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Austroalpine Liassic Ammonites from Vorarlberg (Austria, Northern Calcareous Alps)

by

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Contents

Abstract

The historical collection of the Sinemurian – Pliensbachian ammonites from the Vorarlberger Naturschau (Dornbirn) are herein described, illustrated and placed into their biostratigraphical framework. Additionally some new investigations in Lorüns Quarry and in Steinernes Meer support this study.

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Zusammenfassung

Die Ammoniten des Sinemurium und Pliensbachium der Nördlichen Kalkalpen aus der historische Sammlung der Vorarlberger Naturschau (Dornbirn) werden beschrieben, abgebildet und biostratigraphisch verortet. Neuaufsammlungen im Steinbruch Lorüns sowie im Steinernen Meer (Lechquellengebiet) ergänzen die Studie.

1. Introduction

This study is based mainly on the (historical) collections of the Vorarlberger Naturschau (Dornbirn, Austria). Most of the specimens were collected by the founder of the museum, Siegfried Fussenegger, and determined in the late 20-ies to early 30-ies by Walter Biese in Berlin (Friebe, 1999). Biese visited Vorarlberg several times for field work. The preserved correspondance between him and Fussenegger indicates that a manuscript containing both a description of the fossils and a documentation of the outcrops was nearly finished, when Biese left Germany and emmigrated to Chile in 1934. Thus this paper was never published. Fussenegger, however - relying on Biese to write the documentation - recorded only the name of the location and an approximate lithostratigraphic position.
Additional material originates from the former collection of the Vorarlberger Landesmuseum in Bregenz (Friebe, 2000) and from private donations by Joe Vincenz and Antonio Wehinger. Obviously most of these specimens were found in the scree.
Thus no reliable documentation of the exact locations is available. Field studies in the Lorüns quarry and in the Lechquellen area (Steinernes Meer) helped to establish a rough correlation between some of the fossils in the collection and the stratigraphic column. Moreover the comparison with well horizonted material of several recent studies in the Austrian Upper Austroalpine units (Blau & Meister,1991; Meister & Böhm, 1993; Meister et al., 1994; Böhm et al., 1995; Dommergues et al, 1995) allow to precise the biostratigraphical position and to revise the taxonomy of the Vorarlberg ammonites.

2. Regional Setting

In the Northern Calcareous Alps of Vorarlberg two main nappes can be distinguished (figs. 1, 2). A more or less complete stratigraphic succession from the Late Permian / Early Triassic to the Cretaceous is preserved in the (upper) Lechtal nappe, which covers the Rhätikon, the Lechquellen and the Arlberg area. Gypsum beds whichin the Raibl Formation acted as a detatchment horizon for the (lower) Allgäu nappe, which thus contains only Upper Triassic to Cretaceous sediments. In Vorarlberg the latter can be found in the eastern Grosswalsertal and the Hochtannberg area (Oberhauser, 1998). These two nappes roughly correspond to a liassic facies diffentiation. Red nodular limestones of the Adnet Formation are characteristic for the Lechtal nappe, whereas the Allgäu nappe containes predominantly well bedded marl-limestone alternations of the Allgäu Formation (fig 3).

Figure 1: Geological overview of Vorarlberg.

Lechtal Nappe – Lorüns

Lorüns Quarry (figs. 4-8)

A complete profile from the Upper Triassic (Rhaetian) to the Upper Cretaceous (Cenomanian / Turonian) of the Lechtal Nappe is exposed in the Lorüns Quarry (cf. Bertle et al., 1979; Furrer in Oberhauser, 1986). The successsion starts with alternating limestones and marls, including coral carpets and *Megalodon* beds, of the Ramoz Member (Kössen Formation) and the informal Zirmenkopf limestone (partly corresponding to the "Oberrhätkalk" in earlier publications; Furrer, 1993). The succeeding alternation of shales, marls and marly limestones represents the (informal) Schattwald beds. It is dated as early Hettangian.
Limestone sedimentation started again with the (informal) Lorüns oolite, a massive to poorly bedded oncoid / ooid packstone to grainstone (Text-Fig. 3). The original micritic matrix is commonly recristallised. Euhedral dolomite rhomboeders are concentrated along stylolithic seams. Macrofossils are scarce. The term "oolite" is misleading. Ooids dominate only in the uppermost part of the unit. They are commonly outranged by onkoids. In former studies this unit was regarded as a special development of the "R(h)ätoliaskalk" (e.g. Helmcke, 1974; Doert & Helmcke, 1976; Uchdorf, 1984: "Oolith", "Onkoid-Mikrit" with *Involutina liassica* Jones). A badly preseved ammonite points to Early Hettangian (Furrer, 1993). However, holoturian sclerites indicate a still Triassic age (Bauer, 1997). Geocemical data confirm the liassic interpretation of the ammonite (McRoberts et al., 1997).
The Lorüns oolite is succeeded by thickly bedded, micritic limestone of various colours. Pressure solution is common. In spite of the simmilar microfacies it differs from typical Adnet Limestone by the absence of a pronounced nodular fabric and a less red or even (greenish) grey colour. Its base shows some influence of the preceeding unit (crinoid microonkoid packstone; intermittent facies between microfacies [= MF] 24: microonkoid packstone and MF 16: crinoidal packstone / wackestone [after Böhm. 1992]). The main part of the unit is dominated by MF 5b: spiculitic microbioclastic wackestone. Additionally spots of MF 9: spiculitic stromatactis wackestonne and layers enriched in crinoid debris (comparable to MF 10: ostracod foraminifera brachiopod packstone or MF 25a: cronoidal packstone) occure. At the top MF 6: nodular microbioclastic Wackestone becomes more common. The upper boundary is difficult to define. The onset of a intensive red colour and a pronounced nodular fabric would be a good criterium for field mapping. However, Furrer (1993) defined the boundary at the top of the last layer enriched in crinoid debris. The grey, slightly nodular beds above this layer are allready regarded as part of the Adnet Limestone.
In previous studies this unit was treated very controversely. It is not shown in the lithostratigraphic columns by Furrer (in Bertle et al., 1979; and Fig. A25 in Oberhauser, 1986). However, in the text he mentioned "*Kalke, die mit lokal angereicherten Crinoidenresten Anklänge an die Hierlatzkalk-Fazies zeigen*" (=limestone, locally enriched in cri-

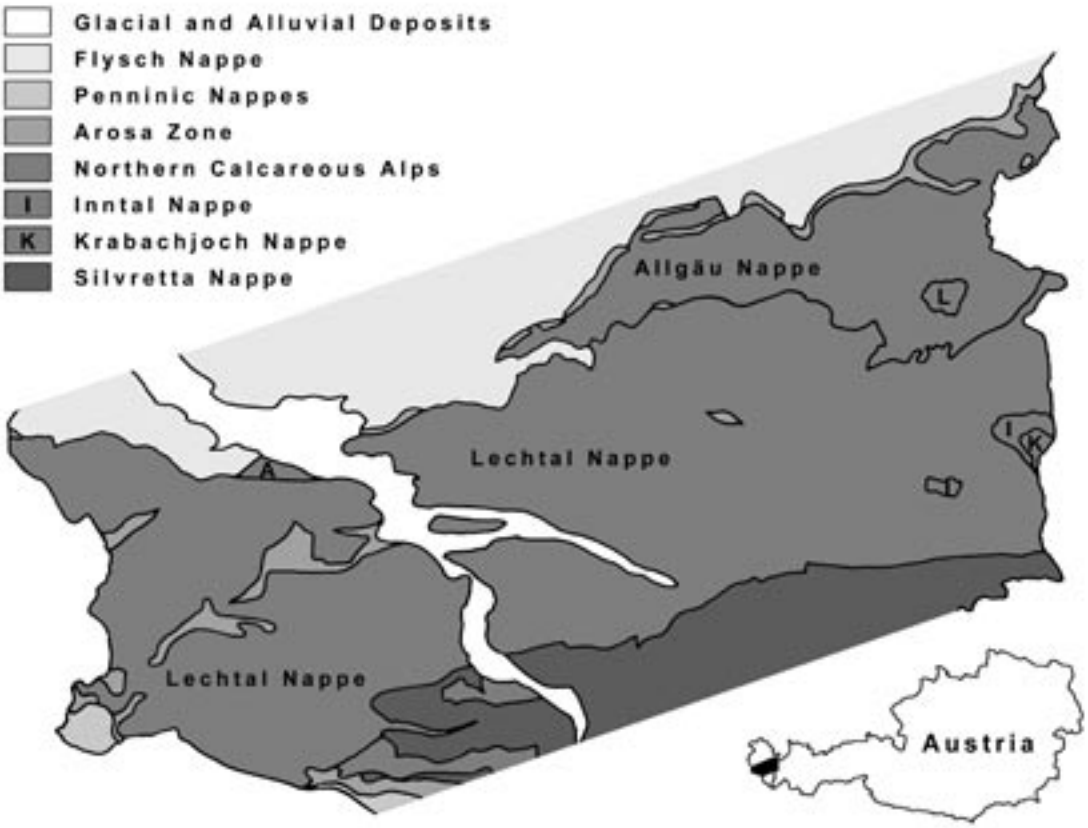

Figure 2: The two main nappes of the studied area in the Northern Calcareous Alps of Vorarlberg.

noid debris, with some similarities to Hierlatz Kalk facies), which have a transitional position between the Lorüns oolite beneath and the Adnet Kalk above. Later he denominated this unit as Hierlatz Kalk and defined the top of the last crinoidal bed as its upper boundary (FURRER 1993). According to BÖHM (1992), however, the Hierlatz Kalk is represented exclusively by sparitic microfacies without larger amounts of micritic matrix. He introduced the term Hierlatzbasiskalk for massive to thickly bedded, brownish grey micrite with sponge spicula and brachiopods (MF 9: spicula stromatactis wackestone), but without significant crinoid debris beneath Hierlatz kalk s. str. (BÖHM, 1992: 63). This name was applied by LANTSCHNER (1994) for wacke- to packstones with crinoid ossicles and sponge spicula as major constituents beneath the Adnet Kalk in the Arlberg region (Vorarlberg/Tyrol). In some former studies that unit was regarded as part of the R(h)ätoliaskalk" and/or the "Unterlias-Rotkalk" (e.g., HELMCKE, 1974; UCHDORF 1984: "Algen-Stromatolithe", Abb. 68). In this paper the lower part of the limestone described above is (informally) called Hierlatz Bsiskalk. In accordance with FURRER (1993) its upper boundary is defined with the uppermost layer with significant amounts if crinoid ossicles. The overlying beds until the onset of red colour are informally regarded as transitional facies between Hierlatz Basiskalk and Adnet Kalk s.str (fig. 3) They correspond approximately to the "Bunte Lias-Cephalopodenkalke" and "Grauer Liasbasiskalk" of TOLLMANN (1976).

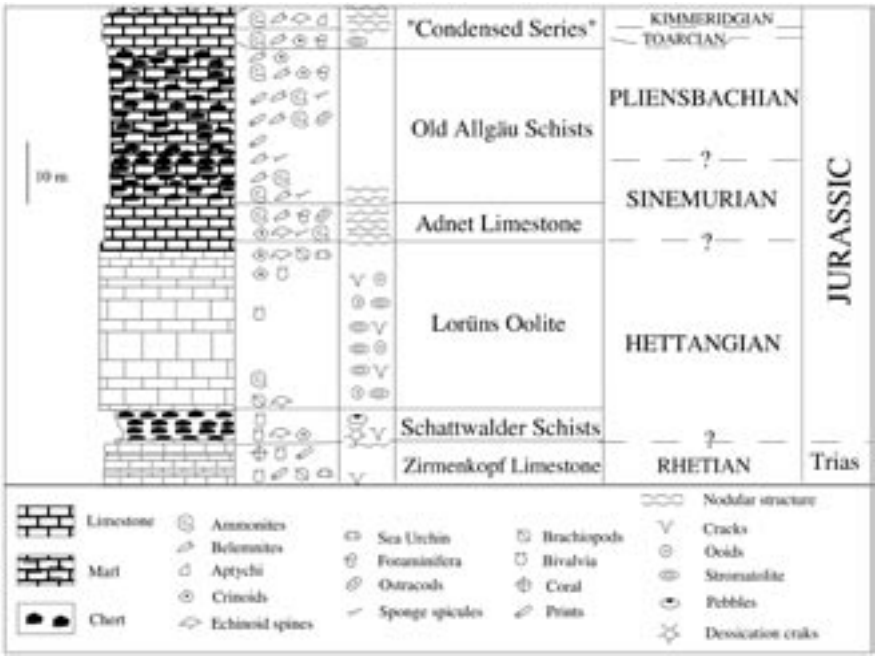

Figure 3: Stratigraphic setting of the study area.

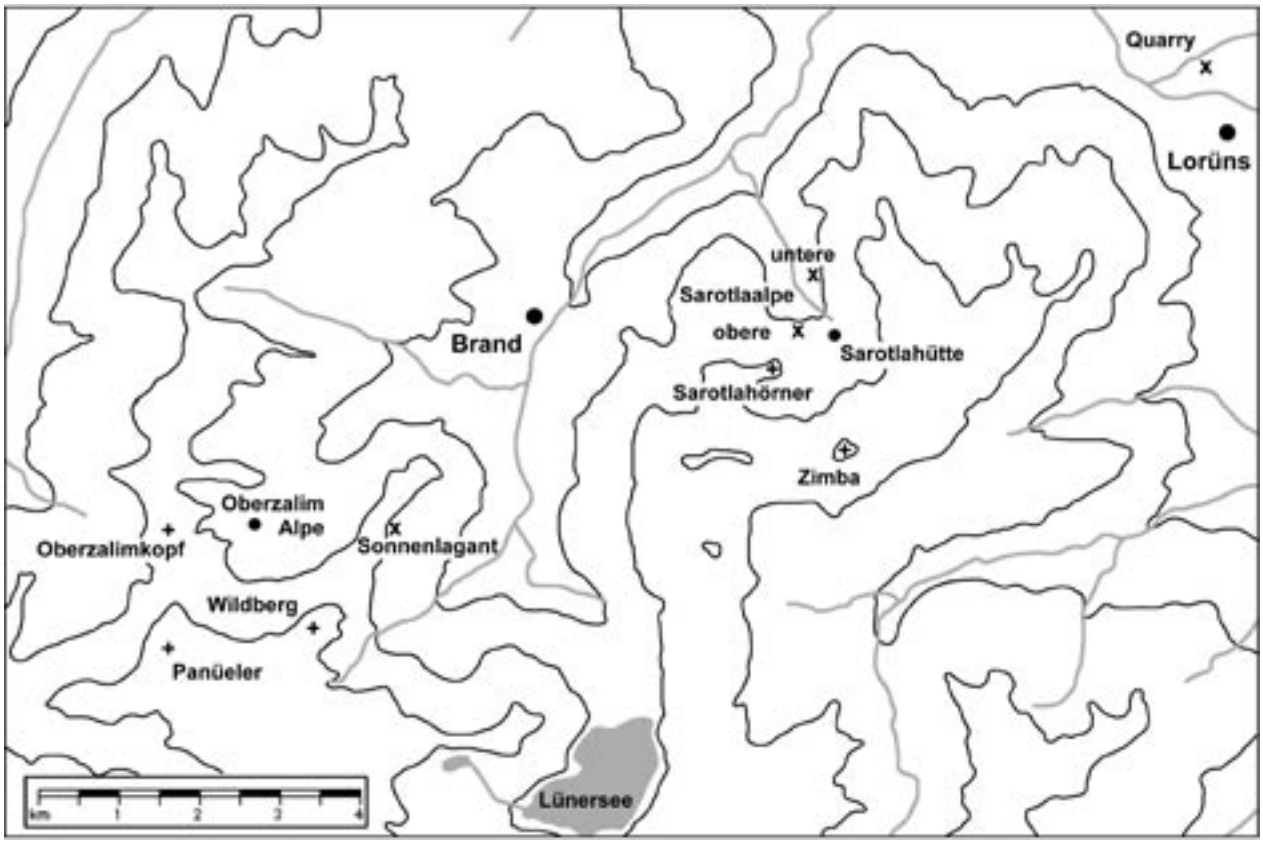

Figure 4: Geographical map showing the locations of the outcrops in Brand and Lorüns area.

The overlying 6 to 10 meter thick Adnet Kalk (Sinemurian; Furrer,1993) is characterised by an intensiv red colour and a pronounced nodular fabric. MF 6: nodular microbioclastic wackestone dominates. The irregular bedding planes are covered by red marl (enhanced by pressure solution). Localy wackestone is intercalated by small channels with crinoid ossicles. Crinoid debris may also be concentrated as solution residual. Due to pressure solution abundant ammonite steinkerns are only badly preserved.

The nodular limestone is succeeded by thinnly bedded, red to grey limestone of the Allgäu Formation. It is characterized by the common occurance of silex nodules, calciturbidites and bioturbated layers ("Fleckenmergel"). Ammonites often show strong flattening. This 20 to 30 meter thick unit was informally called Bunte Allgäu-Schichten by Furrer (1993). It corresponds to the Altere Allgäu-Schichten of Jacobshagen (1965).

The upper boundary of the Allgäu Formation is a condensed section. Its lower part contains abundand ammonites and nautilids covered by stromatolitic crust and encrusting foraminifera of the Toarcian. Iron and manganese give them a dark red, green, or black colour. The top of the condensed section is a hardground with corroded Kimmeridgian ammonites. Cretaceous shales ("Kreideschiefer Serie") form the top of the exposed stratigraphic column. They are dated as upper Aptian to lower Turonian (Furrer in Bertle et al,. 1979).

Lechtal Nappe – Lechquellen area (fig. 2)

Steinernes Meer (figs. 9, 10; see p.16)

A similar succession is exposed in the Lechquellen area at the eastern end of Steinernes Meer. The profile starts with greyish, greenish to pinkish limestones denominated herein as "transitional facies" between Hierlatz Basiskalk and Adnet Limestone s.str. ("Bunter Liaskalk" of previous workers). It is characterised by spiculitc wackestones with echinodermal debris, foraminifera and ostracodes. Pressure solution resulted in flaser bedding and microstylolites, but not in a nodular fabric. However, based on the microfacies Furrer (1993) allready included similar sediments of the Lorüns quarry into his Adnet Formation. As in Lorüns this unit is succeeded by rather thinly bedded, red nodular limestone (Adnet Formation s.str.). The typical microfacies is a bioclastic wackestone with spicula, foraminifera, ostracods and echinodermal debris (Bauer, 1997).

Weg zum Gehrengrat (see p.16)

Steinernes Meer and Spullersee (see below) are separated by a mountain crest called Gehrengrat. According to the collection lables some ammonites from the Adnet Formation have been found along the path leading to this crest

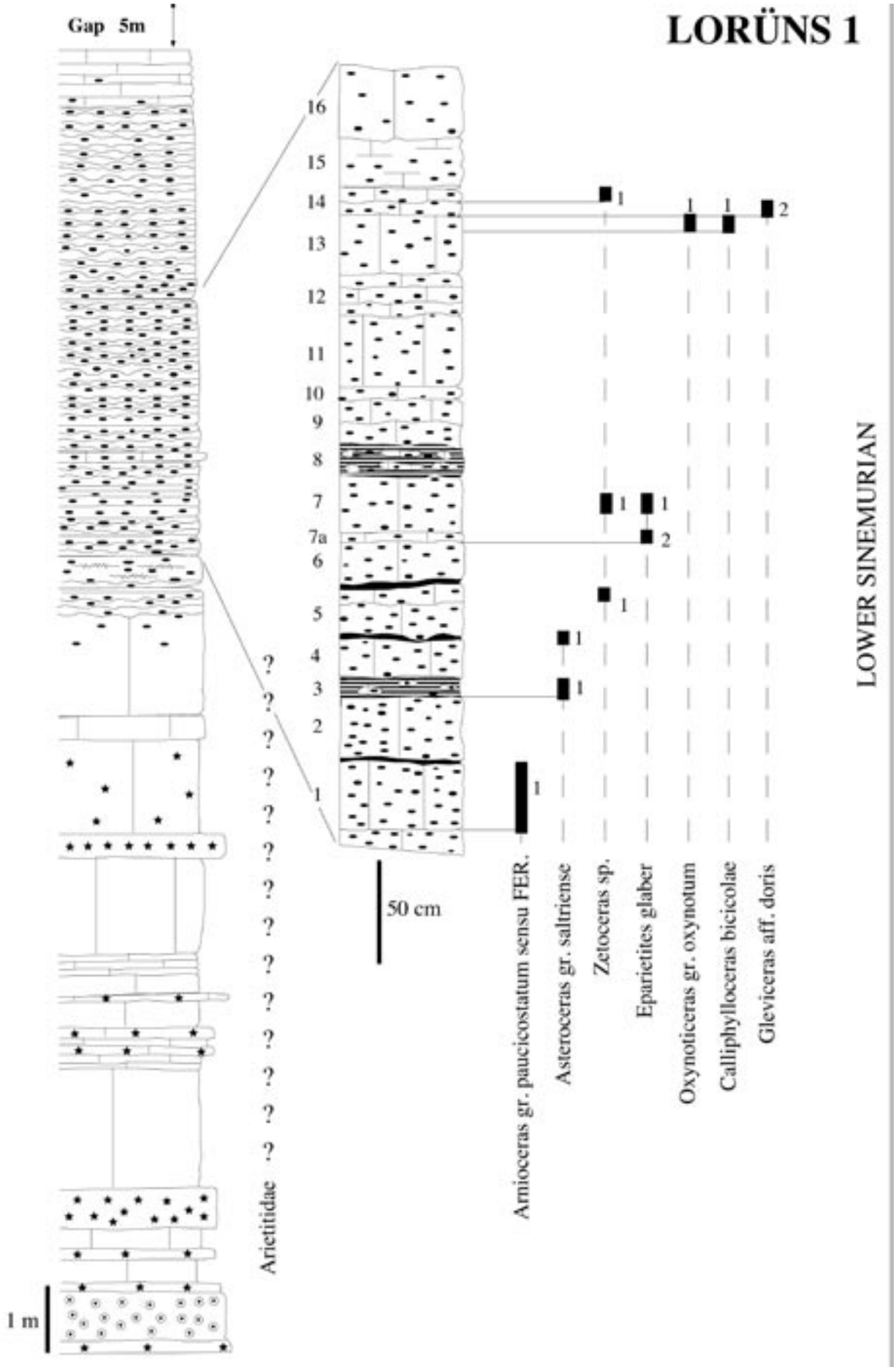

Figure 5: Lithological profile in Lorüns 1 and ammonite ranges.

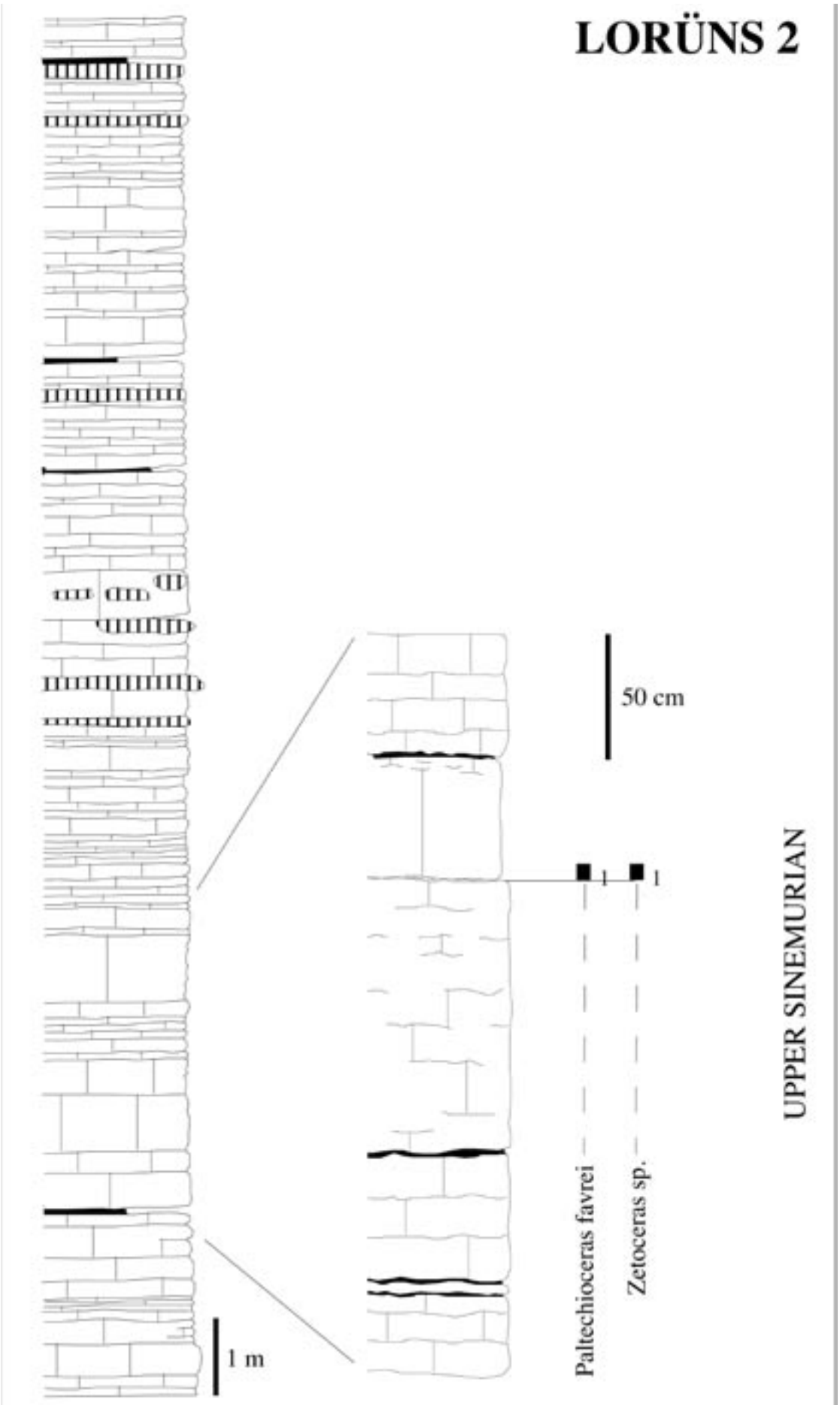

Figure 6: Lithological profile in Lorüns 2 and ammonite ranges.

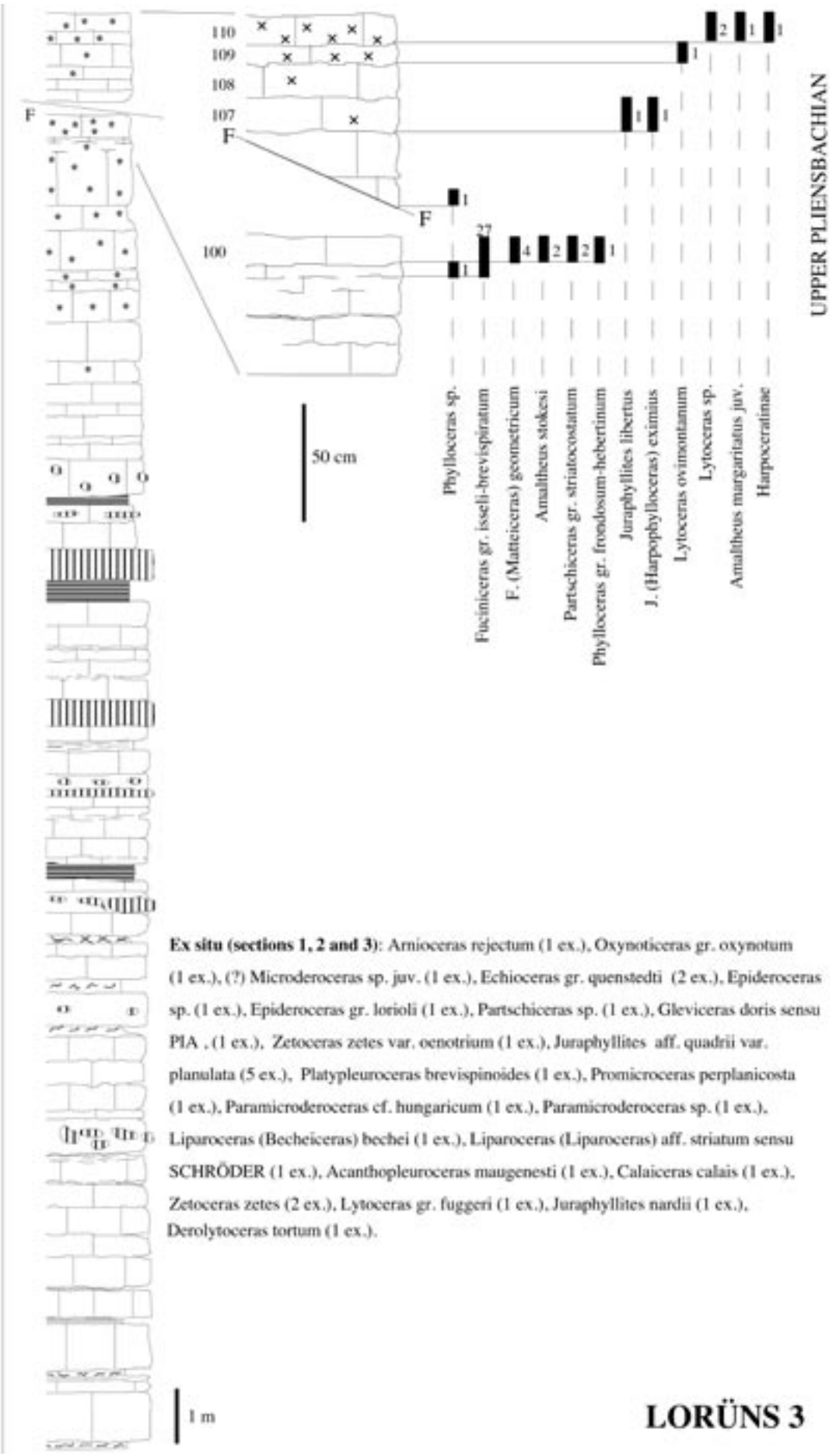

Figure 7: Lithological profile in Lorüns 3 and ammonite ranges.

Figure 8: Views of Lorüns quarry. Left – Sinemurian (mainly Obtusum Zone), right – Upper Sinemurian to Pliensbachian.

("Weg zum Gehrengrat"). East of the crest - in the Spullersee area - the path crosses nearly exclusively Cretaceous marls. Thus this location can be regarded as identical to Steinernes Meer.

Coroniceras sp. 210-11 (11), 210-11 (12)
Agassiceras ? sp. 210-11 (13)
Remark: Lower Sinemurian

Formaletsch (fig. 9)

All specimens originate from red nodular limestone of the Adnet Formation, which can be found east, north and west of Formaletsch, a small peak between Formarinsee and Steinernes Meer. The stratigraphic position thus corresponds in part to Steinernes Meer.

Coroniceras sp. P13402
Asteroceras sp. P7242
Echioceras gr. *quenstedti* (Schafhäutl) P7245
Remark: Lower to Upper Sinemurian.

Formarinsee (fig. 9)

Eingemauerte or Rothorn – probably not Seeköpfe: no further information available.
Arietitidae
Coroniceras sp. 210-12 (5, 11, 12)
Uptonia jamesoni (Sowerby) E
Tropidoceras sp. E
Partschiceras gr. *striatocostatum* (Meneghini) E
Juraphyllites libertus (Gemmellaro) E
Lytoceras gr. *fimbriatum* (Sowerby) E
Remark: Sinemurian to Lower Carixian (Jamesoni - ? Ibex Zones).

Rote Wand - Rothorn – Eingemauerte (fig. 9)

North of the Formarinsee several mountains owe their names to the red liassic limestone. The most striking morphological feature is the nearly vertical cliff of the Rote Wand. There the Adnet Formation forms a small band in the upper part of the cliff. It might be possible to find ammonites in the scree, but this area was not sampled by Fussenegger.
Accessable outcrops both of Adnet and Allgäu Formation, respectively, can be found southwest of the Rote Wand in the flanks of the Rothorn. Serveral specimens in the Fussenegger collection were found there (another Rothorn is located east of Rote Wand). Both formations also crop out in an area marked in old maps as Eingemauerte. Lables and determination lists by Biese give this location as "Eingemauerte südlich Rothorn". Specimens from the collection Vincenz originate from the vast scree cones north and northeast of the Rothorn and belong to Adnet Formation and Allgäu Formation.

Rothorn (fig. 9)

Arietites sp.
Asteroceras gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi P1583
Asteroceras aff. *acceleratum* Hyatt 210-4(7)
Metophioceras sp. 210-11(2)
Eparietites glaber Guerin-Franiatte E20
Eparietites fowleri (Buckman) 210-4
Eparietites sp. P13400
Schlotheimiidae P7233
Echioceras gr. *quenstedti* (Schafhäutl) P1582, P7237
Paltechioceras gr. *rothpletzi* (Böse) P2452
Epideroceras gr. *lorioli* (Hug) P1793
Epideroceras sp. P1591, P1627
Eoderoceratidae
Uptonia sp. P7150
Uptonia jamesoni (Sowerby)
Metaderoceras gemmellaroi (Levi) P7149
Phylloceras gr. *frondosum - hebertinum* (Reynes)
Partschiceras gr. *striatocostatum* (Meneghini) P13368
Juraphyllites nardii (Meneghini)
Juraphyllites sp. P7232
Lytoceras aff. *fimbriatoides* Gemmellaro
Lytoceras gr. *fimbriatum* (Sowerby) P13370
Lytoceras sp. P13369, P7148
Lytoceratidae

Remark: The age corresponds to an interval situated between the Lower Sinemurian until the Mid-Carixian (Ibex Zone).

Eingemauerte (fig. 9)

Arietitidae
Arietites sp. E
Asteroceras gr. *saltriensis* (Parona) P7225
Eparietites aff. *denotatus* (Simpson) juv. P003, 210-9
Angulaticeras sp. 210-6(1), 210-4(14)
Gleviceras aff. *boucaultianum* (Dumortier) sensu Pia 210-4(17)
Epideroceras sp. P7755, E
Echioceras gr. *quenstedti* (Schafhäutl) 210-11
Paltechioceras sp. E
Eoderoceratidae
Platypleuroceras brevispina (Sowerby) P7131
Platypleuroceras rotundum (Quenstedt)
Uptonia jamesoni (Sowerby) P13355, P13361, P7134, E
Tropidoceras gr. *masseanum* (d'Orbigny) 210-8
Tropidoceras sp. P7127, P7139
Acanthopleuroceras sp. P7130
Metaderoceras gemmellaroi (Levi) 210-3
Metaderoceras sp.
L. (*Liparoceras*) aff. *striatum* (Reinecke) *sensu* Schröder P7123
Liparoceras sp. P7122
Fuciniceras sp. P7128
Phylloceras gr. *frondosum - hebertinum* (Reynes)
Phylloceras sp. 210-9b
Calliphylloceras bicicolae (Meneghini) E
Partschiceras gr. *striatocostatum* (Meneghini) P13356, P13363, P13364, P13365
Partschiceras sp. P13352
Juraphyllites nardii (Meneghini) P7125
Juraphyllites libertus (Gemmellaro) P7124, P7126
Juraphyllites aff. *limatus* (Rosenberg) 210-9a
J. (*Harpophylloceras*) *eximius* (Hauer) P13351, P13357
Juraphyllites sp. P7138, P7121
Tragophylloceras undulatum (Smith)
Lytoceras gr. *fimbriatum* (Sowerby) E
Lytoceras sp. P13360, P13349, P13358, P13359
Remark: It corresponds to a period between the Upper Sinemurian (Obtusum Zone) until the Lower Domerian (Margaritatus Zone).

Klesenza – Rothorn (fig. 9)

One specimen - probably originating from the Allgäu Formation - was found east of Rote Wand in the Klesenza - Rothorn (II) area

Epideroceras sp. P1788
Remark: Upper Sinemurian.

Spullersee – Goppelspitze (fig. 9)

Liassic sediments (red nodular limestone and "Fleckenbergel") can be found east of the Spullersee at the Goppelspitze, as well as on the southwestern shore near the dam. "Fleckenmergel" of the Allgäu Formation can also be found north of the lake. Fussenegger sampled in this area and all these ammonites have been determined by Walter

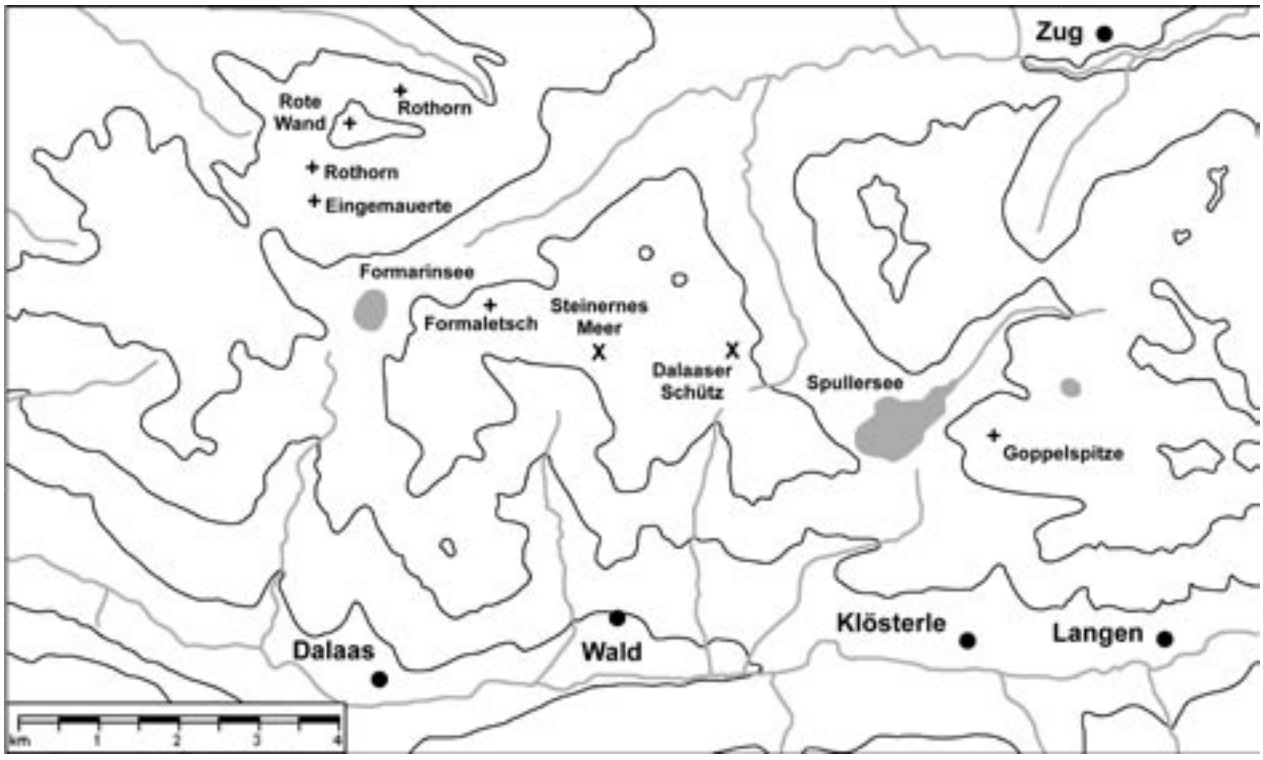

Figure 9: Geographical map showing the locations of the outcrops in Dalaas and Zug area.

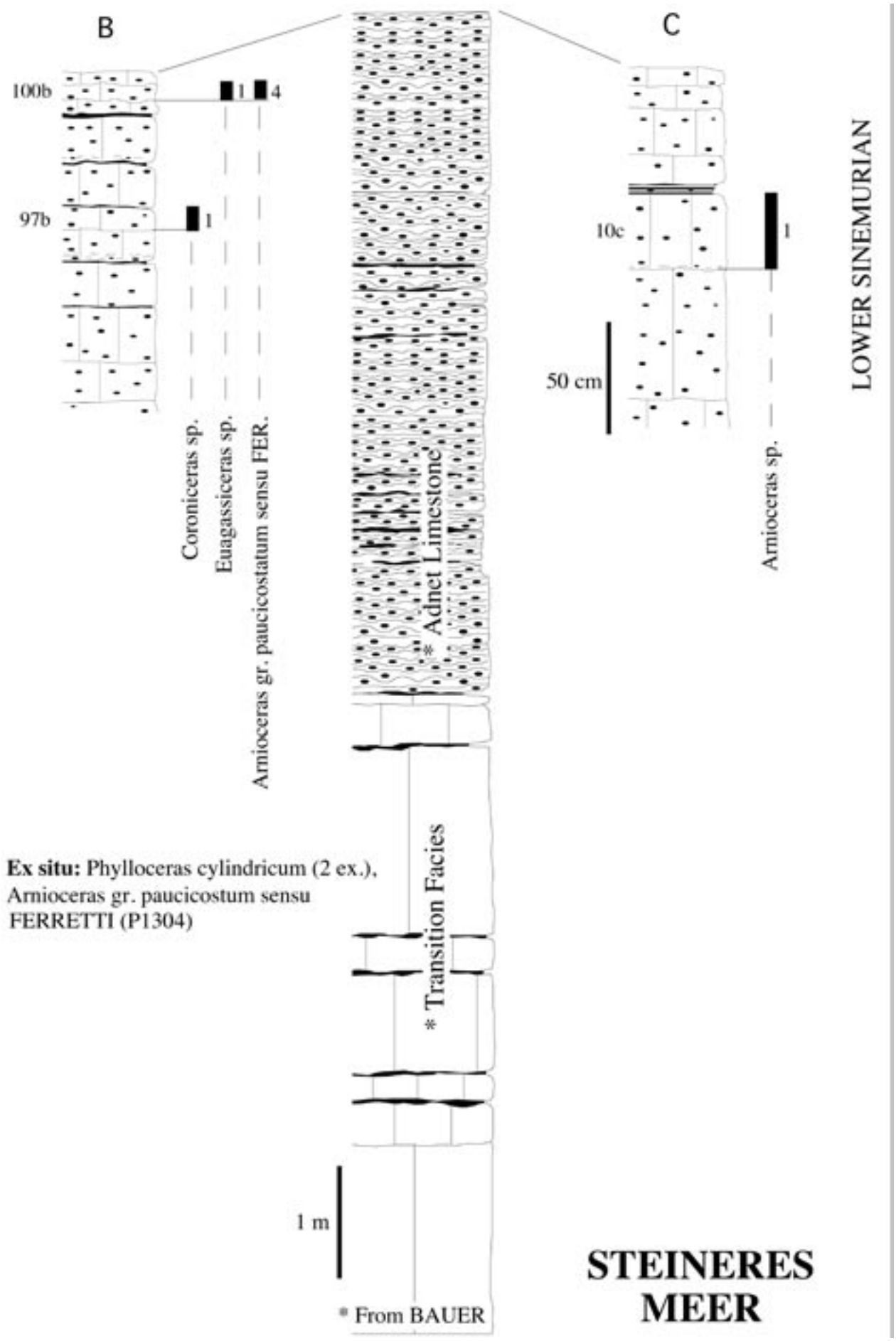

Figure 10: Lithological profile in Steineres Meer and ammonite ranges.

Biese. The specimens from the collection of Joe Vincenz have been found in the same area.

Goppelspitze (fig. 9)

Microderoceras aff. *gigas* (Quenstedt) P1554
Arnioceras rejectum Fucini P1564
Arnioceras sp. P1769
Paltechioceras gr. *tardecrescens* (Hauer) P13392
Paltechioceras charpentieri (Schafhäutl) P2311-3
Epideroceras gr. *lorioli* (Hug) P2311-2
Platypleuroceras gr. *brevispina* (Sowerby) P1547
Uptonia jamesoni (Sowerby) P7797, P7201
Tropidoceras sp. P7203
Metaderoceras sp. P7052
Aegoceras sp. P7217
Fuciniceras gr. *isseli* (Fucini) - *brevispiratum* (Fucini) P7046, P7693. 211-3
Fuciniceras gr. *cornacaldense* (Tausch) P8659, P7048
Fuciniceras sp. P7205, P7045, P7044, P7700, P13232, P13235
Phylloceras gr. *frondosum* - *hebertinum* (Reynes) P1527, P13390, P13391, P11141
Calliphylloceras bicicolae (Meneghini) P1552, P13394, P7211, P7212
Zetoceras sp. P7213
Partschiceras gr. *striatocostatum* (Meneghini) P13233, P13230, P13229, P7675, P2311-1
Partschiceras sp. P1565, P8658, P13386
Juraphyllites gr. *diopsis* (Gemmellaro) P2662
Juraphyllites sp. P7208, P13395, P13396
Tragophylloceras ibex (Quenstedt) P7050
Lytoceras sp. P7214
Remark: The age of the fauna corresponds to a period including the Upper Sinemurian to Lower Domerian (Subnodosus Subzone).

Spullersee (fig. 9; see p. 16)

Epideroceras sp.
Platypleuroceras amplinatrix (Quenstedt) P1561
Uptonia sp.
Tropidoceras aff. *stahli* (Oppel) P2675
Tropidoceras sp.
Aegoceras maculatum (Young & Bird) 211-2, 211-2
Fuciniceras gr. *celebratum* (Fucini) 211-2, 211-10
Lytoceras sp. P376
Remark: This fauna indicates an age between (?) Upper Sinemurian until Domerian (Stokesi Subzone).

Dalaaser Schütz (fig. 9; see p. 16)

"Fleckenmergel" of the Allgäu Formation forms a small cliff at Dalaaser Schütz between Gehrengrat and Spullersee. The only visible fossils in the scree were two irregular echnoids in marly limestone. Ammonites were discovered during size reduction of this block.

Amaltheus margaritatus de Montfort P8667
Pleuroceras gr. *solare* (Phillips) P8666
Juraphylites sp.
Phylloceras sp.
Lytoceras sp.
Remark: Domerian age (Gibbosus to Apyrenum Subzones).

Lechtal Nappe – Rätikon (fig. 2)

Sarotlatal - Alpe Sarotla – Sarotlahütte (Text-Fig. 4)

The Sarotlatal is narrow and steep valley in the Rätikon northeast of Brand which cuts a large, notheast-southwest striking synclinal stucture. Thus Liassic sediments can be found both near the entrance of the valley and in the mountainous area farther up. Fussenegger predominantly sampled the southeastern flank of the synclinal. There he distinguished two main localities: Alpe Sarotla or Unter Sarotlaalpe denominates outcrops at the northeastern valley flank, where both red cephalopod limestone of the Adnet Formation and "Fleckenmergel" occur. Sarottlahütte or Obere Sarotlaalpe includes outcrops of "Fleckenmergel" west of Sarotlahütte. In the exhibition these outcrops were also called Wildberg. Both locations are marked in the geological map of the Rätikon (Heissel at al. 1965).

Alpe Sarotla / *Untere Sarotlaalpe* (fig. 4)

(Adneter Kalk and Fleckenmergel)
Echioceras gr. *quenstedti* (Schafhäutl) P7175
Aegoceras maculatum (Young & Bird) P13772
Calliphylloceras bicicolae (Meneghini) P13421, P13423
Partschiceras retroplicatum (Rosenberg) sensu Bettoni P.7281
Juraphyllites sp. P7717
Tragophylloceras undulatum (Smith) P7722
Lytoceras sp. P13419
Remark: Upper Sinemurian (Raricostatum Zone) to Upper Carixian (Maculatum Subzone).

Sarotlahütte / *Obere Sarotlaalpe* / Wildberg (fig. 4)

(Fleckenmergel)
No specimens of Fussenegger's collection from this locality were included in the study. However, Joe Vincenz found several well preserved ammonites in that area in the scree north of Sarotlahörner.

Asteroceras aff. *suevicum* (Quenstedt) P2770
Asteroceras sp. P2767
Paltechioceras favrei (Hug) P1613, P2347

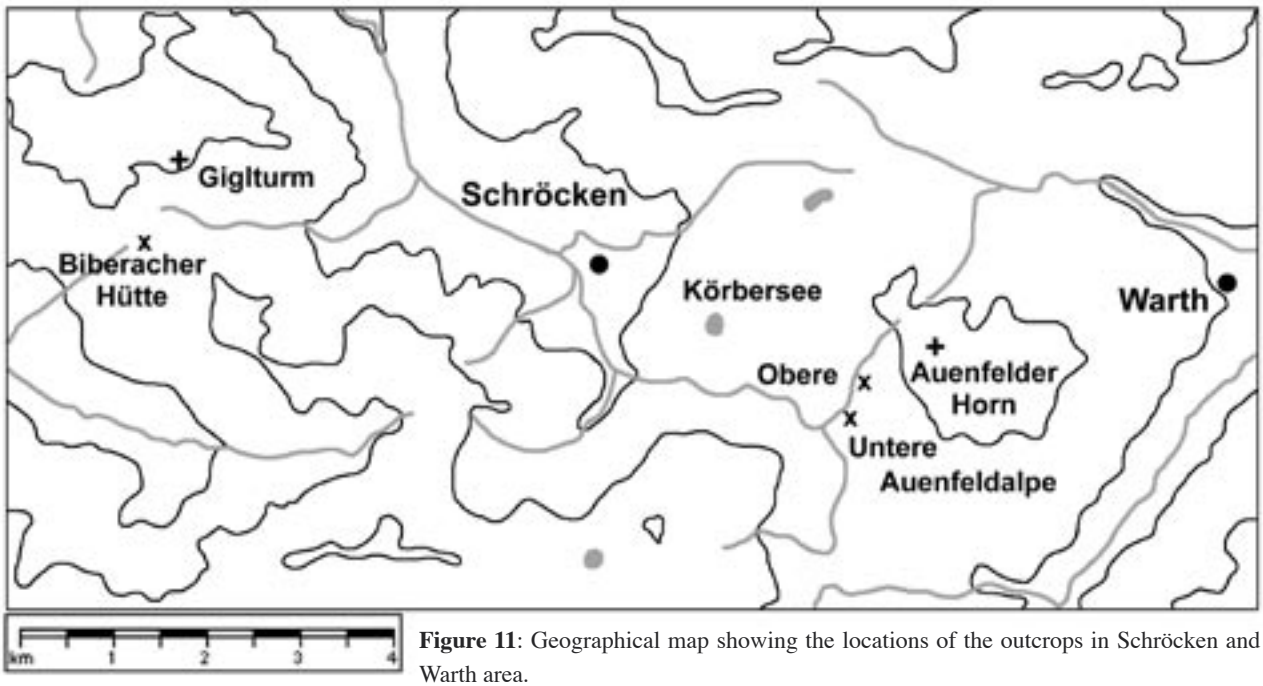

Figure 11: Geographical map showing the locations of the outcrops in Schröcken and Warth area.

Gleviceras gr. *subguibalianum* (Pia) P1607
Phylloceras gr. *frondosum - hebertinum* (Reynes) P2747
Lytoceras sp. P2778
Remark: Upper Sinemurian (Obtusum to Raricostatum Zones).
Additional material:
Epophioceras gr. *landrioti* (d'Orbigny) 393
Uptonia jamesoni (Sowerby) E
Prodactylioceras sp.
Phylloceras gr. *frondosum - hebertinum* (Reynes)
Juraphyllites sp.
Lytocerataceae
Remark: Lower Sinemurian to Upper Carixian (Davoei Zone).

Sonnenlagant (fig. 4; see p. 16)

Only a small outcrop of "Fleckenmergel" is exposed north-west of Obere Sonnenlagant-Alpe. In the geological map of the Rätikon it is marked as a fossil location (Heissel et al., 1965). The path to Mottakopf crosses this outcrop.

Partschiceras aff. *retrofalcatum* (Stur *in* Geyer) P1495
Remark: Sinemurian - Pliensbachian

Oberzalim (fig. 4; see p. 16)

Joe Vincenz gave the location of several, in part strongly silizified fossils of the Allgäu Formation (see also Furrer, 1993) as "Oberzalim". The area between Oberzalimalpe and Oberzalimkopf represents Hauptdolomit and Kössen Formation (Heissel et al., 1965). Small occurances of "Fleckenmergel" are restricted to the area northeast of Panüeler Kopf, larger occurances of "Fleckenmergel" and Radiolarite can be found around Wildberg. Scree from both localities reaches the Oberzalimhütte approximately 1000 meters below the two peaks.

Paltechioceras charpentieri (Schafhäutl) P.1497
Remark: Upper Sinemurian (Macdonnelli Subzone).

Allgäu nappe (fig. 2; see p. 16)

Whereas red nodular limestone of the Adnet Formation is a common feature in the Lechtal nappe, in the Allgäu nappe it occurs mainly in one location on the path from Kalbelesee to Körbersee. There the overall successon is very similar to Lorüns, but strongly reduced in thickness. Light grey oolite (Lorüns Oolith) is overlain by greyish wackestone locally enriched in crinoid debris (Hierlatz Basiskalk) and greyish to greenish wackestone of the "transitional facies". Red nodular limestone forms the top of the succession (Adnet Formation). Ammonites are not yet known from this locality. Most other outcrops of liassic sediments are restricted to the Allgäu Formation. They were described in detail by Jacobshagen (1965).

Schröcken - Auenfeld - Auenfelder Alpe (fig. 11)

"Lias-Fleckenmergel" of the Allgäu Formation is the main lithological unit in the source area of the Bregenzerache between Schröcken and Auenfelder Alpe. According to the collection numbers, Fussenegger distinguished two different locations, but confused them when he presented the fossils in his museum. No determination list of Biese is preserved.

Galaticeras gr. *harpoceroides* (Gemmellaro) P13263
Eoderoceras gr. *armatum* (Sowerby) FS40

Echioceras gr. *quenstedti* (Schafhäutl) P13261, P7103, P7091
Paltechioceras charpentieri (Schafhäutl) P7075, P7082
Paltechioceras gr. *tardecrescens* (Hauer) P7080
Leptechioceras sp. P7095
Gleviceras gr. *subguibalianum* (Pia) SA25, FS60
Epideroceras gr. *lorioli* (Hug) P7098
Platypleuroceras gr. *brevispina* (Sowerby) P13260
Platypleuroceras rotundum (Quenstedt) 211-7(4)
Platypleuroceras sp.
Uptonia jamesoni (Sowerby) P13268, P7093, P7109
Uptonia bronni (Roemer) P6708
Tropidoceras gr. *masseanum* (d'Orbigny) SA50
Tropidoceras rotundum (Futterer) P7083
Tropidoceras sp. P7105
Tropidoceras erythraeum (Gemmellaro) P7084, P7076
Metaderoceras gemmellaroi forme *kondai* (Geczy) P7107
Aegoceras maculatum (Young & Bird) P13270, P7088
Prodactylioceras gr. *davoei* (Sowerby) 211-7
Amaltheus stokesi (Sowerby) P6707
Arieticeras gr. *algovianum* (Oppel) juv. P13275, P13280
Arieticeras sp. P13279, P13285, P7090, P13283, P7102, P13282, P13284
Phylloceras gr. *frondosum - hebertinum* (Reynes) P13259, P13242, P13249, P13257, P13252, P13258, P13243, P13244
Partschiceras gr. *striatocostatum* (Meneghini) P6713, P13255, P13254, P13251
Partschiceras retroplicatum (Rosenberg) sensu Bettoni P13250, P7078
Zetoceras sp. P13245
Juraphyllites aff. *limatus* (Rosenberg) P13273
J. (*Harpophylloceras*) *eximius* (Hauer) P13276
Juraphyllites sp. P13274
Lytoceras sp. P13265
Lytoceras aff. *fimbriatoides* Gemmellaro P7089
Derolytoceras tortum (Quenstedt) P7077
Remark: The fauna indicates an age between the Upper Sinemurian (Raricostatum Subzone) to Mid-Domerian (Gibbosus Subzone).

Biberacher Hütte (fig. 11; see p. 16)

The immediate surroundings of Biberacher Hütte are characterised by "Fleckenmergel", whereas a relatively large outcrop of Adnet Formation can be found a little to the northeast. Biese stated in his determination lists that the fossils originate from "cephalopod limestone", but gave no further information about the exact location. Other specimens in the collection clearly represent the Allgäu Formation.

Oxynoticeras aff. *soemanni* (Dumortier) P7165
Arieticeras aff. *algovianum* (Oppel) P17107, P17108
Arieticeras gr. *algovianum* (Oppel) juv. 210-12(1)
Remark: Upper Sinemurian (Oxynotum Zone) to Mid-Domerian (Gibbosus Subzone).

Giglturm (fig. 11)

Both Adnet and Allgäu Formations make up the summit of Giglturm. There is no information on the exact location available.

Ectocentrites sp.
Remark: Probably Sinemurian.

Diverse or unknown localities:

Asteroceras aff. *margarita* (Parona)
Eparietites aff. *denotatus* (Simpson) juv. P003
Paltechioceras favrei (Hug) P2347 (Braz: alluvial debris)
Tropidoceras rotundum (Futterer) 210-10
Acanthopleuroceras maugenesti (d'Orbigny) P2435
Zetoceras zetes (d'Orbigny) 210-11 (Weg zum Gehrengrat or Rothorn)
Derolytoceras tortum (Quenstedt) P247

3. Systematic Paleontology

Some of the taxa described herein have already been analyzed in our previous work. Consequently detailed descriptions and discussions will not be repeated in the present study. Only some remarks will be added and we refer to Meister (1986, 1989), Dommergues & Meister (1987 a/b, 1989 a/b, 1990a), Meister & Loup (1989), Dommergues et al. (1990, 1994, 1995, 1997) Blau & Meister (1991), Meister & Böhm (1993), Alkaya & Meister (1995) and Geczy & Meister (1998). By contrast original taxa will be more acutely discussed.
Remark: We follow the taxonomical hierarchy proposed by Dommergues (2002).

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

Genus: *Phylloceras* Suess, 1865
Type species: *Ammonites heterophyllus* Sowerby, 1820.

***Phylloceras cylindricum* (Sowerby, 1833)**
pl. 1, fig. 4

1833 *Ammonites cylindricum* Sowerby, 1812-46, p. 333, fig. 62.
1901 *Phylloceras cylindricum* (Sowerby). — Fucini, Pl. 2, Fig. 6-8.

1901 *Phylloceras cylindricum* var. *bielzii* Herb. — Fucini, 1901-05, Pl. 3, Fig. 1-4.
1994 *Phylloceras cylindricum* (Sowerby). — Dommergues, Ferretti & Meister, Pl. 1, Fig. 1-2.
1995 *Phylloceras cylindricum* (Sowerby). — Dommergues, Meister & Böhm, Pl. 1, Fig. 3.
1996 *Geyeroceras cylindricum bielzii* (Herbich). — Popa & Patrulius, Pl. 17, Fig. 1.
1996 *Geyeroceras cylindricum* (Sowerby). — Popa & Patrulius, Pl. 17, Figs. 3, 4.
? 1996 *Geyeroceras cylindricum compressum* (Fucini). — Popa & Patrulius, Pl. 16, Fig. 7.
1999 *Geyeroceras cylindricum* (Sowerby). — Rakus, P. 347, text-fig. 7.
1999 *Geyeroceras cylindricum* (Sowerby). — Böhm et al., Pl. 25, Fig. 6.
2000 *Geyeroceras cylindricum* (Sowerby). — Kment, Pl. 2, Fig. 1.

Several samples of *Phylloceras*, associated with *Arnioceras*, are characterized by parallel sides and a quite narrow, rounded but less convex ventral area. They were collected in Steinernes Meer. Well known in the Mediterranean Province, *P. cylindricum* (Sowerby) has already been described from the Austrian Upper Austroalpine by Geyer (1886), Hauer (1854a) and recently by Dommergues et al. (1995) and Blau (1998).
Age and distribution: According to Rakus & Lobitzer (1993: 923) the species occurs from early Hettangian up to Upper Sinemurian. The species seems to be more frequent around the late Hettangian (early Sinemurian) and quite well represented until the Raricostatum Zone. It is known from the Tethyan Realm.

Phylloceras gr. *frondosum-hebertinum* (Reynes, 1868)
pl. 1, figs. 1–3

1868 *Ammonites Hebertinus* Reynes, Pl. 2, Fig. 3.
1868 *Ammonites frondosus* Reynes, Pl. 5, Fig. 1.
1884 *Phylloceras Meneghinii* Gemmellaro, Pl. 2, Fig. 13-17.
1989 *Phylloceras frondosum* (Reynes). — Meister, Pl. 2, Fig. 2, non Fig. 1; with synonymy.
1989 *Phylloceras hebertinum* (Reynes). — Meister, Pl. 2, Fig. 5, 7; with synonymy.
1993 *Phylloceras* gr. *frondosum* (Reynes). — Meister & Böhm, Pl. 2, Fig. 1, 2.
1996 *Phylloceras* gr. *hebertinum* (Reynes)-*frondosum* (Reynes). — Dommergues, Ferretti & Meister, Pl.1, Fig. 4.
1995 *Phylloceras frondosum* (Reynes). — Alkaya & Meister, Pl. 1, Fig. 1, 2.
1995 *Phylloceras hebertinum* (Reynes). — Alkaya & Meister, Pl. 1, Fig. 6.
1996 *Phylloceras frondosum* (Reynes). — Popa & Patrulius, Pl. 3, Fig. 2.
1996 *Phylloceras hebertinum* (Reynes)-*frondosum* (Reynes). — Geczy & Meister, Pl. 1, Fig. 1-4.
1998 *Phylloceras* cf. *hebertinum* (Reynes). — Geczy, Pl. 1, Fig. 1, 2.
2000 *Phylloceras frondosum* (Reynes). — Joly, Pl. 4, Fig. 10.
2000 *Phylloceras hebertinum* (Reynes). — Joly, Pl. 4, Fig. 11.

Many specimens of *Phylloceras* from Vorarlberg well correspond to the *Phylloceras frondosum-hebertinum* (Reynes) group which is herein understood as widely variable mainly in regard of the whorl section. With their quite compressed form most of the Austrian specimens are closer to the *Phylloceras frondosum* (Reynes) morphological pole. Only few specimens show a more globular whorl section close to the *P. hebertinum* (Reynes) pole.
Age and distribution: In Lorüns, they are associated with a characteristic fauna of the Lower Domerian (Isseli-Brevispiratum Horizon). Present in the Western Tethys, *Phylloceras hebertinum* (Reynes)-*frondosum* (Reynes) is also recorded from the southern part of the Euroboreal Realm (e.g. Causses). The total range is not known with precision but it includes the Upper Sinemurian until the Lower Toarcian.
Remark: Not well preserved specimens from bed 100a of Lorüns and from bed 10 of Dalaaser Schütz are here attribute to *Phylloceras* sp.

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

Calliphylloceras bicicolae (Meneghini, 1874)
pl. 1, figs. 5–7

1874 *Phylloceras Bicicolae* Meneghini, p. 106.
1989 *Calliphylloceras bicicolae* (Meneghini). — Meister, Pl. 2, Fig. 3, 4 with synonymy.
1993 *Calliphylloceras bicicolae* (Meneghini). — Meister & Böhm, Pl. 1, Fig. 2, 5.
1995 *Calliphylloceras bicicolae* (Meneghini). — Alkaya & Meister, Pl. 2, Fig. 3-5.
1996 *Calliphylloceras bicicolae* (Meneghini). — Popa & Patrulius, Pl. 10, Fig. 4.
1997. *Calliphylloceras bicicolae* (Meneghini). — Dommergues, Meister & Schirolli, Pl. 1, Fig. 1.
1998 *Calliphylloceras bicicolae* (Meneghini). — Geczy & Meister, Pl. 1, Fig. 10.
2000 *Calliphylloceras bicicolae* (Meneghini). — Joly, Pl. 14, Fig. 1-5.

Well distributed in the Vorarlberg area, typical constricted Phylloceratidae attributed to *Calliphylloceras bicicolae* (Meneghini) have been recorded from the outcrops of Formarinsee where this taxon is only associated with *Phylloceras* and Juraphyllitidae. They are also known from Spullersee and Lorüns without further information available. In Lorüns this species occurs together with *O.* gr. *oxynotum* (Quenstedt) indicating the Oxynotum Zone.
Age and distribution: The whole interval of existence of

C. bicicolae (Meneghini) could correspond to a period of uncertainty from the (? already Lower) Upper Sinemurian up to the Upper Domerian perhaps still comprising the Lower Toarcian.
This species is well known in the Tethyan Realm with the exception of the extreme part of the western Tethys (High Atlas) and can be observed in the southern part of the Euroboreal Realm (Causses).

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

***Calaiceras calais* Meneghini, 1874**
pl. 1, fig. 10

1867-1881 *A.* (*Phylloceras) calais* Meneghini, Pl. 3, Fig. 1, 2.
1971 *Calaiceras calais* (Meneghini). — Fantini Sestini, Pl. 31, Fig. 1.
1987 *Calaiceras calais* (Meneghini). — Braga & Rivas, Pl. 2, Fig. 1.
1993 *P. (Calaiceras calais)* (Meneghini). — Meister & Böhm, Pl. 1, Fig. 1.
1998 *Calaiceras calais* (Meneghini). — Geczy & Meister, Pl. 1, Fig. 6, 8.
? 2001 *Calaiceras calais* (Meneghini). — Venturi & Ferri, P. 66.

Two constricted phragmocones with a diameter of 80 mm and 30 mm of diameter, respectively, are recorded from Lorüns. They are characterized by a thick quadrate whorl section, parallel flanks and a not well expressed umbilicus edge. On this basis, they are attributed without doubt to the *Calaiceras calais* (Meneghini) group. *Hantkeniceras hantkeni* (Schloenbach) differs only by the presence/absence of constriction (Geczy & Meister, 1998).
Age and distribution: *C. calais* (Meneghini) is present in the Western Tethys (excepted High Atlas) and far East (Pontides and Tibet). Its range is comprised between Upper Sinemurian (Raricostatum Zone) and Toarcian (lower part ?).

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

***Zetoceras zetes* (d'Orbigny, 1850)**
pl. 2, figs. 1, 3, 5

1845-1849 *Ammonites heterophyllus amalthei* Quenstedt, Pl. 6, Fig. 1.
1850 *Ammonites zetes* d'Orbigny, P. 247.
? 1908 *Phylloceras pseudo-zetes* Fucini, P. 12.
1977 *Zetoceras zetes* (d'Orbigny). — Wiedenmayer, Pl. 5, Fig. 5-8.
? 1977 *Zetoceras pseudozetes* (Fucini). — Wiedenmayer, Pl. 5, Fig. 9 - 10; with synonymy.
1993 *Phylloceras* (*Zetoceras*) gr. *zetes* (d'Orbigny). — Meister & Böhm, Pl. 1, Fig. 3, 4.
1994 *Zetoceras zetes* (d'Orbigny). — Dommergues, Ferretti & Meister, Pl. 1, Fig. 3.
1998 *Zetoceras zetes* (d'Orbigny). — Geczy & Meister, Pl. 2, Fig. 2, 3; Pl. 3, Fig. 1, 4.
2000 *Zetoceras zetes* (d'Orbigny). — Joly, Pl. 10, Fig. 6; Pl. 12, Fig. 1, 2.

We group here some *Zetoceras* characterized by a quite elliptic whorl section with flat flanks and a narrow umbilicus. *Zetoceras zetes* (d'Orbigny) is well distributed in the Rotkalk facies of the Upper Austroalpine.
One specimen from Lorüns shows a wider umbilicus but it remains compressed and probably belongs to the variability of the group.
Age and distribution: Known from the Lower Sinemurian *Z. zetes* (d'Orbigny) is still present in the Upper Pliensbachian or perhaps still in the Lower Toarcian. Its geographical repartition is wide: Tethys (excepted High Atlas) and in some regions of the Euroboreal Realm (England, Germany).

***Zetoceras zetes* var. *oenotrium* (Fucini, 1901)**
pl. 2, fig. 2

1901 *Phylloceras oenotrium* Fucini, Pl. 5, Fig. 8, 9; Pl. 6, Fig. 1.
1977 *Zetoceras oenotrium* (Fucini). — Wiedenmayer, Pl. 6, Fig. 1 with synonymy.
1982 *Phylloceras* (*Zetoceras*) *oenotrium* (Fucini). — Alkaya, Pl. 2, Fig. 4-6.
1991 *Phylloceras* (*Zetoceras*) *oenotrium* (Fucini). — Cope, Pl. 1, Fig. 10, 11.
1993 *P.* (*Zetoceras*) *zetes* var. *oenotrium* (Fucini). — Meister & Böhm, Pl. 2, Fig. 3.

The *Zetoceras* collected in Lorüns is characterized by an elliptical, compressed whorl section. This feature easily distinguishes *Z. zetes* var. *oenotrium* (Fucini) from the more common species of *Zetoceras* like *Z. zetes* (d'Orbigny), *Z. lavizzarii* (Hauer) or *Z. bonarelli* (Bettoni) which present an ogival whorl section with flanks converging towards the venter, having their maximum width near the umbilicus.
Age and distribution: In the literature *Z. zetes* var. *oenotrium* (Fucini) indicates a Sinemurian age. In the Upper Austroalpine they are known in Salzburg area (Meister & Böhm, 1993); other Tethyan regions are Pontides, Southern Calcareous Alps and Apennines.

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

***Partschiceras* gr. *striatocostatum* (Meneghini, 1853)**
pl. 1, figs. 8, 13, 14; pl. 2, figs. 4, 7

1851 *Ammonites Partschi* Stur, P. 26 (nomen nudum).

1853 *Ammonites striatocostatus* MENEGHINI, P. 28.
1977 *Partschiceras sturi* (STUR). — WIEDENMAYER, Pl. 2, Fig. 6, 7; Pl. 5, Fig. 1-4 with synonymy.
1977 *Partschiceras striatocostatum* (MENEGHINI). — WIEDENMAYER, Pl. 4, Fig. 5-8 with synonymy.
1993 *Partschiceras striatocostatum* (MENEGHINI). — MEISTER & BÖHM, Pl. 2, Fig. 4 with synonymy.
1995 *Partschiceras* gr. *striatocostatum* (MENEGHINI). —DOMMERGUES, MEISTER & BÖHM, Pl. 1, Fig. 9, 12.
1995 *Partschiceras striatocostatum* (MENEGHINI). — ALKAYA & MEISTER, Pl. 1, Fig. 4; Pl. 2, Fig. 1, 2.
1996 *Partschiceras striatocostatum* (MENEGHINI). — FARAONI, MARINI, PALLINI & VENTURI, Pl. 1, Fig. 8.
1998 *Partschiceras striatocostatum* (MENEGHINI). — BLAU, Pl. 1, Fig. 8, 9, 14.
1998 *Partschiceras striatocostatum* (MENEGHINI). — GECZY & MEISTER, Pl. 4, Fig. 3, 5, 6.
1999 *Partschiceras striatocostatum* (MENEGHINI). — RAKUS, Pl. 1, Fig. 9, 10, 11.
2000 *Partschiceras striatocostatum* (MENEGHINI). — JOLY, Pl. 4, Fig. 5.
2000 *Partschiceras striatocostatum* (MENEGHINI). — DOMMERGUES, MEISTER, BONNEAU, CADET & FILI P. 333, Fig. 4 (3).

Two samples are recorded from the Sinemurian beds of Lorüns and Spullersee and two others from bed 100a of Lorüns indicating a Domerian age. They present a quite coarse rectiradiate primary and secondary ribbing already well expressed in the inner whorls at about 30 mm of diameter. *P. striatocostatum* (MENEGHINI) can be easily distinguished from the very finely ribbed forms as *P. tenuistriatum* (MENEGHINI) or rursiradiate ones like *P. proclive* (ROSENBERG), *P. sturi* (STUR) and *P. anonymum* (HAAS). The two last taxa are often considered as synonyms of MENEGHINI's species.
Age and distribution: This species is known from the Sinemurian and Pliensbachian of the Tethyan Realm and the southern part of North-West Europe (e.g. Causses Basin).

Partschiceras aff. *retrofalcatum* (STUR in GEYER, 1886)
pl. 1, fig. 12

1886 *Phylloceras* sp. indet (*Phyll. retrofalcatum* STUR m.s.). — GEYER, Pl.1, Fig. 16.
1909 *Phylloceras retrofalcatum* STUR. — ROSENBERG, P. 218.
1971 *Partschiceras retrofalcatum* (STUR in GEYER). — FANTINI SESTINI, P. 393.
1998 *Partschiceras retrofalcatum* (STUR in GEYER). — BLAU, Pl. 1, Fig. 3.

This not well preserved *Partschiceras* from Brand - Sonnenlagant is here put *in affinis* with *P. retrofalcatum* (STUR in GEYER) only because of a very fine and close ribbing which is rursiradiate on the outer part of the whorl.
Age and distribution: This rare species is recorded without precision from the upper part of the Raricostatum (Upper Sinemurian) Zone or following BLAU (1998) from the Macdonnelli or Aplanatum Zones. It is known from Upper Austroalpine Unit and Apennines (Tethyan Realm).

Partschiceras retroplicatum (ROSENBERG) sensu BETTONI, 1900
pl. 1, figs. 9, 11

non 1893 *Phylloceras retroplicatum* GEYER, Pl. 6, Fig. 3-6.
non 1898 *Phylloceras retroplicatum* ? GEYER. — FUCINI, Pl. 1, Fig. 1.
1900 *Phylloceras retroplicatum* GEYER. — BETTONI, Pl. 3, Fig. 12-14.
non 1934 *Phylloceras* cf. *retroplicatum* GEYER. — MONESTIER, Pl. 6, Fig. 2.
1987 *Partschiceras proclive* (ROSENBERG). — BRAGA & RIVAS, Pl. 2, Fig. 3, 6.

It is a not constricted Phylloceratidae with a quite complex suture line, smooth on the phragmocone and ornamented with quite coarse rursiradiate ribs on the body chamber which cross the venter making rursiradiate ventral chevrons.
Our two samples are very close to *P. retroplicatum* (GEYER) illustrated by BETTONI (1900, Pl. 3, Fig. 14). Another similar fauna has been described by BRAGA & RIVAS (1987) in the Subbeticas under the name *P. proclive* (ROSENBERG).
For us *P. retroplicatum* (GEYER) s.s. is a constricted Phylloceratidae (only juvenile stages) with a more simple suture line and with a habitus close to *Calliphylloceras* or *Phylloceras*.
P. proclive (ROSENBERG) which is based on Figure 5 of *P. retroplicatum* of GEYER, is the genotype of the genus *Procliviceras* FUCINI 1920 which according to WIEDENMAYER (1977) is closely related to the genus *Partschiceras*. If this is the case, we must keep in mind that *Partschiceras* was described only in 1923 by FUCINI, and consequently *Procliviceras* has the taxonomic priority.
Age and distribution: The age of the Vorarlberger specimens is not known, but the authors (BETTONI, 1900; BRAGA & RIVAS, 1987) indicates mostly the Pliensbachian and specially the Domerian period for this Tethyan species.

Family: Juraphyllitidae ARKELL, 1950

Genus: *Juraphyllites* MÜLLER, 1939
Type species: *Phylloceras diopsis* GEMMELLARO, 1884.

Juraphyllites nardii (MENEGHINI, 1853)

1853 *Ammonites Nardii* MENEGHINI, P. 27.
1866 *Ammonites transylvanicus* HAUER, P. 192.
1901 *Rhacophyllites nardii* (MENEGHINI). — FUCINI, Pl. 7, Fig. 1-7.
1901 *Rhacophyllites nardii* var. *dorsocurvata* FUCINI, Pl. 8, Fig. 7.

1993 *Juraphyllites nardii* (Meneghini). — Meister & Böhm, Pl. 2, Fig. 8, with synonymy.
1994 *Juraphyllites* (?) aff. *nardii* (Meneghini). — Palfy, Smith & Tipper, Pl. 1, Fig. 6.
1995 *Juraphyllites nardii* (Meneghini). — Dommergues, Meister & Böhm, Pl. 1, Fig. 6.
1998 *Juraphyllites nardii* (Meneghini). — Blau, Pl. 1, Fig. 7, 16.
2001 *Juraphyllites nardii* (Meneghini). — Venturi & Ferri, p. 70 et 74.

We group here some not well preserved *Juraphyllites* from Lorüns and Rothorn which are in the adult stage characterized by a ribbing covering the flanks from the umbilical edge until the ventral part.
Age and distribution: Known in the Upper Sinemurian, *J. nardii* (Meneghini) is distributed in Tethyan Realm and Pacific area.

Juraphyllites libertus (Gemmellaro, 1884)
pl. 2, fig. 6

1884 *Phylloceras libertum* Gemmellaro, Pl. 2, Fig. 1 - 5.
1977 *Juraphyllites libertus* (Gemmellaro). — Wiedenmayer, Pl. 1, Fig. 4; Pl. 3, Fig. 1, 2, 5.
1986 *Juraphyllites libertus* (Gemmellaro). — Meister, Pl. 2, Fig. 8.
1986 *Juraphyllites libertus* (Gemmellaro). — Gakovic, Pl. 2, Fig. 1.
1989 *Juraphyllites libertus* (Gemmellaro). — Meister, Pl. 2, Fig. 9.
1990 *Juraphyllites* gr. *libertus* (Gemmellaro). — Dommergues & Meister, Fig. 3 (15).
1993 *Juraphyllites* gr. *libertus* (Gemmellaro). — Meister & Böhm, Pl. 3, Fig. 4.
1995 *Juraphyllites libertus* (Gemmellaro). — Dommergues, Meister & Böhm, Pl. 1, Fig. 5.
1995 *Juraphyllites* gr. *libertus* (Gemmellaro). — Alkaya & Meister, Pl. 3, Fig. 1, 5, 7.
1996 *Juraphyllites libertus* (Gemmellaro). — Faraoni, Marini, Pallini & Venturi, Pl. 1, Fig. 7.
1998 *Juraphyllites libertus* (Gemmellaro). — Blau, Pl. 1, Fig. 4, 11, 18.
1998 *Juraphyllites libertus* (Gemmellaro). — Geczy & Meister, Pl. 4, Fig. 3, 5, 6.

One *Juraphyllites* from Eingemauerte is characterized by numerous constrictions with prorsiradiate ribs only visible on the upper part of the flanks, crossing the venter and making quite fine chevrons. It belongs to the well known species *J. libertus* (Gemmellaro).
Another fragmentary specimen is recorded from the bed 107 of Lorüns.
Age and distribution: This species has a long range from the Lower Carixian until the Lower Toarcian and its distribution is wide: Tethyan Realm until Caucasus and southern part of the Euroboreal Realm.

Juraphyllites gr. *diopsis* (Gemmellaro, 1884)
pl. 3, fig. 1

1884 *Phylloceras diopsis* Gemmellaro, Pl. 2, Fig. 6 -8; Pl. 6, Fig. 1, 2.
1977 *Juraphyllites diopsis* (Gemmellaro). — Wiedenmayer, Pl. 8, Fig. 4-7 with synonymy.
non 1987 *Juraphyllites* cf *diopsis* (Gemmellaro). — Hillebrandt, Pl. 1, Fig. 9
1991 *Juraphyllites* gr. *diopsis* (Gemmellaro). — Blau & Meister, Pl. 2, Fig. 10.
1991 *Juraphyllites diopsis* (Gemmellaro). — Cope, Pl. 2, Fig. 2, 3, 10, 11.
1993 *Juraphyllites* gr. *diopsis* (Gemmellaro). — Meister & Böhm, Pl. 2, Fig. 10.
1996 *Juraphyllites diopsis* (Gemmellaro). — Faraoni, Marini, Pallini & Venturi, Pl. 1, Fig. 2.
1995 *Juraphyllites diopsis* (Gemmellaro). — Alkaya & Meister, Pl. 3, Fig. 3, 9.
2000 *Juraphyllites* aff. *diopsis* (Gemmellaro). — Dommergues, Meister, Bonneau, Cadet & Fili, P. 333, Fig. 4 (7).

The *Juraphyllites* collected at Spullersee-Goppelspitze doesn't show any constrictions. The phragmocone is smooth and the body chamber is characterized by sharp concave ribs, restricted to the outer two thirds of the whorl sides which are less prominent and more densely spaced at the beginning of the body chamber than near the aperture. The ribs cross the venter quite strongly projected. The lack of constrictions is the main difference with *J. libertus* (Gemmellaro).
Age and distribution: The total range of this species is not well known; *J. diopsis* (Gemmellaro) appears in the Raricostatum Zone (Alkaya & Meister, 1995) and is still present in the Lower Carixian. It is known in the Tethyan Realm.

Juraphyllites aff. *limatus* (Rosenberg, 1909)
pl. 3, figs. 2, 3

1909 *Rhacophyllites limatus* Rosenberg, Pl. 2, Fig. 10ab, 11.
1913 *Rhacophyllites limatus* Rosenberg var. *asiatica* Pia, Pl. 13, Fig. 2.
1942 *Rhacophyllites limatus* Rosenberg. — Kovács, Pl. 2, Fig. 11; Pl. 5, Fig. 6.
1977 *Juraphyllites limatus limatus* Rosenberg. — Wiedenmayer, Pl. 3, Fig. 4; Pl. 8, Fig. 8, 12; with synonymy.
1998 *Juraphyllites* gr. *limatus* Rosenberg. — Geczy & Meister, Pl. 17, Fig. 1, 3 with synonymy.

We group here a set of *Juraphyllites* which are clearly different from all the other representatives of this species discussed here. They bear no constrictions and are thoroughly smooth [21/210-9] or with very evanescent ribs

on the body chamber like the specimen from Auenfeld (Pl. 3, Fig. 2).
Age and distribution: This Tethyan species is recorded from the Alps (Southern Calcareous Alps, Upper Austroalpine Units) and Pontides. Its age is not well known, probably Lower Carixian to Middle Domerian.

***Juraphyllites* aff. *quadrii* var. *planulata* (Fucini, 1901)**
pl. 3, figs. 4, 6-8

1901 *Rhacophyllites quadrii* Meneghini var. *planulata* Fucini, Pl. 11, Fig. 7, 8.
? 1942 *Rhacophyllites quadrii* Meneghini var. *planulata* Fucini. — Kovacs, Pl. 2, Fig. 10.
? 1977 *Juraphyllites quadrii planulatus* (Fucini). — Wiedenmayer, Pl. 8, Fig. 13, 14.
? 1986 *Juraphyllites libertus* (Gemmellaro). — Gakovic, Pl. 2, Fig. 1.

Although our specimens from Lorüns are similar to *J. libertus* (Gemmellaro) in regard of their high number of constrictions and the style of the ribbing (e.g. Fucini, 1896, Pl. 1, Fig. 22 and 1899, Pl. 20, Fig.1), these ammonites are all adults not exceeding 40 mm of diameter. Moreover their constrictions are more sigmoid and irregularly spaced. Could they be microconchs of *J. libertus* (Gemmellaro)? Without stratigraphical support we prefer at the moment to keep them within *Juraphyllites* aff. *quadrii* var. *planulata* (Fucini). *J. bucovinicus* Uhlig (1900, Pl. 1, Fig. 2) has a similar ribbing but with more spaced constrictions and differs mainly by the raising of an outlining keel on the ventral part near the aperture.
Age and distribution: According to Wiedenmayer (1977) the range of this Tethyan species is from the Sinemurian to Carixian

***Juraphyllites* sp.**

Some very bad preserved platicone ammonites from Rothorn and Dalaaser Schütz are attributed with doubt to the genus *Juraphyllites*. Especially the forms originating from Dalaaser Schütz (which are associated with *Phylloceras* sp.) are deformed by the Alpine tectonics and in part dissolved.

Subgenus: *Harpophylloceras* Spath, 1927
Type species: *Ammonites eximius* Hauer, 1854.

***J.* (*Harpophylloceras*) *eximius* (Hauer, 1854)**
pl. 3, fig. 5

1854 *Ammonites eximius* Hauer, Pl. 2, Fig. 1-4.
1977 *Harpophylloceras eximius* (Hauer). — Wiedenmayer, Pl. 9, Fig. 6-13 with synonymy.
1989 *J.* (*Harpophylloceras*) *eximius* (Hauer). — Meister, Pl. 3, Fig. 1-3.
1995 *J.* (*Harpophylloceras*) *eximius* (Hauer). — Dommergues, Meister & Böhm, Pl. 1, Fig. 10.
1996 *Harpophylloceras eximius* (Hauer). — El Hariri, Dommergues, Meister, Souhel & Chafiki, Pl. 67, Fig. 3, 4.
1998 *J.* (*Harpophylloceras*) *eximius* (Hauer). — Geczy & Meister, Pl. 4, Fig. 4, 7.
2000 *Harpophylloceras eximius* (Hauer). — Joly, Pl. 1, Fig. 1.
2001 *Harpophylloceras eximius* (Hauer). — Venturi & Ferri, P. 72.

A platicone involute ammonite with a fine, close, ventrolateral ribbing and a keel, whose suture line shows relatively spatulate endings, well corresponds to *Juraphyllites* (*Harpophylloceras*) *eximius* (Hauer).
Age and distribution: Recorded from the Tethyan and southern Euroboreal Realms, the age of this species corresponds to a not well defined interval from the Middle (? or already Lower) Carixian to Lower Toarcian.

Genus *Tragophylloceras* Hyatt, 1900
Type species: *Ammonites heterophyllus numismalis* Quenstedt, 1845.

***Tragophylloceras ibex* (Quenstedt, 1843)**
pl. 3, fig. 11

1843 *Ammonites ibex* Quenstedt, P. 179.
1845 *Ammonites ibex* Quenstedt. — Quenstedt, Pl. 6, Fig. 6.
1893 *Phylloceras ibex* (Quenstedt). — Futterer, Pl. 8; Fig. 9, 10.
1936 *Phylloceras ibex* (Quenstedt). — De Brun & Brousse, Pl. 4, Fig. 7.
1961 *Tragophylloceras ibex* (Quenstedt). — Dean, Donovan & Howarth, Pl. 69, Fig. 4.
1964 *Tragophylloceras ibex* (Quenstedt). — Howarth & Donovan, Pl. 49, Fig. 2, 3 with synonymy.
1966 *Tragophylloceras ibex* (Quenstedt). — Kollarova-Andrusova, Pl. 2, Fig. 1, 2.
1968 *Tragophylloceras ibex* (Quenstedt). — Jordan, Pl. 5; Fig. 5, 6.
1969 *Tragophylloceras ibex* (Quenstedt). — Calvez, Lefavrais-Raymond & Lhegu, Pl. 2, Fig. 7.
1976 *Tragophylloceras ibex* (Quenstedt). — Schlegelmilch, Pl. 2, Fig. 5.
1977 *Tragophylloceras ibex* (Quenstedt). — Schlatter, Pl. 3, Fig. 3.
1978 *Tragophylloceras ibex* (Quenstedt). — Dommergues & Mouterde, Pl. 3, Fig. 22.
1979 *Tragophylloceras ibex* (Quenstedt). — Dommergues, Pl. 6, Fig. 1.
1980 *Tragophylloceras ibex* (Quenstedt). — Schlatter, Pl. 1, Fig. 3.
1982 *Tragophylloceras ibex* (Quenstedt). — Hoffmann, Pl. 4, Fig. 1, 2, (?) 3, 4; Pl. 3, Fig. 9, 10.
1986 *Tragophylloceras ibex* (Quenstedt). — Meister, Pl. 1, Fig. 6.

1991 *Tragophylloceras ibex* (Quenstedt). — Schlatter, Pl. 1; Fig. 4.
1994 *Tragophylloceras ibex* (Quenstedt). — in Fischer, Pl. 23; Fig. 10.
1997 *Tragophylloceras ibex* (Quenstedt). — Dommergues, Meister & Mouterde, Pl. 7, Fig. 3.
2000 *Tragophylloceras ibex* (Quenstedt). — Joly, Pl. 1, Fig. 10-12.

A highly distinctive *Tragophylloceras* of the Middle Carixian (Valdani Subzone) characterized by a very original ornamentation made of thick, prorsiradiate, ventral pointing chevrons which are not connected with the lateral ribbing.
Age and distribution: The distribution of this species is restricted to the Euroboreal Realm and it indicates the Ibex Zone of the Middle Carixian.

Tragophylloceras undulatum (Smith, 1817)

1817 *Ammonites undulatum* Smith, P. 114.
1930 *Tragophylloceras undulatum* (Smith). — Cox, Pl. 12, Fig. 5.
1964 *Tragophylloceras undulatum* (Smith). — Howarth & Donovan, Pl. 48, Fig. 6-9; Pl. 49, Fig. 1 with synonymy.
1976 *Tragophylloceras undulatum* (Smith). — Schlegelmilch, Pl. 2, Fig. 4.
1980 *Tragophylloceras undulatum* (Smith). — Schlatter, Pl. 1, Fig. 2.
1982 *Tragophylloceras undulatum* (Smith). — Hoffmann, Pl. 1, Fig. 6; Pl. 3, Fig. 1-8, Text-fig. 19a.
1984 *Tragophylloceras undulatum* (Smith). — Weitschaft & Hoffmann, Pl. 1, Fig. 5.
1986 *Tragophylloceras undulatum* (Smith). — Meister, Pl. 2, Fig. 2-4.
1991 *Tragophylloceras undulatum* (Smith). — Schlatter, Pl. 1, Fig. 3.
2000 *Tragophylloceras undulatum* (Smith). — Joly, Pl. 3, Fig. 2-4.

For the first time *T. undulatum* (Smith) is recorded from Tethyan regions. Although not well preserved these Austrian *Tragophylloceras* can nevertheless be put near the similar French specimens from the Causses Basin (Meister, 1982, 1986), especially the specimen illustrated Fig. 4 Pl. 2 (ibidem, 1986) which is characterized by a prorsiradiate sigmoid, well expressed ribbing, more vigorous near the outer part and, like in *Juraphyllites*, making ventral chevrons.
Age and distribution: Distributed in the Euroboreal Realm, this species is now also known from Upper Austroalpine units (Tethyan Realm). It range corresponds to the upper Jamesoni Zone up to the Ibex Zone (Lower to Middle Carixian) (see Meister, 1993).

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 sp.
pl. 3, fig. 12

A fragment of a Lytoceratoidea characterized by subquadrate whorl section with subparallel flank, a receding umbilical edge and a broad and flattened rounded ventral part which seems to be smooth (preservation !) is attributed to the genus *Ectocentrites*. With fine, quite irregular, prorsiradiate ribs which are more or less sinuous and more vigorous on the ventro-lateral part, the style of the ribbing is similar to other representatives of this genus [e.g. *E. altiformis* (Bonarelli)].
For an exhaustive discussion on the taxonomy, biostratigraphy and paleogeography of this genus, we refer to Meister et al. (2000).

Family: Lytoceratidae Neumayr, 1875

Genus: *Lytoceras* Suess, 1865
Type species: *Ammonites fimbriatus* Sowerby, 1817.

Lytoceras gr. *fuggeri* Geyer, 1893
pl. 3, fig. 9

1893 *Lytoceras fuggeri* Geyer, Pl. 8, Fig. 7-9.
1909 *Lytoceras fuggeri* Geyer. — Rosenberg, Pl. 11, Fig. 23.
1909 *Lytoceras fuggeri* Geyer var. *biangulata* Rosenberg, Pl. 11, Fig. 24.
1994 *Lytoceras* gr. *fuggeri* Geyer. — Dommergues, Ferretti & Meister, Pl. 1, Fig. 13-16.
1997 *Lytoceras* aff. *fuggeri* Geyer. — Dommergues, Meister & Schirolli, Pl. 1, Fig. 3.
1998 *Lytoceras* cf. *fuggeri* Geyer. — Lachkar, Dommergues, Meister, Neige, Izart & Lang, Fig. 5 (5-6).
1998 *Lytoceras fuggeri* Geyer. — Blau, Pl. 2, Fig. 1-2.

This *Lytoceras* has a slightly compressed whorl section. The ribbing and the constrictions are prorsiradiate on the first third of the flank, afterwards becoming all rursiradiate. The constrictions draw concave sulci on the venter. A crenulation depending most probably of the preservation is visible.
L. czjzeki (Hauer) is a very close species and there are very little differences, perhaps only due to the preservation of the specimen. Indeed the major distinguishable feature between both is the development of the rib-crenulation associated with a compressed subrectangular whorl section in Hauer's species. In Geyer's species, the whorl

section is subquadrate. Other differences are the smooth inner whorls in *L. fuggeri* GEYER and the strong crenulate-fimbriate ones in *L. czjzeki* (HAUER). With our material it is impossible to decide whether these two forms belong to one single species.
Age and distribution: *L. fuggeri* GEYER is present in the Upper Sinemurian, mainly in the Raricostatum Zone. It is recorded from the Upper Austroalpine units, the Southern Calcareous Alps and the High Atlas.

Lytoceras aff. *fimbriatoides* GEMMELLARO, 1884

1884 *Lytoceras fimbriatoides* GEMMELLARO, Pl. 3, Fig. 20-23.
? 1909 *Lytoceras* sp. nov. aff. *fimbriatoides* GEMMELLARO. — ROSENBERG, Pl. 11, Fig. 13.
? 1913 *Lytoceras* sp. nov. aff. *fimbriatoides* GEMMELLARO. — HAAS, Pl. 2, Fig. 1, 2.
1942 *Lytoceras fimbriatoides* GEMMELLARO. — KOVACS, Pl. 2, Fig. 19.
1975 *Lytoceras fimbriatoides* GEMMELLARO. — FERRETTI, Pl. 24, Fig. 1, 2.
1994 *Lytoceras* aff. *fimbriatoides* GEMMELLARO. — DOMMERGUES, FERRETTI & MEISTER, Pl. 2, Fig. 1-4.
2000 *Lytoceras fimbriatoides* GEMMELLARO. — DOMMERGUES, MEISTER, BONNEAU, CADET & FILI P. 336, Fig. 5 (1).

A particularly finely ribbed *Lytoceras* from the Rothorn is very close to the specimen from Albania illustrated by DOMMERGUES et al. (2000, Pl. 2, Fig. 1) with a quite fast growth of the whorl-height (H) and a fine and weakly sinuous ribbing. The ribs are slightly rursiradiate on the umbilical wall, then a little prorsiradiate on the lower flank, becoming rursiradiate again from the middle of the flank to the outer part. Some ribs can appear near the mid-side and some ribs are clearly fimbriate alternated with less or not crenulated ones. Another fragmentary specimen from Auenfeld is also placed near *L. fimbriatoides* GEMMELLARO.
Age and distribution: Known in the Upper Sinemurian and in the Lower Carixian, this species is only recorded from the Tethyan Realm.

Lytoceras gr. *fimbriatum* (SOWERBY, 1817)

1817 *Ammonites fimbriatus* SOWERBY, Pl. 164.
1986 *Lytoceras fimbriatum* (SOWERBY). — MEISTER, Pl. 1, Fig. 1, 2 with synonymy.
1987 *Lytoceras fimbriatum* (SOWERBY). — BRAGA, JIMENEZ & RIVAS, Pl. 1, Fig. 1, 2.
1990 *Lytoceras* gr. *fimbriatum* (SOWERBY). — DOMMERGUES & MEISTER, Fig. 5 (22).
1991 *Lytoceras fimbriatum* (SOWERBY). — SCHLATTER, Pl. 1, Fig. 6, 7.
1993 *Lytoceras* gr. *fimbriatum* (SOWERBY). — MEISTER & BÖHM, Pl. 4, Fig. 1, 2.
1994 *Lytoceras fimbriatum* (SOWERBY). — in: FISCHER, Pl. 25, Fig. 1-4.
1995 *Lytoceras* aff. gr. *fimbriatum* (SOWERBY). — ALKAYA & MEISTER, Pl. 4, Fig. 1, 5.
1996 *Lytoceras fimbriatum* (SOWERBY). — EL HARIRI, DOMMERGUES, MEISTER, SOUHEL & CHAFIKI, Pl. 67, Fig. 11, 12.
1997 *Lytoceras fimbriatum* (SOWERBY). — CASSEL, Pl. 16, Fig. 5.
1998 *Lytoceras* cf. *fimbriatum* (SOWERBY). — GECZY, Pl. 1, Fig. 5.
1998 *Lytoceras* gr. *fimbriatum* (SOWERBY). — GECZY & MEISTER, Pl. 5, Fig. 2; Pl. 4, Fig 10.

Two body chambers of *Lytoceras* from Auenfeld and Rothorn are linked up to *L. fimbriatum* (SOWERBY) because of their simple annular, more or less fimbriate ribbing and their subcircular whorl section.
Age and distribution: This quite ubiquitous species is well represented in the Euroboreal Realm, at the northern margin of the Tethys and even in Asia (Tibet and Indonesia). Its range is comprised between the Lower Carixian to the Lower Toarcian.

Lytoceras ovimontanum GEYER, 1893
pl. 3, fig. 14; pl. 4, fig. 1

1893 *Lytoceras ovimontanum* GEYER Pl. 8, Fig. 1.
1977 *Kallilytoceras ovimontanum* GEYER. — WIEDENMAYER, Pl. 10, Fig. 12; with synonymy.
1996 *Lytoceras ovimontanum* GEYER. — EL HARIRI, DOMMERGUES, MEISTER, SOUHEL & CHAFIKI, Pl. 67, Fig. 15.
1998 *Lytoceras ovimontanum* GEYER. — GECZY & MEISTER, Pl. 5, Fig. 1, 6, 7.

This *Lytoceras* is characterized by a polyfurcate ribbing appearing on the high flanks near the ventral area, and by a suboval whorl section. These features bring it close to *L. ovimontanum* GEYER, a well known ammonite of the Lower Domerian. Two specimens are characterized by a fine and close ribbing. Another one bears more spaced and stronger ribs on the body chamber evoking the habitus of *L.* gr. *baconicum* VADASZ (in BLAU & MEISTER, 1991, Pl. 4, Fig. 1).
Age and distribution: *L. ovimontanum* GEYER is know in the western Tethys from the Lower Domerian to the Upper Domerian.

Lytoceras sp.
pl. 3, fig. 13

We group here several not well preserved specimens of *Lytoceras* of different age. A fragment, *ex situ*, of an ammonite with a rounded whorl section belongs to *Lytoceras*, but it is too poorly preserved to be specifically determined. Its age is probably Sinemurian (related to the facies). Another *Lytoceras* sp. has been collected *ex situ* at Dalaaser Schütz in association with Amaltheidae (Domerian age). Two other specimens from the Lower Domerian were found in bed 109 and 110 in Lorüns.

Genus: *Derolytoceras* Rosenberg, 1909
Type species: *Ammonites lineatus tortus* Quenstedt, 1885.

***Derolytoceras tortum* (Quenstedt, 1885)**
pl. 4, figs. 2, 5

* 1885 *Ammonites lineatus tortus* Quenstedt, Pl. 39, Fig. 12, 13.
1989 *Derolytoceras tortum* (Quenstedt). — Meister, Pl. 1, Fig. 4, 5.
1990 *Derolytoceras tortum* (Quenstedt). — Dommergues, Meister & Mettraux, Pl. 6, Fig. 8, 9 with synonymy.
1990 *Derolytoceras tortum* (Quenstedt). — Dommergues & Meister, Fig. 3 (13, 14); Fig. 5 (23).
1993 *Derolytoceras tortum* (Quenstedt). — Meister & Böhm, Pl. 3, Fig. 1.
1997 *Derolytoceras* aff. *tortum* (Quenstedt). — Corna, Dommergues, Meister & Page, Pl. 1, Fig. 1.

Lytoceratidae bearing constrictions and characterized by an annular strong ribbing mainly developed at the end of the body chamber by the adults are attributed to this species. The taxon is often regarded as the microconch of *Lytoceras fimbriatum* (Sowerby) (see Meister, 1986).
Age and distribution: This species is recorded from the Tethyan and Euroboreal Realms. Its range is not well known, probably Carixian and Domerian.

Superfamily: Psiloceratoidea Hyatt, 1867
Subfamily: Discamphiceratinae Guex & Rakus, 1991

Genus: *Galaticeras* Spath, 1938
Type species: *Amphiceras harpoceroides* Gemmellaro, 1884.

***Galaticeras* gr. *harpoceroides* (Gemmellaro, 1884)**
pl. 3, fig. 10

1884 *Amphiceras harpoceroides* Gemmellaro, Pl. 1, Fig. 8-12; Pl. 4, Fig. 4.
1909 *Amphiceras harpoceroides* Gemmellaro. — Rosenberg, Pl. 14, Fig. 13.
? 1977 *Galaticeras harpoceroides* (Gemmellaro). — Wiedenmayer, Pl. 15, Fig. 1, 2, 9.
1987 *Galaticeras harpoceroides* (Gemmellaro). — Cecca, Dommergues, Mouterde & Pallini, Pl. 2, Fig. 2.
1996 *Galaticeras harpoceroide* (Gemmellaro). — Faraoni, Marini, Pallini & Venturi, Pl. 1, Fig. 1.
? 1996 *Galaticeras* sp. Faraoni, Marini, Pallini & Venturi, Pl. 4, Fig. 6.

This *Galaticeras* is characterized by a quite narrow umbilicus (O/D = 28%) and a fine, close sigmoid ribbing well expressed on the lower 3/5 of the flank and crossing the venter. In comparison *G. flexistriatum* (Gemmellaro) shows a coarser ribbing in the inner whorls; *G. rosenbergi* (Fucini) presents clearly broader whorls with finer ribs and *G. propinquum* (Gemmellaro) is a more involute species.
Age and distribution:In the Tethyan areas, *Galaticeras* is predominantly abundant during the Lower and Middle Carixian.

Family: Schlotheimiidae Spath, 1923

Genus: *Angulaticeras* Quenstedt, 1883
Type species: *Ammonites lacunatus* Buckman, 1844.

***Angulaticeras* sp.**
pl. 4, figs 3, 4

Previously discussed in Dommergues et al. (1995, P. 172) but herein necessarely repeated: We use the genus *Angulaticeras* for quite more involute and more recent forms, in another word for more "derived" morphologies. Such forms like "*Schlotheimia*" *marmorea* (Oppel) mark the transition between true *Schlotheimia* and true *Angulaticeras*. According to some authors it is already an *Angulaticeras* (e.g. Bloss, 1988) whereas it is still a *Schlotheimia* for others (e.g. Dommergues et al. 1995; Corna et al., 1997a).
We group here two not well preserved specimens which vary in rib density: fine and densely ribbed to more spaced and coarse. They show the characteristic features of *Angulaticeras* with a narrow, smooh groove and a involute conch with high whorls.
Age: The genus is known from the Lower to Upper Sinemurian.

Family: Arietitidae Hyatt, 1875
Subfamily: Arietitinae Hyatt, 1875

Genus: *Coroniceras* Hyatt, 1867
Type species: *Ammonites kridion* Zieten,1830 (ICZN opinion 324).

Remark: The genus is taken sensu Donovan et al. (1981) and Corna & Dommergues (1995).

Subgenus: *Arietites* Sowerby, 1816
Type species: *Ammonites bucklandi* Sowerby, 1816.

***C.* (*Arietites*) (?) sp.**

A very poorly preserved large and evolute Arietitidae (more than 30 cm of diameter) from Lorüns is characterized by a very coarse, quite spaced ribbing and by a tricarenate ventral part with a rectangular to subquadrate whorl-section. It is here with doubt attributed to the genus *Arietites*.
Age: It belongs most probably to Bucklandi Zone.

Coroniceras **(*Arietites*) aff. *bisulcatus* (Bruguiere) sensu Vialli, 1959**

pl. 4, figs 8, 9; pl. 5, fig. 1

? 1898 *Arietites bisulcatus* (Bruguiere). — Parona, Pl. 12, Fig. 1.
1959 *Coroniceras bisulcatum* (Bruguiere). — Vialli, Pl. 15, Fig. 7.
1961 *Coroniceras bisulcatum* (Bruguiere). — Sacchi Vialli & Cantaluppi, Pl. 2, Fig. 2.

These evolute, slightly deformed ammonites show a subquadrate whorl-section. The ribbing seems to be tight subradiate to slightly prorsiradiate; ribs bear a ventro-lateral tubercle which is more or less visible on the different specimens. On the tricarenate venter the ribs become finer and evanescent, and are projected forward and interrupted along the lateral keel. The prominent keel and the sulci occupy a large part of the venter which is quite flat.
The largest specimen from Steineres Meeres with more than 25 cm of diameter still bears ventro-lateral tubercles. Its broard tricarenate morphology occupies a large part of the venter comparable to the illustrations of Guerin-Franiatte (1966, Pl. 6) and Corna (1985, Pl. 5, Figs 3, 4). All these forms probably belong to the genus *Coroniceras*. This fauna is very close to the Tethyan species previously described by Parona (1898) Vialli (1959), Sacchi Vialli & Cantaluppi (1961). *Coroniceras bisulcatus* (Bruguiere) sensu Vialli shows little differences like more arched lateral ribs. Some affinities with *Coroniceras lyra* Hyatt sensu Popa & Patrulius (1996, pl. 15, fig. 9) and *Coroniceras* (*Primarietites*) *reynesi* (Spath) sensu Vialli (1959, pl. 16, fig. 3) are obvious but the tricarenate part is narrower for the first one and the ribs broader spaced for the last one.
Age and distribution: The range of the genus indicates a period comprising the Rotiforme and Bucklandi Subzones as well as the base of Semicostatum Zone. Until now, this taxon is known only from the Alps (Tethyan part).
Remark: Another specimen (Pl. 4, fig. 6) is characterized by an open umbilicus, a coarse, spaced, rursiradiate ribbing which is strongly bent forward and interrupted before it reaches the keel, and a suquadrate whorl section (E/H = 0.9). The ventral area is slightly fastigate with a small and quite fine keel bordered by a massive smooth band. This specimen is attributed to *Coroniceras* sp.

Genus *Metophioceras* Spath, 1924

Type species: *Ammonites conybeari* Sowerby, 1816.

Metophioceras **sp.**

pl. 4, fig. 10

An evolute ammonite from Steineres Meer with a diameter of 10 cm is attributed to *Metophioceras* because of its tricarenate venter with very large sulci (the three keels have the same height), a medium ribdensity, regular ribs slightly arched and rursiradiate, and a subelliptical whorl section with a flat outer part (E/H = 0.90 to 0.85); no tubercles are visible.
Metophioceras conybeari (Sowerby) and specially the specimen illustrated by Hauer (1856, pl. 2, fig. 1, 2) shows a very close habitus mainly in the whorl section and in the rib density. Another specimen from Lorüns collected below the red nodular limestones is similar to the previous one, but has a more subquadrate whorl section.
The age is Lower Sinemurian (Conybeari to ? Rotiforme Zones).

Subfamily Agassiceratinae Spath, 1924

Genus *Euagassiceras* Hyatt, 1875

Type species: *Ammonites sauzeanus* d'Orbigny, 1844.

Euagassiceras **sp.**

pl. 4, fig. 7

A fragment of a quite evolute ammonite is characterized by spaced radiate lateral ribs bearing a little ventro-lateral tubercle. The whorl-section is rectangular with a slightly fastigate venter. The keel disapears and is replaced by evanescent chevrons. These characters well correspond to the *Euagassiceras* diagnosis.
Age: The genus ranges from the Semicostatum Zone up to the (?) Turneri Zone (Lower Sinemurian).

Genus: *Arnioceras* Hyatt, 1867

Type species: *Arnioceras cuneiforme* Hyatt, 1867.

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

pl. 5, fig. 4

non 1901-05 *Arnioceras ceratitoides* var. *paucicosta* Fucini, Pl. 18, Fig. 9, 10, 12-14.
1975 *Arnioceras ceratoides paucicosta* Fucini. — Ferretti, Pl. 22, Fig. 1-3.
1993 *Arnioceras* gr. *mendax* var. *rariplicatum* Fucini. — Meister & Böhm, Pl. 4, Fig. 4.
1994 *Arnioceras* gr. *paucicosta* sensu Ferretti non Fucini. — Dommergues, Ferretti & Meister Pl. 2, Fig. 9-12.
? 1994 *Arnioceras* gr. *ceratitoides* (Quenstedt). — Rakus, Pl. 5, Fig. 1.

The major part of the *Arnioceras* from Steineres Meer are forms with coarse to very coarse, spaced ribs. They are grouped within *A.* gr. *paucicostum* Fucini sensu Ferretti even although the bad preservation does not allow to observe the lenght of the smooth stage in the inner whorl which normally can reach 1,5 cm of diameter. Few specimens are more closely and finely ribbed; but as already underlined (Dommergues et al., 1994) we suppose a broard variability in rib density and in thickness of the whorl sec-

tion for this species. One specimen, not well preserved, from the boundary between the grey limestones and the red nodular limestones in Lorüns, is put *in affinis* into this group by reason of a coarse spaced ribbing.
Age and distribution: In Vorarlberg, *A.* gr. *paucicostum* Fucini sensu Ferretti indicates the lower or middle part of the Semicostatum Zone. This species can perhaps extend into the Lower part of the Upper Sinemurian. It is known from Adnet area and from Apennines.

Arnioceras rejectum Fucini, 1902
pl. 5, fig. 2

1902 *Arnioceras rejectum* Fucini, Pl. 17, Fig. 14; Pl. 19, Fig, 1-6.
1993 *Arnioceras* gr. *ceratitoides* (Quenstedt). — Meister & Böhm, Pl. 4, Fig.3, 5, 6, 10.
1994 *Arnioceras rejectum* Fucini. — Dommergues, Ferretti & Meister Pl. 2, Fig. 13-17.
1995 *Arnioceras rejectum* Fucini. — Dommergues, Meister & Böhm, Pl. 4, Fig. 2-4; Pl. 3, Fig. 12, 14-16.
1998 *Arnioceras* cf. *rejectum* Fucini. — Lachkar, Dommergues, Meister, Neige, Izart & Lang, Pl. 4, Fig. 2-4; Pl. 3, Fig. 12, 14-16.

The significance of this species was already discussed by Dommergues et al. (1994, 1995). To summarize, *A. rejectum* Fucini is charaterized by a quite short smooth stage, not exceeding 1 cm of diameter with a medium ribdensity. Our conception of the species is wide and includes the major part of the *Arnioceras* illustrated by Fucini (1901-05) from the Mte di Cetona. *A. rejectum* Fucini represents a medium morphology. Nevertheless we keep in mind that the systematic of the genus is not well known and needs a major revision supported by acute biostratigraphy.
Age and distribution: This species is also known from from the High Atlas and from the Adnet area and Apennines where it is associated with *Asteroceras* (Obtusum Zone). Its total range is not yet known.

Subfamily: Asteroceratinae Spath, 1946

Genus: *Asteroceras* Hyatt, 1867
Type species: *Ammonites stellaris* Sowerby, 1815.

Asteroceras gr. *saltriensis* (Parona, 1896)
pl. 6, fig. 1; pl. 7, figs. 1, 3; pl. 8, fig. 1

1896 *Arietites saltriensis* Parona, Pl. 8, Fig. 2, 3.
1903 *Asteroceras saltriense* (Parona). — Fucini, Pl. 33, Fig. 4-6.
1961 *Asteroceras* sp. gr. *stellare* (Sowerby). — Sacchi-Vialli & Cantaluppi, Pl. 3, Fig. 6 (only).
? 1991 *Asteroceras saltriense* ? (Parona). — Palfy, Pl. 10, Fig. 9.
? 1994 *Asteroceras obtusum* (Sowerby). — Rakus, Pl. 5, Fig. 3.
? 1994 *Asteroceras* cf. *saltriense* ? (Parona). — Palfy & Smith, Pl. 1, Fig. 1.
1995 *Asteroceras* aff. *saltriensis* (Parona). — Dommergues, Meister & Böhm, Pl. 5, Fig. 11.
1997 *Asteroceras* cf. *saltriensis* (Parona). — Johannson, Smith & Gordey, Pl. 1, Fig. 5.

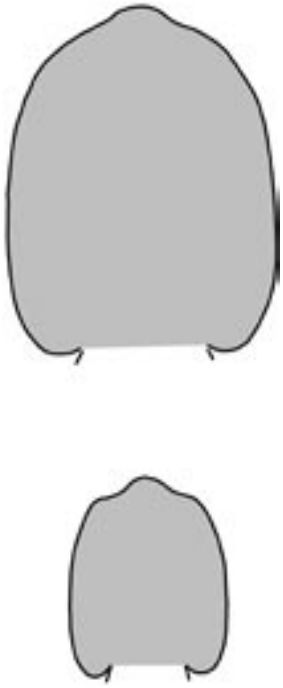

Figure 12: *Asteroceras* gr. *saltriensis* (Parona) whorl sections.

This *Asteroceras* is characterized by the disappearance of the sulci, sometimes already in the inner whorls, which are replaced by two slopes on both sides of the keel (fig. 12). The ribbing is well expressed even on the ventral-lateral part; the ribs are subradiate to slightly prorsiradiate, stronger and thick on the lateral part and slightly arched forward near the slopes. The whorl section is rather compressed for an *Asteroceras*. In the adult stage, the keel becomes blunt and tends to disapear. Consequently the venter is more fastigate. Similar specimens have been described from Adnet (Dommergues et al., 1995, Pl. 5, fig. 11). *A.* gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi (1961), also from Adnet, is clearly different with a subrectangular whorl-section characterized by a large nearly tricarinate ventral area with broad sulci, and a prominent narrow keel. *A suevicum* (Quenstedt) is also a close form, but the ribs are straighter and finer, and less projected forward near the ventro-lateral part.
With 170 mm of diameter the largest specimen is recorded from Eingemauerte (P 7225). Another large specimen was found in Lorüns (fig. 13).

Figure 13: Large *Asteroceras* gr. *saltriensis* (Parona) from Lorüns quarry.

Age and distribution: This species is related with the Stellare Subzone and it occurs in the Tethyan Realm and perhaps in the Pacific province.

Asteroceras aff. *suevicum* (Quenstedt, 1884)

1882-85 *Ammonites obtusus suevicus* Quenstedt, Pl. 20, Fig. 1.
1966 *Asteroceras suevicum* (Quenstedt). — Guerin-Franiatte, Pl. 163-166.
1976 *Asteroceras* (*Asteroceras*) *suevicum* (Quenstedt). — Schlegelmilch, Pl. 18, Fig. 5.
1985 *Asteroceras* cf. *suevicum* (Quenstedt). — Braga, Martin-Algarra & Rivas, Pl. 1, Fig. 5.
1997 *Asteroceras* aff. *suevicum* (Quenstedt). — Corna, Dommergues, Meister & PAGE, Pl. 10, Fig. 1.
1998 *Asteroceras* cf. *suevicum* (Quenstedt). — Blau, Pl. 2, Fig. 13-16; Pl. 14, fig. 6.

The specimen (P2770) from the Fleckenmergel of Sarotlahütte is slightly deformed. It differs from the Lorüns specimen only by a straight rigid and quite spaced ribbing not bent forward on the venter. This feature is well expressed in *A. suevicum* (Quenstedt), a species very close to *A. saltriense* (Parona). Nevertheless, our specimen is only put in affinis with Quenstedt's species mainly due to a more feable expression of the ventral sulci in comparison with the holotype illustred by Guerin-Franiatte (1966, Pl. 163).
Age and distribution: *A. suevicum* (Quenstedt) characterizes the Stellare Subzone and is recorded from both the Euroboreal realm and the Tethyan realm. Not true *A. suevicum* (Quenstedt) are known from Pacific area.

Asteroceras gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi, 1961
pl. 5, fig. 3

? 1927 *Asteroceras retusum* (Reynes). — Schröder, Pl. 10, Fig. 5.
1961 *Asteroceras retusum* (Reynes). — Sacchi-Vialli & Cantaluppi, Pl. 4, Figs. 1-4.
? 1961 *Asteroceras confusum* Spath. — Sacchi-Vialli & Cantaluppi, Pl. 4, Fig. 5.
1993 *Asteroceras* aff. *confusum* Spath. — Meister & Böhm, Pl. 4, Figs. 7, 9, 11.
1995 *Asteroceras* gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi. — Dommergues, Meister & Böhm, Pl. 4, Figs. 6-10; Pl. 5, Figs. 1-10.

The *Asteroceras* from Rothorn (P 1583) is characterized by a quite broard nearly tricarinate ventral area with a prominent siphonal keel and wide sulci. The ribbing is well expressed until the ventro-lateral part and prorsiradiate. Such forms have already been descibed from the Upper Austroalpine Units (Adnet area and ? Bavaria) and named *A.* gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi (see Pl. 5, Fig. 1 and 4 in Dommergues et al., 1995).
Age and distribution: This taxon is again correlated with the Stellare Subzone and its occurance is restricted to the Alps (nothern margin of the Tethys).

Asteroceras aff. *acceleratum* Hyatt, 1889
pl. 7, fig. 2

1889 *Asteroceras acceleratum* Hyatt, Pl. 9, Fig. 4; Pl. 10, Fig. 3.
1966 *Asteroceras acceleratum* Hyatt. — Guerin-Franiatte, Pl. 167 (LT); Pl. 168.
1976 *Asteroceras (Asteroceras) acceleratum* Hyatt. — Schlegelmilch, Pl. 18, Fig. 4.
1997 *Asteroceras acceleratum* Hyatt. — Cassel, Pl. 13, Fig. 5.

We compare a quite involute *Asteroceras* from Rothorn with *A. acceleratum* Hyatt because:
a) its umbilicus becomes quite rapidly narrower during the ontogeny, but the whorl section remains quite massive (fig. 14).
b) the ventral part is characterized by very broard sulci and by a thick median keel.
c) the ribs are thick and more or less spaced; in the inner whorl they are well expressed on the ventral part, but in the outer ones they become blunt on this part.
d) Guerin-Franiatte (1966) counted about 16 ribs per half whorl (D = 106 mm). Our specimen shows the same number at a diameter of 125 mm.
In *A. evolutum* Guerin-Franiatte, only the median keel is pronounced. No sulci or flat bands are visible. *A. margarita* Parona is more compressed with a closer and finer ribbing. *A.* gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi always remains more evolute.
Age and distribution: This species characterizes the Stellare Subzone and is well known in the Euroboreal realm; for the first time it is recorded from a Tethyan area.

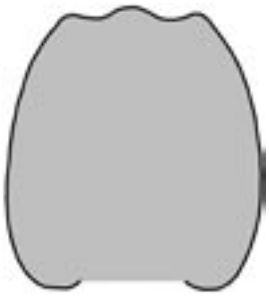

Figure 14: *Asteroceras* aff. *acceleratum* Hyatt whorl section.

Asteroceras aff. *margarita* (Parona, 1896)
pl. 5, fig. 5

1896 *Arietites margarita* Parona, Pl. 5, Fig. 8.
1903 *Asteroceras margarita* (Parona). — Fucini, Pl. 32, Fig. 4, 5.
? 1927 *Asteroceras margarita* (Parona). — Schröder, Pl. 10, Fig. 4.
1936 *Asteroceras* cf. *margarita* (Parona). — Termier, Pl. 23, Fig. 4.
1966 *Asteroceras margarita* (Parona). — Guerin-Franiatte, Pl. 159 (HT); Pl. 160; Pl. 161, Fig. 1, 2.

1966 *Asteroceras* aff. *margarita* (Parona). — Guerin-Franiatte, Pl. 162.
1984 *Asteroceras margarita* (Parona). — Maubeuge, P. 22, Fig. 11.
1986 *Asteroceras* cf. *margarita* (Parona). — Mouterde, Corna, Olivier & Mourier, Pl. 1, Fig. 2; Pl. 2, Fig. 5 (aff.).
? 1991 *Asteroceras* aff. *margarita* (Parona). — Palfy, Pl. 10, Fig. 5.
1994 *Asteroceras* aff. *margarita* sensu Fucini non Parona. — Dommergues,Ferretti & Meister, Pl. 2, Fig. 19.
? 1997 *Asteroceras* aff. *margarita* (Parona). — Palfy & Smith, Pl. 1, Fig. 4.
1998 *Asteroceras* aff. *margarita* (Parona). — Elmi et al., P. 191, Fig. 22.

A specimen with a compressed whorl section (fig. 15), a quite close and fine ribbing and a broad tricarenate outer part is put in affinity with *A. margarita* (Parona). The type mainly differs by a closer ribbing and (?) perhaps a more involute coiling. Our specimen also shows some similarities with the Algerian fauna (Elmi et al., 1998, p. 191, fig. 22).
Age and distribution: Most probably, *A.* aff. *margarita* (Parona) belongs to the Stellare Subzone too; this species is recorded from the North-West European, Mediterranean and Pacific areas.

Figure 15: *Asteroceras* aff. *margarita* (Parona) whorl section.

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

***Epophioceras* gr. *landrioti* (d'Orbigny, 1850)**
pl. 9, fig. 4

1850 *Ammonites Landrioti* d'Orbigny, P. 213.
1879 *Ammonites Landrioti* d'Orbigny. — Reynes, Pl. 29, Fig. 1-5.
1907 *Ammonites Landrioti* d'Orbigny. — Thevenin, Pl. 7, Fig. 4-5.
?1902 *Vermiceras landrioti* (d'Orbigny). — Fucini, Pl. 7, Fig. 1-2.
1955 *Epophioceras landrioti* (d'Orbigny). — Donovan, P. 30.
1966 *Epophioceras landrioti* (d'Orbigny). — Guerin-Franiatte, P. 329, Pl. 217, 218.
1976 *Epophioceras landrioti* (d'Orbigny). — Schlegelmilch, Pl. 20, Fig. 2.
1985 *Epophioceras landrioti* (d'Orbigny). — Braga, Martin-Algarra & Rivas, Pl. 1, Fig. 1.
1998 *Epophioceras landrioti* (d'Orbigny). — Blau, Pl. 2, Fig. 12.

A very serpenticone ammonite from Sarotlatal is attributed to the genus *Epophioceras*. The ribs are coarse, spaced, subradiate to subprorsiradiate and become smooth near the ventral part. The whorl section is subquadrate, a little more high than thick with convex flanks. The venter, with a blunt keel, seems to be less convex than the type in Guerin-Franiatte (1966, pl. 217), but is similar to the specimen illustrated by Schlegelmilch (1976 pl. 20, fig. 2).
E. deciduum (Hyatt) is characterized by very spaced coarse ribbing and a rounded ventral part. The generic attribution of Hyatt's species to either *Epophioceras* or *Echioceras* sensu Getty (1973) is still in discussion.
E. longicella (d'Orbigny), a widespread species too, shows a more clearly prorsiradiate ribbing and seems to be more compressed.
Age and distribution: This species indicates the Stellare Subzone. It is known from other part of the Upper Austroalpine unit (Bayerische Alpen and Adnet) and has a quite ubiquitous distribution in the western Tethys and in the Euroboreal realm.

Genus: *Eparietites* Spath, 1924
Type species: *Arietites tenellus* Simpson in Buckman, 1912.

Three morphologies of *Eparietites* are represented in our collection: one with a quite coarse ribbing put in affinity with *E. denotatus* (Simpson), a second one characterized by a quite finer, short ornamented stage regrouped here in the *E. glaber* Guerin-Franiatte group, and a third one which shows an intermediate habitus is herein attributed to *E. fowleri* (Buckman).

***Eparietites fowleri* (Buckman, 1844)**
pl. 9, fig. 1

1844 *Ammonites fowleri* Buckman, Pl. 12, Fig. 7.
? 1874 *Ammonites fowleri* Buckman. — Buckman, Pl. 45, Fig. 17, 18.
1966 *Eparietites fowleri* (Buckman). — Guerin-Franiatte , Pl. 197, Fig. 1 (HT), 2.
1993 *Eparietites fowleri* (Buckman). — Dommergues, Pl. 3, Fig. 5.
1997 *Eparietites fowleri* (Buckman). — Corna, Dommergues, Meister & Mouterde, Pl. 4, Fig. 1.

We include within *E. fowleri* (Buckman) two compressed *Eparietites* with a well developed, straight, quite fine and close ribbing which seems to persist at least to a diameter of 58 mm. Our samples well correspond to the holotype illustrated by Guerin-Franiatte (1966). *E. denotatus* (Simpson) and *E. impedens* (Young & Bird) are refered to the coarse and more spaced ribbed morphologies.
Age and distribution: This species indicate the Denotatus Subzone (Fowleri Horizon) and was until now known from the Euroboreal realm only.

***Eparietites* aff. *denotatus* (Simpson, 1855) juv.**
pl. 6, figs. 2, 4

1855 *Ammonites denotatus* Simpson, P. 76.
1876 *Arietites impedens* Young & Bird. — Tate & Blake, Pl.

6, Fig. 7.
1912 *Eparietites denotatus* (Simpson). — Buckman, Pl. 67AB.
? non 1923 *Arietites denotatus* Simpson. — Siemiradzki, Pl. 7, Fig. 11.
1961 *Eparietites denotatus* (Simpson). — Dean, Donovan & Howarth, Pl. 66, Fig. 4.
1966 *Eparietites denotatus* (Simpson). — Guerin-Franiatte, Pl. 194; 195, Fig. 1, 2; Pl. 196.
non 1987 *Eparietites denotatus* (Simpson). — Quinzio Sinn, Pl. 4, Fig. 2.

Dommergues (1993) described a wide variability within the *E. fowleri* (Buckman) group, including a pole with a long stage of coarse ribs [*E. denotatus* (Simpson) and *E. impedens* (Youg & Bird)] and a pole with a little shortened, finely and densely ribbed stage [*E. fowleri* (Buckman) s.s.]. If we follow this conception our specimen can also be integrated into *E. fowleri* (Buckman) *sensu* Dommergues (1993). Without stratigraphical support, we prefer to keep this specimen with a coarse and quite spaced ribbing separate and to put it *in affinis*.
Age and distribution: *E. denotatus* (Simpson) characerizes the Denotatus Subzone (Denotatus Horizon); classicaly known in the Euroboreal realm, this species is recorded for the first time from the northern margin of the Tethys.

Eparietites glaber Guerin-Franiatte, 1966
pl. 6, fig. 3; pl. 9, fig. 3

1966 *Eparietites glaber* Guerin-Franiatte, Pl. 198, Fig. 1, 2.
1990 *Eparietites* aff. *glaber* Guerin-Franiatte. — Dommergues, Meister & Mettraux, Pl. 198, Fig. 1, 2.
1993 *Eparietites glaber* Guerin-Franiatte. — Dommergues, Pl. 3, Fig. 2, 3.
1995 *Eparietites glaber* Guerin-Franiatte. — Dommergues, Meister & Böhm, Pl. 7, Fig. 1.
1998 *Eparietites glaber* Guerin-Franiatte. — Blau, Pl. 2, Fig. 9-11.

The large, quite compressed specimen from Lorüns (bed 7 bottom) shows a particulary coarse ribbing in the inner whorls and conversely a strong smoothing of the ornamentation on the outer whorl. The ventral area is subfastigate. The keel is thick and prominent, lined by two quite flat bands. This specimen is very close to the recently described *Eparietites glaber* Guerin-Franiatte from Adnet which differs nevertheless by its finer ribbing on the inner whorls. The juvenile ornamentation and the size of our specimen show an intermediate morphology between *E. collenoti* (d'Orbigny) and true *E. glaber* Guerin-Franiatte. Indeed the ornamentation disappears near 4 - 7 cm of diameter. In comparison to *E.* aff. *glaber* Guerin-Franiatte from the Median Prealps the smooth stage appears later. Some other small specimens from Lorüns show a more classic habitus of the ornamentation with a finer and closer ribbing and an earlier smoothing of the ornamentation.
Age and distribution: This species indicates the upper part of the Denotatus Subzone (Glaber Horizon). Its distribution is restricted to the borders of the Paris Basin and to the Alps (Euroboreal and Tethyan realms).

Family: Oxynoticeratidae Hyatt, 1875

Genus: *Oxynoticeras* Hyatt, 1875
Type species: *Ammonites oxynotus* Quenstedt, 1845.

Oxynoticeras gr. *oxynotum* (Quenstedt, 1845)
pl. 9, figs. 5, 7

1845 *Ammonites oxynotus* Quenstedt, Pl. 5, Fig. 11.
1856 *Ammonites oxynotus* Quenstedt. — Hauer, Pl. 13, Fig. 4-10.
1882/85 *Ammonites oxynotus* Quenstedt. — Quenstedt, Pl. 22, Fig. 28-36, 43, 44.
1956 *Oxynoticeras oxynotum* (Quenstedt). — Söll, Pl. 17, Fig. 1-10; Pl. 18, Fig. 1.
1961 *Oxynoticeras oxynotum* (Quenstedt). — Dean, Donovan & Howarth, Pl. 66, Fig. 5; Pl. 67, Fig. 3.
1977 *Oxynoticeras oxynotum* (Quenstedt). — Urlichs, Pl. 4, Fig. 3.
1984 *Oxynoticeras oxynotum* (Quenstedt). — Corna, Pl. 11, Fig. 5.
1985 *Oxynoticeras oxynotum* (Quenstedt). — Comas Rengifo, Pl. 2, Fig. 6 with synonymy.
1987 *Oxynoticeras oxynotum* (Quenstedt). — Dommergues & Meister, Pl. 1, Fig. 1-6, 8.
1993 *Oxynoticeras oxynotum* (Quenstedt). — Dommergues, Pl. 4, Fig. 5.
1995 *Oxynoticeras oxynotum* (Quenstedt). — Dommergues, Meister & Böhm, Pl. 9, Fig. 2.

All specimens from Vorarlberg have been collected in the Lorüns quarry. In comparison to the recently described sample from Adnet (Dommergues et al. 1995, Pl. 9, Fig. 2) they show a finer ribbing.
A larger *Oxynoticeras*, with a diameter of 120 mm, is characterized by a fine ribbing, well expressed near the umbilicus and on the outer part where the ribs are bent forward. The umbilicus is narrow, but less than by *O.* aff. *soemanni* (Dumortier), a smooth species which is also descibed in this paper.
The second specimen (D = 60mm), is a finely ribbed form with perhaps a little broader whorl section than the holotype (Dean et al., 1961, pl. 66, fig. 5).
Age and distribution: Index species of the Oxynotum Subzone. This taxon is widely spread in the Euroboreal realm and in the northern margin of the Tethys (Upper Austroalpine units).

Oxynoticeras aff. *soemanni* (Dumortier, 1867)
pl. 9, fig. 2

1867 *Ammonites soemanni* DUMORTIER, Pl. 40, Figs. 2-4; Pl. 43, Figs. 1, 2.
1879 *Oxynoticeras soemanni* (DUMORTIER). — REYNES, Pl. 45, Figs. 44-46.
1901 *Oxynoticeras soemanni* (DUMORTIER). — FUCINI, Pl. 1, Fig. 1.
1914 *Oxynoticeras soemanni* (DUMORTIER). — PIA, Pl. 6, Fig. 25; Pl. 10, Fig. 4.
? non 1991 *Oxynoticeras soemanni* (DUMORTIER). — COPE, Pl. 4, Fig. 4.
1995 *Oxynoticeras* aff. *soemanni* (DUMORTIER). — DOMMERGUES, MEISTER & BÖHM, Pl. 7, Figs. 3, 4.

The fragmentary suture line indicates without doubt the genus *Oxynoticeras*. This very oxycone and smooth form has already been recorded in the Upper Austroalpine from the Rotkalk of Adnet area (PIA, 1914; DOMMERGUES et al., 1995). On the contrary, our specimen is derived from the more detritic facies of the Fleckenmergel.
Other smooth forms like *O. inornatum* (PIA) or *O. simpsoni* (SIMPSON) show a broader umbilicus than DUMORTIER's species. *O. soemanni* (DUMORTIER) displays a habitus between these forms and the true *Radstockiceras* which presents a much narrower umbilicus, very compressed sides and a more complex suture line.
Age and distribution: The total range of this species is not well known. It seems to correspond to an interval from the ? upper part of the Oxynotum Zone up to the middle part of the Raricostatum Zone. The species is recorded from the Tethys (mainly from the northern margin) and from France in the Euroboreal realm.

Genus: *Gleviceras* BUCKMAN, 1918
Type species: *Gleviceras glevense* BUCKMAN, 1918.

Gleviceras doris (REYNES) sensu PIA, 1914
pl. 9, fig. 6

non 1879 *Ammonites doris* REYNES, Pl. 41, Fig. 13-15.
1914 *Oxynoticeras doris* (REYNES). — PIA, Pl. 1, Fig. 1; Pl. 6, Fig. 1; pl. 8, Fig. 1.
? 1987 *Gleviceras* aff. *doris* (REYNES). — CECCA, DOMMERGUES, MOUTERDE & PALLINI, Pl. 2, Fig. 1.
1995 *Gleviceras doris* (REYNES) sensu PIA. — DOMMERGUES, MEISTER & BÖHM, Pl. 9, Fig. 1.

The broard specimen from Lorüns is characterized by a quite strong and coarse ribbing associated with a thick whorl section, by a very rough umbilical edge and a large and flat umbilical wall. The ventral area is slightly fastigate (Text-Fig. 16). From the Adnet area we recently described a similar form (DOMMERGUES et al., 1995, Pl. 9, Fig. 1). *G. grenoughi* (SOWERBY) sensu HAUER, also known from Adnet (ibidem, Pl. 9, Fig. 3), is a smoother and more compressed species. On the contrary, *G. doris* (REYNES) shows a more rounded venter and more parallel flanks.

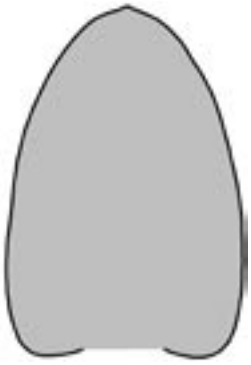

Figure 16: *Gleviceras doris* (REYNES) sensu PIA whorl section.

Age and distribution: The range of *G. doris* (REYNES) sensu PIA corresponds to a part of the Raricostatum Zone and its distribution is restricted to the Mediterranean Tethys.
Remark: Several oxycone ornamented ammonites, not well preserved, have been collected in Lorüns bed 53 (146). Because of their quite opened umbilicus and relatively rounded venter they are refered to *Gleviceras* with some affinities with the *G. doris* (REYNES) group, mainly due to the quite coarse ribbing [*Gleviceras* aff. *doris* (REYNES) *sensu* PIA].

Gleviceras gr. *subguibalianum* (PIA, 1914)
pl. 10, figs. 1, 2, 4

1881 *Amaltheus guibalianus* d'ORBIGNY. — WRIGHT, Pl. 45, Fig. 1, 2, 6, 7 (only).
1899 *Oxynoticeras* cf. *victoris* DUMORTIER. — HUG, Pl. 8, Fig. 2.
1914 *Oxynoticeras subguibalianum* PIA, Pl. 5, Fig. 5; Pl. 6, Fig. 6.
1958 *Oxynoticeras* (*Gleviceras*) *subguibalianum* PIA. — DONOVAN, Pl. 1.
1985 *Gleviceras subguibalianum* (PIA). — PRINZ, Pl. 4, Fig. 6.
1987 *Gleviceras* aff. *subguibalianum* (PIA). — DOMMERGUES & MEISTER, Pl. 1, Fig. 9, 12, 13.
1989 *Gleviceras* aff. *subguibalianum* (PIA). — DOMMERGUES & MEISTER, Pl. 1, Fig. 1.
1990 *Gleviceras subguibalianum* (PIA). — DOMMERGUES, MEISTER & METTRAUX, Pl. 4, Fig. 1.
1991 *Gleviceras subguibalianum* (PIA). — SCHLATTER, Pl. 8, Fig. 6, 5; Pl. 9, Fig. 1.
non 1991 *Gleviceras* aff. *subguibalianum* (PIA). — SCHLATTER, Pl. 9, Fig. 3.
? 1991 *Gleviceras* cf. *subguibalianum* (PIA). — PALFY, Pl. 13, Fig. 2, 3.
1991 *Gleviceras subguibalianum* (PIA). — DOMMERGUES & MEISTER, Pl. 1, Fig. 8.
1993 *Gleviceras subguibalianum* (PIA). — DOMMERGUES, Pl. 4, Fig. 7.
1997 *Gleviceras subguibalianum* (PIA). — CASSEL, Pl. 9, Fig. 1.

Some specimens from the Fleckenmergel facies belong to a quite compressed *Gleviceras* with slightly flexuous and close ribbing. Considering these characters, they are regrouped into *G. subguibalianum* (PIA), a well known species from the western Alps (Subbriançonnais Alpine unit). *G. rigidum* (PIA), a very close species, is more involute and more compressed with more (?) rigid ribs. However, due to the different size of the types of *G. subguibalianum*

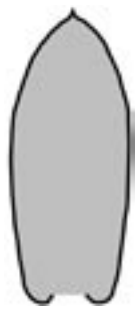

Figure 17: *Gleviceras* aff. *boucaultianum* (Dumortier) sensu Pia whorl section.

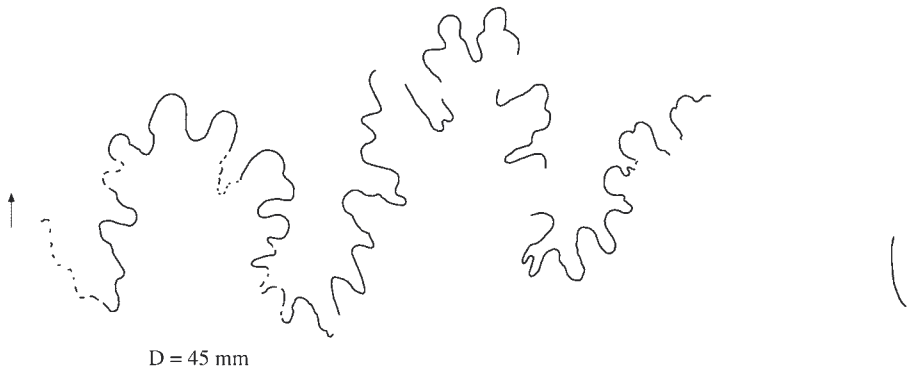

Figure 18: *Gleviceras* aff. *boucaultianum* (Dumortier) sensu Pia suture line.

(Pia) and *G. rigidum* (Pia) the comparisons at different ontogenetic stages does not allow a rigorous determination and it cannot be exluded to consider both species as synonymes. *G. guibalianum* (d'Orbigny) shows a blunt umbilical edge and the umbilical wall is rounded and short; moreover the primary ribs are more spaced and the flanks remain more convex.

Age and distribution: *G. subguibalianum* occurs in the major part of the Raricostatum Zone and is widely distributed (Pacific area, Tethys and European archipelago).

Gleviceras aff. *boucaultianum* (Dumortier) sensu Pia, 1914

pl. 10, figs. 3, 5

1914 *Oxynoticeras boucaultianum* Dumortier. — Pia, Pl. 2, Fig. 1; Pl. 6, Fig. 2; Pl. 8, Fig. 4 pars, non c; Pl. 9, Fig. 7.

Our specimens are very compressed (fig. 17) and quite smooth ammonites (partly due to bad preservation). A ventro-lateral ribbing is hardly visible on only one small ammonite. In comparison with the illustrations of Pia (1914) the suture line confirms the systematic position of that fauna in *Gleviceras* (fig. 18). *G. lotharinghium* (Reynes) or *G. boucaultianum* (Dumortier) sensu Pia are quite smooth taxa to which our samples may correspond. However, in Reynes's species the whorls remain clearly broader than in our material. Other compressed taxa like *G. rigidum* (Pia) or *G. victoris* (Dumortier) exhibit a well expressed ornamentation.

Our specimens also differ from the other species described here especially in the suture line which seems to be less complex in *Gleviceras boucaultianum* (Dumortier) sensu Pia (1914, Pl. 8, Fig. 4).

Age and distribution: The range of *G.* aff. *boucaultianum* (Dumortier) sensu Pia is not known with precision but corresponds to the Upper Sinemurian (Raricostatum Zone). It is only known from Upper Austroalpine units.

Family: Echioceratidae Buckman, 1913

Genus *Echioceras* Bayle, 1878

Type species: *Ammonites raricostatum* Zieten, 1831.

Echioceras gr. *quenstedti* (Schafhäutl, 1847)

pl. 10, figs. 6-8; pl. 11, figs. 1, 2

1847 *Ammonites quenstedti* Schafhäutl, Pl. 8, Fig. 1; Pl. 15, Fig. 9.
1851 *Ammonites quenstedti* Schafhäutl, Pl. 17, Fig. 24 (only).
1867 *Ammonites raricostatus* Zieten. — Dumortier, Pl. 25, Fig. 4, 5.
1914 *Echioceras rhodanicum* Buckman, P. 96c.
1914 *Echioceras quenstedti* (Schafhäutl). — Buckman, P. 96c.
1973 *Echioceras quenstedti* (Schafhäutl). — Getty, Pl. 2, Fig. 7.
1987 *Echioceras* gr. *quenstedti* (Schafhäutl). — Dommergues & Meister, Pl. 2, Fig. 7, 9-11.
1989 *Echioceras* gr. *quenstedti* (Schafhäutl). — Dommergues & Meister, Pl. 1, Fig. 4-17.
1990 *Echioceras* cf. *quenstedti* (Schafhäutl). — Dommergues, Meister & Mettraux, Pl. 4, Fig. 6.
1991 *Echioceras* cf. *quenstedti* (Schafhäutl). — Dommergues & Meister, P. 308.
1998 *Echioceras quenstedti* (Schafhäutl). — Blau, Pl. 4, Fig. 1, 2.
? 2000 *Paltechioceras raricostatum quenstedti* (Schafhäutl). — Schlögl, Aubrecht & Tomasovych, P. 48, Fig. 3.

These specimens of *Echioceras* develop a subcircular whorl section, a slightly depressed venter with a feable keel and no sulci. The ribs are quite spaced and sharp, hardly more sharper on the ventro-lateral part. Whereas the ribbing can be very fine and close on the inner whorls (see Dommergues & Meister, 1989, Pl. 1, Fig. 4 à 17), the rib density rapidly decreases during ontogeny. *E. rhodanicum* Buckman, a contemporeanous species is more densely ribbed.

Age and distribution: This species characterizes the Quenstedti Horizon of the Raricostatum Zone (Blau & Meister, 2000) and is mainly known from the Alps (Subbriançonnais and Upper Austroalpine).

Genus *Paltechioceras* Buckman, 1924

Type species: *Paltechioceras elicitum* Buckman, 1924.

Paltechioceras charpentieri (Schafhäutl, 1847)
pl. 11, figs. 4, 6

1847 *Ammonites Charpentieri* Schafhäutl, P. 810.
1851 *Ammonites Charpentieri* Schafhäutl, Pl. 16, Fig. 22 (only).
1973 *Leptechioceras charpentieri* (Schafhäutl). — Getty, Pl. 2, Fig. 6.
1987 *Paltechioceras charpentieri* (Schafhäutl). — Schlatter, Fig. 1a.
1998 *Leptechioceras charpentieri* (Schafhäutl). — Blau, Pl. 6, Fig. 2.
1998 *Leptechioceras* cf. *charpentieri* (Schafhäutl). — Blau, Pl. 6, Fig. 1, 4.

An Echioceratidae from Oberzalim is characterized by an intermediate adult morphology between the genera *Leptechioceras* and *Paltechioceras*. The ventral bands near the keel are broad and more or less flat. The ventral area is more deflated than in *Leptechioceras meigeni* (Hug) and less rounded than in *Paltechioceras favrei* (Hug). The ribbing is clearly prorsiradiate and quite spaced. All these features well correspond to *P. charpentieri* (Schafhäutl) (see Schlatter 1987).
Age and distribution: In Vorarlberg, this species was for the first time found in the Rotkalk facies. It was also recorded in situ from the Lienz Dolomites where it occurs in association with the first *L. meigeni* (Hug) (Blau, 1998). The species characterizes the Charpentieri Horizon (Macdonnelli Subzone) (Blau & Meister, 2000). It is mainly known from the Alps (Subriançonnais and Upper Austroalpine units).

Paltechioceras favrei (Hug, 1899)
pl. 11, figs. 3, 7, 8

1899 *Arieticeras favrei* Hug, Pl. 12, Fig. 5, 6.
1958 *Paltechioceras favrei* (Hug). — Donovan, Pl. 2, Fig. 7.
1967 *Echioceras favrei* (Hug). — Mouterde & Rosset, P. 134, Fig. 2.
1967 *Echioceras* cf. *favrei* (Hug). — Mouterde & Rosset, P. 134, Fig. 3.
? 1974 *Echioceras favrei* (Hug). — Suarez Vega, Pl. 4A, Fig. 3.
? 1983 *Paltechioceras favrei* (Hug). — Blau, Pl. 4, Fig. 1-3.
non 1987 *Paltechioceras boehmi* var. *favrei* (Hug). — Dommergues & Meister, Pl. 4, Fig. 3 (= *L. meigeni* (Hug) in Dommergues, Meister & Mettraux, P. 319.
1991 *Paltechioceras favrei* (Hug). — Schlatter, Pl. 7, Fig. 3-5.
1983 *Paltechioceras favrei* (Hug). — Blau, Pl. 5, Fig. 1-7, 9-11.
2002 *Paltechioceras* cf. *favrei* (Hug). — Hillebrandt, Pl. 11, Fig. 6-8.

In the literature, *P. favrei* (Hug) is often put into the synonymy with *P. boehmi* (Hug). However, the morphology of *P. favrei* (Hug) already shows some affinities with the genus *Leptechioceras*. The difference to the underlying *P. boehmi* (Hug) is essentially based on the development of a compressed whorl section - mainly in the ventral part - in the adult stage. On the other hand the rib density decreases. Some adult specimens sometimes show a smoothing of the body chamber. Supported by stratigraphy (Blau, 1998), these differences are sufficient to consider *P. favrei* (Hug) as an independent species.
Age and distribution: In Lienz Dolomites, *P. favrei* (Hug) is present in higher beds than *P. boehmi* (Hug). The species characterizes the Favrei Horizon (Raricostatum Subzone) (Blau & Meister, 2000). It has been recorded in the Alps (Subriançonnais and Upper Austroalpine units), Europe and America (e.g. Hillebrandt, 2002).

Paltechioceras gr. *rothpletzi* (Böse, 1894)
pl. 11, fig. 12

1894 *Arietites rothpletzi* Böse, Pl. 56, Fig. 5, 6.
1902 *Vermiceras rothpletzi* Böse. — Fucini, Pl. 12, Fig. 12.
? 1923 *Vermiceras rothpletzi* Böse. — Siemiradzki, Pl. 7, Fig. 6.
non ? 1956 *Vermiceras* aff. *rothpletzi* (Böse). — Erben, Pl. 36, Fig. 8, 9.
? 1965 *Paltechioceras rothpletzi* (Böse). — Bremer, Pl. 13, Fig. 4.
? 1965 *Vermiceras rothpletzi* (Böse).— Andrusov, Pl. 49, Fig. 3.
1981 *Paltechioceras rothpletzi* (Böse). — Smith, Pl. 5, Fig. 5, 6; Pl. 6, Fig. 1.
1985 *Paltechioceras* cf. *rothpletzi* (Böse). — Prinz, Pl. 4, Fig. 3.
? 1987 *Paltechioceras* (?) aff. *rothpletzi* (Böse). — Cecca, Dommergues, Mouterde & Pallini, Pl. 1, Fig. 5, 6.
1991 *Paltechioceras* cf. *rothpletzi* (Böse). — Palfy, Pl. 13, Fig. 5.
1994 *Paltechioceras* aff. *rothpletzi* (Böse). — Dommergues, Ferretti & Meister, Pl. 3, Fig. 12-16.

The specimen from Rothorn (P 2452) is very evolute and very densely ribbed, mainly in the inner whorls. The ribs are prorsiradiate, sometimes slightly undulated and very rarely irregular as in *P. oosteri* (Dumortier). This form belongs to the densely and prorsiradiate ribbed *Paltechioceras* which include a variety of species.
P. rothpletzi (Böse) shows almost the same arrangement of the ribbing but with higher ribdensity throughout the complete ontogeny similar to *P. liciense* Blau, a very close species.
P. oosteri (Dumortier) shows coarser ribs with more irregularity in the ornament. *P. hierlatzicum* (Hauer) develops this strange ribbing too, and in the very inner whorls the ribs are more spaced.
P. bavaricum (Böse) seems to be more involute with an a little more spaced ribbing throughout the complete ontogeny. In *P. meisteri* Blau the ribbing remains more spaced too, but it is still more rigid and prorsiradiate.
The *P.* aff. *rothpletzi* (Böse) recently described from the

Central Apennine show a more close ribbing habitus close to *P. liciense* (Blau 1998).
Age and distribution: These densely ribbed *Paltechioceras*, *P. rothpletzi* (Böse) and adjoining species are well represented in the Tethyan realm and in the Pacific area. The species characterizes the Rothpletzi Horizon (upper Raricostatum Subzone) (Blau & Meister, 2000).

Paltechioceras gr. *tardecrescens* (Hauer, 1856)
pl. 11, figs 10, 11

* 1856 *Ammonites tardecrescens* Hauer, P. 20; Pl. 3, Figs. 10-12.
1879 *Ammonites tardecrescens* Hauer. — Reynes, Pl. 13, Fig 8-10.
1973 *Paltechioceras tardecrescens* (Hauer). — Getty, Pl. 4, Fig. 2a, b.
1981 *Paltechioceras tardecrescens* (Hauer). — Smith, Pl. 6, Figs. 2, 3.
? 1981 *Paltechioceras tardecrescens* (Hauer). — Smith, Pl. 6, Fig. 4.
1985 *Paltechioceras* (*paltechioceras*) cf. *tardecrescens* (Hauer). — Comas Rengifo, Pl. 2, Fig. 3.
1989 *Paltechioceras tardecrescens* (Hauer). — Dommergues & Meister, Pl. 4, Figs. 1, 3.
1990 *Paltechioceras* gr. *tardecrescens* (Hauer) - *insigne* (Trueman & Williams). — Dommergues & Meister, Pl. 1, Figs. 8-10; Pl. 2, Figs. 1, 4.
1991 *Paltechioceras tardecrescens* (Hauer). — Schlatter, Pl. 6, Figs. 1-3.
1992 *Paltechioceras tardecrescens* (Hauer). — Dommergues & Meister, Pl. 1, Figs. 27-29.
1992 *Paltechioceras tardecrescens* (Hauer). — Dommergues & Meister, P. 223, Figs. 5.1-4.
1993 *Paltechioceras tardecrescens* (Hauer). — Dommergues, Pl. 8, Fig. 5.
1993 *Paltechioceras tardecrescens* forme *nobile* Trueman & Williams. — Dommergues, Pl. 8, Fig. 56.
1994 *Paltechioceras tardecrescens* (Hauer). — Rakus, Pl. 5, Fig. 4. 1998 *Paltechioceras tardecrescens* (Hauer). — Blau, Pl. 10, Figs. 1-6, 9; Pl.14, Fig. 4.
non 2000 Paltechioceras sp. ? tardecrescens (Hauer) — Schlögl, Aubrecht & Tomasovych, Pl. 1, Fig. 2.
2000 *Paltechioceras tardecrescens* (Hauer). — Blau, Meister, Ebel & Schlatter, P. 273, Figs. 11.1, 2, 3, 5.
2002 *Paltechioceras* cf. *tardecrescens* (Hauer). — Hillebrandt, Pl. 11, Fig. 23; Pl. 12, Figs. 1-10.

The specimen from Goppelspitze (P. 13392) is a true *Paltechioceras* with well expressed sulci and a dense ribbing on the inner whorls which is a little more, but regularly spaced on the intermediate and adult stages. In spite of the deformation, on our specimen the ribs seem to be radiate to slightly prorsiradiate. It belongs to the late evolute *Paltechioceras* with a quite compressed tricarinate whorl section. In *P. insigne* Trueman & Williams the ribs appear more arched (a little concave) on the flanks.

A large crushed specimen from Schröcken (P 7080) is very close to the illustration of Schlatter (1991, Pl. 6, Fig. 3) and of Dommergues & Meister (1990, Pl. 2, Fig. 1).
Age and distribution: The species indicates everywhere the Aplanatum Subzone and the top of the Sinemurian. It is quite ubiquitous.

Genus *Leptechioceras* Buckman, 1923
Type species: *Ammonites macdonnelli* Portlock, 1843.

Leptechioceras gr. *meigeni* (Hug, 1899)
pl. 11, figs. 5, 9

1867 *Ammonites Nodotianus* d'Orbigny. — Dumortier, Pl. 24, Fig. 3-4.
1899 *Arietites meigeni* Hug, Pl. 11, Fig. 2, 3.
1914 *Echioceras meigeni* (Hug). — Buckman, P. 96c.
1914 *Echioceras hugi* Buckman, P. 96c.
1925 *Leptechioceras hugi* (Buckman). — Trueman & Williams, P. 730.
1931 *Arietites* (*Echioceras*) *nodotianus meigeni* Hug. — Andrusov, Pl. 8, Fig.5.
1958 *Paltechioceras* cf. *favrei* Donovan, Pl. 2, Fig. 7.
1958 *Leptechioceras meigeni* (Hug). — Donovan, Pl. 2, Fig. 1, 4.
1967 *Echioceras* cf. *meigeni* Hug. — Mouterde & Rosset, Pl. 1, Fig. 5.
1973 *Leptechioceras meigeni* (Hug). — Getty, P. 12.
1980/81 *Leptechioceras* cf. *hugi* (Buckman). — Fauré, Pl. 1, Fig. 1.
aff. 1987 *Leptechioceras meigeni* (Hug). — Schlatter, Pl. 1, Fig. 4
1987 *Leptechioceras meigeni* (Hug). — Dommergues & Meister, Pl. 4, Fig. 6-9; Pl. 5, Fig. 7.
1989 Leptechioceras meigeni (Hug). — Dommergues & Meister, Pl. 3, Fig. 3, 4.
1990 Leptechioceras meigeni (Hug). — Dommergues & Meister, PL. 1, Fig. 4-6.
1991 *Leptechioceras meigeni* (Hug). — Schlatter, Pl. 4, Fig. 12; Pl. 5, Fig. 1.
1991 *Leptechioceras* cf. *meigeni* (Hug). — Schlatter, Pl. 5, Fig. 2.
? 1991 *Leptechioceras* aff. *meigeni* (Hug). — Schlatter, Pl. 5, Fig. 3.
1993 *Leptechioceras* (*Leptechioceras*) *meigeni* (Hug). — Dommergues, Pl. 9, Fig. 1-2.
1993 *Leptechioceras* gr. *meigeni* (Hug). — Meister & Böhm, Pl. 4, Fig. 13.
1997 *Leptechioceras* (*Leptechioceras*) *meigeni* (Hug). — Corna, Dommergues, Meister & Mouterde, Pl. 5, Fig. 11.
1998 *Leptechioceras meigeni* (Hug). — Blau, Pl. 6, Fig. 3, 5-15; Pl. 7, Fig. 1-11; Pl. 8, Fig. 1-8.
2000 *Leptechioceras meigeni* (Hug). - Blau, Meister, Ebel & Schlatter, P. 264, Fig. 5-2; P. 265, Fig. 6-2,4.

Our Echioceratidae possesses an ogival and keeled, com-

pressed whorl section without sulci. These features are characteristic of the genus *Leptechioceras*. The ribs are rectiradiate to prorsiradiate and quite spaced. Well marked in the middle and lower flanks, they become evanescent on the ventrolateral part.

L. subplicatum (Trueman & William) shows a still broader whorl section, which is more rounded near the venter. Moreover, the keel is bordered with two flat bands. *L. subplicatum* (Trueman & William) seems to be a little more evolute than *L. meigeni* (Hug). *L. planum* (Trueman & William), a very evolute ammonite, shows - mainly on the inner whorls - a transitional morphology between *Paltechioceras* and *Leptechioceras*. Like *L. subplicatu*m (Trueman & William) its ventro-lateral part is not compressed.

Age and distribution: This species characterizes the Macdonnelli Subzone (Meigeni Horizon). It is known only from the Euroboreal realm and the nothern margin of the Tethys (Upper Austroalpine unit).

Superfamily: Eoderoceratoidea Spath, 1929
Family: Eoderoceratidae Spath, 1929

Genus: *Eoderoceras* Spath, 1925
Type species: *Deroceras bispinigerum* Buckman, 1918.

***Eoderoceras* gr. *armatum* (Sowerby, 1815)**
pl. 12, fig. 4

1815 *Ammonites armatus* Sowerby, P. 215, Pl. 95.
1855 *Ammonites miles*. — Simpson, P. 65.
1842-51 *Ammonites armatus* Sowerby. — d'Orbigny, P. 270, Pl. 78.
? pars 1858 *Ammonites armatus* Sowerby. — Chapuis, Pl. 4, Fig. 4c (non a, b)
1882-85 *Ammonites armatus* Sowerby. — Quenstedt, Pl. 23, Fig. 16-18.
1869 *Ammonites armatus* Sowerby. — Dumortier, P. 59, Pl. 8, Fig. 1- 2.
1878-86 *Aegoceras armatum* (Sowerby). — Wright, Pl. 28, Fig. 1-5.
? 1878-86 *Aegoceras armatum* (Sowerby). — Wright, Pl. 29, Fig. 6.
1879 *Ammonites armatus* Sowerby. — Reynes, Pl. 45, Fig. 43, Pl. 50, Fig. 9,13.
pars 1899 *Aegoceras armatum* (Sowerby). — Hug, P. 25, Pl. 7, Fig. 4.
? 1909 *Deroceras armatum* (Sowerby). — Rosenberg, P. 264, Pl. 4 (13), Fig. 6.
1911 *Deroceras miles* (Simpson). — Buckman, Pl. 44, Fig. 1-2 (Holotype).
non 1920 *Deroceras* aff. *armato* (Sowerby). — Krumbeck, P. 196, Pl. 17, Fig. 16.
1925 *Deroceras obesum* nov. sp. — Spath, P. 139, 170, Fig. 2h.
1926 *Deroceras eusculptum* nov. sp. — Lang & Spath, P. 175, Pl. 10, Fig. 3.
1927 *Deroceras armatum* (Sowerby). — Schröder, P. 213, Pl. 12, Fig. 1
1950 *Eoderoceras postarmatum*. — Hoffmann, P. 92, Pl. A, Fig. 4 (with synonymy).
1958 *Eoderoceras armatum* (Sowerby). — Donovan, P. 32, Pl. 3, Fig. 4-5.
1963 *Eoderoceras armatum* (Sowerby). — Maubeuge, P. 16, Pl. 4, Fig. 1.
? 1963 *Eoderoceras armatum* (Sowerby). — Maubeuge, P. 16, Pl. 2, Fig. 1.
1963 *Eoderoceras miles* (Simpson). — Maubeuge, P. 17, Pl. 1, Fig. 1, Pl. 4, Fig. 3.
1963 *Eoderoceras* cf. *miles* (Simpson) var. *postarmatum* Hoffmann. — Maubeuge, P. 19, Pl. 1, Fig. 3,Pl. 3, Fig. 2.
1965 *Eoderoceras* aff. *miles* (Simpson). — Zeiss, Pl. 2, Fig. 4.
? 1977 *Eoderoceras* cf. *armatum* (Sowerby). — Wiedenmayer, P. 57, Pl. 12, Fig. 14.
1984 *Eoderoceras* cf. *miles* (Simpson) var. *postarmatum* Hoffmann. — Maubeuge, P. 45, Fig. 30.
1991 *Eoderoceras miles* (Simpson). — Schlatter, P. 60, Pl. 13, Fig. 1-3, 5.
1991 *Eoderoceras* cf. *miles* (Simpson). — Schlatter, P. 61, Pl. 13, Fig. 4.
1991 *Eoderoceras postarmatum* Hoffmann. — Schlatter, P. 61, Pl. 13, Fig. 6.
1993 *Eoderoceras armatum* (Sowerby). — Dommergues, P. 145, Pl. 10, fig. 16.
1998 *Eoderoceras armatum* (Sowerby). — Blau, Pl. 11, Fig. 4.
2000 *Eoderoceras armatum* (Sowerby). — Blau, Meister, Ebel & Schlatter, P. 263, Fig 4-1 to 5; P. 264, Fig. 5-1,3,5; P. 265, Fig. 6-1.

Our specimen is very close to *E. armatum* (Sowerby) as described by Schröder (1927, pl. 12, fig. 1). It is characterized by serpenticone, rather smooth inner whorls [*Tubellites* stage sensu Dommergues, 1993)] until 1 cm of diameter, followed by an ornamented stage with coarse simple ribs ending in latero-ventral spines, and a secondary lateral ribbing which tends to cover all. The slightly arched venter bears a fine, regular, close ribbing. On the intermediate and outer whorls the primary ribs become evanescent.

A small corroded Eoderoceratidae (D = 20mm) from Lorüns is here considered as the inner whorls of *Eoderoceras* (*Eoderoceras* sp. juv.).

This quite long ranging and rather rare genus is not very easy to identify at species level, which is especially true for *E. armatum* (Sowerby) and *E. miles* (Simpson).

Because of the loss of the type of *E. armatum* (Sowerby) and the poor figure of Sowerby, *E. miles* (Simpson), a later described species, is more commonly used in literature, specially in NW Germany.

According to Hoffmann (1950) *E. armatum* (Sowerby) differs from *E. miles* (Simpson) in being higher, more densely ribbed and having a longer smooth stage. *E. armatum* (Sowerby) is situated below the Raricostatoides

Zone whereas *E. miles* (Simpson) is recorded from the Middle and Upper Raricostatum Zone. For us, these two species are very close and moreover their variability is not well known. The differences, if there are differences at all, probably record merely the intraspecific variability.
Moreover the ontogeny of *E. armatum* (Sowerby) is well discussed in a recent paper by Blau et al. (2000) and we follow herein their taxonomic position: *E. armatum* (Sowerby), *E. miles* (Simpson) and *E. postarmatum* Hoffmann are conspecific.
Age and distribution: *E. armatum* (Sowerby) including *E. miles* (Simpson) (see Blau et al., 2000) has a long range from the Densinodulum Zone until the Aplanatum Subzone. This species is mainly known from the Euroboreal realm and partly from the northern margin of the Tethys (Upper Austroalpine units).

Genus *Microderoceras* Hyatt, 1871
Type species: *Ammonites birchi* Sowerby, 1820.

***Microderoceras* aff. *gigas* (Quenstedt, 1883)**
pl. 13, fig. 1

1882/85 *Ammonites birchii gigas* Quenstedt, Pl. 18, Fig. 13.
1928 *Microderoceras gigas* (Quenstedt). — Buckman, Pl. 762.
1993 *Microderoceras* aff. *gigas* (Quenstedt). — Meister & Böhm, Pl. 3, Fig. 3.
1995 *Microderoceras* aff. *gigas* (Quenstedt). — Dommergues, Meister & Böhm, Pl. 8, Fig. 2.

The specimen from Spullersee (P. 1554) well corresponds to the fauna from Adnet (Meister & Böhm, 1993; Dommergues et al., 1995). It is a large, very evolute ammonite (D = 150 mm) characterized by a homogeneous, regular, and persistent ornamentation with widely spaced, coarse, bituberculated ribs. No lateral secondary ribbing can be observed.
Age and distribution: In the Jura Mountains this species is associated with *Asteroceras* (Corna, 1985) and in Salzburg with *Gleviceras*. At the present time the total range includes the Obtusum Zone up to the lower (?) part of the Raricostatum Zone. This rare species is recorded from the Euroboreal realm and from the northern margin of the Tethys (Upper Austroalpine units).
A juvenile specimen from Lorüns, illustrated herein (Pl. 12, Fig. 2), is attributed to *Microderoceras* sp.

***Paramicroderoceras* cf. *hungaricum* (Geczy, 1976)**
pl. 12, fig. 7

1976 *Hyperderoceras hungaricum* Geczy, Pl. 10, Fig. 1-3.
? non 1982 *Hyperderoceras hungaricum* Geczy. — Venturi, P. 46, Fig. 47.

This bituberculate Eoderoceratidae is attributed to *Paramicroderoceras hungaricum* Geczy with which it shares - on the intermediate and outer whorls - an elliptic whorl section and a special segmentary ornament. The latter is a broad segmentary-like ornamentation with very narrow inter-segments, like incisions. In Geczy's species the outer row of tubercles is not conspicuous anywhere; moreover the ventral ribbing is more evanescent. On the contrary, the inner whorls of our specimen are bituberculate like in *P. birchoides* (Rosenberg); during the ontogeny the inner tubercles get already obliterated in the intermediate whorls whereas the outer ones are sporadically spiny and remain until the adult stage where they become coarser. The main lateral ribs are straight and blunt, sometimes splitting into 2 or 3 fine ribs.
Age and distribution: This species seems to characterize the base of the Pliensbachian (Jamesoni Zone). It is recorded from the Upper Austroalpine only.

Genus *Promicroceras* Spath, 1925
Type species: *Ammonites planicosta* Sowerby, 1814.

***Promicroceras perplanicosta* (Spath, 1925)**
pl. 12, fig. 5

1879 *Ammonites planicosta* Sowerby. — Reynes, Pl. 34, Fig. 27-29.
1881 *Aegoceras planicosta* (Sowerby). — Wright, Pl. 24, Fig. 3 (HT).
1925 *Xipheroceras perplanicosta* Spath, P. 269.
1926 *Promicroceras perplanicosta* (Spath). — Spath, Pl. 9, Fig. 2 (HT).
1963 *Promicroceras perplanicosta* (Spath). — Blaison, Pl. 1, Fig. 3.
1969 *Promicroceras perplanicostum* (Spath). — Reyment, P. 211, Fig. 8.
1984 *Promicroceras perplanicosta* (Spath). — Guerin Franiatte & Hoffmann, Pl. 1, Fig. 15-16.
1994 *Promicroceras perplanicosta* (Spath). — Cope, Pl. 2, Fig. 3.

Following Guerin Franiatte & Hoffmann (1984, p. 51) we distinguish *P. planicosta* (Sowerby) from coarser ribbed forms with a more quadrate and thick whorl section and a quite flat ventral part bearing blunt chevrons-like ribs (see the type in Spath, 1926, pl. 9, fig. 9), which belong to *P. perplanicosta* (Spath). Our samples well correspond to the SPATH's species.
Age and distribution: Until now only known from the Euroboreal realm, this species is here for the first time recorded from the Upper Austroalpine (Tethyan Realm). Its range seems to extend from the Turneri Zone to the Obtusum Zone.

Family Epideroceratidae Dommergues & Meister, 1999

Genus *Epideroceras* Spath, 1923
Types species: *Ammonites roberti* Hauer, 1854.

Epideroceras gr. *lorioli* (HUG, 1899)
pl. 12, figs. 1, 3, 6

1899 *Aegoceras lorioli* HUG, Pl. 8, Fig. 1; Pl. 9, Fig. 3.
1958 *Epideroceras hugi* DONOVAN, Pl. 4, Fig. 1.
1958 *Epideroceras grande* DONOVAN, Pl. 3, Fig. 1.
1983 *Epideroceras lorioli* (HUG). — BLAU, Pl. 6, Fig. 1, 2.
1983 *Epideroceras* cf. *hugi* DONOVAN. — BLAU, Pl. 6, Fig. 3.
1983 *Epideroceras lorioli* (HUG). — BLAU, Pl. 6, Fig. 1, 2.
1987a *Epideroceras* gr. *lorioli* (HUG). — DOMMERGUES & MEISTER, Pl. 5, Fig. 9 with synonymy.
1989 *Epideroceras* (*Epideroceras*) *lorioli* (HUG). — DOMMERGUES & GECZY, Pl. 2, Fig. 1-4.
1989 *Epideroceras lorioli* (HUG). — DOMMERGUES & MEISTER, Pl. 4, Fig. 2, 4; Pl. 5, Fig. 1, 2; Pl. 6, Fig. 3.
1989 *Epideroceras lorioli* forme *hugi* DONOVAN. — DOMMERGUES & MEISTER, Pl. 6, Fig. 1.
1990 *Epideroceras lorioli* (HUG). — DOMMERGUES, MEISTER & METTRAUX, Pl. 5, Fig. 2.
1990 *Epideroceras* aff. *lorioli* (HUG). — DOMMERGUES & MEISTER, Pl. 2, Fig. 2, 6, 7.
1991 *Epideroceras* gr. *lorioli* (HUG). — DOMMERGUES & MEISTER, Pl. 3, Fig. 1.
1991 *Epideroceras lorioli* (HUG). — SCHLATTER, Pl. 14, Fig. 4, 5.
1993 *Epideroceras* gr. *lorioli* (HUG). — MEISTER & BÖHM, Pl. 5, Fig. 1.
1993 *Epideroceras* (*Epideroceras*) *lorioli* (HUG). — DOMMERGUES, Pl. 10, Fig. 17.
1995 *Epideroceras* gr. *lorioli* (HUG). — ALKAYA & MEISTER, Pl. 5, Fig. 16.
1996 *Epideroceras* sp. aff. *E. lorioli* (HUG). — POPA & PATRULIUS, Pl. 19, Fig. 4.
1997 *Epideroceras lorioli* (HUG). — CORNA, DOMMERGUES, MEISTER & PAGE, Pl. 10, Fig. 2; Pl. 11, Fig. 5.
1997 *Epideroceras* (*Epideroceras*) *lorioli* (HUG). — CORNA, DOMMERGUES, MEISTER & MOUTERDE, Pl. 5, Fig. 1.
1998 *Epideroceras lorioli* (HUG). — BLAU, Pl. 11, Fig. 5-11; Pl. 12, Fig. 1-13; Pl. 14, Fig. 1.

The Austrian specimens are quite evolute, with broad inner whorls. They bear coarse, subradiate, tuberculated ribs. The inner tubercle line disappears very early near 2 cm in diameter whereas the outer one remains until a diameter of 7-8 cm. Secondary ribbing on the ventral part is well developed in the juvenile stage but disappears quite rapidly in the middle; it is still visible at a diameter of 8 cm. This morphology is close to the specimen illustrated by HUG (1899, Pl. 9, Fig. 3). At this stage the whorl section becomes more oval, high and compressed, the venter smooth (Text-Fig. 19). These Epideroceras are grouped into *E. lorioli* (HUG). In our opinion *Epideroceras* gr. *lorioli* (HUG) shows a high variability of the whorl-section and the umbilicus which ranges from the very evolute *E. frischmanni* (QUENSTEDT) with a quite subquadrate whorl section to the involute *E. steinmanni* (HUG) with a quite compressed whorl section. We group all intermediate morphologies within *E.* gr. *lorioli* (HUG).

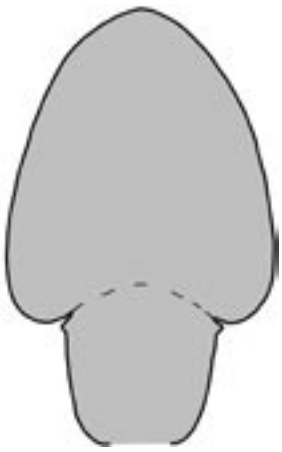

Figure 19: *Epideroceras* gr. *lorioli* (HUG) whorl section.

One *Epideroceras* from Rothorn (P.1793) well fits the more evolute *E. lorioli* referred to as *E.* gr. *lorioli* form *hugi* DONOVAN and illustrated by DOMMERGUES & MEISTER (1989). Its intermediate whorl still bears a slight ventrolateral tubercle and the whorl-section is subtrapezoidal with a quite weakly rounded venter. The outer whorl, on the other hand, is suboval with a high rounded ventral part and without tubercles.

Age and distribution: The range of this species corresponds to the middle part of the Raricostatum Subzone to Aplanatum Subzone; it is mainly known from the Alps and the adjacents northern areas (mainly SW Germany and France).

Family Dubariceratidae DOMMERGUES & MEISTER, 1999

Genus *Metaderoceras* SPATH, 1925 (syn. *Farinaccites* FARAONI, MARINI, PALLINI & VENTURI, 1996)

Type species: *Ammonites muticus* d'ORBIGNY, 1844.

Metaderoceras gemmellaroi (LEVI, 1896)
pl. 13, figs. 3, 4

*1896 *Aegoceras gemmellaroi* LEVI, Pl. 8, Fig. 3, 6.
1921 *Deroceras evolutum* FUCINI, Pl. 1, Fig. 14.
1983 *Metaderoceras gemmellaroi* (LEVI). — RIVAS, Pl. 2, Fig. 4-10 with synonymy.
1983 *Metaderoceras evolutum* (FUCINI). — RIVAS, Pl. 1, Fig. 1-8 with synonymy.
1991 *Metaderoceras gemmellaroi* (LEVI). — FERRETTI, Pl. 3, Fig. 2, 3; Pl. 4, Fig. 1.
1993 *Metaderoceras* gr. *gemmellaroi* (LEVI). — MEISTER & BÖHM, Pl. 7, Fig. 1 with synonymy.
1994 *Metaderoceras gemmellaroi* (LEVI). — FARAONI, MARINI & PALLINI, Pl. 2, Fig. 6.
1996 *Metaderoceras gemmellaroi* (LEVI). — EL HARIRI, DOMMERGUES, MEISTER, SOUHEL & CHAFIKI, Pl. 69, Fig. 4, 5.
? 1996 *Metaderoceras evolutum* (LEVI). — SMITH & TIPPER, Pl. 18, Fig. 1; Pl. 16, Fig. 3-5, 7.
1996 *Metaderoceras gemmellaroi* (LEVI). — FARAONI, MARINI, PALLINI & VENTURI, Pl. 8, Fig. 10.
2000 *Metaderoceras gemmellaroi* (LEVI). — DOMMERGUES, MEISTER, BONNEAU, CADET & FILI, P. 351, Fig. 10-1,2.
2001 *Metaderoceras gemmellaroi* (LEVI). — VENTURI & FERRI, P. 121; P. 128.

Two fragments of *Metaderoceras* are grouped here within the species *M. gemmellaroi* (Levi) due to a well developed ventro-lateral row of acute spines, a development of secondary fine ribs which more or less deface the primary ribbing, an almost smooth ventral part, and a medium spaced ribbing compared to the very coarsely ribbed *M. venarense* (Oppel) group. *M. gemmellaroi* forma *kondai* (Geczy) shows a closer, fine, and more sinuous ribbing.
Age and distribution: This species indicates the Middle Carixian (Ibex Zone). It may be the equivalent of the Venarense Horizon of the Euroboreal Realm (Meister, 1995). Its distribution covers the Tethyan Realm and partly the Pacific area.

Metaderoceras gemmellaroi forma *kondai* (Geczy, 1976)

pl. 13, fig. 2

1972 *Uptonia* sp. Geczy, Pl. 5, Fig. 1, pl. 6, fig. 1.
1976 *Uptonia kondai* Geczy, Pl. 13, Fig. 4-6, Pl. 14, Fig. 1.
? 1996 *Farinaccites kondai* (Geczy). — Faraoni, Marini, Pallini & Venturi, Pl. 6, Fig. 8.

This *Metaderoceras* is characterized by the regularity of the ribbing in spacing and size. The ribs are quite fine and close during the ontogeny with a more flexuous drawing than *M. gemmellaroi* (Levi) s.s. Although the conception of the Levi's species is wide, the subspecies differs by a fine, regular and closer ribbing on the inner and median whorls and especially by the ribs crossing the venter. Moreover the ventro-lateral spine is quite fine even on the inner whorls.
The ribs cross the slightly convex venter making a relief like in *M. venarense* (Oppel) in Meister (1986, Pl. 11, Fig. 2).
In the Bakony, this subspecies is associated with *M. gemmellaroi* (Levi) s.s. and may represent mere intraspecific variability.
M. evolutum (Fucini) is a coarser ribbed form which most probably represents the coarse pole of the species *M. gemmellaroi* (Levi).
Like *Metaderoceras* sp. 3 and sp. 4 described from Ibericas by Colera et al. (1978) *M. meneghini* (Fucini) is also a close species (e.g. Faugeres, 1978, Pl. 42, fig. 6). The regularity of the ornamentation reminds of *M. apertum* El Hariri, Dommergues, Meister, Souhel & Chafiki from the High Atlas, but its ribbing is finer and closer spaced, and the umbilicus is more open.
The genus *Dubariceras* which is derived from *Metaderoceras* shows very close, fine, more acute ribs which remain more or less flexuous throughout the ontogeny. The ventral part is smooth, but the lateral ribs touch the lateral part of the venter.
Age and distribution: This species ranges from the Jamesoni Zone (Apennines) to the Ibex Zone (Bakony). Its distribution is restricted to the Tethyan Realm.

Subfamily: Reynesocoeloceratinae Dommergues, 1986

Genus: *Prodactylioceras* Spath, 1923

Type species: *Ammonites Davoei* Sowerby, 1822.

Prodactylioceras gr. *davoei* (Sowerby, 1822)

pl. 13 , fig. 5

*1822 *Ammonites Davoei* Sowerby, P. 71, Pl. 350.
1986 *Prodactylioceras davoei* (Sowerby). — Meister, Pl. 18, Fig. 8; Pl. 19, Figs. 3, 7 with synonymy.
1986 *Prodactylioceras davoei enode* (Quenstedt). — Meister, Pl. 19, Fig. 4 with synonymy.
1986 *Prodactylioceras davoei nodosissimus* (Quenstedt). — Meister, Pl. 19, Fig. 1; Pl. 23, Fig. 5 with synonymy.
1986 *Prodactylioceras davoei* (Sowerby). — Büchner, Hoffmann & Jordan, Pl. 4, Fig. 1.
1991 *Prodactylioceras davoei* (Sowerby). — Schlatter, Pl. 21, Fig. 1, 2.
1991 *Prodactylioceras davoei enode* (Quenstedt). — Schlatter, Pl. 21, Fig. 3.
1991 *Prodactylioceras davoei nodosissimus* (Quenstedt). — Schlatter, Pl. 21, Fig. 4.
1993 *Prodactylioceras* gr. *davoei* (Sowerby). — Meister & Böhm, Pl. 7, Figs. 8, 10 with synonymy.
1994 *Prodactylioceras davoei* (Sowerby). — in: Fischer, Pl. 24, Fig. 3.
1994 *Prodactylioceras davoei* (Sowerby). — Rakus, Pl. 6, Fig. 4.
1997 *Prodactylioceras davoei* (Sowerby). — Dommergues, Meister & Mouterde, Pl. 7, Fig. 17.
1997 *Prodactylioceras davoei* (Sowerby). — Cassel, Pl. 11, Fig. 1.
1998 *Prodactylioceras davoei* (Sowerby). — Rulleau, Pl. 27, Fig. 2, 4; Pl. 28, Fig. 1.
1998 *Prodactylioceras davoei* var. *enode* (Quenstedt). — Rulleau, Pl. 27, Fig. 3.
1998 *Prodactylioceras davoei* var. *nodosissimus* (Quenstedt). — Rulleau, Pl. 27, Fig. 5.
2000 *Prodactylioceras davoei* (Sowerby). – Schlögl, Aubrecht & Tomasovych, Pl. 1, Fig. 6.

A fragment of a constricted body chamber of *Prodactylioceras* is characterized by irregularly spaced, prorsiradiate ribs, which are slightly curved near the outer part and sometimes ornamented with a weak tubercle. They cross the venter. All these features coincide with the classical descriptions of *Prodactylioceras davoei* (Sowerby) (e.g. Dommergues 1980, 1987; Meister, 1986).
Age and repartition: Known from the Euroboreal Realm and some parts of the northern margin of the Tethys, this species characterizes the Davoei Zone (Capricornus to Figulinum Subzones).

Family: Polymorphitidae Haug, 1887

Genus: *Platypleuroceras* Hyatt, 1867

Type species: *Ammonites brevispina* Sowerby, 1827.

Platypleuroceras gr. *brevispina* (Sowerby, 1827)

pl. 14, figs. 1-3

1827. *Ammonites brevispina* Sowerby, Pl. 556, Fig. 1.
1845 *Ammonites lataecosta* Sowerby, Quenstedt, Pl. 4, Fig. 15 a-c, non d.
non 1856 *Ammonites brevispina* Sowerby. — Hauer, Pl. 17, Fig. 4-10.
? 1856 *Ammonites lataecosta* Sowerby. — Quenstedt, Pl. 14, Fig. 14.
1882 *Aegoceras brevispina* (Sowerby). — Wright, Pl. 32, Fig. 2, 3, non 4; pl.50, fig. 13 ?, 14 ?
1885 *Ammonites brevispina* (Sowerby). — Quenstedt, Pl. 33, Fig. 6, ? 10.
non 1899. *Aegoceras* (*Platypleuroceras*) aff. *brevispina* (Sowerby). — Söhle, Pl. 11, Fig. 3.
1925 *Platypleuroceras brevispina* (Sowerby). — Tutcher & Trueman, P. 649, Fig. 16b.
1938 *Platypleuroceras brevispina* (Sowerby). — Roman, Pl. 69, Fig. 7.
1961. *Platypleuroceras brevispina* (Sowerby). — Dean, Donovan & Howarth, Pl. 69, Fig. 1 a, b.
1970 *Platypleuroceras brevispina* (Sowerby). — Jahnel, Pl. 2, Fig. 9.
1977 *Platypleuroceras brevispina* (Sowerby). — Schlatter, Pl. 2, Fig. 2.
1976 *Platypleuroceras brevispina* (Sowerby). — Schlegelmilch, Pl. 29, Fig. 3, 4.
1980 *Platypleuroceras brevispina* (Sowerby). - Schlatter, Pl. 7, Fig. 8; Pl. 8, Fig. 1 with synonymy.
1982 *Platypleuroceras brevispina* (Sowerby). — Hoffmann, Pl. 21, Fig. 1, 2.
1985 *Platypleuroceras brevispina* (Sowerby). — Comas Rengifo, Pl. 4, Fig. 5.
1986 *Platypleuroceras brevispina* (Sowerby). — Büchner, Hoffmann & Jordan, Pl. 1, Fig. 1.
1986 *Platypleuroceras* aff. *brevispina* (Sowerby). — Meister, Pl. 3, Fig. 2.
1987 *Platypleuroceras* gr. *brevispina* (Sowerby). — Dommergues, Pl. 8, Fig. 1-7.
1987 *Platypleuroceras* cf. *brevispina* (Sowerby). — Dommergues, Pl. 7, Fig. 12-15.
1989 *Platypleuroceras* gr. *brevispina* (Sowerby). – *brevispinoides* Tutcher & Trueman. — Meister & Loup, Pl. 4, Fig. 1, 3, 4; Pl. 5, Fig. 2, 3; Pl. 6, Fig. 1.
1997 *Platypleuroceras* gr. *brevispina* (Sowerby). — Cassel, Pl. 17, Fig. 1.

We group into *P.* gr. *brevispina* (Sowerby) three evolute and bituberculate ammonites (P.1547 Goppelspitze; P.13260 Auenfeld; P.7131 Eingemauerte) characterized by simple, strong, regularly spaced, subradiate to prorsiradiate ribs which cross the venter but are very evanescent on this part. The ventral part is rounded. *P. brevispina* (Sowerby) and *P. oblongum* (Quenstedt) are two very close species; only the ratio of the whorl-section (E/H) is different with E/H = 73-74% for the first species with a rounded habitus and E/H = 63-64% for the second with a subrectangular habitus, respectively. Having a ratio exceeding 70%, the Austrian specimen are closer to Sowerby's species. Moreover, the row of umbilical tubercles persists in the adult stage as in *P. brevispina* (Sowerby), whereas in *P. oblongum* (Quenstedt) it already disappears on the middle whorls.

Age and distribution: This species is well known from the Euroboreal Realm and sporadically from the northern margin of the Tethys (Upper Austroalpine units, Pontides). It characterizes the Brevispina Horizon (Brevispina Subzone, Jamesoni Zone, Lower Carixian).

Platypleuroceras brevispinoides Tutcher & Trueman, 1925

pl. 14, fig. 6

1925 *Platypleuroceras brevispinoides* Tutcher & Trueman, Pl. 40, Fig. 2.
1976 *Platypleuroceras brevispinoides* Tutcher & Trueman. — Schlegelmilch, Pl. 29, Fig. 6.
1980 *Platypleuroceras brevispinoides* Tutcher & Trueman. — Schlatter, Pl. 9, Fig. 4.
1982 *Platypleuroceras* cf. *brevispinoides* Tutcher & Trueman. — Hoffmann, Pl. 22, Fig. 2.
1986 *Platypleuroceras brevispinoides* Tutcher & Trueman. — Meister, Pl. 3, Fig. 3, 4.
1991 *Platypleuroceras* aff. gr. *brevispina* (Sowerby) – *brevispinoides* Tutcher & Trueman. — Meister, Pl. 1, Fig. 8.
1991 *Platypleuroceras* aff. gr. *brevispina* (Sowerby) – *brevispinoides* Tutcher & Trueman. — Dommergues & Meister, Pl. 3, Fig. 3.

This evolute, bituberculated ammonite (P.2335) is characterized by spaced strong ribs and a massive suboval whorl section. The inner row of tubercles is weakly developed on the body chamber, but the outer ones remain well expressed. This corresponds well to the diagnosis of *P. brevispinoides* Tutcher & Trueman. *P. brevispina* (Sowerby), a very closely related species, shows a narrower whorl section and finer, closer spaced ribs. *P. rotundum* (Quenstedt) is characterized by a more rounded whorl section with a well expressed bituberculation and a smoother ventral part.

Age and distribution: Until now, Tutcher & Trueman's species was restricted to the Euroboreal Realm. It characterizes the Brevispina Subzone (Jamesoni Zone, Lower Carixian).

Platypleuroceras rotundum (Quenstedt, 1845)

pl. 13, figs. 6, 7

1845 *Ammonites natrix rotundus* Quenstedt, Pl. 4, Fig. 17.

1856 *Ammonites natrix rotundus* Quenstedt. — Quenstedt, Pl. 14, Fig. 11.
1885 *Ammonites natrix rotundus* Quenstedt. — Quenstedt, Pl. 33, Fig. 3, 11, 16, 18.
? 1976 *Acanthopleuroceras natrix* (Zieten). — Schlegelmilch, Pl. 29, Fig. 7.
non 1976 *Platypleuroceras rotundum* (Quenstedt). — Geczy, Pl. 14, Fig. 2, 3, ? 4.
1977 *Crucilobiceras rotundum* (Quenstedt). — Schlatter, Pl. 2, Fig. 4.
non 1978 *Platypleuroceras* cf. *rotundum* (Quenstedt). — Dubar & Mouterde, Pl. 2, Fig. 5.
1979 *Platypleuroceras rotundum* (Quenstedt). — Dommergues, Pl. 4, Fig. 6.
1980 *Platypleuroceras rotundum* (Quenstedt). — Schlatter, Pl. 9, Fig. 2.
1980 *Platypleuroceras* cf. *rotundum* (Quenstedt). — Schlatter, Pl. 9, Fig. 3.
1982 *Platypleuroceras rotundum* (Quenstedt). — Schlatter, Pl. 23, Fig. 1, 2.
1982 *Platypleuroceras rotundum* (Quenstedt). — Braga, Comas Rengifo, Goy & Rivas, Pl. 1, Fig. 4.
1984 *Platypleuroceras rotundum* (Quenstedt). — Cubaynes, Boutet, Delfaud & Faure, Pl. 1, Fig. 8-10.
1985 *Platypleuroceras rotundum* (Quenstedt). — Comas Rengifo, Pl. 4, Fig. 6, 8.
1986 *Platypleuroceras rotundum* (Quenstedt). — Meister, Pl. 3, Fig. 6.
? 1987 *Platypleuroceras* (microconque) sp. 3 Dommergues, Pl. 6, Fig. 23, 24.
1995 *Platypleuroceras* cf. *rotundum* (Quenstedt). — Alkaya & Meister, Pl. 7, Fig. 12.
1997 *Platypleuroceras rotundum* (Quenstedt). — Dommergues & Meister & Mouterde, Pl. 6, Fig. 4.

Our specimen is a very evolute, bituberculate *Platypleuroceras* (211-7) with a rounded subquadrate whorl section (E/H = ~ 80%), thick evanescent ribs and two rows of sharp tubercles (see discussion in Meister, 1986, p. 33).
Age and distribution: Like *P. brevispina* (Sowerby), *P. rotundum* (Quenstedt) is well known in the Euroboreal Realm and sporadically in the northern margin of the Tethys (Upper Austroalpine units, Pontides). It characterizes the Brevispina Subzone (Jamesoni Zone, Lower Carixian).

Platypleuroceras amplinatrix (Quenstedt, 1885)
pl. 14, fig. 5

1885 *Ammonites amplinatrix* Quenstedt, Pl. 32, Fig. 7.
1979 "*Platypleuroceras*" *amplinatrix* (Quenstedt). — Dommergues, Pl. 4, Fig. 2.
1980 *Platypleuroceras* aff. *amplinatrix* (Quenstedt). — Schlatter, Pl. 14, Fig. 2.
1985 *Platypleuroceras amplinatrix* (Quenstedt). — Comas Rengifo, Pl. 4, Fig. 9.

This form represents an intermediate morphology between the genera *Platypleuroceras* (evolute conch and broad whorl section) and *Uptonia* (platycone conch with compressed whorl section). The morphological differences between *P. amplinatrix* (Quenstedt) and *P. tenuilobus* (Futterer) are little. Indeed Quenstedt's species has a habitus closer to *Platypleuroceras* (e.g. Comas Rengifo, 1985, pl. 4, fig. 9) than *P. tenuilobatus* (Futterer) (e.g. Meister, 1986, pl. 5, fig. 1) which already show an *Uptonia* morphology. Being a little more involute than the typical *Platypleuroceras,* our specimen is characterized by a subovaI, rather compressed whorl section. The ribs are rigid moderately spaced, rursiradiate. No tubercles are visible, only a slight ventro-lateral reinforcement. The rounded venter bears blunt chevrons.
Age and distribution: For the first time this Euroboreal species is recorded from the Upper Austroalpine unit (northern margin of the Tethys). Both *P. amplinatrix* (Quenstedt) and *P. tenuilobus* (Futterer) are known from Causses, Ibericas, Burgundy, SW Germany and Alps in the uppermost part of the Brevispina Subzone (Jamesoni Zone).

Genus: *Uptonia* Buckman, 1887
Type species: *Ammonites Jamesoni* Sowerby, 1827.

Uptonia jamesoni (Sowerby, 1827)
pl. 14, fig. 7; pl. 15, figs. 1, 6

1827 *Ammonites Jamesoni* Sowerby, Pl. 555, Fig. 1.
? 1927 *Uptonia Jamesoni* (Sowerby). — Brun & Brousse, Pl. 2, Fig. 5.
1973 *Uptonia jamesoni* (Sowerby). — Donovan & Forsey, Pl. 4, Fig. 3.
non 1976 *Uptonia angusta* (Quenstedt) nov. subsp. — Geczy, Pl. 13, Fig. 2.
1976 *Uptonia jamesoni* (Sowerby). — Schlegelmilch, Pl. 28, Fig. 11.
1976 *Uptonia angusta* (Quenstedt). — Schlegelmilch, Pl. 28, Fig. 12.
1977 *Uptonia* "*jamesoni*" (Sowerby). — Schlatter, Pl. 3, Fig. 1.
? 1978 *Uptonia angusta* (Quenstedt). — Dubar & Mouterde, Pl. 2, Fig. 8.
? 1980 *Uptonia jamesoni* (Sowerby). — Wiedenmayer, Pl. 2, Fig. 2, 3.
1980 *Uptonia jamesoni* (Sowerby). — Schlatter, Pl. 12, Fig. 1.
1980 *Uptonia lata* (Quenstedt). — Schlatter, Pl. 11, Fig. 4, 6; Pl. 12, Fig. 2-4; Pl. 13, Fig. 1.
? 1981 *Uptonia* cf. *U. jamesoni* (Sowerby). — Imlay, Pl. 9, Fig. 17.
1986 *Uptonia jamesoni* (Sowerby). — Büchner, Hoffmann & Jordan, Pl. 2, Fig. 3.
1986 *Uptonia jamesoni* (Sowerby). — Meister, Pl. 6, Fig. 1, 5; Pl. 4, Fig. 8.
1987 *Uptonia lata* (Quenstedt). — Dommergues, Pl. 10, Fig. 1-5.

1991 *Uptonia* gr. *jamesoni* (Sowerby). — Dommergues & Meister, Pl. 5, Fig. 1; pl. 3, Fig. 7.
1991 *Uptonia lata* (Quenstedt). — Schlatter, Pl. 17, Fig. 1, 2.
1993 *Uptonia* gr. *jamesoni* (Sowerby). — Meister & Böhm, Pl. 6, Fig. 1; Pl. 5, Fig. 4, 5.
1995 *Uptonia lata* (Quenstedt). — Alkaya & Meister, Pl. 9, Fig. 1.
? 1996 *Uptonia jamesoni* (Sowerby). — Popa & Patrulius, Pl. 1, Fig. 2.
? 1996 *Uptonia* aff. *jamesoni* (Sowerby). — Popa & Patrulius, Pl. 1, Fig. 5.
1997 *Uptonia jamesoni* (Sowerby). — Cassel, Pl. 12, Fig. 2.
1998 *Uptonia jamesoni* (Sowerby). — Geczy, Pl. 27, Fig. 1, 2, 3.
1997 *Uptonia jamesoni* (Sowerby). — Dommergues, Meister & Mouterde, Pl. 6, Fig. 1.
1998 *Uptonia jamesoni* (Sowerby). — Rulleau, Pl. 24, Fig. 1, 2 (cf.).

The specimens from Vorarlberg (P.13268 Auenfeld, P.7797 Goppelspitze, P.13355 Eingemauerte) are platycone evolute with a suboval to subelliptic whorl section and fine prorsiradiate ribs, which are more spaced on the outer whorls and cross the venter making broad ventral chevrons. An external row of fine tubercles is well expressed on the inner whorls and may persist more or less long depending on the specimen. These features are characteristic of *U. jamesoni* (Sowerby) according to the opinion of Meister (1986, p. 38). This particularly means that we include *U. lata* (Quenstedt) in Sowerby's species.
Age and distribution: The distribution of *U. jamesoni* (Sowerby) includes the Euroboreal Realm and the northern margin of the Tethys (e.g. Southern Calcareous Alps, Upper Austroalpine units). This species characterizes the Jamesoni Subzone (Upper part of the Lower Carixian).

Uptonia bronni (Roemer, 1836)
pl. 14, fig. 4

1836 *Ammonites Bronnii* Roemer, Pl. 12, Fig. 8.
1984 *Uptonia* gr. *bronni* (Roemer). — Cubaynes, Boutet, Delfaud & Faure, Pl. 2, Fig. 5, 6, 8, 9.
1984 *Polymorphites* (*Uptonia*) *bronni* (Roemer). — Weitschaft & Hoffmann, Pl. 2, Fig. 5.
1986 *Uptonia* (? *Uptonia*) *bronni* (Roemer). — Büchner, Hoffmann & Jordan, Pl. 2, Fig. 2.
1986 *Polymorphites bronni* (Roemer). — Meister, Pl. 4, Fig. 1, 5, 6 with synonymy.
1987 *Polymorphites* gr. *bronni* (Roemer). — Dommergues, Pl. 10, Fig. 6, 7.
1990 *Uptonia bronni* (Roemer). — Dommergues & Meister, P. 369, Fig. 5 (3).
1991 *Polymorphites bronni* (Roemer). — Schlatter, Pl. 15, Fig. 3.
1993 *Uptonia bronni* (Roemer). — Meister & Böhm, Pl. 6, Fig. 2.
1997 *Uptonia bronni* (Roemer). — Dommergues, Meister & Mouterde, Pl. 6, Fig. 7, 8.
2000 *Uptonia* aff. *bronni* (Roemer). — Dommergues, Meister, Bonneau, Cadet & Fili, P. 347, Fig. 9 (4).

This small platycone evolute species (P.6708, Schröcken) not exceeding 3 to 4 cm in diameter is characterized by an outer row of tubercles with a high position on the latero-ventral border, by the typical ribbing of the Uptonia group (see above) and by a ventral keel which bridges the chevrons. This species is interpreted as the microconch of *U. jamesoni* (Sowerby) (see Meister, 1986, p. 126 and Dommergues, 1987).
Age and distribution: This species is recorded from the Euroboreal Realm and some parts of the northern margin of the Tethys (Upper Austroalpine units). Its presence is also mentioned from the Ionian zone (Albania). It characterizes the Jamesoni Subzone (Upper part of the Lower Carixian)

Family: Acanthopleuroceratidae Arkell, 1950

Genus: *Tropidoceras* Hyatt, 1867
Type species: *Ammonites Masseanum* d'Orbigny, 1844.

The *Tropidoceras* described here originate exclusively from the Fleckenmergel facies. Two groups can be distinguished. The first comprises evolute forms with a coarse ribbing, whereas the second group presents fine ornaments with a more platicone shell and compressed whorls.

Tropidoceras gr. *masseanum* (d'Orbigny, 1844)
pl. 15, figs. 2, 4

1844 *Ammonites Masseanum* d'Orbigny, Pl. 58, Fig. 1-3.
1961 *Tropidoceras masseanum* (d'Orbigny). — Dean, Donovan & Howarth, Pl. 69, Fig. 2.
1980 *Tropidoceras masseanum masseanum* (d'Orbigny). — Schlatter, Pl. 19, Fig. 3 with synonymy.
1986 *Tropidoceras masseanum masseanum* (d'Orbigny). — Meister, Pl. 6, Fig. 8; pl. 7, Fig. 2, 3.
1990 *Tropidoceras* gr. *masseanum* (d'Orbigny). — Dommergues & Meister, P. 639, Fig. 1, 2.
1991 *Tropidoceras masseanum* (d'Orbigny) *rotundum* (Futterer). — Dommergues & Meister, Pl. 6, Fig. 1, 2.
non ? 1991 *Tropidoceras* cf. *masseanum* (d'Orbigny). — Cope, Pl. 4, Fig. 1, 3.
1994 *Tropidoceras masseanum* (d'Orbigny). — in: Fischer, Pl. 22, Fig. 13.
? 1996 *Tropidoceras masseanum* (d'Orbigny). — Popa & Patrulius, Pl. 1, Fig. 5; Pl. 2, Fig. 1.
1997 *Tropidoceras masseanum* (d'Orbigny). — Cassel, Pl. 15, Fig. 3.
1997 *Tropidoceras* cf. *masseanum* (d'Orbigny). — Corna, Dommergues, Meister & Page, Pl. 12, Fig. 5.
1997 *Tropidoceras masseanum* (d'Orbigny). — Dommergues, Meister & Mouterde, Pl. 6, Fig. 12.

? 2001 *Tropidoceras* gr. *masseanum* (d'Orbigny). — Venturi & Ferri, P. 140.

The Austrian specimens are *ex situ* and quite distorted. They are characterized by a quite platicone evolute conch in the adult stage, which is still more evolute in the inner whorls. The primary ribs are well expressed on the inner whorls where they are quite spaced and rigid. On the outer whorls, on the contrary, the ornament consists of finer and closer ribs, which are sometimes slightly sinuous, and of a secondary ribbing with fine and close prorsiradiate ribs developed on the latero-ventral part. The ventral area is narrow and the keel high and sharp.
We attribute the Austrian forms to *T.* gr. *masseanum* (d'Orbigny) rather than to *T. mediterraneum* (Gemmellaro) mainly because of the sharp coarse ribbing on the inner whorls (see by comparison Gemmellaro, 1884, pl. 5, fig. 1 and Braga & Rivas, 1985, pl. 3, fig. 7). In spite of the Alpine deformation the ribs show a rigid plotting. Moreover, at comparable size *T. mediterraneum* (Gemmellaro) is more involute. As for the rib density our specimens in the adult stage present an intermediate density between *T. mediterraneum* (Gemmellaro) and *T. masseanum* (d'Orbigny).
Age and distribution: *T. masseanum* (d'Orbigny) is recorded with certainty in the Euroboreal realm and in some part of the northern margin of the Tethys (Upper Austroalpine). It characterizes the Masseanum Subzone (base of Ibex Zone, Middle Carixian).

Tropidoceras rotundum (Futterer, 1893)
pl. 15, figs. 5, 7, 8

1893 *Cycloceras masseanum* var. *rotunda* Futterer, Pl. 12, Fig. 3, 4.
1980 *Tropidoceras masseanum rotunda* (Futterer). — Schlatter, Pl. 19, Fig. 4; Pl. 20, fig. 1, 2.
1986 *Tropidoceras masseanum rotunda* (Futterer). — Meister, Pl. 6, Fig. 6; Pl. 7, Fig. 1.
1991 *Tropidoceras masseanum rotundum* (Futterer). — Dommergues & Meister, Pl. 3, Fig. 4-6; Pl. 4, Fig. 4; Pl. 5, Fig. 2; non Pl. 6, Fig. 1, 2 [T. masseanum (d'Orbigny) s.s.].
1995 *Tropidoceras rotundum* (Futterer). — Alkaya & Meister, Pl. 12, Fig. 1.
1996 *Tropidoceras masseanum rotunda* (Futterer). — Smith & Tipper, Pl. 10, Fig. 1, 2.

The specimens from Eingemauerte and Auenfeld are evolute *Tropidoceras* with strong, rigid, subradiate, spaced ribs, hardly and abruptly arched toward the aperture on the ventro-lateral area. On the inner whorls the ribbing is already spaced and coarse. Depending mostly on preservation the swellings, sometimes almost tubercles (Pl.15, Figs. 5, 8), are irregularly expressed on our specimens. Even in the inner whorls the ventral part is acute.
Similar specimens have been described from the Subbriançonnais Alpine Unit (Dommergues & Meister, 1991). "*T.*" *carinatum* (Quenstedt) is a more evolute form with a better expressed bituberculation and a rather squared whorl section. Another close species is *T. stahli* (Oppel) which develops tighter ribs and shows a more opened umbilicus; the ventral part remains less sharp.
Age and distribution: The taxon is known from the southern part of the Euroboreal realm (Causses to SW Germany and Alps until Pontides). Everywhere it indicates the Masseanum Subzone (Lower part of Ibex Zone).

Tropidoceras aff. *stahli* (Oppel, 1856)
pl. 16, fig. 1

1853 *Ammonites radians numismalis* Oppel, Pl. 3, Fig. 2.
1856 *Ammonites Stahli* Oppel, P. 288.
non 1884 *Harpoceras Stahli* Oppel. — Haug, Pl. 13, Fig. 1.
1885 *Ammonites Masseanus* (d'Orbigny). — Quenstedt, Pl. 36, Fig. 12.
1899 *Cycloceras Stahli* (Oppel). — Fucini, Pl. 22, Fig. 2.
? 1927 *Acanthopleuroceras Stahli* (Oppel). — Schroeder, Pl. 13, Fig. 8.
non 1928 *Tropidoceras* aff. *stahli* (Oppel). — Spath, Pl. 17, Fig. 1.
1976 *Acanthopleuroceras stahli* (Oppel). — Geczy, Pl. 18, Fig. ? 4, 5, 6.
1977 *Tropidoceras stahli* (Oppel). — Wiedenmayer, Pl. 14, Fig. 3-11.
1979 *Tropidoceras* gr. *stahli* (Oppel). — Dommergues, Pl. 4, Fig. 3-4.
1980 *Tropidoceras stahli* (Oppel). — Schlatter, Pl. 20, Fig. 3; Pl. 21, Fig. 1.
1986 *Tropidoceras* aff. *stahli* (Oppel). — Meister, P. 46, Fig. 43.
? 1987 *Tropidoceras* cf. *stahli* (Oppel). — Hillebrandt, Pl. 3, Fig. 1-3.
1992 *Tropidoceras stahli* (Oppel). — Schlegelmilch, Pl. 55, Fig. 4 (HT).
? 2001 *Tropidoceras stahli* (Oppel). — Venturi & Ferri, P. 141.

Our specimen is a very evolute *Tropidoceras* with subradiate, strong and sharp, tight, regularly spaced ribs, hardly arched toward the aperture at the ventro-lateral edge. It is a phragmocone of about 90 mm in diameter at the beginning of the body chamber. The tuberculation is quite evanescent. The ventral part with a rather blunt keel corresponds well to Fig. 13f of Wiedenmayer (1977).
Age and distribution: This species is recorded with certainty in the Euroboreal realm, in some part of the northern margin of the Tethys (e.g. Upper Austroalpine) and doubtfully in other areas. It belongs to the Masseanum Subzone (base of Ibex Zone, Middle Carixian).

Tropidoceras erythraeum (Gemmellaro, 1884)
pl. 16, figs. 2, 3

1884 *Harpoceras erythraeum* Gemmellaro, Pl. 5, Fig. 10-16.

1896 *Tropidoceras erythraeum* (GEMMELLARO). — FUCINI, Pl. 2, Fig. 22ab.
1896 *Tropidoceras erythraeum* (GEMMELLARO). — LEVI, Pl. 8, Fig. 10.
non ? 1956 *Tropidoceras* aff. *erythraeum* (GEMMELLARO). — SPATH, Pl. 9, Fig. 7.
1965 *Tropidoceras erythraeum* (GEMMELLARO). — BREMER, P. 187, Abb. 2c.
? 1980 *Tropidoceras* cf. *erythraeum* (GEMMELLARO). — SCHLATTER, P. 150, Fig. c, d.
1985 *Tropidoceras erythraeum* (GEMMELLARO). — BRAGA & RIVAS, Pl. 1, Fig. 1, 2.
non ? 1988 *Tropidoceras* aff. *erythraeum* (GEMMELLARO). — SMITH et al., Pl. 1, Fig. 9.
1995 *Tropidoceras* cf. *erythraeum* (GEMMELLARO). — ALKAYA & MEISTER, Pl. 10, Fig. 5, 6; Pl. 11, Fig. 2, 5.
1996 *Tropidoceras erythraeum* (GEMMELLARO). — FARAONI, MARINI, PALLINI & VENTURI, Pl. 7, Fig. 7.
non ? 1996 *Tropidoceras* cf. *erythraeum* (GEMMELLARO). — SMITH & TIPPER, Pl. 10, Fig. 4, 7.

These medium sized *Tropidoceras* from Auenfeld (less than 80 mm in diameter), are characterized by the development of a quite irregular and evanescent ornamentation mainly on the body chamber. The very inner whorls are smooth, followed by a stage with quite coarse and rather strong, slightly sigmoid, irregularly spaced ribs fading near the venter. They vanish on the body chamber or sometimes already at the beginning of the last whorl; afterwards the ribbing is barely visible.
Age and distribution: *T. erythraeum* (GEMMELLARO) is a Tethyan species also recorded from its northern margin (Pontides, Austroalpine units). It indicates most probably the Masseanum Subzone (Ibex Zone, Middle Carixian).

***Tropidoceras* sp.**
pl. 15, fig 3

Slightly sigmoid rursiradiate sharp ribs, weak sulci, no distinguishable umbilical edge characterize this evolute *Tropidoceras*.
Tropidoceras (*Catriceras*) *catriense* VENTURI shows a similar ventral area with perhaps more abruptly arched ribs at the ventro-lateral part and a more evolute (?) coiling. *T. stahli* (OPPEL) seems to develop a light flattening near the keel (see Fig. 13d in WIEDENMAYER, 1977) too, but the sketch of the ribbing is different with tight ribs.
Age: It belongs probably to the Masseanum Subzone.

Genus: *Acanthopleuroceras* HYATT, 1900
Type species: *Ammonites valdani* d'ORBIGNY, 1844.

***Acanthopleuroceras maugenesti* (d'ORBIGNY, 1844)**
pl. 16, fig. 5

1844 *Ammonites Maugenesti* d'ORBIGNY, Pl. 70, Fig. 1-3.
1845 *Ammonites Maugenestii* d'ORBIGNY. — QUENSTEDT, Pl. 5, Fig. 1.
1853 *Ammonites Maugenesti* d'ORBIGNY. — OPPEL, Pl. 2, Fig. 3.
1856 *Ammonites Maugenesti* d'ORBIGNY. — HAUER, Pl. 16, Fig. 7-9.
1856 *Ammonites Maugenestii* d'ORBIGNY. — QUENSTEDT, Pl. 16, Fig. 5, non Fig. 6.
1882 *Aegoceras Maugenesti* (d'ORBIGNY). — WRIGHT, Pl. 37, Fig. 1, 2.
1885 *Ammonites Maugenestii* d'ORBIGNY. — QUENSTEDT, Pl. 35, Fig. 8-13; Pl. 36, non Fig. 1, 2.
? 1927 *Acanthopleuroceras Maugenesti* (d'ORBIGNY). — SCHRÖDER, Pl. 13(7), Fig. 5.
1976 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — SCHLEGELMILCH, Pl. 30, Fig. 3.
1978 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — DOMMERGUES & MOUTERDE, Pl. 1, Fig. 23, 24; Pl. 2, Fig. 1-5.
1980 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — SCHLATTER, Pl. 16, Fig. 1-4.
1981 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — DOMMERGUES & MOUTERDE, Pl. 1, Fig. 11-13.
1984 Acanthopleuroceras maugenesti (d'ORBIGNY). — WEITSCHAFT & HOFFMANN, Pl. 1, 3.
1986 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — BÜCHNER, HOFFMANN & JORDAN, Pl. 3, Fig. 6.
1986 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — MEISTER, Pl. 9, Fig. 5-7.
1991 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — SCHLATTER, Pl. 17, Fig. 7, 8; Pl. 18, fig. 1.
? 1994 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — RAKUS, Pl. 6, Fig. 3.
1994 *Acanthopleuroceras maugenesti* (d'ORBIGNY). — in: FISCHER, Pl. 23, Fig. 1, 2.

Being a typical Acanthopleuroceratidae from the Fleckenmergel, our specimen is characterized by an evolute conch, by a subrectangular whorl section and by spaced, rigid, subradiate and quite thick ribs bearing a ventrolateral, broad and blunt tubercle. The ventral area is very slightly fastigate and presents a feeble and blunt keel which disappears more or less completely in the adult stage. This specimen without doubt belongs to *A. maugenesti* (d'ORBIGNY).
Age and distribution: The species indicates the middle part of the Valdani Subzone and is well known in the European Euroboreal realm and also in the Upper Austroalpine area which seems to be its more southern position (DOMMERGUES & MEISTER, 1991).

Family: Liparoceratidae HYATT, 1867 emend.
Subfamily: *Liparoceratinae* HYATT, 1867

Genus: *Liparoceras* HYATT, 1867
Type species: *Liparoceras bronni* SPATH, 1938 (ICZN opinion 308).

***Liparoceras* (*Liparoceras*) aff. *striatum* (Reinecke) sensu Schröder, 1927**
pl. 16, fig. 6

1927 *Liparoceras striatum* (Reinecke). — Schröder, Pl. 13, Fig. 1.
1986 *Liparoceras striatum* (Reinecke) sensu Schröder. — Meister, Pl. 13, Fig. 1.

Two involute specimens are herein grouped into *Liparoceras* s.s.: one recovered from Lorüns and the second from Eingemauerte (P.7123). They are characterized by spaced, coarse, blunt, subradiate to prorsiradiate lateral ribs bearing umbilico-lateral and ventro-lateral rows of strong tubercles. On the venter the ribs are closer, finer and more numerous (about two for each outer tubercle). The shape of the whorl section is not visible. *L. striatum* (Reinecke) sensu Schröder shows the same habitus with an identical lateral position of the two rows of tubercles, the same irregularity in the ribbing and a similar thickness and space of the ventral ribs. *L. pseudostriatum* Trueman is also a close species, but the ornamentation is finer. *L. bronni* Spath is characterized by a very broad whorl section.
Age and distribution: This taxon is recorded from the Upper Austroalpine and the Causses Basin. It total range is not well known; at present it corresponds to the Middle part of the Ibex Zone.

Subgenus: *Becheiceras* Trueman, 1918
Type species: *Ammonites bechei* Sowerby, 1821 (see Donovan & Forsey, 1973, P. 13).

***Liparoceras* (*Becheiceras*) *bechei* (Sowerby, 1821)**
pl. 16 , fig. 4

*1821 *Ammonites bechei* Sowerby, Pl. 280.
1986 *Liparoceras* (*Becheiceras*) *bechei* (Sowerby). — Meister, Pl. 13, Fig. 4 with synonymy.
1991 *Becheiceras* gr. *bechei* (Sowerby). — Blau & Meister, Pl. 4, Fig. 5.
1991 *Liparoceras* (*Becheiceras*) *bechei* (Sowerby). — Schlatter, Pl. 18, Fig. 9.
? 1994 *Liparoceras* (*Becheiceras*) *bechei* (Sowerby). — Faraoni Marini & Pallini, Pl. 2, Fig. 1.
1995 *Becheiceras bechei* (Sowerby). — Alkaya & Meister, Pl. 14, Fig. 1, 2.
1996 *Liparoceras* (*Becheiceras*) *bechei* (Sowerby). — Smith & Tipper, Pl. 19, Fig. 2; Pl. 20, Fig. 1.
1998 *Liparoceras* (*Becheiceras*) *bechei* (Sowerby). — Rulleau, Pl. 25, Fig. 1-3.
2001 *Becheiceras bechei* (Sowerby). — Venturi & Ferri, P. 142.

A small globular specimen (D = 35 mm) from Lorüns is characterized by smooth inner whorls. The only visible ornamentation is restricted to the venter. It is constituted by fine, quite close, simple, radiate, ribs. The tuberculation is not visible because of the preservation. The partially perceptible suture line is typical of Liparoceratidae. This kind of morphology belongs without doubt to the *L.* (*B.*) *bechei* (Sowerby) group. The ornamentation of *L.* (*B.*) *gallicum* (Spath) is at the same diameter already well developed.
Age and distribution: This ubiquitous species ranges from the Middle Carixian (Ibex Zone) until the Middle Domerian (Gibbosus Subzone).

Genus: *Aegoceras* Waagen, 1869
Type species: *Ammonites capricornus* Schlotheim, 1820.

***Aegoceras maculatum* (Young & Bird, 1822)**
pl. 16, figs. 7, 8

*1822 *Ammonites maculatus* Young & Bird, Pl. 14, Fig. 12.
1938 *Androgynoceras maculatum* (Young & Bird). — Spath, Pl. 9, Figs. 2, 3; Pl. 13, Figs. 2, 8; Pl. 14, Fig. 3; Pl. 16, Figs. 11, 12; Pl. 17, Figs. 2, 3; Pl. 19, Figs. 1, 2, 13; Pl. 20, Figs. 3, 6, non 5; Pl. 26, Fig. 5 with synonymy.
1938 *Androgynoceras hybrida* (d'Orbigny). — Spath, Pl. 26, Fig. 2.
1961 *Androgynoceras maculatum* (Young & Bird). — Dean, Donovan & Howarth, Pl. 70, Figs. 4.
1979 *Aegoceras maculatum* (Young & Bird). — Dommergues, Pl. 7, Figs. 1, 2.
1985 *Aegoceras maculatum* (Young & Bird). — Phelps, Pl. 1, Fig. 2; Pl. 2, Fig. 8.
1986 *Androgynoceras maculatum* (Young & Bird). — Büchner, Hoffmann & Jordan, Pl. 4, Figs. 4.
1986 *A.* (*Aegoceras*) *maculatum* (Young & Bird). — Meister, Pl. 15, Figs. 4, 5 with synonymy.
1990 *Aegoceras maculatum* (Young & Bird). — Dommergues & Meister, P. 639, Figs. 5, 6.
1991 *Aegoceras maculatum* (Young & Bird). — Schlatter, Pl. 19, Figs. 9, 10.

Three crushed evolute ammonites are characterized by coarse ribs chevron-like crossing the venter. They belong to the "capricorn" Liparoceratidae and specially to *Aegoceras maculatum* (Young & Bird). For discussions and comparisons we refer to Dommergues (1979, 1987), Phelps (1985) and Meister (1986).
Age and repartition: The biostratigraphic position of this Euroboreal species is well known. It corresponds to the Maculatum Horizon of the Maculatum Subzone (Davoei Zone, Upper Carixian).

Subfamily: Amaltheinae Hyatt, 1867

Genus: *Amaltheus* de Montfort, 1808
Type species: *Amaltheus margaritatus* de Montfort, 1808.

The Fleckenmergel from Dalaaser Schütz provided some Amaltheinae (*Amaltheus* and *Pleuroceras*).

Amaltheus stokesi (SOWERBY, 1818)
pl. 16, figs. 9, 14; pl. 17, fig. 1

*1808 *Amaltheus stokesi* SOWERBY, Pl. 190.
1958 *Amaltheus stokesi* (SOWERBY). — HOWARTH, Pl. 1, Fig. 5, 7, 12-14; Pl. 2, Fig. 1, 3, 10; Text-Fig. 4, 5 with synonymy.
1974 *Amaltheus stokesi* (SOWERBY). — ELMI, ATROPS & MANGOLD, Pl. 1, Fig. 2, 3.
1986 *Amaltheus stokesi* (SOWERBY). — MEISTER, Pl. 19, Fig. 2; Pl. 20, Fig. 1, 8 with synonymy.
1988 *Amaltheus stokesi* (SOWERBY). — MEISTER, Pl. 1, Fig. 1.
1990 *Amaltheus stokesi* (SOWERBY). — DOMMERGUES & MEISTER, P. 639, Fig. 5 (12-14); P. 637, Fig. 637 (5-6).
1990 *Amaltheus stokesi* (SOWERBY). — DOMMERGUES, MEISTER & METTRAUX, Pl. 6, Fig. 3 (gr.),4-6.
1991 *Amaltheus stokesi* (SOWERBY). — BLAU & MEISTER, Pl. 5, Fig. 9.
1991 *Amaltheus stokesi* (SOWERBY). — SCHLATTER, Pl. 21, Fig. 5-7.
1991 *Amaltheus* gr. *stokesi* (SOWERBY). — DOMMERGUES & MEISTER, Pl. 4, Fig. 2, 3.
1992 *Amaltheus (Amaltheus) stokesi* (SOWERBY). — in: WESTERMANN, Pl. 17, Fig. 1, 3, 6.
1992 *Amaltheus stokesi* (SOWERBY). — in: WESTERMANN, Pl. 3, Fig. 11; Pl. 5, Fig. 9; Pl. 6, Fig. 4 (cf.).
1993 *Amaltheus (Amaltheus) stokesi* (SOWERBY). — JAKSCH, Pl. 1, Fig. 7.
? 1994 *Amaltheus stokesi* (SOWERBY). — JACOBS & PÁLFY, Pl. 1, Fig. 8, 9.
1994 *Amaltheus* cf. *stokesi* (SOWERBY). — PÁLFY & HART, Pl. 1, Fig. 12.
1995 *Amaltheus stokesi* (SOWERBY). — DOMMERGUES, MEISTER & BÖHM, Pl. 10, Fig. 1.
1996 *Amaltheus stokesi* (SOWERBY). — POPA & PATRULIUS, Pl. 2, Fig. 3-5.
1996 *Amaltheus stokesi* (SOWERBY). — SMITH & TIPPER, Pl. 19, Fig. 1; Pl. 20, Fig. 3.
1997 *Amaltheus stokesi* (SOWERBY). — CASSEL, Pl. 13, Fig. 2.
1997 *Amaltheus stokesi* (SOWERBY). — JOHANNSON, SMITH & GORDEY, Pl. 2, Fig. 12, 13.
1997 *Amaltheus stokesi* (SOWERBY). — DOMMERGUES, MEISTER & MOUTERDE, Pl. 7, Fig. 14, 15.
1998 *Amaltheus stokesi* (SOWERBY). — RULLEAU, Pl. 28, Fig. 8; Pl. 29, Fig. 1.
1998 *Amaltheus stokesi* (SOWERBY). — GECZY & MEISTER, Pl. 6, Fig. 10.

Some typical *Amaltheus* collected in bed 104a of Lorüns are characterized by ribs still connected with the chevrons of the cordate keel. For more details on *A. stokesi* (SOWERBY) see MEISTER (1986, 1989). A larger specimen from the same quarry, but ex situ, with a diameter of 118 mm can be referred to this species too. Other specimens from Schröcken (P. 6707/307-16) shows the same habitus.
Age and repartition: *A. stokesi* (SOWERBY), a quite ubiquitous species, characterizes the Lower Domerian (Stokesi Subzone) and is recorded from the Boreal, Euroboreal, Tethyan and Pacific realms and specially from quite unusual areas (e.g. Siberia, Japan,…).

Amaltheus margaritatus de MONTFORT, 1808

*1808 *Amaltheus margaritatus* de MONTFORT, P. 91, Fig. 90.
1958 *Amaltheus margaritatus* de MONTFORT. — HOWARTH, Pl. 3, Figs. 4-6; Text-Figs. 8, 9; with synonymy.
1986 *Amaltheus margaritatus* de MONTFORT. — MEISTER, Pl. 20, Fig. 9; Pl. 22, Fig. 1; Pl. 23, Fig. 6; with synonymy.
1988 *Amaltheus margaritatus* de MONTFORT. — MEISTER, Pl. 1, Figs. 2-4; Pl. 2, Figs. 1-3. 5; Pl.3, Figs. 3-5, 10; Pl. 4, Figs. 1, 3, 4.
1991 *Amaltheus margaritatus* de MONTFORT. — BLAU & MEISTER, Pl. 5, Fig. 10.
1997 *Amaltheus margaritatus* de MONTFORT. — DOMMERGUES, MEISTER & MOUTERDE, Pl. 8, Fig. 14.
1998 *Amaltheus margaritatus* de MONTFORT. — RULLEAU, Pl. 29, Fig. 2-5.

Our specimen is a typical adult of *A. margaritatus* de MONTFORT (D = ˜ 130 mm) with a tendency of the ornamentation to disappear on the body chamber. It is very close to the illustration of MEISTER (1986, Pl. 22, Fig. 1), which is a large specimen too.
Another specimen of A. margaritatus de MONTFORT was found in bed 110 of Lorüns.
Age and repartition: This species has a wide geographical distribution quite similar to the one of *A. stokesi* (SOWERBY) (e.g. Siberia, Iran...). It ranges from the Subnodosus Subzone until the lower part of the Aperynum Subzone (Domerian).

Genus: *Pleuroceras* HYATT, 1867
Type species: *Ammonites spinatus* BRUGUIERE, 1789.

Pleuroceras gr. *solare* (PHILLIPS, 1829)
pl. 16, figs 10, 11

1829 *Ammonites solaris* PHILLIPS, Pl. 4, Fig. 29.
1958 *Pleuroceras solare* (PHILLIPS). — HOWARTH, Pl. 4, Figs. 1-7 with synonymy.
1960 *Pleuroceras solare* (PHILLIPS). — JORDAN, Pl. 4, Figs. 6-7.
1961 *Pleuroceras solare* (PHILLIPS). — TINTANT, GAUTHIER & LACROIX, Pl. 1, Fig. 5.
1969 *Pleuroceras solare* (PHILLIPS). — POPA, Pl. 1, Figs. 1-4.
1976 *Pleuroceras solare* (PHILLIPS). — SCHLEGELMILCH, Pl. 36, Figs. 2.
1980 *Pleuroceras solare* (PHILLIPS). — WIEDENMAYER, Pl. 3, Figs. 8-13.
1980 *Pleuroceras solare* (PHILLIPS) var. *trapezoidiforme* (MAUBEUGE). — WIEDENMAYER, Pl. 3, Figs. 22, 23.

1980 *Pleuroceras solare* (Phillips) var. *leve* (Maubeuge). — Wiedenmayer, Pl. 3, Figs. 14-19.
1982 *Pleuroceras solare* (Phillips). — Braga, Comas Rengifo, Goy & Rivas, Pl. 3, Fig. 8.
1983 *Pleuroceras solare* (Phillips). — Braga, Pl. 15, Figs. 14-16.
1985 *Pleuroceras solare* (Phillips). — Mantea, Pl. 6, Figs. 3-5.
1984 *Pleuroceras solare* (Phillips). — Cubaynes, Boutet, Delfaud & Faure, Pl. 3, Fig. 20.
1985 *Pleuroceras solare* (Phillips). — Comas Rengifo, Pl. 10, Figs. 5-9; Pl. 11, Fig. 4.
1986 *Pleuroceras solare* (Phillips). — Meister, Pl. 6, Figs. 6, 7, 9-11; Pl. 7, Figs. 1-3.
1988 *Pleuroceras solare* (Phillips). — Braga, Comas Rengifo, Goy & Rivas, Pl. 1, Fig. 1-13.
1991 *Pleuroceras* aff. *solare* (Phillips). — Blau & Meister, Pl. 5, Figs. 6-8.
1991 *Pleuroceras* gr. *solare* (Phillips). — Dommergues & Meister, Pl. 4, Fig. 5; Pl. 5, Fig. 3-5.
1993 *Pleuroceras solare* (Phillips). — Elmi & Rulleau, Pl. 1, Fig. 1-2.
1996 *Pleuroceras solare* (Phillips). — Popa & Patrulius, Pl. 3, Fig. 4-10, 14.
1997 *Pleuroceras solare* (Phillips). — Cassel, Pl. 16, Fig. 2.
1998 *Pleuroceras* cf. *solare* (Phillips). — Elmi et al., P. 169, Fig. f.
1998 *Pleuroceras solare* (Phillips). — Rulleau, Pl. 29, Fig. 6.

With a quite open umbilicus, fine but sharp, relatively closed and regular ribs, a weakly cordate and acute keel and a subrectangular whorl section, our two little Amaltheidae from Dalaaser Schütz can be brought near *P. solare* (Phillips).
Age and repartition: Well distributed in the Euroboreal realm, this taxon occurs in the Mediterranean Tethys too. Its indicates the Apyrenum Subzone (Upper Domerian).

Superfamily: Hildoceratoidea Hyatt, 1867
Family: Hildoceratidae Hyatt, 1867
Subfamily: Harpoceratinae Neumayr, 1875

Genus: *Fuciniceras* Haas, 1913
Types species: *Hildoceras lavinianum* Meneghini in Fucini, 1900.
Remark: The use of the genera *Fuciniceras* and *Protogrammoceras* corresponds to the opinion of Dommergues et al. (in press).

Fuciniceras gr. *isseli* (Fucini, 1900) – *brevispiratum* (Fucini, 1900)
pl. 17, figs. 2–7

1900 *Grammoceras isseli* Fucini, Pl. 9, Fig. 6-8.
1900 *Hildoceras Lavinianum* var. *brevispirata* Fucini, Pl. 8, Fig. 6.
1983 *Fuciniceras isseli* (Fucini). — Braga, Pl. 2, Fig. 10; Pl. 3, Fig. 1-5.
1983 *Fuciniceras brevispiratum* (Fucini). — Braga, Pl. 2, Figs. 4-9.
1983 *Protogrammoceras isseli* (Fucini). — Dommergues, Ferretti, Geczy & Mouterde, Pl. 4, Fig. 1-12.
1991 *Protogrammoceras* gr. *isseli* (Fucini). — Blau & Meister, Pl. 5, Fig. 15-22.
1993 *Protogrammoceras* gr. *isseli* (Fucini). — Meister & Böhm, Pl. 8, Fig. 11-14.
1995 *Protogrammoceras* gr. *isseli* (Fucini). — Dommergues, Meister & Böhm, Pl. 9, Fig. 6.
1998 "*Fuciniceras*" gr. *isseli* (Fucini) – *brevispiratum* (Fucini). — Geczy & Meister, Pl. 9, Fig. 4, 6-10; Pl. 10, Fig. 1-9; Pl. 11, Fig. 1-3.
? non 2000 Protogrammoceras gr. *isseli* (Fucini). — Schlögl, Aubrecht & Tomasovych, Pl. 1, Fig. 11.
2001 *Fuciniceras isseli* (Fucini). — Venturi & Ferri, P. 179, Fig. H.

In bed 100a from Lorüns quarry several Harpoceratinae have been collected. The major part of these forms are characterized by a quite narrow ventral area and slightly sigmoïd ribs weakly orientated towards the aperture on the ventro-lateral part. They present an intermediate morphology between the typical *Fuciniceras* habitus with a tricarinate venter and angustirursiradiate ribs and the typical *Protogrammoceras* habitus with falciform ribs and a pinched ventral area.
Some specimens from Lorüns still shows slightly angustirursiradiate ribs with an already bit more pinched venter mainly on the inner and intermediate whorls. All these observations force to group all specimens into *Fuciniceras* gr. *isseli* (Fucini) - *brevispiratum* (Fucini) where *F. isseli* (Fucini) represents the finely ornamented pole and *F. brevispiratum* (Fucini) the coarse one. Although in bed 100a of Lorüns both morphologies are present finely ornamented specimens clearly dominate. On the contrary, in bed 100b the specimens exhibit a coarser ornamentation being closer related to the pole represented by *F. brevispiratum* (Fucini).
Some other specimens recorded from the Fleckenmergel are crushed and consequently the rib sketch is obviously modified.
Age and repartition: *F.* gr. *isseli* (Fucini) - *brevispiratum* (Fucini) is well known in the Mediterranean Tethys and indicates the Lower Domerian (Stokesi Subzone).

Fuciniceras gr. *celebratum* (Fucini, 1900)
pl. 17, figs. 8, 13, 14

1900 *Grammoceras celebratum* Fucini, Pl. 10, Fig. 1, 2.
1900 *Grammoceras celebratum* var. *italica* Fucini, Pl. 10, Fig. 3.
1983 *Protogrammoceras celebratum* (Fucini). — Braga, Pl. 4, Fig. 2-6.
1989 *P.* (*Protogrammoceras*) *celebratum* (Fucini). — Meister, Pl. 3, Fig. 14, 15; Pl. 4, Fig. 1 with synonymy.

1991 *Fuciniceras celebratum* (FUCINI). — FERRETTI, Pl. 11, Fig. 4-6.
1991 *Protogrammoceras* aff. gr. *celebratum* (FUCINI). — BLAU & MEISTER, Pl. 5, Fig. 24-25.
1996 *Protogrammoceras celebratum* (FUCINI). — EL HARIRI, DOMMERGUES, MEISTER, SOUHEL & CHAFIKI, Pl. 71, Fig. 4, 5.
1997 *Protogrammoceras celebratum* (FUCINI). — DOMMERGUES, MEISTER & MOUTERDE, Pl. 8, Fig. 3.
1997 *Protogrammoceras celebratum* (FUCINI). — DOMMERGUES, MEISTER & SCHIROLLI, Pl. 2, Fig. 16, 21.
1998 *Protogrammoceras* gr. *celebratum* (FUCINI). — GECZY & MEISTER, Pl. 12, Fig. 7-9; Pl. 13, Figs. 1-3, 5.
1998 *Protogrammoceras* aff. *celebratum* (FUCINI). — RULLEAU, Pl. 27, Fig. 6.
? non 2000 Protogrammoceras gr. *celebratum* (FUCINI). — SCHLÖGL, AUBRECHT & TOMASOVYCH, Pl. 1, Fig. 9.
2001 *Protogrammoceras celebratum* (FUCINI). — VENTURI & FERRI, P. 178, Fig. e, g, h, l-n.

Some Harpoceratinae with falciform ribs and a high, pinched, ventral area bearing an acute keel are attributed to the typical *F. celebratum* (FUCINI). The lack of flattening on both sides of the keel distinguishes FUCINI's species from the older *F. marianii* (FUCINI).
The specimens are a little more coarsely ribbed. *F. celebratum* (FUCINI) differs from *F.* gr. *isseli* (FUCINI) - *brevispiratum* (FUCINI) in having more falciform ribs with a strong projection forwards at the ventrolateral part throughout the ontogeny.
Age and repartition: Known from the Mediterranean Tethys and adjacent areas, *F. celebratum* (FUCINI) characterizes the upper part of the Stokesi Subzone.

Subgenus *Matteiceras* WIEDENMAYER, 1980
Type species: *Ammonites nitescens* YOUNG & BIRD, 1913.

***F.* (*Matteiceras*) *geometricum* (PHILLIPS, 1829)**
pl. 16, fig. 12

1829 *Ammonites geometricus* PHILLIPS, Pl. 14, Fig. 9
1934 *Harpoceras falciplicatum* (FUCINI). — MONESTIER, Pl. 1, Fig. 3, 13, 32, 33, 36, 37; non Pl. 10, Fig. 40, 41.
1962 *Arieticeras geometricum* (PHILLIPS). — HOWARTH, Pl. 18, Fig. 2.
1975 *Protogrammoceras monestieri* FISCHER, Pl. 1, Fig. 13-17; App. 10, 14, Fig. 4-7; App. 15, Fig. 5.
1980 *P. monestieri* FISCHER. — DOMMERGUES & MOUTERDE, P. 301, Pl. 3, Fig. 4-6; Pl. 4, Fig. 1-4; ? Pl. 2, Fig. 9-14.
1985 *P.* (*Matteiceras*) *monestieri* (FISCHER). — DOMMERGUES, MEISTER & FAURÉ, Pl. II, Fig. 1; Pl. III, Fig. 3; Pl. IV, Fig. 3-4
1986 *P.* (*Matteiceras*) *monestieri* (FISCHER). — MEISTER, Pl. 21, Fig. 3, 4, 8, 9.
1989 *P.* (*Matteiceras*) *monestieri* (FISCHER). — MEISTER, P. 38 with synonymy.
1990 *P.* (*Matteiceras*) *monestieri* (FISCHER). — DOMMERGUES & MEISTER, Fig. 5 (20).
1991 *Protogrammoceras* (*Matteiceras*) gr. *monestieri* (FISCHER). — BLAU & MEISTER, Pl. 6, Fig. 3, 4.
1992 *P.* (*M.*) *geometricum* (PHILLIPS). — HOWARTH, Pl. 3, fig. 5; Pl. 4, Fig. 1-3.
1993 *P.* (*M.*) *monestieri* (FISCHER). — MEISTER & BÖHM, Pl. 9, Fig. 1
1998 *P.* (*Matteiceras*) *monestieri* (FISCHER). — GECZY & MEISTER, Pl. 6, Fig. 13, 14.

Associated with *Fuciniceras* gr. *isseli* (FUCINI) - *brevispiratum* (FUCINI) in bed 100a at Lorüns some Harpoceratinae with a quite spaced, coarse, sigmoid and rursiradiate ornament were found. They are attributed to the subgenus *F.* (*Matteiceras*). The ribs are quite evanescent on the lower part of the flanks and become broad and acute on the upper part near the venter. They thus correspond to *F.* (*M.*) *geometricum* (PHILLIPS). This species is well known from the Euroboreal realm where it has been described in detail (MEISTER, 1986; DOMMERGUES et al., 1985; DOMMERGUES & MEISTER, 1989).
Age and repartition: *F.* (*M.*) *geometricum* (PHILLIPS) indicates the lower part of the Stokesi Subzone in the Euroboreal realm where it characterizes the Geometricum Horizon. This species is a good element of correlation between the Euroboreal and Tethyan realms, mainly the Austroalpine Units in Austria and Hungary. However, in Hungary we have demonstrated a slight shifting for the correlation with the Lavinianum, Isseli and Marianii Horizons of the Tethys area and the Geometricum horizon of the Euroboreal realm (GECZY & MEISTER, 1998). Indeed at the base of the Isseli Horizon occur *F.* (*M.*) *geometricum* (PHILLIPS) and *F.* (*Matteiceras*) *nitescens* (YOUNG & BIRD) in the upper part of this unit. Consequently correlation horizons by horizons are not exactly coinciding (see DOMMERGUES et al., 1997).

***F.* (*Matteiceras*) *nitescens* (YOUNG & BIRD, 1828)**
pl. 16, fig. 13

1828 *Ammonites nitescens* YOUNG & BIRD, P. 257.
1984 *Arieticeras nitescens* (YOUNG & BIRD). — MAUBEUGE, P. 84, Fig. 56; P. 86, Fig. 57.
1985 *Protogrammoceras nitescens* (YOUNG & BIRD). — COMAS RENGIFO, Pl. 14, Fig. 5-6 with synonymy.
1986 *P.* (*Matteiceras*) *nitescens* (YOUNG & BIRD). — MEISTER, Pl. 3, Fig. 10, 12.
1990 *P.* (*Matteiceras*) *nitescens* (YOUNG & BIRD). — DOMMERGUES & MEISTER, Fig. 3 (11, 12); Fig. 5 (21).
1992 *P.* (*M.*) *nitescens* (YOUNG & BIRD). — HOWARTH, Pl. 3, Fig. 5; Pl. 4, Fig. 1-3.
1997 *Protogrammoceras* (*Matteiceras*) *nitescens* (YOUNG & BIRD). — DOMMERGUES, MEISTER & MOUTERDE, Pl. 8, Fig. 5.
1998 *P.* (*Matteiceras*) *nitescens* (YOUNG & BIRD). — GECZY & MEISTER, Pl. 7, Fig. 2.

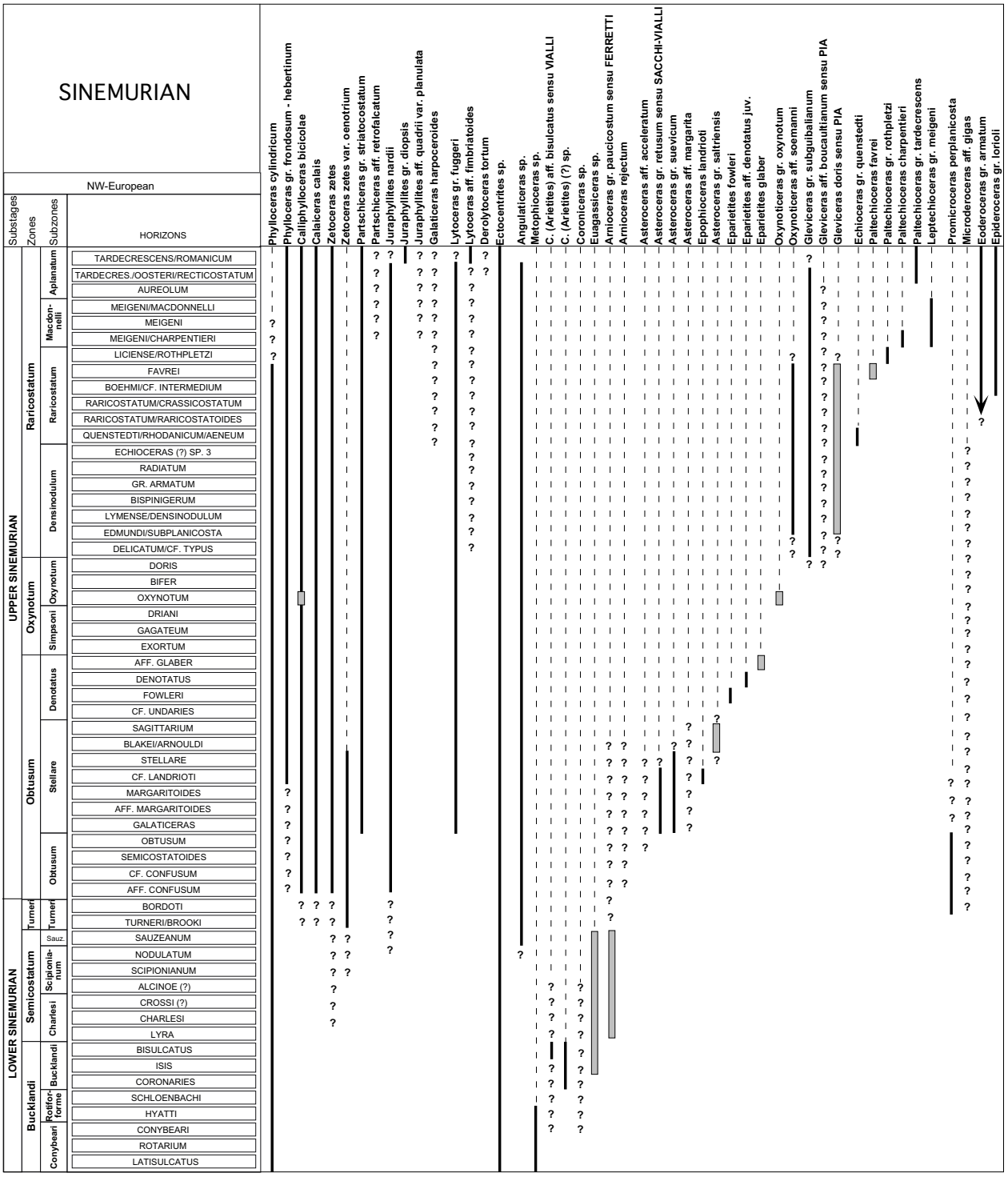

Figure 20: Biostratigraphical framework of the Sinemurian with the ammonite ranges.

? non 2000 *Protogrammoceras* gr. *nitescens* (Young & Bird). — Schlögl, Aubrecht & Tomasovych, Pl. 1, Fig. 10.

We regroup here *F.* (*Matteiceras*) which develop a very coarse and spaced ribbing. It is in fact the exacerbation of the ornament of *F.* (*M.*) *geometricum* (Phillips). Our specimen was collected ex situ in Lorüns quarry.

Age and repartition: In the Euroboreal realm, *F.* (*M.*) *nitescens* (Young & Bird) corresponds to the Nitescens Horizon (Stokesi Subzone). Its presence in the Upper Austroalpine Units allows a good correlation with the Marianii Horizon from the Tethys in spite of a slight shifting (Geczy & Meister, 1998).

Fuciniceras gr. *cornacaldense* (Tausch, 1890)

pl. 17, fig. 12

1890 *Harpoceras cornacaldense* Tausch, Pl. 1, fig. 1.

1895 *Harpoceras* ? *cornacaldense* Tausch var. Bicicolae Bonarelli, P. 339.

1983 *Fuciniceras cornacaldense* (Tausch). — Braga, Pl. 3, Fig. 6-8; Pl. 4, fig. 1, with synonymy.

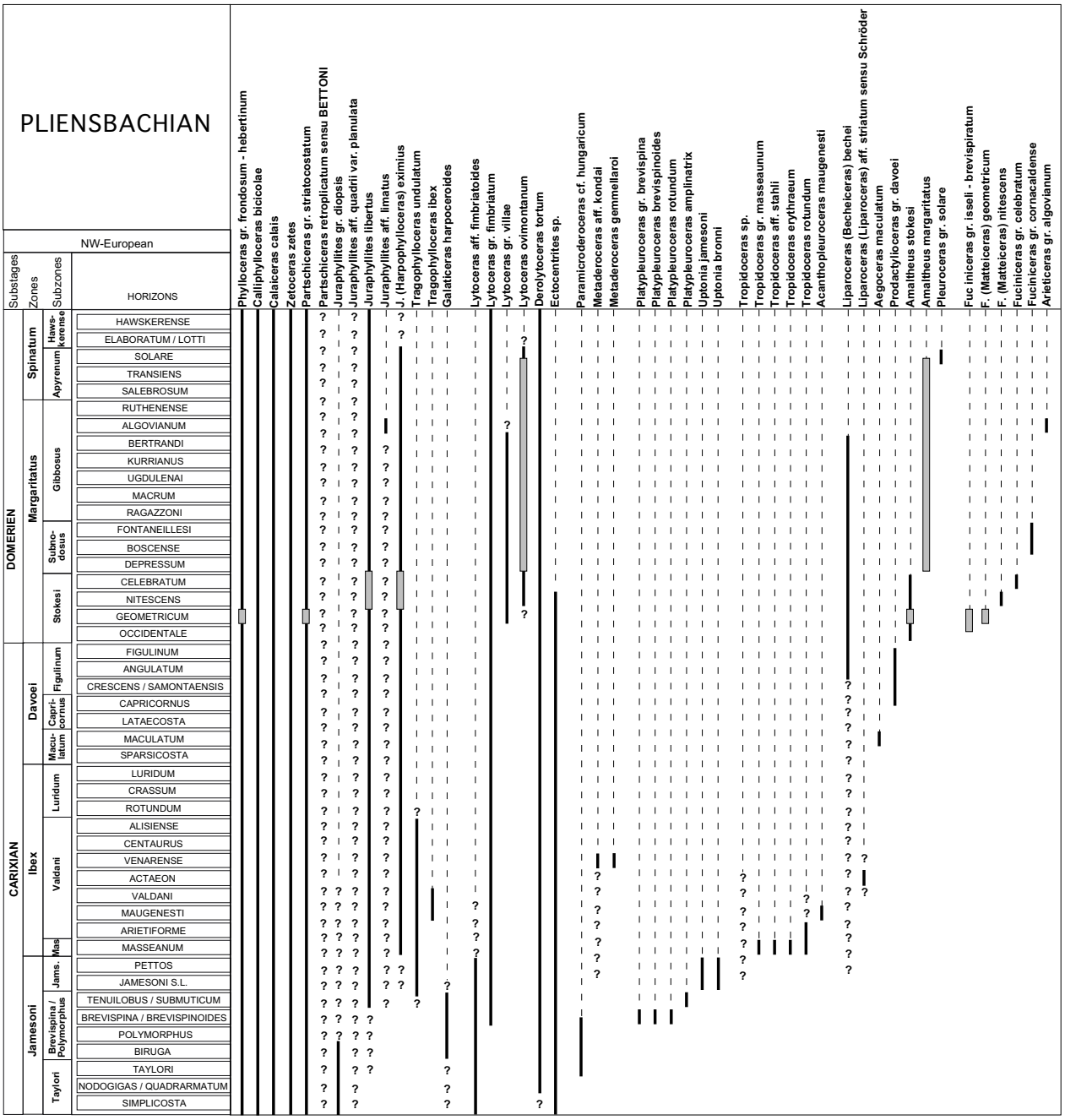

Figure 21: Biostratigraphical framework of the Pliensbachian with the ammonite ranges.

1991 *Fuciniceras* gr. *cornacaldense* (TAUSCH). — BLAU & MEISTER, Pl. 6, Fig. 12-17.

1996 *Fuciniceras cornacaldense* (TAUSCH). — EL HARIRI, DOMMERGUES, MEISTER, SOUHEL & CHAFIKI, Pl. 71, Fig. 8-14.

1998 *Fuciniceras cornacaldense* (TAUSCH). — GECZY & MEISTER, Pl. 13, Fig. 6 (aff.), 10, 11.

The specimen from Goppelspitze (P.8659), although slightly crushed, is a typical Fuciniceras with angulirursiradiate ribs abruptly interrupted near the venter, and a tabular tricarinate venter. Our specimen bears quite coarse ribs on the phragmocone which become finer, closer and sometimes fasciculate on the body chamber. This species has been recently discussed by GECZY & MEISTER (1998).

Age and repartition: *F. cornacaldense* (TAUSCH) characterizes the Cornacaldense horizon of the Subonodosus Subzone (Lower Domerian) in the Tethyan regions. It can be correlated with the Boscense Horizon of the Euroboreal realm (DOMMERGUES et al. 1997).

Subfamily: Arieticeratinae HOWARTH, 1955

Genus: *Arieticeras* SEGUENZA, 1885

Type species: *Ammonites algovianus* OPPEL, 1862.

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

pl. 17, figs. 9, 10, 11, 15

1862 *Ammonites Algovianum* OPPEL, P. 137.

1862 *Ammonites retrosicosta* OPPEL, P. 139.

1931 *Arieticeras almoetianum* Fucini, Pl. 8, Fig. 1, non 2-4.
1984 *Arieticeras ruthenense* (Reynes). — Antoniadis, Pl. 1, Fig. 4.
1988 *Arieticeras* cf. *algovianum* (Oppel). — Smith, Tipper, Taylor & Guex, Pl. 4, Fig. 10, 11.
1989 *Arieticeras algovianum* forme *algovianum* (Oppel). — Meister, Pl. 7, Fig. 12 with synonymy.
1989 *Arieticeras algovianum* forme *retrosicosta* (Oppel). — Meister, Pl. 7, Fig. 10.
1989 *Arieticeras algovianum* forme *almoetianum* Fucini. — Meister, Pl. 7, Fig. 11.
1991 *Arieticeras* gr. *algovianum* (Oppel). — Blau & Meister, Pl. 6, Fig. 23; Pl. 7, Fig. 1-18.
1991 *Arieticeras almoetianum* Fucini morphotypo A, B Ferretti, Pl. 12, Fig. 3 (?), 4; Pl. 13, Fig. 1, 2.
1991 *Arieticeras* gr. *algovianum* (Oppel), Blau & Meister, Pl. 6, Fig. 23; Pl. 7, Fig. 1-18.
? 1992 *Arieticeras* aff. *algovianum* (Oppel). — Smith & Tipper, Pl. 14, Fig. 1-7.
1993 *Arieticeras* gr. *algovianum* (Oppel). — Meister & Böhm, Pl. 9, Fig. 5, 7-10.
1993 *Arieticeras* ex. gr. *algovianum* (Oppel). — Jaksch, Pl. 2, Fig. 1.
1995 *Arieticeras* gr. *algovianum* (Oppel). — Dommergues, Meister & Böhm, Pl. 10, Fig. 2, 3, 5-7.
? 1996 *Arieticeras* aff. *algovianum* (Oppel). — Smith & Tipper, Pl. 20, Fig. 11, 12.
1997 *Arieticeras algovianum* (Oppel). — Cassel, Pl. 15, Fig. 4.
1997 *Arieticeras* gr. *algovianum* (Oppel). — Dommergues, Meister & Schirolli, Pl. 2, Fig. 6, 8, 9, 14.
1998 *Arieticeras* gr. *algovianum* (Oppel). — Geczy & Meister, Pl. 14, Figs. 4-11; Pl. 15, Figs. 1-3, 6.
2001 *Arieticeras algovianum* (Oppel). — Venturi & Ferri, P. 172, Fig. f.

The species sensu Meister (1989) includes several morphologies like *A. algovianum* form *retrosicosta* (Oppel), *A. algovianum* form *almoetianum* (Fucini) and *A. algovianum* (Oppel) s.s. The specimens from Vorarlberg show more rigid ribs than *A. algovianum* (Oppel) s.s. They thus seem to be closer to *A. algovianum* form *almoetianum* (Fucini) (*ibidem* 1929-30, Pl. 8, Fig. 2, 3; Meister 1989, Pl. 7, Fig. 11). The specimens always remain more compressed than *A.* gr. *bertrandi* (Kilian) and belong without doubt to Oppel's species.
Age and repartition: *A. algovianum* (Oppel) s.l. characterizes the Middle Domerian (Gibbosus Subzone) and has a wide geographical distribution (southern part of the Euroboreal Realm [France, Germany, Spain], the Tethyan realm and the northern Pacific domain).

4. Biostatigraphical framework

Remark: This study is based mainly on material from the collections of the Vorarlberger Naturschau, the natural history museum in Dornbirn. Except specimens collected recently by the authors, the ammonites are not horizonted. Thus the range chart shows the intervals of existence for the individual taxa as known from the literature, especially for the long ranged species (e.g. Phylloceratoidea, Lytoceratoidea).
Remark: For the use of the terms "horizon" or "level", we refer to Meister et al. (1994, p. 141) and Blau & Meister (2000, p. 3).

4.1. Sinemurian (fig. 20)

Lower Sinemurian

Besides some long range taxa, this period is represented by Arietitidae [*Metophioceras* sp., *Coroniceras* sp., *C.* (*Arietites*) aff. *bisulcatus* sensu Vialli, *C.* (*Arietites*) (?) sp., *Euagassiceras* sp., and *Arnioceras* gr. *paucicostatum* sensu Ferretti]. The precision remains at zone level.
The genus *Metophioceras* characterizes the base-middle part of the Bucklandi Zone and the *C.* (*Arietites*) aff. *bisulcatus* sensu Vialli, *C.* (*Arietites*) (?) sp. most probably its upper part.
The group *Euagassiceras* sp. and *Arnioceras* gr. *paucicostatum* sensu Ferretti point to the Semiscostatum Zone.
Following Guerin Franiatte & Müller (1984), the range of *Promicroceras perplanicosta* crosses the boundary Lower/Upper Sinemurian.
The ranges of *Arnioceras* gr. *paucicostatum* sensu Ferretti and *Arnioceras rejectum* are not well known and may correspond to this period or still to the Upper Sinemurian (Obtusum zone).

Upper Sinemurian

This period is better represented by ammonites than the previous one.
In the Obtusum Zone, characteristic ammonites from the base (Obtusum Subzone) seem to be missing. On the contrary the Stellare Subzone is well represented by a set of *Asteroceras* [*A.* aff. *acceleratum*, *A.* gr. *retusum* sensu Sacchi-Vialli, *A.* gr. *suevicum*, *A.* aff. *margarita*, *A.* gr. *saltriensis* and probably *Epophioceras* gr. *landrioti* (see Dommergues et al., 1994].
The Denotatus Subzone can be precisely recorded at Horizon level (standard Horizon in Blau & Meister, 2000). The **Fowleri Horizon**, the **Denotatus Horizon** and the **Glaber Horizon** are each represented by their index species.
The Oxynotum Zone is proven only by one *O. oxynotum* associated with *Calliphylloceras bicicolae*.
The Raricostatum Zone is mostly represented by long range taxa like *Gleviceras* gr. *subguibalianum*, *G.* aff. *boucaultianum* sensu Pia, *G. doris* sensu Pia and *Oxyno-*

ticeras aff. *soemanni*. Some *Eoderoceras* gr. *armatum* and *Epideroceras* gr. *lorioli* characterize its upper part. A set of Echioceratidae is correlated to the standard Horizons of the Raricostatum Subzone: *Echioceras* gr. *quenstedti* (**Quenstedti Horizon**), *Paltechioceras favrei* (**Favrei Horizon**), *P.* gr. *rothpletzi* (**Rothpletzi Horizon**), *P. charpentieri* (**Charpentieri Horizon**). The Macdonnelli Subzone is characterized by *Leptechioceras meigeni* and the Aplanatum Subzone by *Paltechioceras* gr. *tardecrescens*.
The fauna of this unit is associated with some Phylloceratoidea and Lytoceratoidea.

4.2. Pliensbachian (fig. 21)

Carixian substage

Only poorly defined Eoderoceratidae, like *Paramicroderoceras* cf. *hungaricum*, seem to occur at the lower part of the Jamesoni Zone, and they do not surely prove the presence of the Taylori Subzone. From the Polymorphus/Brevispina Subzone, on the other hand, a very significant succession can be put in evidence with the classic association of *Platypleuroceras* gr. *brevispina*, *P. brevispinoides*, *P. rotundum* characteristic of the **Brevispina Horizon** and with *P. amplinatrix* (**Tenuilobus Horizon**). The Jamesoni Subzone is only represented by *Uptonia jamesoni* and *U. bronni* (**Jamesoni and Pettos Horizons**). The genus *Tropidoceras* may occur in this zone.
The first subzone of the Ibex Zone (Masseanum Subzone) is well characterized by three species: *Tropidoceras masseanum*, *T.* aff. *stahli* and *T. erythraeum* (**Masseanum Horizon**). *Tropidoceras rotundum* appears in this horizon and persists into the following subzone (Valdani Subzone). This unit is characterized by the presence of *Acanthopleuroceras maugenesti* (**Maugenesti Horizon**), *Tragophylloceras undulatum* and *L.* (*Liparoceras*) aff. *striatum* sensu Schröder. No characteristic ammonites are recorded from the Luridum Subzone. Notice the presence of *T. ibex*, index species of the zone.
Based on the faunal association given by Geczy (1976), *Metaderoceras* aff. *kondai* seems to belong to the Ibex Zone rather than the Jamesoni Zone.
In the Davoei Zone, the Maculatum Subzone is only proved by the index species: *Aegoceras maculatum* (**Maculatum Horizon**). The first *Prodactylioceras davoei* occur near the top of the Capricornus Subzone but they mainly characterize the Figulinum Subzone. *L.* (*Becheiceras*) *bechei*, a long range species, starts to be common from this last subzone onward.

Domerian Substage

All three subzone of the Margaritatus Zone are represented in our material. The Stokesi Subzone is well characterized (mainly in Lorüns) by the index species: *Amaltheus stokesi*, by *F.* (*Matteiceras*) *monestieri* and *Fuciniceras isseli-brevispiratum* (**Monestieri Horizon**), by *F.* (*Matteiceras*) *nitescens* (**Nitescens Horizon**) and *Fuciniceras celebratum* (**Celebratum Horizon**). The Subnodosus Subzone is only known by *Fuciniceras cornacaldense* and finally the Gibbosus Subzone is represented by *Arieticeras algovianum* (**Algovianum Horizon**).
Amaltheus margaritatus which appears in this zone persists into the following Spinatum Zone. A characteristic taxon is the genus *Pleuroceras* which is represented in Vorarlberg by *P.* gr. *solare* (**Solare Horizon**).

5. Conclusion

The examination of the Liassic ammonite collection from the Vorarlberg Naturschau completed with field investigations implies:
• Almost all the zones of the Sinemurian and Pliensbachian can be characterized by ammonites. At this scale, no major faunal gap in the fossil record can be observed.
• Although the Northern Calcareous Alps of Vorarlberg (Upper Austroalpine Unit) are a part of the northern margin of the Tethys, the faunas show paleogeographical affinities to both the Tethyan and Euroboreal realms, respectively. This underlines the key position of the Upper Austroalpine Unit for biostratigraphical correlation between these two realms.
• The relationships between ammonite associations, facies (Fleckenmergel – Rotkalk) and paleogeographical faunal affinities have in part been checked. Most of the Euroboreal faunas are recorded from the Fleckenmergel versus Tethyan faunas from the Rotkalk. But several exceptions occur for the Sinemurian-Pliensbachian period, mainly during the Raricostatum and Margaritatus Zones.

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PLATE 1

Figs. 1–3: ***Phylloceras* gr. *frondosum-hebertinum* (Reynes)** — 1: Lorüns Quarry, P171, 2: Spullersee – Goppelspitze, P1527, 3: Auenfeld, P13259, Upper Sinemurian to Upper Pliensbachian

Fig. 4: ***Phylloceras cylindricum* (Sowerby)** — Steinernes Meer, MHN, Lower Sinemurian

Figs. 5–7: ***Calliphylloceras bicicolae* (Meneghini)** — 5: Spullersee – Goppelspitze, P1552, 6: Lorüns Quarry, P421, 7: Lorüns Quarry, niv. 7 (Upper Sinemurian, Oxynotum Zone), MHN, Upper Sinemurian to Upper Pliensbachian

Figs. 8, 13, 14: ***Partschiceras* gr. *striatocostatum* (Meneghini)** — 8: Goppelspitze, 13: Schröcken - Auenfeld, P6713, 14: Rothorn, P13368, Upper Sinemurian to Upper Pliensbachian

Figs. 9, 11: ***Partschiceras retroplicatum* (Rosenberg) sensu Bettoni** — 9, 11: Auenfeld, P7078, P13250, ? Pliensbachian

Fig. 10: ***Calaiceras calais* Meneghini** — Lorüns Quarry, P291, Upper Sinemurian to Upper Pliensbachian

Fig. 12: ***Partschiceras* aff. *retrofalcatum* (Stur in Geyer)** — Sonnenlagant, P1495, ? Uppermost Sinemurian

PLATE 1

PLATE 2

Figs. 1, 3, 5: ***Zetoceras zetes*** **(d'Orbigny)** — 1, 5: Lorüns Quarry, P215, P284, 3: Weg zum Gehrengrat or Rothorn, 210-11, Upper Sinemurian to Upper Pliensbachian

Fig. 2: ***Zetoceras zetes*** **var.** ***oenotrium*** **(Fucini)** — Lorüns Quarry, MHN, Lower to Upper Sinemurian

Figs. 4, 7: ***Partschiceras*** **gr.** ***striatocostatum*** **(Meneghini)** — 4: Lorüns Quarry, niv. 100 (Lower Domerian, Stokesi Subzone), MHN, 7: Lorüns Quarry, P257, Upper Sinemurian to Upper Pliensbachian

Fig. 6: ***Juraphyllites libertus*** **(Gemmellaro)** — Eingemauerte, P7124, Pliensbachian

PLATE 2

PLATE 3

Fig. 1: ***Juraphyllites* gr. *diopsis* (Gemmellaro)** — Goppelspitze, P2662, Uppermost Sinemurian to Lowermost Pliensbachian

Figs. 2, 3: ***Juraphyllites* aff. *limatus* (Rosenberg)** — 2: Auenfeld, P13273, 3: Eingemauerte, 210-9, Lower Pliensbachian (?) to Upper Pliensbachian

Figs. 4, 6–8: ***Juraphyllites* aff. *quadrii* var. *planulata* (Fucini)** — Lorüns Quarry, P172, P261, P255 (2 ex.), ? Uppermost Sinemurian to Upper Pliensbachian

Fig. 5: ***J.* (*Harpophylloceras*) *eximius* (Hauer)** — Eingemauerte, P1335, Middle Pliensbachian to Upper Pliensbachian

Fig. 9: ***Lytoceras* gr. *fuggeri* Geyer** — Lorüns Quarry, P153, Upper Sinemurian

Fig. 10: ***Galaticeras* gr. *harpoceroides* (Gemmellaro)** — Auenfeld, P13263, Upper Sinemurian to Lower Pliensbachian

Fig. 11: ***Tragophylloceras ibex* (Quenstedt)** — Goppelspitze, P7050, Middle Pliensbachian (Ibex Zone)

Fig. 12: ***Ectocentrites* sp.** — Giglturm, Hettangian to the lowermost Upper Pliensbachian

Fig. 13: ***Lytoceras* sp.** — Spullersee, P376, Sinemurian to Toacian

Fig. 14: ***Lytoceras ovimontanum* Geyer** — Lorüns Quarry, MHN, Upper Pliensbachian

PLATE 3

PLATE 4

Fig. 1: ***Lytoceras ovimontanum*** **Geyer** — Lorüns Quarry, niv. 109, MHN, Middle to Upper Domerian, Subnodosus to Apyrenum Subzones

Figs. 2, 5: ***Derolytoceras tortum*** **(Quenstedt)** — Auenfeld, P247, P7077, Upper Sinemurian (?) to Upper Pliensbachian

Figs. 3, 4: ***Angulaticeras*** **sp.** — Eingemauerte, 210-4, 210-6, Upper Sinemurian

Fig. 6: ***Coroniceras*** **sp.** — Weg zum Gehrengrat, 210-11, Lower Sinemurian

Fig. 7: ***Euagassiceras*** **? sp.** — Steinernes Meer, MHN, Lower Sinemurian

Figs. 8, 9: ***Coroniceras*** **(*Arietites*) aff. *bisulcatus* (Bruguiere) sensu Vialli** — 8: Weg zum Gehrengrat, 210-11, 9: Formarinsee, 210-12, Lower Sinemurian (Bucklandi Zone)

Fig. 10: ***Metophioceras*** **sp.** — Rothorn, 210-11, Lower Sinemurian (Conybeari Zone)

PLATE 4

PLATE 5

Fig. 1: ***Coroniceras* (*Arietites*) aff. *bisulcatus* (Bruguiere) sensu Vialli** — Weg zum Gehrengrat, 210-11, Lower Sinemurian (Bucklandi Zone)

Fig. 2: ***Arnioceras rejectum* Fucini** — Lorüns Quarry, P1564, Upper Sinemurian (Obtusum Zone)

Fig. 3: ***Asteroceras* gr. *retusum* (Reynes) sensu Sacchi-Vialli & Cantaluppi** — Rothorn, P1583, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

Fig. 4: ***Arnioceras* gr. *paucicostum* Fucini sensu Ferretti** — Steinernes Meer, P13406, Lower Sinemurian

Fig. 5: ***Asteroceras* aff. *margarita* (Parona)** — Unknown locality, P13411, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

PLATE 5

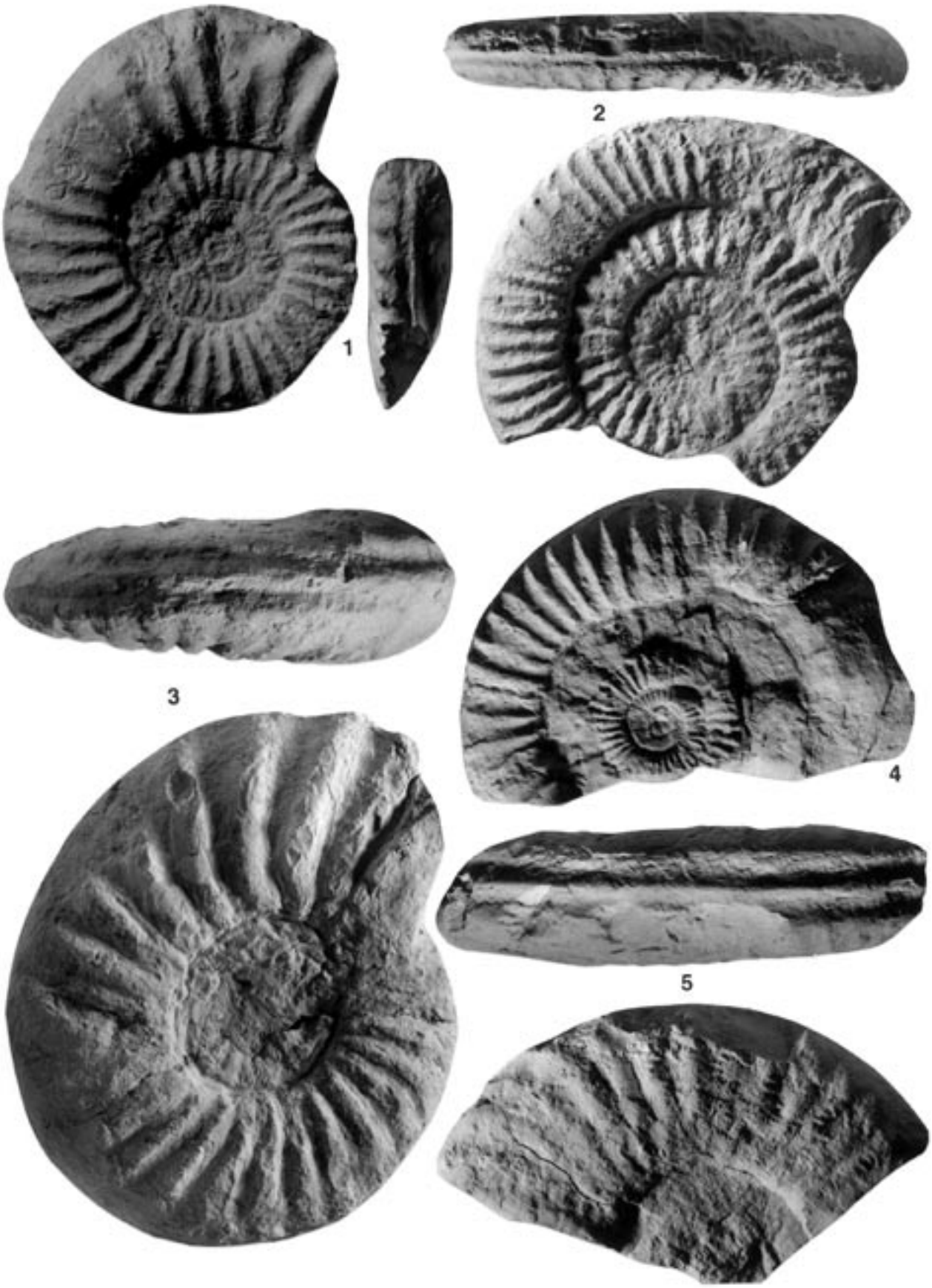


PLATE 6

Fig. 1: ***Asteroceras* gr. *saltriensis* (Parona)** — Eingemauerte, P7225, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

Figs. 2, 4: ***Eparietites* aff. *denotatus* (Simpson) juv.** — 2: Unknown locality, P003, 4: Eingemauerte, 210-4, Upper Sinemurian (Obtusum Zone, Denotatus Subzone)

Fig. 3: ***Eparietites glaber* Guerin-Franiatte** — Lorüns Quarry, niv. 7, MHN, Upper Sinemurian (Obtusum Zone, Denotatus Subzone)

PLATE 6

PLATE 7

Figs. 1, 3: ***Asteroceras* gr. *saltriensis* (Parona)** — 1, 3: Lorüns Quarry, MHN, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

Fig. 2: ***Asteroceras* aff. *acceleratum* Hyatt** — Rothorn, 210/4**,** Upper Sinemurian (Obtusum Zone)

PLATE 7

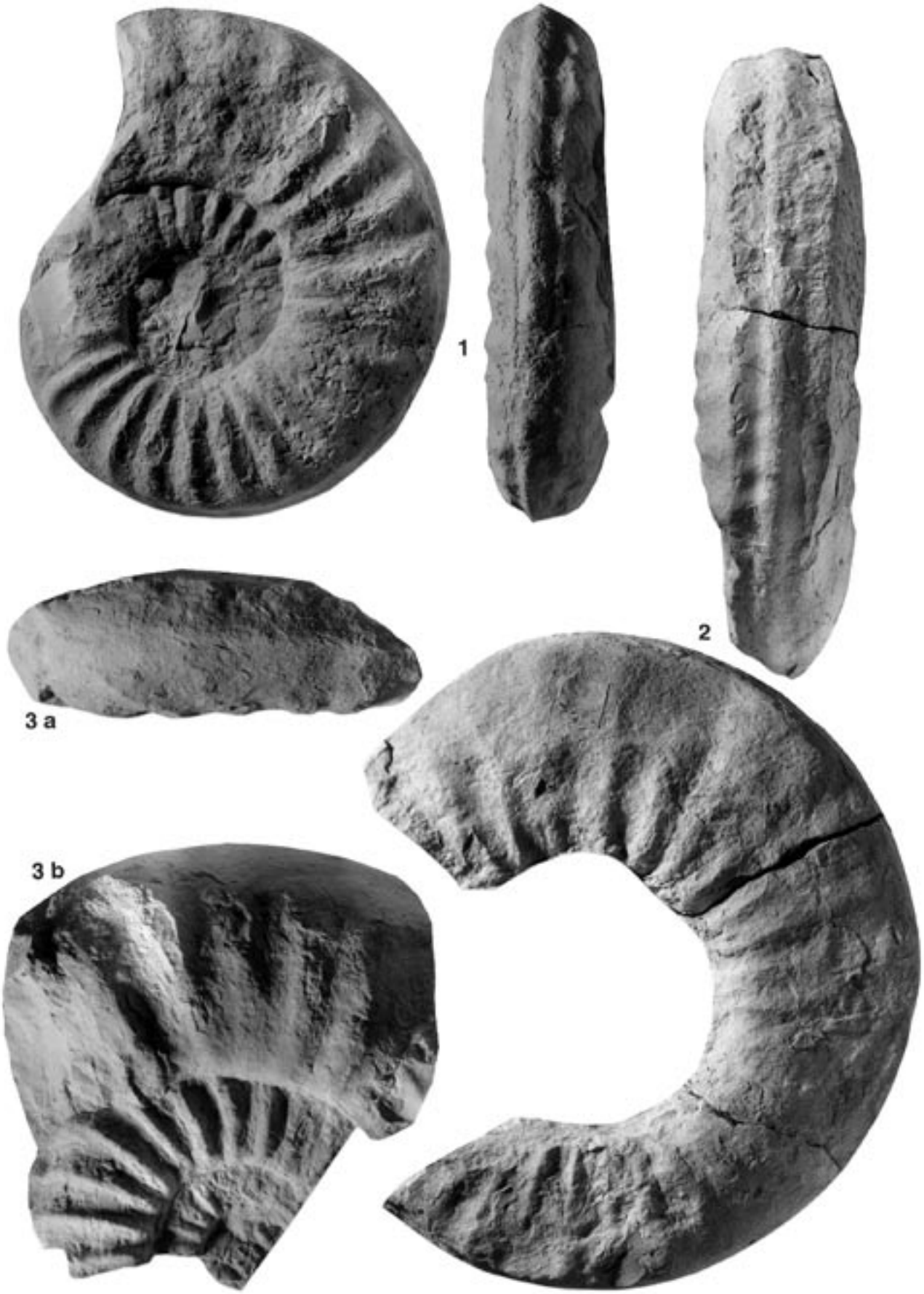
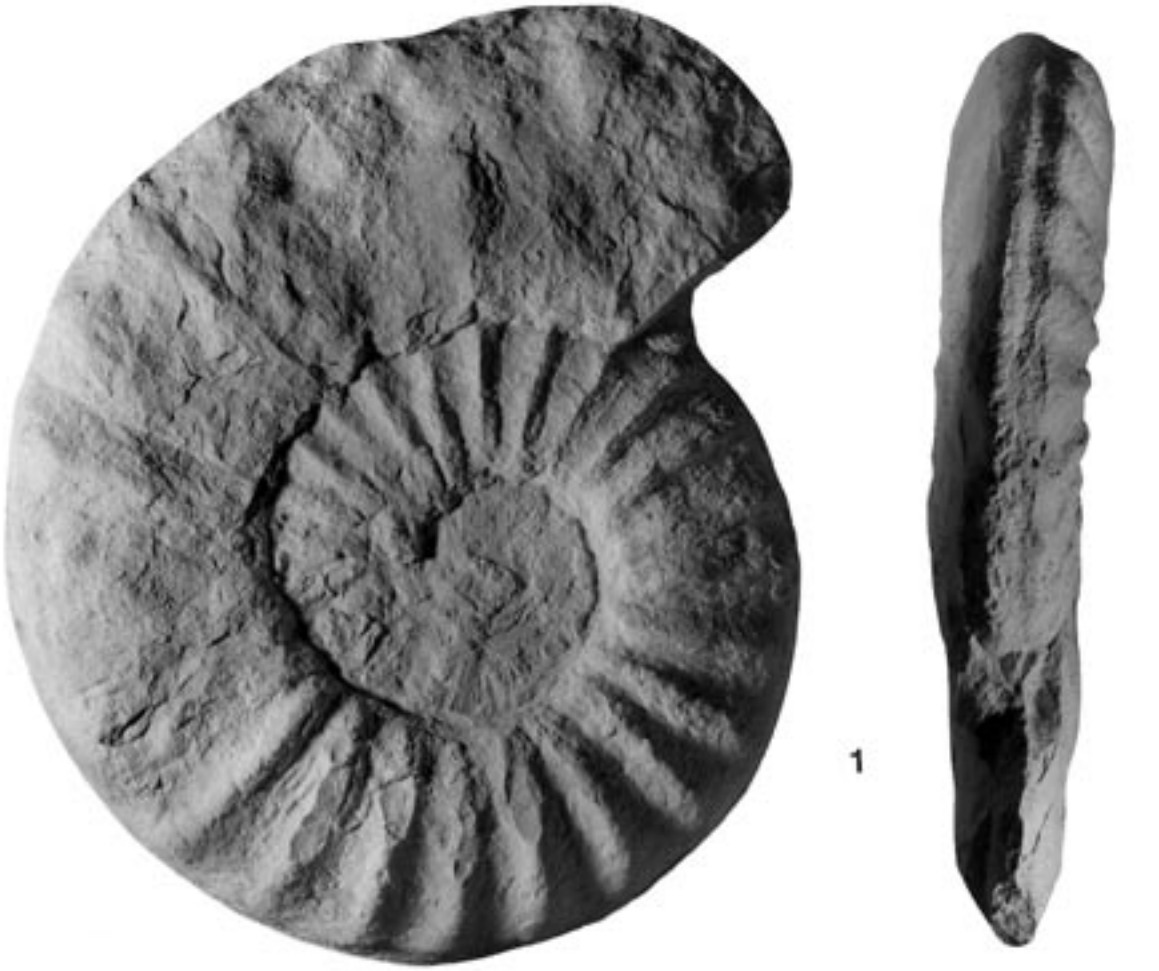


PLATE 8

Fig. 1: ***Asteroceras* gr. *saltriensis* (Parona)** — Lorüns Quarry, MHN, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

Fig. 2: ***Eparietites glaber* Guerin-Franiatte** — Lorüns Quarry, niv. 7a, MHN, Upper Sinemurian (Obtusum Zone, Denotatus Subzone)

PLATE 8



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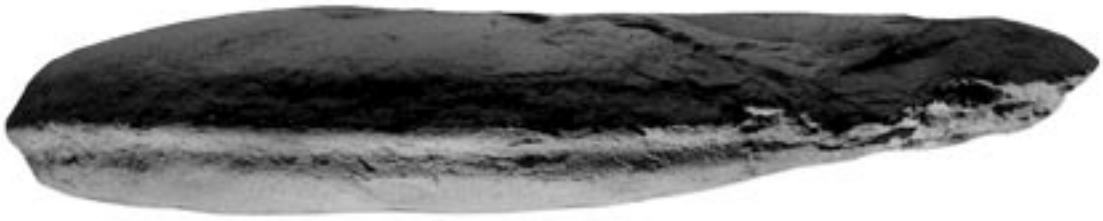

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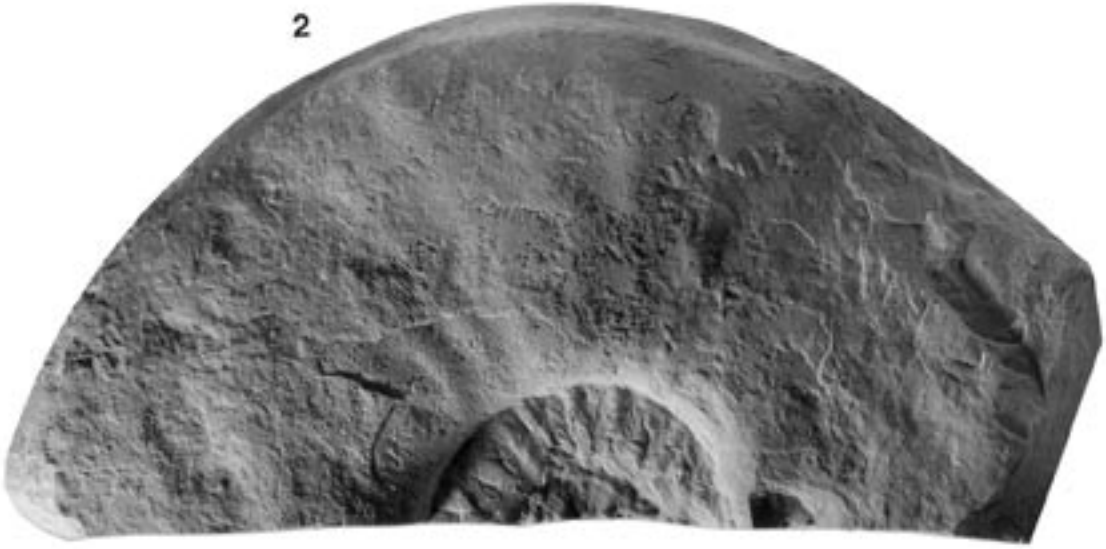

PLATE 9

Fig. 1: ***Eparietites fowleri*** **(Buckman)** — Rothorn, 210-4, Upper Sinemurian (Obtusum Zone, Denotatus Subzone)

Fig. 2: ***Oxynoticeras*** **aff.** ***soemanni*** **(Dumortier)** — Biberacher Hütte, P7165, Upper Sinemurian (Raricostatum Zone)

Fig. 3: ***Eparietites glaber*** **Guerin-Franiatte** — Rothorn, P410, Upper Sinemurian (Obtusum Zone, Denotatus Subzone)

Fig. 4: ***Epophioceras*** **gr.** ***landrioti*** **(d'Orbigny)** — Sarotlatal b. Brand, P393, Upper Sinemurian (Obtusum Zone, Stellare Subzone)

Figs. 5, 7: ***Oxynoticeras*** **gr.** ***oxynotum*** **(Quenstedt)** — 5: Lorüns Quarry, niv. 13, MHN, 7: Lorüns Quarry, P230, Upper Sinemurian (Oxynotum Zone, Oxynotum Subzone)

Fig. 6: ***Gleviceras doris*** **(Reynes) sensu Pia** — Lorüns Quarry, MHN, Upper Sinemurian (Raricostatum Zone)

PLATE 9

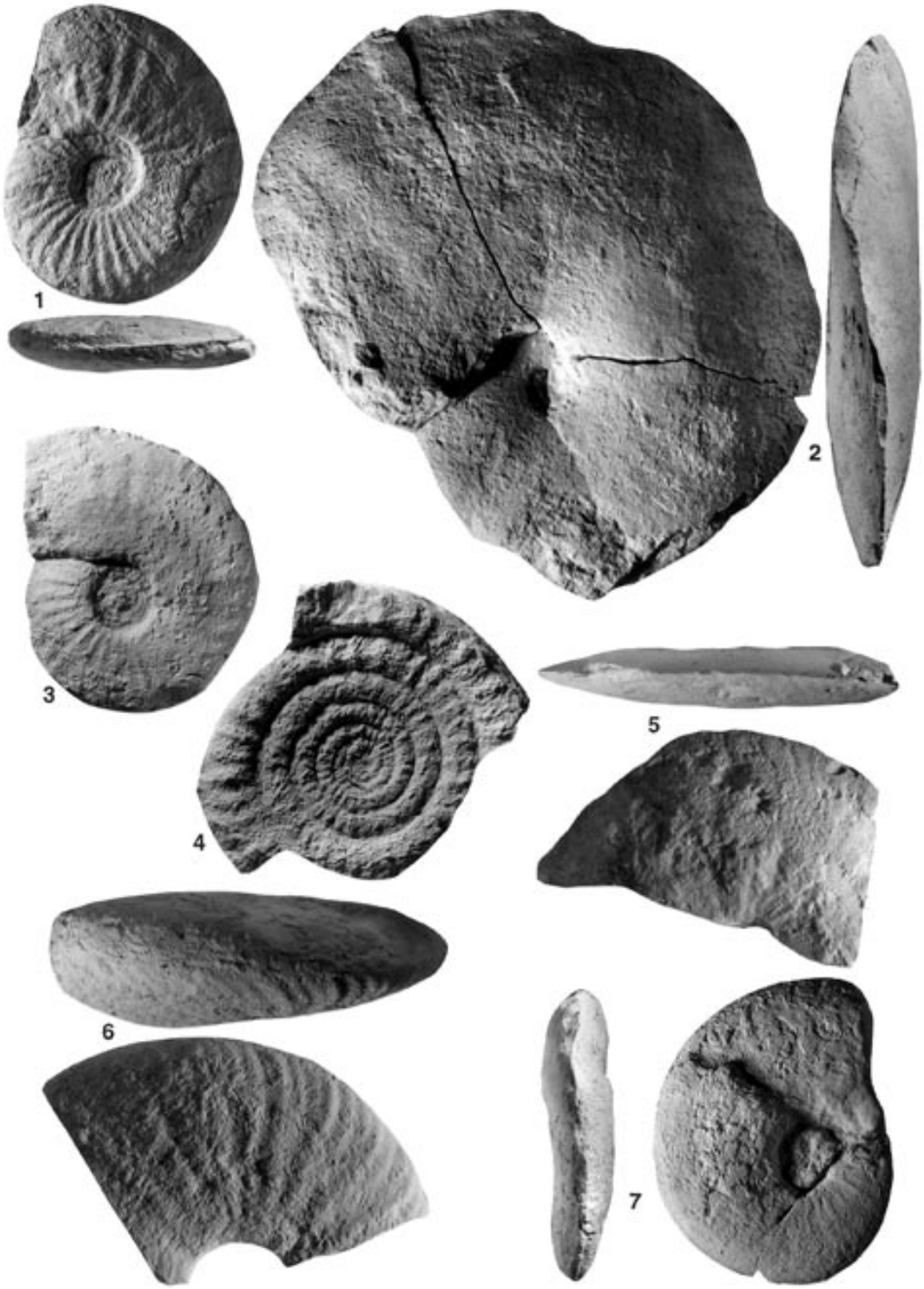

PLATE 10

Figs. 1, 2, 4: ***Gleviceras* gr. *subguibalianum* (Pia)** — 1, 2: Auenfeld, SA25, FS60, 4: Obere Sarotlaalpe, 210-4, Upper Sinemurian (Raricostatum Zone)

Figs. 3, 5: ***Gleviceras* aff. *boucaultianum* (Dumortier) sensu Pia** — Eingemauerte, 210-4 (2 ex.), Upper Sinemurian (Raricostatum Zone)

Figs. 6–8: ***Echioceras* gr. *quenstedti* (Schafhäutl)** — 6, 7: Lorüns Quarry, P281, P292, 8: Auenfeld, P13261, Upper Sinemurian (Raricostatum Zone, Raricostatum Subzone)

PLATE 10

PLATE 11

Figs. 1, 2: ***Echioceras* gr. *quenstedti* (Schafhäutl)** — 1: Lorüns Quarry, P1813, 2: Eingemauerte, 210-11, Upper Sinemurian (Raricostatum Zone, Raricostatum Subzone)

Figs. 3, 7, 8: ***Paltechioceras favrei* (Hug)** — 3: Obere Sarotlaalpe, P1613, 7, 8: Lorüns Quarry, P382, P2347, Upper Sinemurian (Raricostatum Zone, Raricostatum Subzone)

Figs. 4, 6: ***Paltechioceras charpentieri* (Schafhäutl)** — 4: Oberzalim, P1497, 6: Auenfeld, P7075, Upper Sinemurian (Raricostatum Zone, Macdonnelli Subzone)

Figs. 5, 9: ***Leptechioceras* gr. *meigeni* (Hug)** — 5, 9: Lorüns Quarry, LOx7/4, P229, Upper Sinemurian (Raricostatum Zone, Macdonnelli Subzone)

Figs. 10, 11: ***Paltechioceras* gr. *tardecrescens* (Hauer)** — 10: Schröcken, P7080, 11: Goppelspitze, P13392, Upper Sinemurian (Raricostatum Zone, Aplanatum Subzone)

Fig. 12: ***Paltechioceras* gr. *rothpletzi* (Böse)** — Rothorn, P2452, Upper Sinemurian (Raricostatum Zone, Raricostatum Subzone)

PLATE 11

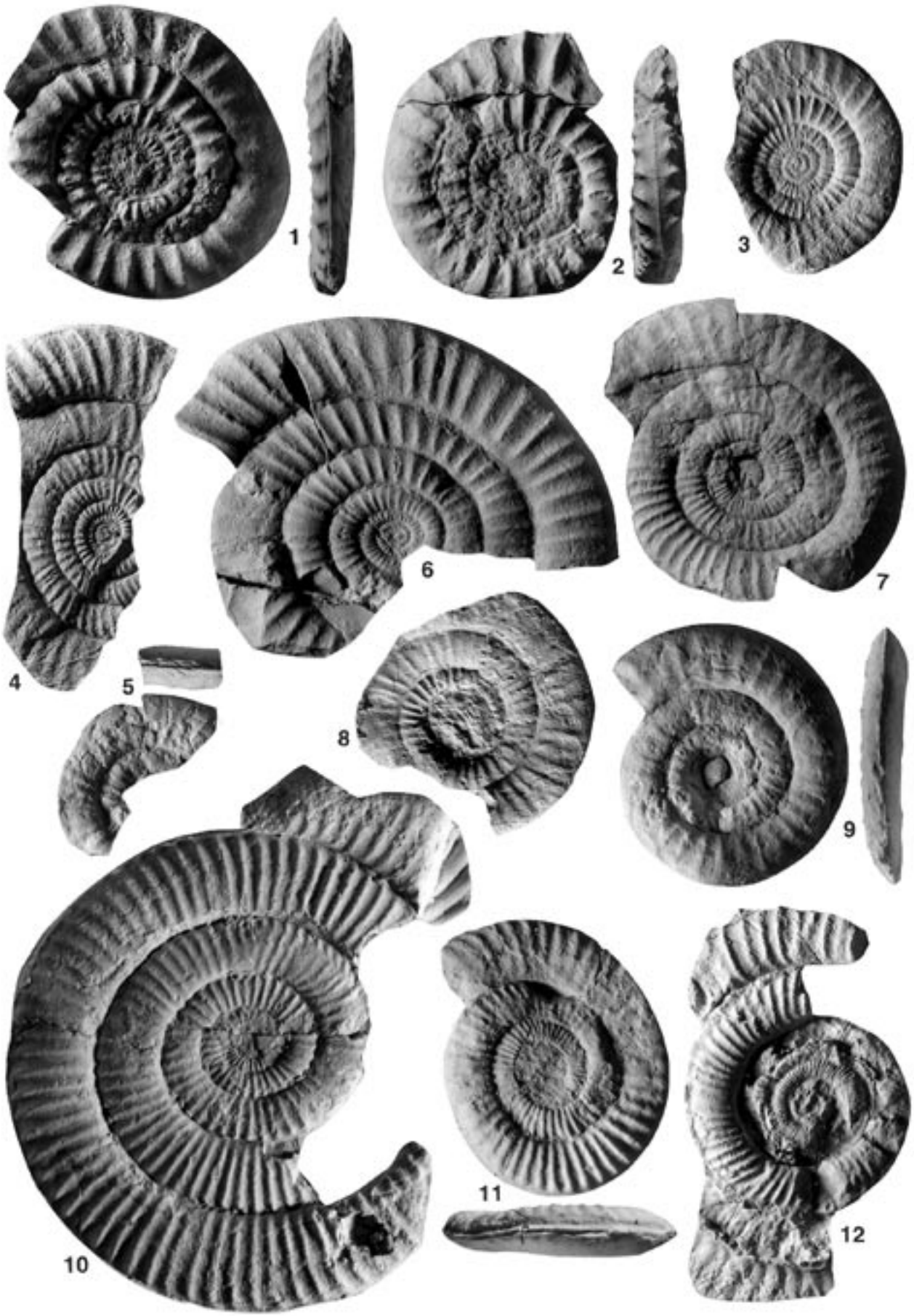

PLATE 12

Figs. 1, 3, 6: ***Epideroceras* gr. *lorioli* (Hug)** — 1: Lorüns Quarry, P1793, 3: Goppelspitze, P2311, 6: Auenfeld, P7098, Upper Sinemurian (Raricostatum Zone)

Fig. 2: ***Microderoceras* sp.** — Lorüns Quarry, MHN, Upper Sinemurian

Fig. 4: ***Eoderoceras* gr. *armatum* (Sowerby)** — Auenfeld, FS40, Upper Sinemurian (Raricostatum Zone)

Fig. 5: ***Promicroceras perplanicosta* (Spath)** — Lorüns Quarry, P190, Topmost Lower Sinemurian to lowermost Upper Sinemurian

Fig. 7: ***Paramicroderoceras* cf. *hungaricum* (Geczy)** — Lorüns Quarry, P2303, Lower Pliensbachian (Jamesoni Zone)

PLATE 12

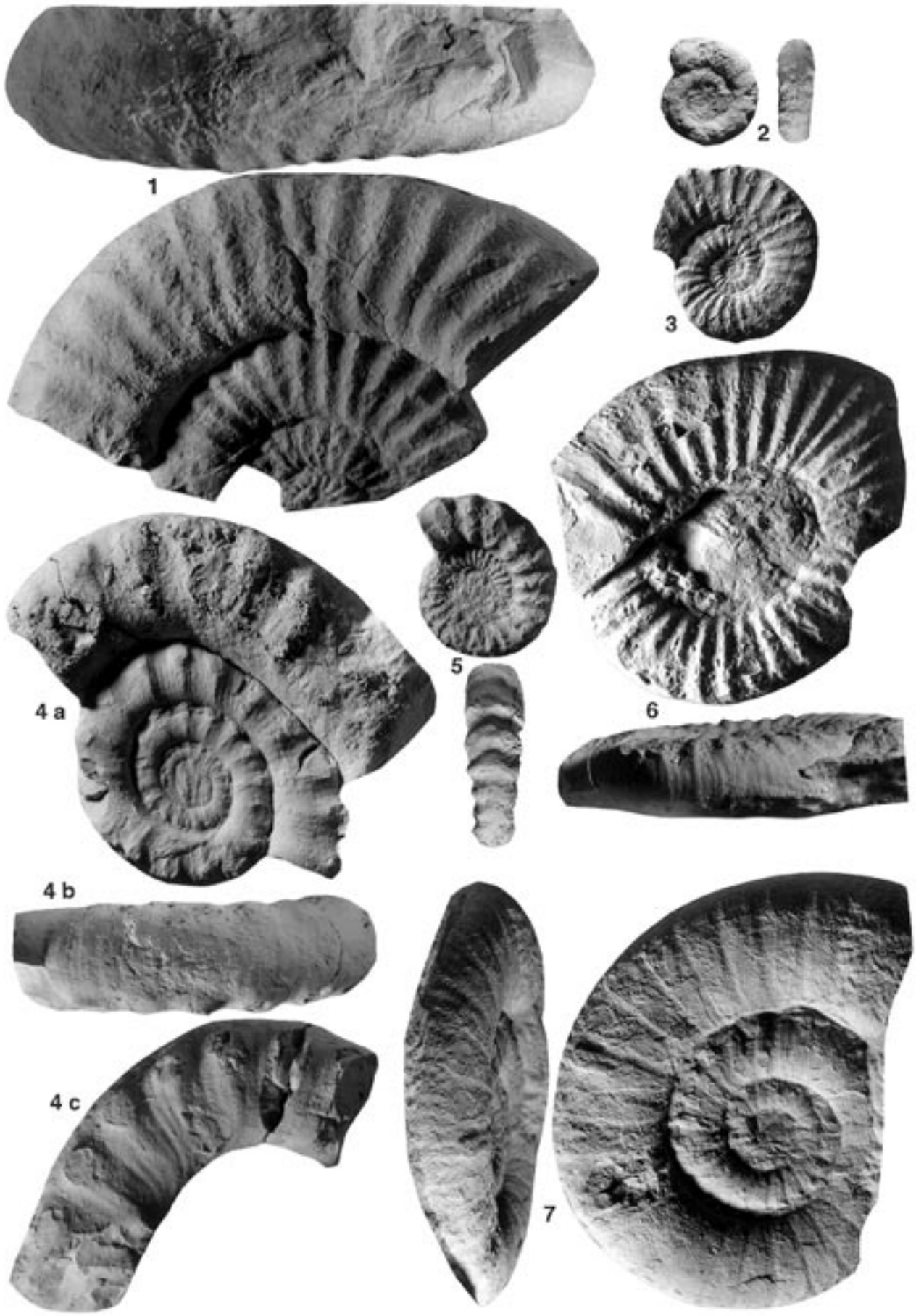

PLATE 13

Fig. 1: ***Microderoceras* aff. *gigas* (Quenstedt)** — Goppelspitze, P1554, Upper Sinemurian

Fig. 2: ***Metaderoceras gemmellaroi* forma *kondai* (Geczy)** — Auenfelder Alpe, P7107, Lower Pliensbachian (Ibex Zone, Valdani Subzone)

Figs. 3, 4: ***Metaderoceras gemmellaroi* (Levi)** — 3: Eingemauerte, 210-3, 4: Rothorn, P7149, Lower Pliensbachian (Ibex Zone, Valdani Subzone)

Fig. 5: ***Prodactylioceras* gr. *davoei* (Sowerby)** — Auenfeld, 211-7, Lower Pliensbachian (Davoei Zone)

Figs. 6, 7: ***Platypleuroceras rotundum* (Quenstedt)** — 6: Auenfelder Alpe, 211-7, 7: Eingemauerte, Lower Pliensbachian (Jamesoni Zone, Brevispina/Polymorphus Subzone)

PLATE 13

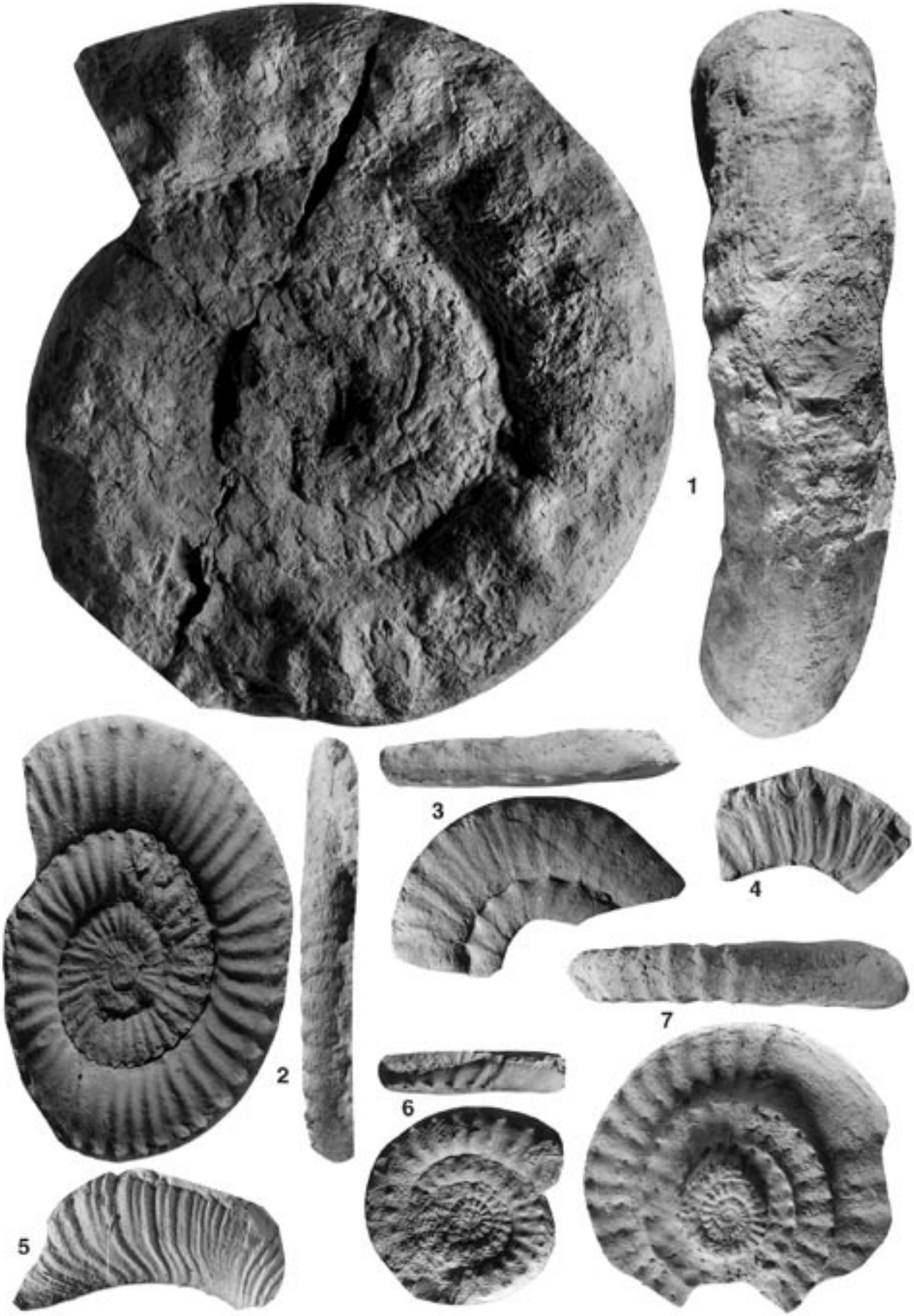

PLATE 14

Figs. 1–3: ***Platypleuroceras* gr. *brevispina*** **(Sowerby)** — 1: Auenfeld, P13260, 2: Goppelspitze, P1547, 3: Eingemauerte, P7131, Lower Pliensbachian (Jamesoni Zone, Brevispina/Polymorphus Subzone)

Fig. 4: ***Uptonia bronni*** **(Roemer)** — Schröcken, P6708, Lower Pliensbachian (Jamesoni Zone, Jamesoni Subzone)

Fig. 5: ***Platypleuroceras amplinatrix*** **(Quenstedt)** — Spullersee, P1561, Lower Pliensbachian (Jamesoni Zone, Brevispina/Polymorphus Subzone)

Fig. 6: ***Platypleuroceras brevispinoides*** **Tutcher & Trueman** — Lorüns Quarry, P2335, Lower Pliensbachian (Jamesoni Zone, Brevispina/Polymorphus Subzone)

Fig. 7: ***Uptonia jamesoni*** **(Sowerby)** — Goppelspitze, P7797, Lower Pliensbachian (Jamesoni Zone, Jamesoni Subzone)

PLATE 14

PLATE 15

Figs. 1, 6: ***Uptonia jamesoni*** **(Sowerby)** — 1: Eingemauerte, P13355, 6: Auenfeld, P13268, Lower Pliensbachian (Jamesoni Zone, Jamesoni Subzone)

Figs. 2, 4: ***Tropidoceras*** **gr.** ***masseanum*** **(d'Orbigny)** — 2, 4: Auenfeld, SA50 (2 ex.), Lower Pliensbachian (Ibex Zone, Masseanum Subzone)

Fig. 3: ***Tropidoceras*** **sp.** — Auenfeld, P7105, Lower Pliensbachian (Jamesoni to Ibex Zones)

Figs. 5, 7, 8: ***Tropidoceras rotundum*** **(Futterer)** — 5: Eingemauerte, P7127, 7: Auenfeld, P7083, 8: Unknown locality, 210-9, Lower Pliensbachian (Ibex Zone, Masseanum to Valdani Subzones)

PLATE 15

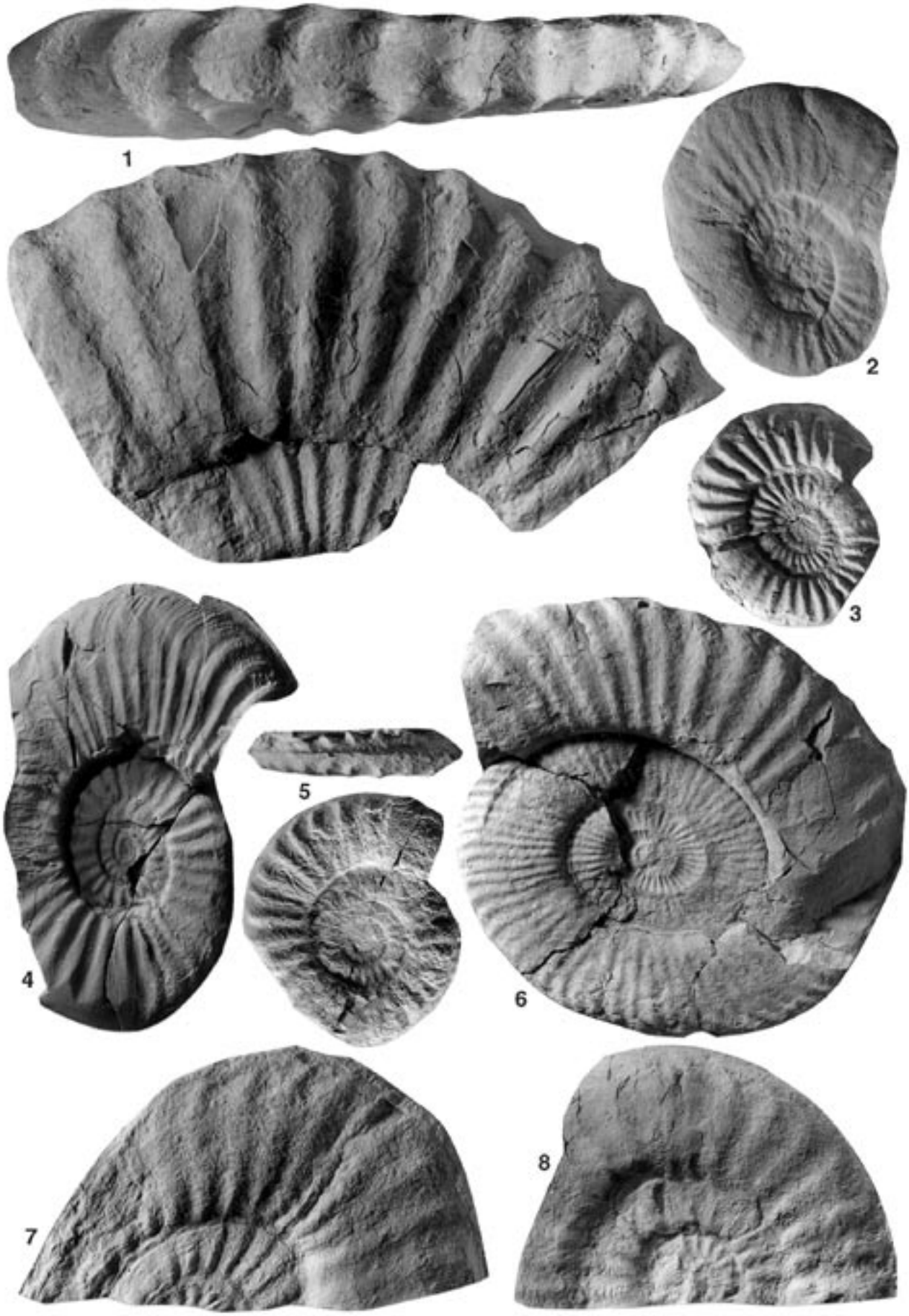

PLATE 16

Fig. 1: ***Tropidoceras* aff. *stahli* (Oppel)** — Spullersee, P2675, Lower Pliensbachian (Ibex Zone, Masseanum Subzone)

Figs. 2, 3: ***Tropidoceras erythraeum* (Gemmellaro)** — 2, 3: Auenfeld, P7084, P7076, Lower Pliensbachian (Ibex Zone, Masseanum Subzone)

Fig. 4: ***Liparoceras* (*Becheiceras*) *bechei* (Sowerby)** — Lorüns Quarry, P419, Pliensbachian

Fig. 5: ***Acanthopleuroceras maugenesti* (d'Orbigny)** — Unknown locality, P2435, Lower Pliensbachian (Ibex Zone, Valdani Subzone)

Fig. 6: ***Liparoceras* (*Liparoceras*) aff. *striatum* (Reinecke) sensu Schröder** — Eingemauerte, P7123, Lower Pliensbachian (Ibex Zone)

Figs. 7, 8: ***Aegoceras maculatum* (Young & Bird)** — 7: Untere Sarotlaalpe, P13372, 8: Spullersee, 211-2, Lower Pliensbachian (Davoei Zone, Maculatum Subzone)

Figs. 9, 14: ***Amaltheus stokesi* (Sowerby)** — 9: Auenfeld, P6707, 14: Lorüns Quarry, niv. 100, MHN, Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

Figs. 10, 11: ***Pleuroceras* gr. *solare* (Phillips)** — 10, 11: Dalaaser Schütz, P8668, P8666, Upper Pliensbachian (Spinatum Zone, Apyrenum Subzone)

Fig. 12: ***F.* (*Matteiceras*) *geometricum* (Phillips)** — Lorüns Quarry, niv. 100, MHN, Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

Fig. 13: ***F.* (*Matteiceras*) *nitescens* (Young & Bird)** — Lorüns Quarry, P1747, Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

PLATE 16

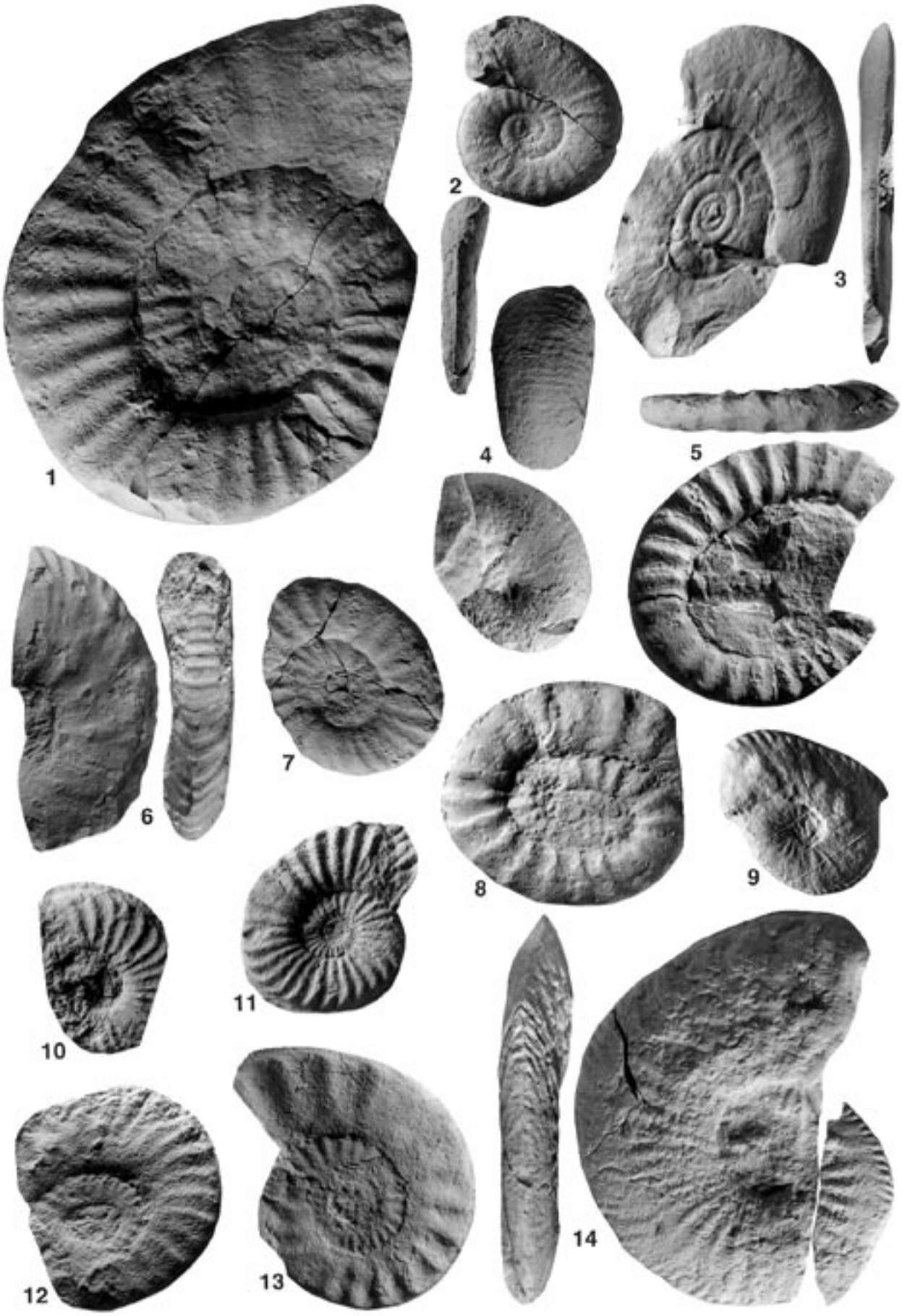

PLATE 17

Fig. 1: ***Amaltheus stokesi*** **(Sowerby)** — Lorüns Quarry, P2045, Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

Figs. 2–7: ***Fuciniceras*** **gr.** ***isseli*** **(Fucini) -** ***brevispiratum*** **(Fucini)** — 2, 3, 7: Lorüns Quarry, niv. 100, , MHN (2 ex.), P003, 4, 5: Lorüns Quarry, P150, P6731, 6: Goppelspitze, P7046, Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

Fig. 8, 13, 14: ***Fuciniceras*** **gr.** ***celebratum*** **(Fucini)** — 8, 13, 14: Spullersee, 211-10, 210-3 (2 ex.), Upper Pliensbachian (Margaritatus Zone, Stokesi Subzone)

Fig. 9, 10, 11, 15: ***Arieticeras*** **gr.** ***algovianum*** **(Oppel)** — 9, 11: Auenfeld, P13280, P13275, 10, 15: Biberacher Hütte, 210-12, Upper Pliensbachian (Margaritatus Zone, Gibbosus Subzone)

Fig. 12: ***Fuciniceras*** **gr.** ***cornacaldense*** **(Tausch)** — Goppelspitze, P8659, Upper Pliensbachian (Margaritatus Zone, Subnodosus Subzone)

PLATE 17