* species are grouped here in the *E. fervidum* Fucini. The specimens illustrated pl. 15, fig. 15 and pl. 16, fig. 4 well show the fading of the ribbing on the uppermost part of the flanks.

Local record. Ronchi di Brescia, Gussago (Val Navezze), Provaglio d'Iseo.

Age and distribution. This species is only known in the Western Tethys (Southern Calcareous Alps, Apennines, Bakony and Haut Atlas) and its age corresponds to the upper-middle part of the Spinatum Chronozone.

Remark. *E*. gr. *archimedis* (Fucini) is present in the area of Mt. Domaro and in Provaglio d'Iseo (Dommergues et al. 1997b, pl. 2, figs 2, 7, 22) and is present in the middle-upper part of the Spinatum Chronozone.

Genus *Canavaria* Gemmellaro, 1886
Type species: *Harpoceras* (*Gramoceras*) *haugi* Gemmellaro, 1885

Canavaria sp.

Bad preserved specimens from Punta dell'Orto (Dommergues et al. 1997b, pl. 2, figs 27, 28) are attributed to the genus *Canavaria*. Indeed rather rigid, regularly spaced ribs and the presence of very small tubercles support this taxonomic position.

Age. This specimen is present in the latest part of the Pliensbachian.

Remarks. Several *Canavaria* like *C*. gr. *finitinum* (Fucini), *C*. cf. *naxensis* and *C*. gr. *zancleana* (Fucini) - *peloritana* (Fucini) are recorded from Provaglio d'Iseo (Dommergues et al. 1997b, p. 16 and 17) also characterizing the uppermost Pliensbachian. Some «*Tauromeniceras*» aff. *nerinea* (Fucini) are known in Punta dell'Orto in the uppermost part of the Spinatum Chronozone (*ibidem* 1997b, pl. 2, fig. 23).

Family to precise
Subfamily Hypasteroceratinae Venturi & Nannarone, 2002
Genus *Hypasteroceras* Spath, 1923
Type species: *Asteroceras* ? *ceratiticum* Fucini, 1903
(= *Hypasteroceras Montii* Meneghini in De Stefani, 1877)

Hypasteroceras aff. ***montii*** (Meneghini, 1877)
Pl. 6, fig. 2

aff. 1877 *Ammonites Montii* Meneghini in De Stefani, p. 82
aff. 1898 *Arietites montii* - Fucini, pl. 2, fig. 1.
aff. 1903 *Asteroceras montii* - Fucini, pl. 33, fig. 9; pl. 34, figs 12-14.
aff. 1903 *Asteroceras exiguum* Fucini, pl. 34, figs 4-11.
aff. 1994 *Hypasteroceras montii* - Dommergues, Ferretti & Meister, pl. 4, figs 9-12.
non ? 2006. *Hypasteroceras montii* - Macchioni et al., pl. 7, figs 3, 4.

Our specimen is a rather platycone evolute (U/D = 0.37) and compressed form close to *H. montii* (Meneghini in De Stefani) in Fucini (1898) (U/D = 0.39). It is possibly an adult form with half whorl for the body chamber. The ribbing is evanescent, irregularly developed, subradiate to slightly rursiradiate, one constriction is obvious. A sharp keel is obvious. *H. planulatum* (Fucini) is distinguishable by a smaller umbilicus (U/D = 0.30). If the ornamentation, if present, is not well expressed in this genus, nevertheless it remains more developed in *H. planulatum* (Fucini). Based on the umbilic size, the best character to distinguish these two species, our specimen belongs to Meneghini's species.

Local record. Virle.

Age and distribution. This species is recorded from Central Apennine, Southern Calcareous Alps, Beticas and Slovakian Carpathes. Its age corresponds to the Obtusum Chronozone. The genus is also known in Bakony (see Géczy & Meister 2007) and perhaps in North America. In Brescia area, it is associated with *Ectocentrites*.

Biostratigraphical framework

It should be noted that for the considered period and mainly for the Sinemurian, the ammonites are not well constraint stratigraphically or are coming from museum collections. Consequently we only speak in term of maximum range with references and correlations with regions where the biostratigraphical framework is better constraint (Fig. 16).

Early Jurassic

Hettangian - Sinemurian

In Brescia area, no ammonite of Hettangian age have been found. The first record of ammonite occurs in quarries (Lassa QRQ) in the Corna Fm. rather below the first beds bearing determinable ammonites. These ammonites are impossible to extract and it is only on the basis of whorl sections that we attribute to them an age to be situated in the middle - late part of the Early Sinemurian. An ammonite illustrated by Cantaluppi & Cassinis (1970, p. 328, fig. 2) under the name *Paradasyceras stella* (Sowerby) cannot be determined because of its bad preservation (strongly corroded); the age of this specimen is probably Early Sinemurian.

Early - Late Sinemurian

• Semicostatum - Obtusum Chronozones

Arnioceras aff. gr. *paucicostum* represents the older Jurassic ammonite in the Brescian Alps. Its range corresponds to a wide period from the Semicostatum Chronozone to the lower part of the Obtusum Chronozone (Obtusum Subchronozone). The *Arnioceras* sp. Horizon in Dommergues et al. (1997b) probably covers the same period. *Arnioceras* sp., *A.* (*Boucaulticeras*) sp. and *Geyeroceras cylindricum* assemblage from Mt. Denno also corresponds to a similar period but maybe could be extended to Stellare Subchronozone.

• Obtusum Chronozone

The presence of *Asteroceras varians* and *Arnioceras rejectum* indicates a not precise period in the Obtusum and Stellare Subchronozones whereas the association of *Asteroceras* sp. and *Arnioceras* sp. from St. Eufemia indicate the Obtusum Chronozone without more precision.

Ectocentrites aff. *altiformis* belongs to this period too as well as *Hypasteroceras* aff. *montii* and *Epophioceras* sp. indet.

• Oxynotum Chronozone

No characteristic ammonites from the Oxynotum Chronozone have been found.

• Raricostatum Chronozone

The presence of *Echioceras quenstedti* can be very precisely correlated with the base of the Raricostatum Subchronozone. Several other taxa belong to this period, named «Assemblage a» by Dommergues et al. (1997b), they are *Gleviceras* aff. *guibalianum*, «*Microderoceras*» sp., *Lytoceras* aff. *fuggeri*, *Angulaticeras* sp. and *Juraphyllites nardii*. *Juraphyllites* gr. *diopsis* as well *Lytoceras fimbriatoides* range from the Late Sinemurian to the Early Pliensbachian.

Pliensbachian

Early Pliensbachian

No ammonite from Brescia allow to characterize exactly the Sinemurian - Pliensbachian stage boundary (see Meister et al. 2006; Meister 2010). Only the presence of *Catriceras* sp. in the lower part of the Piensbachian indicates the proximity to this boundary. *Bakonyceras* aff. *evolutum* also could indicate the proximity of this limit, but less accuratly because this taxon is ranging from the middle part of the Raricostatum Chronozone to the base of the Jamesoni Chronozone.

• Jamesoni Chronozone

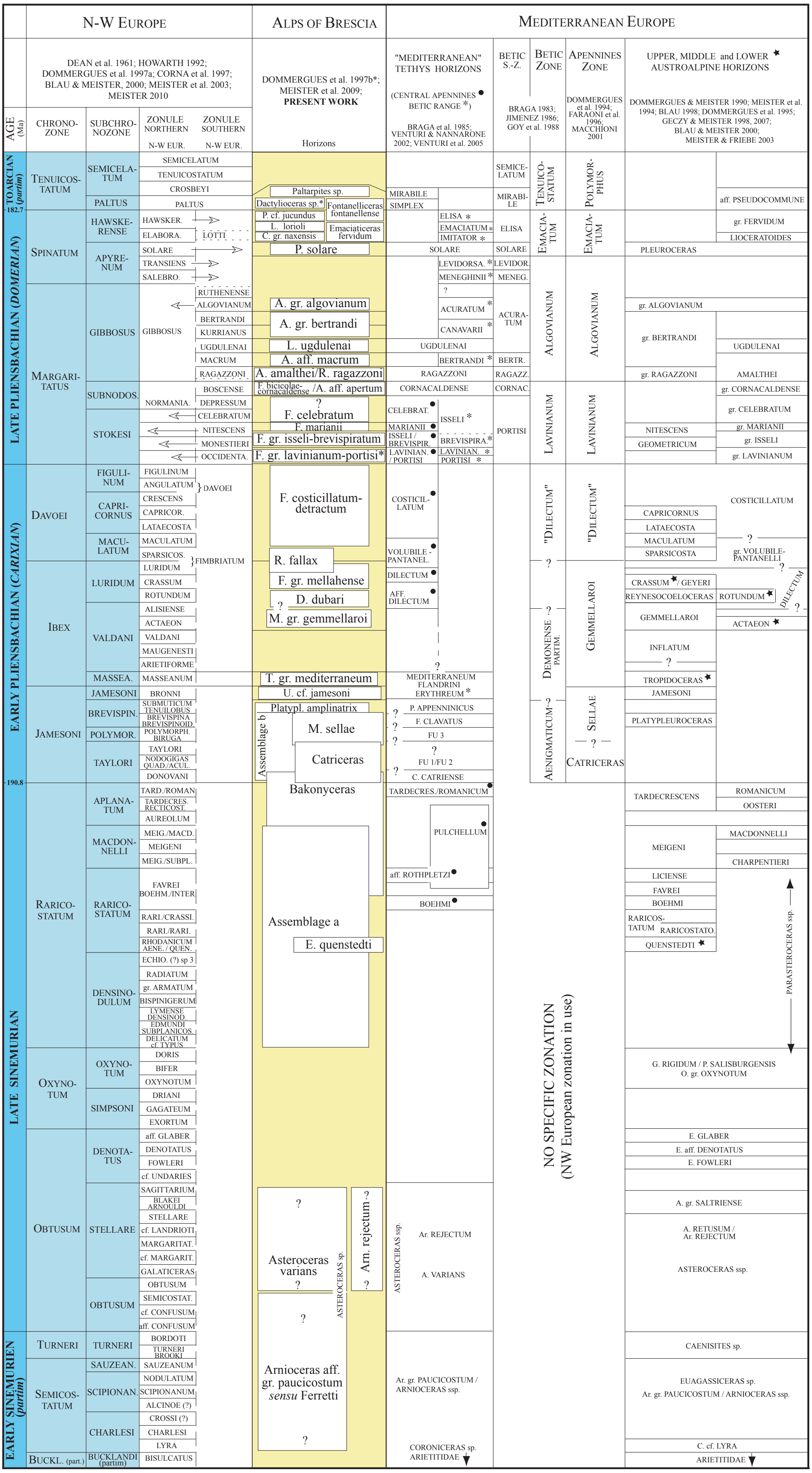
Several taxa correspond to this period. Some can be precisely correlated: *Miltoceras sellae* characterizes the middle-upper part of this chronozone; *Platypleuroceras amplinatrix* is precisely correlated with the upper part of the Brevispina Subchronozone and *Uptonia* cf. *jamesoni* associated with *Tropidoceras flandrini* characterize the Jamesoni Subchronozone. Other taxa like *Capreoliceras*, some *Lytoceras* aff. *fimbriatum*, *Ectocentrites* sp. («Assemblage b» in Dommergues et al. 1997b) also belong to this period. *Tropidoceras flandrini* also could be a member of this chronological unit because it ranges from Jamesoni to Valdani Subchronozones.

• Ibex Chronozone

The presence of *Tropidoceras* gr. *mediterraneum* and *T. demonense* characterizes the Masseanum Subchronozone, first period of this unit. Then succeed two horizons characterizing the middle and the upper part of the Valdani Subchronozone, from the oldest to the youngest: *Metaderoceras* gr. *gemmellaroi* and *Dubariceras dubari* Horizons. *Fuciniceras* gr. *mellahense* Horizon corresponds to the Luridum Subchronozone.

The presence of some *Reynesocoeloceras* like *R.* aff. *simulans subplanata* and mainly *R. fallax*, as well as *Prodactylioceras* cf. *colubriforme* sensu Fucini, indicates a period to be situated in the upper part of Ibex to

Fig. 16 - Ammonite horizon succession for the Brescian Prealps during the Sinemurian-Pliensbachian-basal Toarcian and correlation with the standard Euroboreal zonation and the Mediterranean zonations. Numerical ages are based on Cohen et al. (2016).


N-W EUROPE
ALPS OF BRESCIA
MEDITERRANEAN EUROPE
DEAN et al. 1961; HOWARTH 1992; DOMMERGUES et al. 1997a; CORNA et al. 1997; BLAU & MEISTER, 2000; MEISTER et al. 2003; MEISTER 2010
DOMMERGUES et al. 1997b*; MEISTER et al. 2009; PRESENT WORK
"MEDITERRANEAN" TETHYS HORIZONS
(CENTRAL APENNINES ● BETIC RANGE *)
BRAGA et al. 1985; VENTURI & NANNARONE 2002; VENTURI et al. 2005
BETIC S.-Z.
BRAGA 1983; JIMENEZ 1986; GOY et al. 1988
BETIC ZONE
APENNINES ZONE
DOMMERGUES et al. 1994; FARAONI et al. 1996; MACCHIONI 2001
UPPER, MIDDLE and LOWER AUSTROALPINE HORIZONS
DOMMERGUES & MEISTER 1990; MEISTER et al. 1994; BLAU 1998; DOMMERGUES et al. 1995; GECZY & MEISTER 1998, 2007; BLAU & MEISTER 2000; MEISTER & FRIEBE 2003
AGE (Ma)
CHRONO-ZONE
SUBCHRO-NOZONE
ZONULE NORTHERN N-W EUR.
ZONULE SOUTHERN N-W EUR.
Horizons
TOARCIAN (partim)
182.7
LATE PLIENSBACHIAN (DOMERIAN)
EARLY PLIENSBACHIAN (CARIXIAN)
190.8
LATE SINEMURIAN
EARLY SINEMURIEN (partim)
TENUICOSTATUM
SPINATUM
MARGARITATUS
DAVOEI
IBEX
JAMESONI
RARICOSTATUM
OXYNOTUM
OBTUSUM
TURNERI
SEMICOSTATUM
BUCKL. (part.)
Paltarpites sp.
Dactylioceras sp.*
Fontanelliceras fontanellense
P. cf. jucundus
L. lorioli
C. gr. naxensis
Emaciaticeras fervidum
P. solare
A. gr. algovianum
A. gr. bertrandi
L. ugdulenai
A. aff. macrum
A. amalthei/R. ragazzoni
F. bicicolae-cornacaldense /A. aff. apertum
F. celebratum
F. marianii
F. gr. isseli-brevispiratum
F. gr. lavinianum-portisi*
F. costicillatum-detractum
R. fallax
F. gr. mellahense
D. dubari
M. gr. gemmellaroi
T. gr. mediterraneum
U. cf. jamesoni
Platypl. amplinatrix
Assemblage b
M. sellae
Catriceras
Bakonyceras
Assemblage a
E. quenstedti
Asteroceras varians
ASTEROCERAS sp.
Arn. rejectum
Arnioceras aff. gr. paucicostum sensu Ferretti
NO SPECIFIC ZONATION (NW European zonation in use)
ALGOVIANUM
LAVINIANUM
"DILECTUM"
DEMONENSE PARTIM.
AENIGMATICUM
GEMMELLAROI
SELLAE
CATRICERAS
EMACIATUM
TENUICOSTATUM
POLYMORPHUS
PARASTEROCERAS ssp.

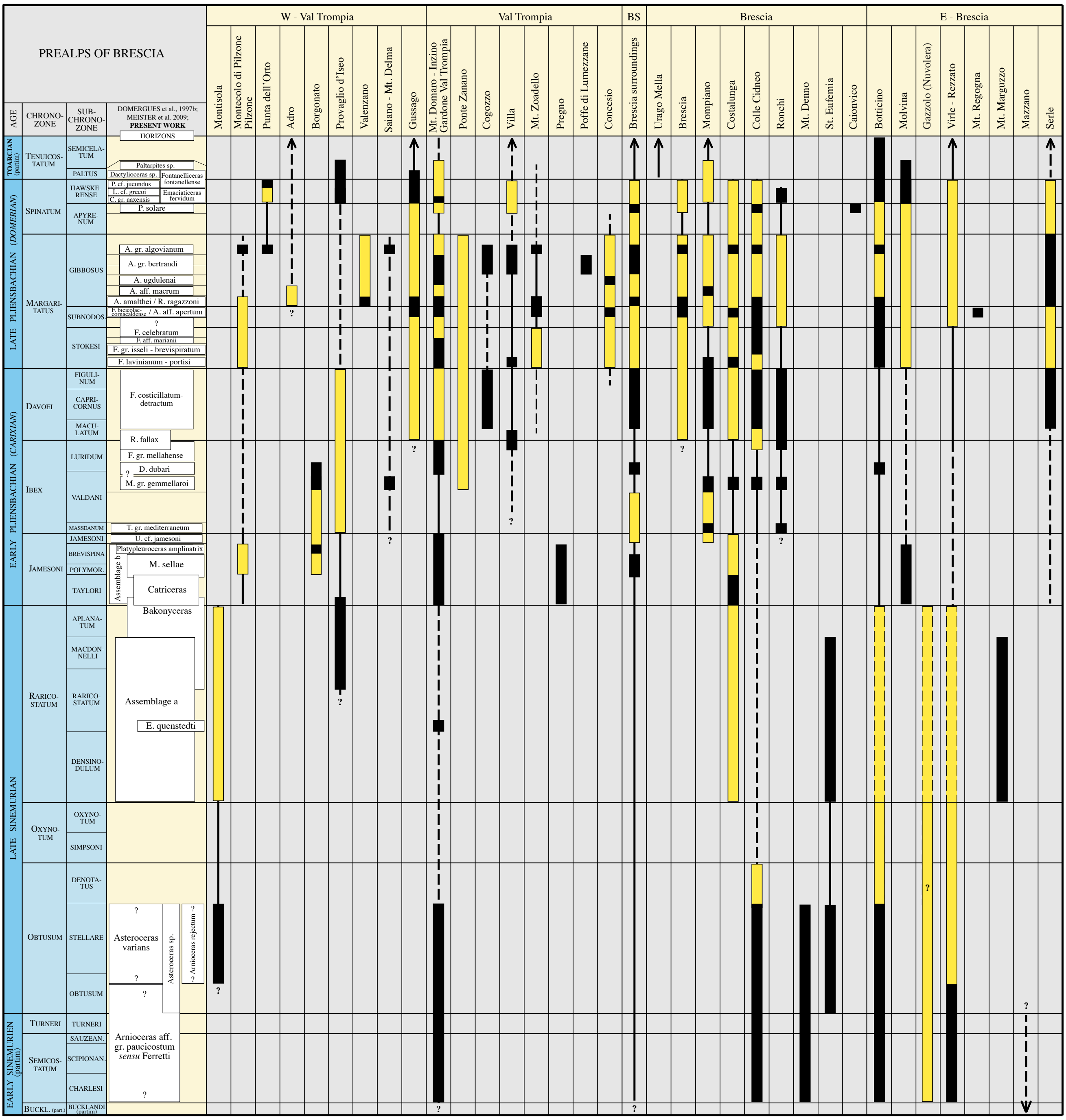


Fig. 17 - Ammonite horizons (in black) to less defined ranges (in yellow) recognized in all localities of the Brescian Prealps investigated in the present work.

the lower part of Davoei Chronozones.

- Davoei Chronozone

Fuciniceras costicillatum - detractum is a good marker for the Davoei Chronozone in the Tethyan realm.

Late Pliensbachian

- Margaritatus Chronozone

In Brescia area, the Early - Late Pliensbachian boundary can precisely be pointed. Indeed the presence of *Fuciniceras* gr. *lavinianum - portisi* determines the base of the Late Pliensbachian in Tethyan realm, this species is the marker of the first horizon of the Margaritatus Chonozone. Moreover *Cetonoceras psiloceroides* also characterizes the earliest part of this age (see Meister 2010, fig. 13). The ranges of several taxa like *Prodactylioceras italicum* and L. (*Becheiceras*) aff. *bechei* cross this boundary.

Succeeding to *Fuciniceras* gr. *lavinianum - portisi*

Horizon occur *F.* gr. *isseli - brevispiratum, F. marianii* and *F. celebratum* Horizons. All belong to the Stokesi Subchronozone. *Prodactylioceras inaequiornatum* also belongs to this period. The presence of the Subnodosus Subchronozone is attested by *Fuciniceras* gr. *cornacaldense - bicicolae* and *Arieticeras* aff. *apertum* markers of the eponym horizons. *Reynesoceras subanguinum* could also belong to this subchronozone. The Gibbosus Subchronozone is characterized by many taxa such as *A. amalthei*, *Reynesoceras ragazzoni*, *Arieticeras* aff. *macrum*, *Leptaleoceras ugdulenai*, *Arieticeras* gr. *bertrandi* and *A.* gr. *algovianum*, also markers of the eponym horizons.

Prodactylioceras ausonicum, «*Reynesoceras*» aff. *mortilleti*, *F.* (*Paltarpites*) aff. *kurrianum*, *F.* (*P.*) *meneghini*, *Lytoceras villae*, *Arieticeras* gr. *disputabile*, *A.* cf. *expulsum*, *A. ignarum*, *A. mirificum*, *Leptaleoceras* cf. *canavari*, *L.* gr. *accuratum*, *L.* gr. *insigne*, *L. accuratum preaccuratum* and some long ranging taxa such as *Juraphyllites libertus*, *Calliphylloceras bicicolae* and *Partschiceras* ssp. also belong to this period. It is by far the most diversified period.

- Spinatum Chronozone

Only one taxa, *Pleuroceras solare* characterizes the lower part of this chronozone (upper part of the Apyrenum Subchronozone). Its presence in these Southern regions is precious because it allows to establish reliable correlations between the North-West European and Mediterranean successions. In contrast, several taxa can be correlated to the upper part of the Chronozone (Hawskerense Subchronozone) with markers like *Canavaria* gr. *naxensis*, *Lioceroides* cf. *grecoi*, *Emaciaticeras emaciatum, E. fervidum* and *F.* (*Paltarpites*) cf. *jucundus*. These forms are associated with *Canavaria* gr. *zancleana - peloritana*, *C.* gr. *finitima*, *Emaciaticeras* gr. *archimedis*, *Lioceratoides lorioli - micitoi*, *Neolioceratoides shopeni*, *N.* cf. *vergai*, «*Tauromeniceras*» aff. *nerinea*, *F.* (*Paltarpites*) *decoratum* and *Fontanelliceras* aff. *ultraspiratum*. *F. fontanellense* is ranging from the uppermost Pliensbachian to the base of the Toarcian.

Meneghiniceras lariense (Meneghini) is present in Molvina and in Cava Mompiano (Dommergues et al. 1997b, pl. 1, fig. 2) and its range corresponds to the Late Pliensbachian - very Early Toarcian.

Toarcian

In Brescia area, the base of the Toarcian seems to be marked by an acme of *Dactylioceras* sp.. *F.* (*Paltarpites*) sp., *Meneghiniceras lariensis* and *Dactylioceras mirabile* seem to be a little later.

Note that the Phylloceratidae with *Phylloceras hebertinum - frondosum*, *Calliphylloceras bicicolae*, *Calaiceras calais*, *Zetoceras zetes*, *Partschiceras* gr. *striatocostatum* and *P. tenuistriatum* are long ranging species and very abundant in the Pliensbachian of Brescian Prealps, some of them also can be present in the lowermost Toarcian.

Conclusion

The biostratigraphic data resulting from the study of ammonites collected in a large number of stratigraphic sections and stratigraphically well-known fossiliferous sites in the Lower Jurassic succession of the central-western Brescian Prealps (Schirolli 1990, 1994, 1997; Dommergues et al. 1997b; Meister et al. 2009) have been integrated with data from the new mapping of the area (ISPRA 2011) and more recent field investigations, with the study of the historical collection of Early Jurassic ammonites preserved in the Museum of Natural Sciences of Brescia and with the revision of the specimens illustrated by Meneghini (1867-81), Parona (1897), Bettoni (1900), Cantaluppi (1966), Cassinis & Cantaluppi (1967), Cantaluppi & Cassinis (1970) and Castelli (1980) referred to the surroundings of Brescia, excluding the fauna of Mt. Domaro.

This work provides a more precise up-to-date stratigraphical framework of the Lower Jurassic succession of Brescian Prealps, supporting the well-known type-locality of the «Domerian» substage (Fig. 17).

From a paleontological and biostratigraphical point of view, 73 taxa for the Sinemurian, Pliensbachian and basal Toarcian are recorded in the Brescian Prealps corresponding to a succession of around 30 horizons or faunal assemblages. The covered period is about 16 m.y. If during the Sinemurian the ammonite record remains not precise and discontinuous allowing exception like *Echioceras quenstedti* Horizon, the Pliensbachian is rather well represented and defined with a rather continuous ammonite horizon succession. Almost all the fauna is composed of ammonites of Tethyan paleogeographical affinity; only rare Euroboreal forms like *Platypleuroceras amplinatrix - tenuilobus*, *Uptonia* cf. *jamesoni* or *Pleuroceras solare* occur in this Southalpine unit that belongs to the forthcoming southern Tethys margin. On this margin the Upper Austroalpine units, situated in a more north-eastern position, give better elements of correlations between the Euroboreal and Tethyan domains. Indeed in this key region coexist ammonites of both domains (see Fig. 16 for the correlations and the numerous author citations).

The new biohorizons recorded in the studied succession allow more thorough correlations both locally between the Val Trompia-Sebino Basin and the Botticino High and regionally between Southern Alps and the other domains of the Tethys. Pliensbachian, and expecially Upper Pliensbachian, appears to be the most fossiliferous level of the Medolo Group not only at Mt. Domaro but throughout the region, in the basinal area as well as on the structural high.

For the first time has been investigated in detail the land around Brescia (Colle Cidneo, Ronchi di Brescia, Costalunga, Mompiano), thanks to the study of numerous ammonites included in the collections of the Natural Sciences Museum of the city. The precise attribution to the lower part of Upper Pliensbachian of the rock wall of Domaro Limestone at the North face of Cidneo Hill (Fig. 8) is in accordance with the large amount of specimens increasing from middle-late part of Early Pliensbachian to Late Pliensbachian. Lower Pliensbachian is especially well represented in the Medolo of Costalunga, as referred by Parona (1897), and Mompiano, but it is recorded also at Colle Cidneo and Ronchi di Brescia. In Brescia also the first presence of Sinemurian Medolo is evidenced. Moreover, a new Sinemurian faunal assemblage is recorded just before the beginning of Medolo deposition at Mt. Denno, i.e. the basinal sector closer to the area of Botticino (Fig. 7).

A new precise horizon of the Raricostatum Chronozone (*Echioceras quenstedti* Horizon) is cited in the Medolo succession of the Mt. Domaro at Gardone Val Trompia, highlighting a Sinemurian part of the Gardone Val Trompia Limestone, unknown until now, stratigraphically below the base of Mt. Domaro section and over the top of the underlying Inzino section (Schirolli 1990, 1997). This horizon allows a precise correlation of a basinal unit, stratigraphically about 250-300 metres above the top of Corna formation, with the basal part of the Rezzato Encrinite in the Botticino High, whereas «Assemblage a» (Dommergues et al. 1997b) is just above the top of Corna platform.

Also in the westernmost Montisola, the Sinemurian Obtusum and Raricostatum Chronozones are recognized in the basal part of the Gardone Val Trompia Limestone (Fig. 9), determining the zone of a generic Lotharingian, as reported in literature by Vecchia (1946).

The *Miltoceras sellae* Horizon recognized in the Gardone Val Trompia Limestone allows to correlate this level of the basinal succession with the coeval faunal «Assemblage b» (Dommergues et al. 1997b), found at the base of the Botticino Corso Rosso at Molvina in the Botticino High (Fig. 6). In Val Trompia and western surroundings, Lower Pliensbachian layers are recorded in the Gardone Val Trompia Limestone of Mt. Domaro section, and in the fossiliferous sites and localities of Pregno, Villa, Cogozzo, Ponte Zanano, Mt. Delma, Provaglio d'Iseo, Montecolo di Pilzone and Borgonato. Ammonites from the last three sites are illustrated by Parona (1897) and the confirmation of Lower Pliensbachian presence in the Medolo of Borgonato and Provaglio d'Iseo is supported by the specimens preserved in the historical museum's collections.

The marly limestones of the Domaro Limestone are regionally very well characterized by a complete Upper Pliensbachian sequence of faunal assemblages and marker species, both near Brescia (Colle Cidneo, Ronchi di Brescia, Costalunga, Mompiano) and from Val Trompia to Lake Iseo (Mt. Domaro, Cogozzo, Villa, Gussago, Provaglio d'Iseo sections and Concesio, Poffe di Lumezzane, Mt. Zoadello, Saiano and Valenzano, Adro, Punta dell'Orto and Montecolo di Pilzone sites), also taking into account the specimens illustrated by Hauer (1861), Meneghini (1867-1881), Parona (1897), Bettoni (1900), Del Campana (1900) and Fucini (1908). The boundary Pliensbachian-Toarcian is recorded in the uppermost part of the Domaro Limestone in the Caricatore old quarry at Gussago (Cantaluppi & Cassinis 1984) and in the Provaglio d'Iseo section (Dommergues et al. 1997b) (Fig. 10). Ammonites ranging from uppermost Pliensbachian to basal Toarcian occur to the top of Medolo in the Mompiano abandoned quarry and Early Toarcian specimens are present in the basal variegated marlstones of the Concesio Group in the Urago Mella and Adro localities.

In the Botticino area (Lassa QRQ site), a new ammonite assemblage fixes to the Early Sinemurian the last stage of productivity of the Corna platform. Between the deposition of this assemblage and the well-known *Arnioceras* bed overlying the top of the formation in the Botticino Mattina (Fig. 5) and St. Eufemia sections (Cantaluppi 1966; Cassinis & Cantaluppi 1967; Dommergues et al. 1997b) can be placed the drowning of platform around the transition Early-Late Sinemurian. Upper Sinemurian beds known from the Rezzato Encrinite of Mt. Marguzzo and St. Eufemia sections («Assemblage a» from Dommergues et al. 1997b) are now confirmed by other specimens collected in the localities of Gazzolo (Nuvolera), Botticino and Virle, preserved in the Museum. Besides in the aforementioned Botticino Corso Rosso at Molvina («Assemblage b» from Dommergues et al. 1997b), the Lower Pliensbachian is recorded also in the Medolo outcropping to the North of Serle.

The beginning of Upper Pliensbachian is well represented in the basal unit of the Botticino Corso Rosso in the stratigraphic sections of Botticino Mattina and Lassa (Schirolli 1997; Dommergues et al. 1997b), while the middle-upper part of Upper Pliensbachian is known in the Medolo of Botticino, Rezzato, Virle and Caionvico. A Late Pliensbachian fauna from «Corso» Auct. is illustrated by Bettoni (1900) and Cantaluppi (1966).

The Apyrenum Subchronozone in the upper part of Domaro Limestone was unknown in the Botticino High, whilst in the basinal area Bettoni (1900) figured Apyrenum Subchronozone ammonites from Brescia Castle and a citation of the existence of this subchronozone, not supported by figured specimens, is coming also from the Caricatore section in Gussago (Cantaluppi & Cassinis 1984).

A faunal assemblage, typical of the Botticino High, ranging from uppermost Pliensbachian to lowermost Toarcian occurs in the red nodular marly limestone bed at the passage between Botticino Corso Rosso and Concesio Group (Molvina Member) in Molvina, where Medolo seems to be desappeared (Cantaluppi 1968; Dommergues et al. 1997b). Basal Toarcian variegated fossiliferous marlstones of the Molvina unit are recorded both in Lassa and Molvina sections (Schirolli 1997) and in Rezzato and Serle localities.

Acknowledgements: The authors thank anonimous reviewers for critical reading of the manuscript and useful suggestions. P. Schirolli is grateful to D. Casali, A. Mantovi and S. Camillucci & U. Pezzola (La Valle Winery) for the reporting of ammonites on the field.

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