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Early Liassic Ammonites from the Steinplatte-Kammerköhralm Area (Northern Calcareous Alps/Salzburg)

By MILOS RAKUS
With contributions by HARALD LOBITZER*)

With 18 Text-Figures and 2 Plates

Salzburg
Nördliche Kalkalpen
Steinplatte
Lias
Ammoniten

Österreichische Karte 1 : 50.000
Blätter 91, 92

Contents

Ammoniten aus dem Unterlias des Gebietes Steinplatte – Kammerköhralm (Nördliche Kalkalpen/Salzburg)

Zusammenfassung

Aufgrund der Palaeogeomorphologie zeigt die Lias-Auflagerung des Kammerköhralm-Steinplatte-Gebietes eine keilförmige Konfiguration, wobei ein Ausdünnen vom Kössener Becken über den Slope zur Karbonatplattform zu beobachten ist. Dementsprechend wird auch die Schichtlücke vom Becken über den oberen Slope bis zur Karbonatplattform zunehmend ausgeprägter, wobei an den von uns studierten drei Aufschlüssen eine kondensierte Ammoniten-Assoziation des Ober Hettang–Unter Sinemur (Marmorea-Zone) dem Oberrhät-Riffkalk auflagert.

Interessant ist ferner der erste und stratigraphisch älteste Fund des Genus *Bouhamidoceras* DUBAR, 1961 in den Alpen, während *Badouxia* GUEX & TAYLOR, 1976 erstmals im Bereich der Tethys angetroffen wurde.

Abstract

The palaeogeomorphological situation of the Kammerköhralm/Steinplatte area implies a wedge-shaped configuration of Liassic limestones. The Upper Triassic intraplatform Kössen basin is overlain by grey cherty biomicrites (Scheibelberg Limestone). Towards the slope and the carbonate platform due to pinching out the stratigraphic gap is getting wider and the Liassic is represented by variegated micritic limestones of Adnet type. The three studied Liassic sections overlying the Upper Rhaetian reef limestone show condensed ammonite assemblages of Late Hettangian–Early Sinemurian age (Marmorea-Zone). The finding of *Bouhamidoceras* DUBAR, 1961 represents the first record in the Alps and shows the stratigraphically earliest appearance of this genus. The occurrence of *Badouxia* GUEX & TAYLOR, 1976 is new for the Tethyan region.

1. Introduction

Since the early studies by MOJSISOVICS (1869) the Steinplatte-Kammerköhralm region represents one of the most attractive playgrounds for Mesozoic carbonate (and siliciclastic) specialists and paleontologists. Most papers are focused on the facies relationships between the Norian/Rhaetian carbonate platform of Steinplatte (lagoonal Dachstein Limestone and Upper Rhaetian "Reef" Limestone) and the transition towards the intraplatform

*) Authors' addresses: Dr. MILOS RAKUS, Dionyz Stur Institute of Geology, Mlynska dolina 1, 81704 Bratislava, Slovakia; Dr. HARALD LOBITZER, Geologische Bundesanstalt, Rasumofskygasse 23, A-1031 Vienna/Austria.

basin of the Kössen Formation; e.g. HAHN, 1910; VORTISCH, 1926; OHLEN, 1959; ZANKL, 1971; PILLER & LOBITZER, 1979; PILLER, 1981; STANTON & FLÜGEL, 1991; KRISTAN-TOLLMANN et al., 1991; WEIN-BRUKNER et al. in press.

However since the monographic papers by WÄHNER (1882–1898) the Steinplatte-Kammerköhralm region is also a classical terrain for Liassic ammonite studies. Particularly the spectacular outcrops in the Middle to Late Liassic Adnet Formation east of Kammerköhr restaurant attracted as well sedimentological investigations (WILSON, 1969; GARRISON & FISCHER, 1969), as also studies of ammonite stratigraphy (e.g. FISCHER, 1966).

This paper presents the results of a stratigraphic study of the Rhaetian/Liassic boundary at three localities in the Steinplatte area (Text-Fig. 1). At all three localities studied, there exists an unconformity between the Upper Rhaetian Limestone ("Oberrhät-Riffkalk") and the variegated Liassic limestone of Adnet type. However, it cannot be ruled out, that there exists an undisturbed and complete section in the intraplatform basin environment from the Norian/Rhaetian (Kössen Formation) to the Early Liassic Scheibelberg Limestone Formation (e.g. Scheibelberg loc. class.). Both these basinal micritic limestones show dark grey colour and bituminous smell, the latter is cherty (KLEBELSBERG, 1935; KRISTAN-TOLLMANN et al., 1991; WEIN-BRUKNER et al. in press). The hanging part of the Kössen Formation of Kammerköhralm holds the Rhaetian index ammonite *Choristoceras marshi* HAUER. Unfortunately the ammonite sections observed so far in the Scheibelberg Limestone did not allow a more distinct determination. It is our impression, that due to different palaeogeomorphology at the Rhaetian/Liassic boundary, the Hettangian sediments formed a sedimentary wedge, pinching out towards the south, i.e. from the Kössen basin in direction to the carbonate platform. Due to the Upper Rhaetian palaeorelief, the transgression of the Liassic sea reached the reef proper respectively the carbonate platform later than the (former) basinal and slope environments. This fact seems to be responsible, that the record of basal Liassic transgression is getting stratigraphically younger from North to South. In addition, of course, the weathering also reduced the geological record in many places almost to nil. Some of the most complete Liassic profiles are preserved in shattered palaeokarst depressions. Similar as in the classical Adnet quarries (BÖHM, 1992), the Hettangian limestones of Steinplatte show a condensation which is underlined also by sedimentary features, such as ferrolitic crusts, deep water stromatolites and subsolution. Also most biota are Fe-encrusted and therefore the ammonites could be easily separated from the parent rock.

The brachiopod assemblage of the three Steinplatte localities was studied simultaneously by SIBLIK (1993; same volume).

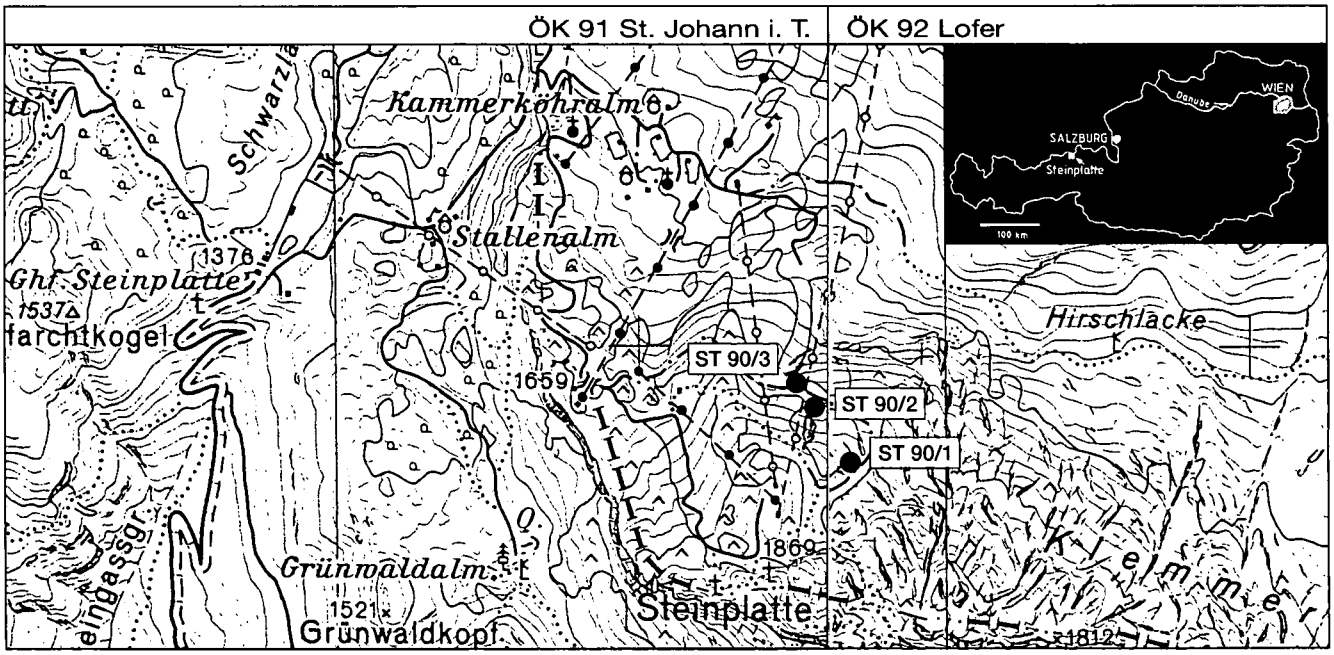
2. Profile Description

The three profiles studied (Text-Fig. 1) are located on the northern palaeoslope of Steinplatte (1869 m).

- **Profile Steinplatte I (ST 90/1)**
  On the eastern flank of the Plattenkogel, close to a seasonal spring (Text-Figs. 2, 3).
- **Profile Steinplatte II (ST 90/2)**
  On the northern slope of the Plattenkogel, above a tourist trail, respectively a skiing route. The outcrops were artificially created by blasting the rugged palaeokarst surface for a skiing slope (Text-Fig. 4–7).
- **Profile Steinplatte III (ST 90/3)**
  Adjacent to ST 90/2, on the tourist trail directly under the eastern ski-lift to the Plattenkogel.

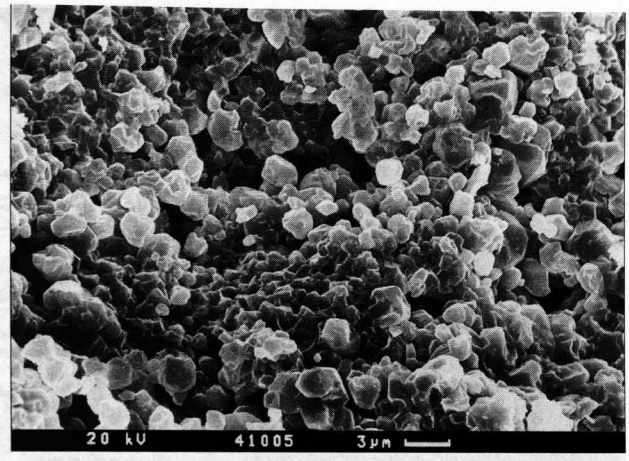
Text-Fig. 4 shows a schematic sketch of the profiles Steinplatte II and III. The following text describes this section from bottom to top:

1) Light-grey to white thick-bedded organogenic limestones, representing the uppermost part of Late Rhaetian coral limestones.
2) Light-grey organogenic limestones in beds of dm-thickness.
3) Light-grey to beige organogenic limestones with scarce bivalves (? *Cardinia* sp.).

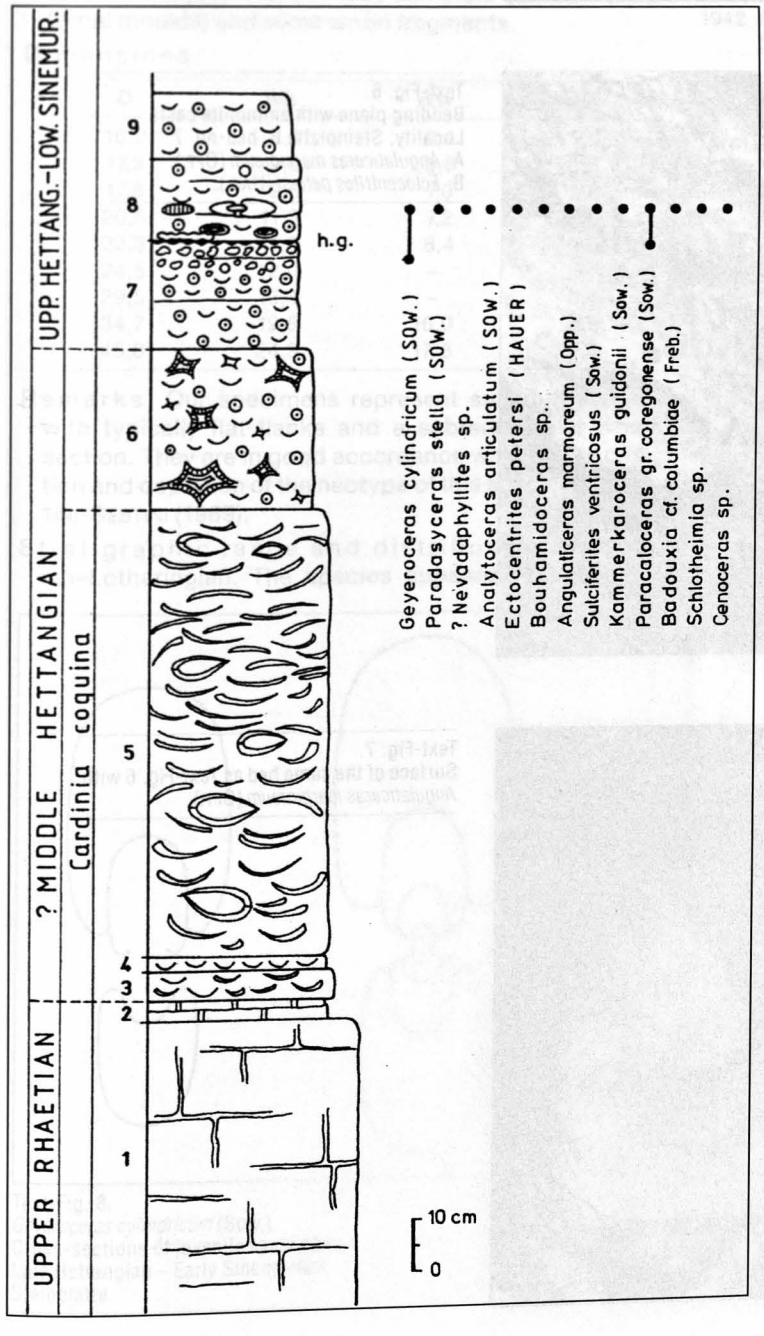


Text-Fig. 1.
Situation map of sample localities Steinplatte ST 90/1 (I), ST 90/2 (II), ST 90/3 (III).

Text-Fig. 2.
View of the contact between Upper Rhaetian reef limestone and red hematitic limestones of the Late Hettangian/Early Sinemurian.
Locality: Steinplatte I.

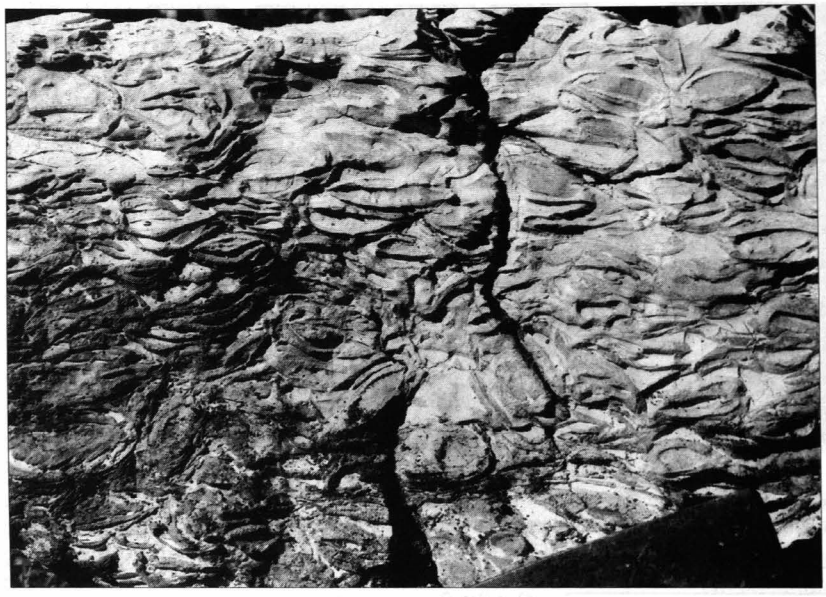


Text-Fig. 3.
SEM-photomicrograph showing micritic variegated Early Liassic limestone of locality ST 90/1.



4) Like 3.
5) Light-grey (base) and pinkish coquina filled with separate or joint shells of ? *Cardinia* sp. (= *Cardinia* coquina). The lumachelle pinches out laterally (Text-Fig. 5).
6) Pink to reddish biomicritic limestones with scarce bivalves brachiopods and frequent disintegrated crinoid fragments. Dissolution cavities filled with RFC (= radiaxial fibrous calcite, MAZZULLO et al., 1990) (Text-Figs. 6, 7).
7) Red, reddish-brown biomicritic limestones with transitions to crinoid-bearing limestones. This layer consists of three, more-or-less distinctly separated beds. The uppermost bed is brecciated and its uneven top surface represents a hardground which is covered by irregular hematite incrustations and flattened concretions of the same composition. This bed contains *Geyeroceras cylindricum* (SOW.) and *Paracaloceras* sp.
8) Red ferrolitic biomicritic limestones with abundant Fe-stromatolite concretions, ammonites, brachiopods and bivalves. Towards the north (in the cut of the ski trail – Steinplatte III) the layer is split into three beds. Abundant ammonites were collected from this layer: *Geyeroceras cylindricum* (SOW.), *Paradasyceras stella* (SOW.), ? *Nevadaphyllites* sp., *Analytoceras articulatum* (SOW.), *Ectocentrites petersi* (HAU.), *Bouhamidoceras* sp., *Angulaticeras marmoreum* (GUEMB.), *Sulciferites ventricosus* (SOW.), *Schlotheimia* gr. *montana* (WÄHNER), *Kammerkaroceras guidonii* (SOW.), *Paracaloceras* gr. *coregonense* (SOW.), *Badouxia* sp., *Cenoceras* sp. The assemblage is characteristic for the Late Hettangian–Early Sinemurian, or for the Marmorea zone.
9) Red crinoidal biosparites.

Text-Fig. 4.
Idealized profile of localities Steinplatte II and III.
h.g. = hardground.



Text-Fig. 5.
Detailed view of the *Cardinia* coquina (bed number 5).
Locality: Steinplatte II.

Text-Fig. 6.
Bedding plane with ammonite casts.
Locality: Steinplatte II, bed-no. 7.
A: *Angulaticeras marmoreum* (OPP.).
B: *Ectocentrites petersi* (HAU.).

Text-Fig. 7.
Surface of the same bed as Text-Fig. 6 with *Angulaticeras marmoreum* (OPP.).

3. Systematic Part

In the following paragraphs a brief description of ammonite taxa encountered in the localities Steinplatte I–III is given.

Phylloceratidae ZITTEL, 1884
Geyeroceras HYATT, 1900

Geyeroceras cylindricum (SOWERBY, 1831)

(Text-Fig. 8; Pl. 1, Figs. 1, 2; Pl. 2, Fig. 1)

1831 *Ammonites cylindricus* SOWERBY. – DE LA BECHE, p. 318, Fig. 54.
1910 *Phylloceras cylindricum* SOW. – HAHN, p. 357.
1969 *Geyeroceras cylindricum* (SOWERBY, 1831). – N. FANTINI-SESTINI, p. 99, Text-Fig. 2; Pl. 1, Figs. 1a,b et Fig. 4a,b (cum syn.).
1971 *Phylloceras cylindricum* (SOWERBY). – WENDT, p. 110.

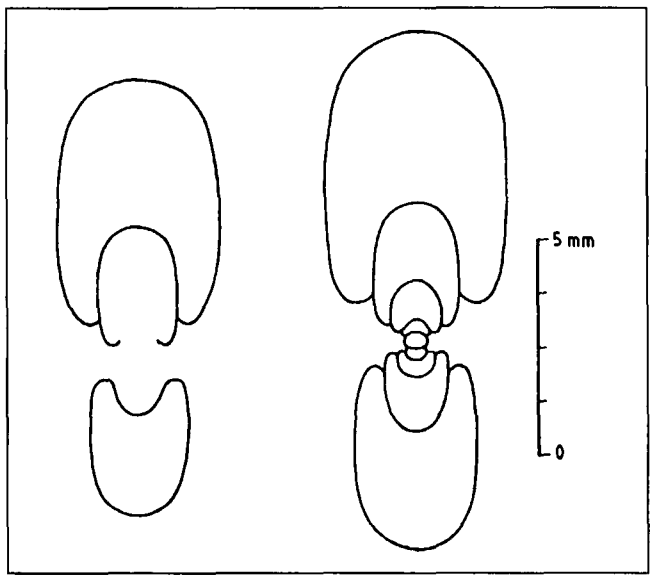
Material: Eleven more or less complete steinkerns (internal moulds) and some whorl fragments.

Dimensions:

D	Wh	Ww	u
16,2	8,4	6,4	1,0
17,3	9,0	6,6	1,8
17,8	9,6	7,0	1,8
20,5	11,3	7,2	2,0
22,3	11,8	8,4	2,0
24,5	12,0	–	–
29,5	16,4	–	3,4
34,7	19,8	16,0	5,8
45,8	24,3	17,8	9,0

Remarks: Our specimens represent subadult stages, with typically flat flanks and a subrectangular whorl section. They are in good accordance with the description and depiction of the neotype of this species by FANTINI-SESTINI (1969).

Stratigraphic range and distribution: Hettangian–Lotharingian. The species appeared for the first time in the Early Hettangian (LANGE, 1952). It is, however, most frequent in the Late Hettangian–Early Sinemurian (= Marmorea zone). The latest occurrences known are from the Early Sinemurian (FUCINI, 1901) to Lotharingian (GEYER, 1896). It occurs in all three Steinplatte profiles.



Text-Fig. 8.
Geyeroceras cylindricum (SOW.).
Cross-sections of juvenile specimens.
Late Hettangian – Early Sinemurian.
Steinplatte.

Juraphyllitidae ARKELL, 1950
Paradasyceras SPATH, 1923

?*Paradasyceras stella* (SOWERBY, 1833)

(Text-Fig. 9; Pl. 1, Fig. 3; Pl. 2, Fig. 8)

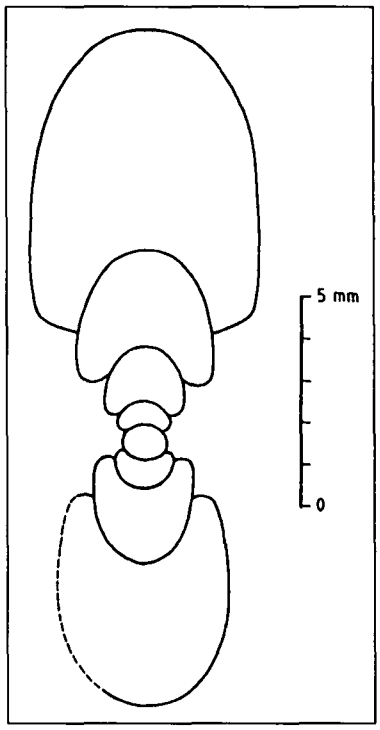
1833 *Ammonites stella* SOWERBY. – DE LA BECHE, p. 333, Fig. 63.
1888 *Rhacophyllites stella* SOW. sp. – CANAVARI, p. 92, Pl. 2, Figs. 1–5.
1901 *Rhacophyllites stella* SOW.. – FUCINI, p. 68; Pl. 7, Figs. 8, 9; Pl. 8, Fig. 8; Pl. 9, Fig. 1; Pl. 12, Fig. 4.
1936 *Rhacophyllites stella* (SOW.). – GUGENBERGER, p. 157, Pl. 13, Fig. 29.
1942 *Rhacophyllites stella* SOWERBY. – KOVACS, p. 97; Pl. 2, Fig. 8 (cum syn.).

Material: Five sub-adult specimens with partly preserved calcified shells.

Dimensions:

D	Wh	Ww	u
D	Wh	Ww	u
15,5	7,0	5,5	2,9
15,7	7,2	5,8	4,2
21,0	10,2	6,8	4,5

Description: A small convolute shell, laterally compressed. The whorl section on the juvenile stage is broad-elliptic, with arched, ventrum-converging flanks and with a strongly rounded non-differentiated umbilical edge. The subadult stage is characterized by an elliptical whorl section with parallel compressed flanks (Text-Fig. 9). The umbilical edge is prominent and the umbilical wall is flat, oblique-oriented. The steinkern shows strongly prorsiradiate constriction, invisible on the shell. The shell surface is smooth.



Text-Fig. 9.
Paradasyceras stella (SOW.).
Cross-section of subadult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte III.

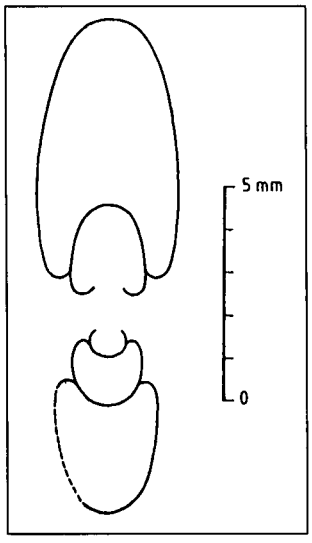
Remarks: The definition of the species *Paradasyceras stella* (SOW.) has been unclear for a long time. CANAVARI (1882) used the term *Rhacophyllites stella* SOW. to denote two morphotypes differing in the presence or absence of constrictions and of the umbilical edge. WÄHNER (1898, p. 175) revised CANAVARI's original material and decided to range to the species *stella* only the forms with constrictions and diphyllous S_1. The forms without constrictions and with triphyllous S_1 are regarded by WÄHNER (l.c.) as typical of the species *P. uermoesense* (HERBICH). So, with respect to this generic definition, it is hardly possible to range the species *stella* to the genus *Paradasyceras*, because the genotype is just characterized by the absence of constrictions! It should, however, be noted that the presence and absence of constrictions and umbilical edge depends upon whether the shell is preserved or not. This fact was perhaps neglected by former authors. Our specimens are in good accordance with the species description and depiction by CANAVARI (1888), GEYER (1886) and FUCINI (1901). The species *Paradasyceras stella* (SOW.) belongs to the easily identifiable and characteristic species of the Late Hettangian assemblage of ammonites at the locality Steinplatte.

Stratigraphic range and distribution: The species is quite frequent from the Late Hettangian–Early Sinemurian (Marmorea zone) to the Lotharingian (Oxynotum zone). It is a typical Tethyan form; Steinplatte III.

Nevadaphyllites sp.

(Text-Fig. 10; Pl. 2, Fig. 9)

Four incomplete specimens of juraphyllitid taxa have been found at the locality Steinplatte II in bed 8a. In their whorl sections and general appearance they are in good accordance with the definition of the genus *Nevadaphyllites*. An exact determination is difficult due to poor preservation.



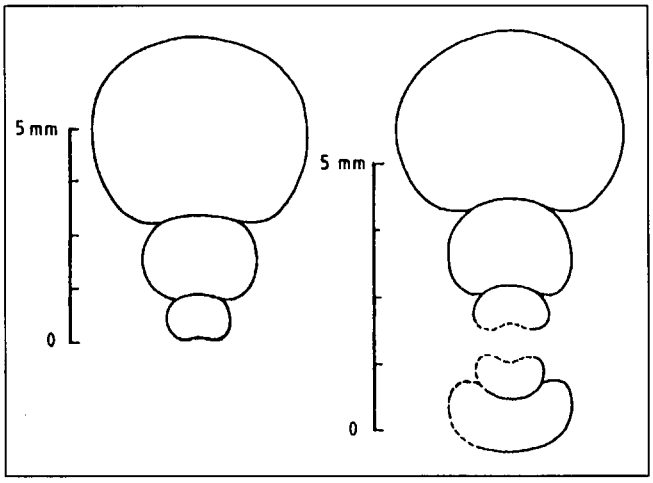
Text-Fig. 10.
Nevadaphyllites sp.
Cross-section of a subadult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte II.

Pleuroacanthitidae HYATT, 1900
Analytoceratinae SPATH, 1927
Analytoceras HYATT, 1900

Analytoceras articulatum (SOWERBY, 1831)

(Text-Fig. 11)

1831 *Ammonites articulatus* SOWERBY. – DE LA BECHE, p. 333, Fig. 70.
1888 *Lytoceras articulatum* SOW. sp. – CANAVARI, p. 113; Pl. 3, Figs. 4–7; Pl. 9, Fig. 8.
1890 *Lytoceras articulatum* SOW. (ORB.). – WÄHNER; p. 44; Pl. 3, Fig. 3; Pl. 7, Figs. 1–5; Pl. 8, Figs. 1–15; Pl. 9, Figs. 1, 2.
1910 *Lytoceras articulatum* SOW.. – HAHN, p. 357.
1958 *Analytoceras articulatum* (SOWERBY). – DONOVAN, p. 210.



Text-Fig. 11.
Analytoceras articulatum (SOW.).
Cross-sections of juvenile specimens.
Late Hettangian – Early Sinemurian.
Steinplatte II.

Remarks: Four incomplete specimens with a diameter smaller than 40 mm. According to their whorl sections, shape, and number of constrictions they evidently belong to *A. articulatum* (SOW.).

Stratigraphic range and distribution: Late Hettangian–Early Sinemurian (Marmorea zone) of the locality Steinplatte II. It is a typical Tethyan form.

Ectocentrites CANAVARI, 1888

Ectocentrites petersi (HAUER, 1856)

(Pl. 2, Fig. 6)

1856 *Ammonites petersi* HAU. – HAUER, p. 65, Pl. 21, Figs. 1–3.
1898 *Ectocentrites petersi* HAU. – WÄHNER, p. 53 et 155, Pl. 9, Figs. 6, 7; Pl. 10, Figs. 1–5; Pl. 20, Figs. 1–5 (cum syn.).
1910 *Ectocentrites petersi* v. HAU. – HAHN, p. 357.
1953 *Ectocentrites petersi* HAUER. – PREDA et RAILEANU, p. 58, Pl. 6.
1970 *Ectocentrites petersi* (HAUER). – WIEDMANN, p. 1002, Fig. 28.

Material: Two incomplete specimens, one of them with a partly preserved body chamber.

Dimensions:

D	Wh	Ww	u
146,9	57,0	33,5	65,8

Remarks: In their whorl section and ornamentation our specimens correspond to the species depiction by WÄHNER (1898).

Stratigraphic range and distribution: Late Hettangian–Early Sinemurian (Marmorea zone) of the locality Steinplatte II. It is a typical Tethyan form, most frequent in the Alpine–Carpathian region.

Ectocentrites sp. juv.

(Pl. 2, Fig. 7)

Remarks: The juvenile specimen originates from the locality Steinplatte II. In its laterally compressed whorl section and constrictional juvenile stage it resembles

the subspecies *E. petersi italicus* (CAN.). A more exact determination is difficult due to poor preservation. The species occurred together with *Geyeroceras cylindricum* (SOW.). It is stratigraphically ranged to the Latest Hettangian–Early Sinemurian.

Psiloceratidae HYATT, 1867
Discamphiceratinae GUEX & RAKUS, 1991
Bouhamidoceras DUBAR, 1961

Bouhamidoceras sp.

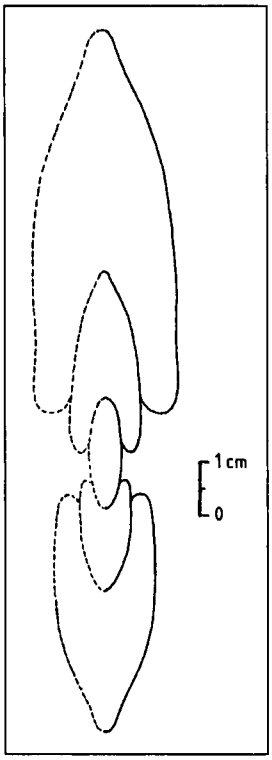
(Text-Fig. 12; Pl. 1, Fig. 10)

Material: Two incomplete steinkerns with partly preserved calcified shell.

Dimensions:

D	Wh	Ww	u
133,5	73,0	29,6	12,5

Remarks: According to their lanceolate whorl sections (Text-Fig. 12), distinctly separated ventrum ("rounded keel"), longitudinal depressions, the shape of the umbilicus (sous-cavé), our specimens belong evidently to the genus *Bouhamidoceras*. According to their stratigraphic position (Marmorea zone) they are the earliest known representatives of this genus. In their slim whorl sections, distinctly separated ventrum and a narrow umbilicus, our specimens differ from all so far known species of the genus *Bouhamidoceras*. In the size and shape of the umbilicus and partly in the whorl section our specimens are most similar to the form described by MOUTERDE et al. (1986) from Rif in Morocco. This form differs from our species in a somewhat wider whorl section and a wider ventrum.



Text-Fig. 12.
Bouhamidoceras sp.
Cross-section of a subadult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte II.

Stratigraphic range and distribution: Late Hettangian–Early Sinemurian (Marmorea zone) of locality Steinplatte II. It is a rare, typical Tethyan form.

Psiloceratidae HYATT, 1867
Kammerkaroceras LANGE, 1941

Kammerkaroceras guidonii (SOWERBY, 1833)

(Text-Figs. 13, 14; Pl. 1, Figs. 6, 7, 8, 9)

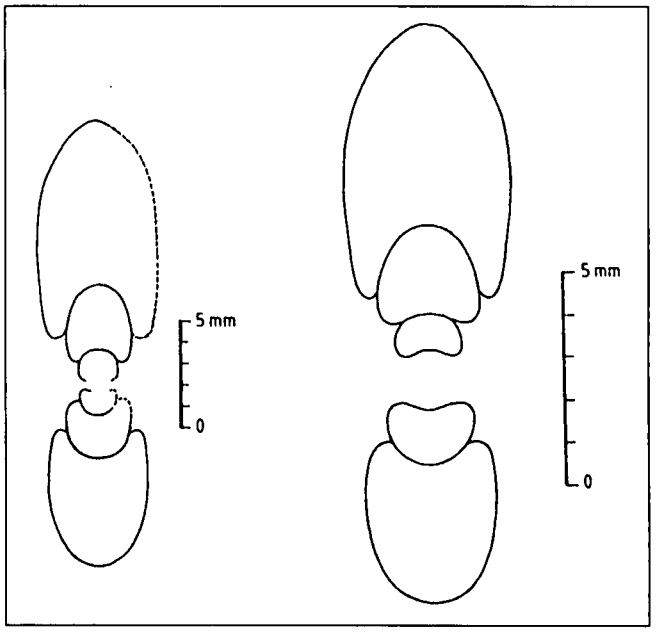
1833 *Ammonites guidonii* SOWERBY. – DE LA BECHE, p. 33, Fig. 69.
1882 *Aegoceras guidonii* SOW. sp. – CANAVARI, p. 167; Pl. 18, Figs. 14–16, (non Fig. 16d).
1886 *Aegoceras emmrichi* GUEMB. – WÄHNER; p. 154; Pl. 26, Figs. 4–6, 8-10.
1886 *Aegoceras guidonii* SOW.. – WÄHNER, p. 161; Pl. 26, Figs. 3, 7.
1888 *Psiloceras guidonii* SOW. sp. – CANAVARI, p. 154; Pl. 4, Figs. 14–16a, Pl. 8, Fig. 8.
1910 *Psiloceras emmrichi* GÜMB.. – HAHN., p. 357.
1910 *?Psiloceras* aff. *guidonii* SOW. (CAN.). – HAHN, p. 357.
1941 *Kammerkaroceras guidonii* (SOW.) (CANAV.). – LANGE, p. 44.
1958 *Kammerkaroceras emmrichi* (GÜMBEL.). – DONOVAN, p. 209.

Material: Six more or less complete specimens and ten whorl fragments.

Dimensions:

D	Wh	Ww	u
12,4	5,6	4,0	2,4
14,8	7,0	4,5	3,0
16,6	8,0	5,2	3,4
17,0	8,4	–	3,6
18,0	8,0	–	5,4
24,0	12,0	7,3	5,2

Description: The shell is small, discoid, laterally compressed. The section of juvenile stages is circular or broad-elliptical. The section of sub-adult stages is elliptical with indications of a rounded "keel" (Text-Fig. 13). The flanks are evenly arched, almost subparallel in the periumbilical area. The umbilicus is relatively narrow; the umbilical edge is rounded, prominent.

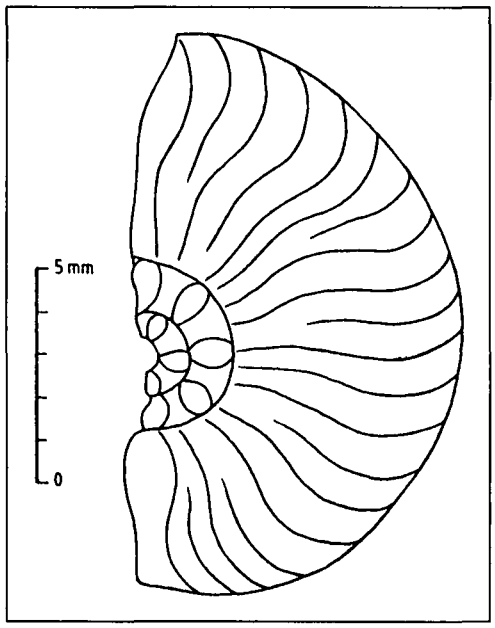


Text-Fig. 13.
Kammerkaroceras guidonii (SOW.).
Cross-sections of subadult specimens.
Late Hettangian–Early Sinemurian.
Steinplatte III.

Ornamentation: The juvenile stages (up to 5–6 mm in diameter) are distinctly tuberculate (Text-Fig. 14). During the ontogeny the tubercles are radially elongating to pass into prominent prorsiradiate ribs.
Sub-adult stages are characterized by even sigmoid ribs – either bifurcated or with an intercalated rib (Text-Fig. 14; Pl. 1, Figs. 7, 9). The ribs are weaker on the ventral side but they extend continuously to the other side. The adult stages are characterized by the fasciculation of the ribs into bundles by 3. Single bundles are separated by a deep intercalated "groove" (Pl. 1, Fig. 8).

Remarks: CANAVARI (1888, p. 155, 156) considers WÄHNER's (1886) description of *"Aegoceras" emmrichi* GUEMB. as

a younger synonym of the species *guidonii* (SOW.). The specimens from locality Steinplatte III are in good accordance with the description and depiction by the above authors. The species *K. guidonii* from the Steinplatte area was already described in the past.



Text-Fig. 14.
Kammerkaroceras guidonii (SOW.).
Distinct tuberculate stage, followed by sigmoidal ribs.
Late Hettangian–Early Sinemurian.
Steinplatte III.

Stratigraphic range and distribution: *K. guidonii* (SOW.) occurs at the locality Steinplatte in the Latest Hettangian–Early Sinemurian (Marmorea zone). WÄHNER (1886) had already found it in the middle Hettangian (Megastoma zone). It is a typical Tethyan form occurring in the Northern Limestone Alps and in Italy (Spezia).

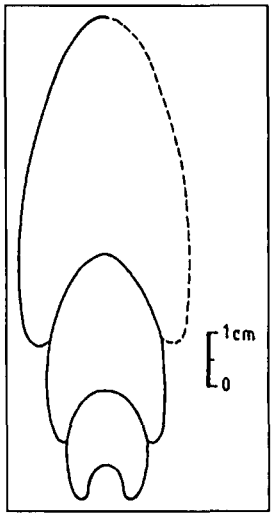
Badouxia GUEX & TAYLOR, 1976

Badouxia cf. *columbiae* (FREBOLD, 1967)

(Text-Fig. 15; Pl. 1, Fig. 4)

Material: One incomplete steinkern with a partly preserved body chamber.

Description: A medium-sized (about 150 mm in diameter), convolute, discoidal shape. The whorl section of sub-adult stages is elliptical, with gently arched flanks and rounded umbilical wall. The adult stages and body chamber show a high elliptical section of whorls with a ventre-converging tendency.



Text-Fig. 15.
Badouxia columbiae (FREBOLD).
Cross-section of an adult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte II.

Ornamentation: slightly prorsiradiate, distinct ribs are located on the subadult stage. From the diameter 45–50 mm they are getting blunt and flat to disappear. The body chamber may be characterized as smooth, with very weak plications on flanks. The sutural line is not preserved.

Remarks: Our specimen is most similar in dimensions and type of costation to *Badouxia columbiae* (FREBOLD, 1967). A more detailed determination is difficult due to poor preservation. We regard it as the first record of this genus in the Alpine Tethys.

Stratigraphic range and distribution: Marmorea zone of Steinplatte II. Western coast of North America, Nevada (GUEX & TAYLOR, 1976; TAYLOR, 1990), Canada (FREBOLD, 1967).

Schlotheimiidae SPATH, 1923
Angulaticeras QUENSTEDT, 1883

Angulaticeras marmoreum (OPPEL, 1862)

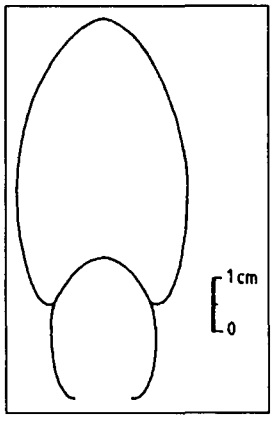
(Text-Fig. 16; Pl. 2, Fig. 2)

1856 *Ammonites charmassei* D'ORBIGNY. – HAUER, p. 49; Pl. 14, Figs. 1–3.
1862 *Ammonites marmoreus* OPPEL. – OPPEL, p. 130.
1886 *Aegoceras marmoreum* OPP. – WÄHNER, p. 180, Pl. 22, Figs. 1–5.
1910 *Schlotheimia marmorea* OPP. – HAHN, p. 359.
1953 *Schlotheimia marmorea* OPP. – PREDA & RAILEANU, p. 61.
1988 *Aegoceras marmoreum* (OPPEL). – BLOOS, p. 6; Pls. 1–3, Pl. 4, Figs. 1–8; Pls. 5–8; Pl. 9, Fig. 1; Text-Fig. 3–11 (cum syn.).

Material: Several incomplete specimens, mainly parts of whorls of phragmocon.

Remarks: The whorl section, the shape and course of ribs on our specimens are in good accordance with the description and depiction of the species by BLOOS (1988). It is particularly similar to Alpine specimens depicted by WÄHNER (1886, Pl. 22, Fig. 1) and by BLOOS (1988). These specimens show indications of a "rounded keel". From the ventral view it looks like a keel stripe.

Stratigraphic range and distribution: The stratigraphic range of this index ammonite is rather controversial (GUEX & TAYLOR, 1976; BLOOS, 1988). On the localities Steinplatte II and III this ammonite is quite frequent and occurs together with an ammonite assemblage of Late Hettangian–Early Sinemurian age. The species is known from the Northern Limestone Alps, southern Germany, eastern France and Italy.



Text-Fig. 16.
Angulaticeras marmoreum (OPPEL).
Cross-section of a subadult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte.

Sulciferites SPATH, 1922

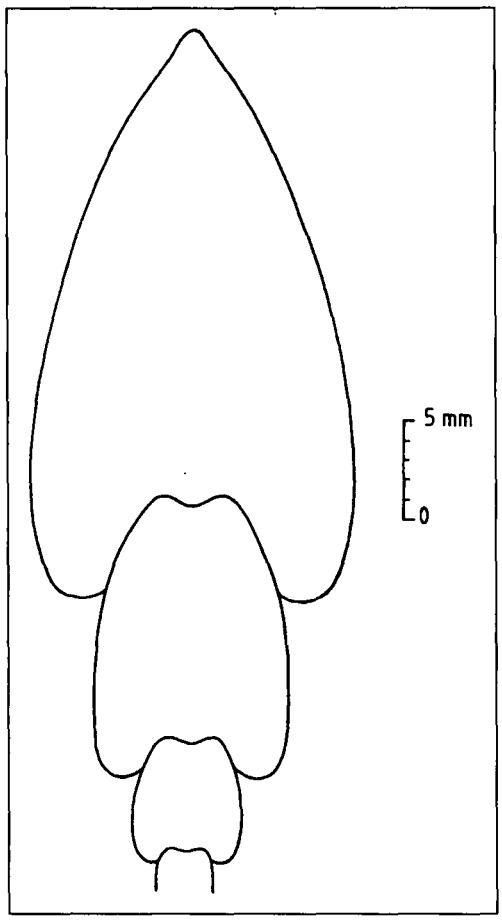
Sulciferites ventricosus (SOWERBY, 1833)

(Text-Fig. 17; Pl. 2, Fig. 5)

1833 *Ammonites ventricosus* SOWERBY; in DE LA BECHE, p. 334; Fig. 72.
1886 *Ammonites ventricosus* SOW. (CANAV.). – WÄHNER, p. 186; Pl. 23, Figs. 5–11.
1888 *Schlotheimia ventricosa* SOW. sp. – CANAVARI, p. 136; Pl. 4, Figs. 10, 11.
1936 *Sulciferites ventricosus* (SOW., 1833). – SCHLEGELMILCH, p. 37; Pl. 7, Fig. 6; Pl. 8, Fig. 3.

Material: Three incomplete specimens.

Remarks: From lateral view the adult specimens of this species may be erroneously regarded as *Angulaticeras marmoreum* (OPP.). They differ from it in their lanceolate adult whorl sections (Text-Fig. 17).
The ventrum consists of a rounded undetached keel. From the ventral view the keel looks blunt – the place of termination of unweakened ribs. The flanks are evenly arched, converging to the umbilicus, so the whorl is broadest in the umbilical part.
The whorl sections on sub-adult stages are trapezoidal, with a "groove" representing the break in ribs.



Text-Fig. 17.
Sulciferites ventricosus (SOW.).
Cross-section of an adult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte II.

Stratigraphic range and distribution: This significant Tethyan form is best known from the Early Sinemurian – the Rotiforme zone. On the locality Steinplatte II it occurs in a Late Hettangian–Early Sinemurian assemblage.

Schlotheimia BAYLE, 1878

Schlotheimia sp.

(Pl. 2, Fig. 4)

Material: Two sub-adult, partly preserved specimens.

Remarks: In the type of their costation the specimens from the locality Steinplatte III resemble the species *S. montana* (WÄHNER, 1884). It was impossible to determine the poorly preserved and immature specimens more exactly. They were found together in an assemblage with *A. marmoreum* (OPP.).

Arietitidae HYATT, 1875
Paracaloceras SPATH, 1923

Paracaloceras* gr. *coregonense (SOWERBY, 1833)

(Text-Fig. 18; Pl. 1, Figs. 5, 11)

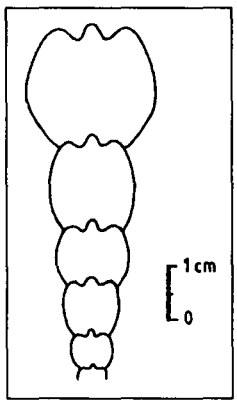
Material: Four incomplete specimens.

Dimensions:

D	Wh	Ww	u
51,4	12,6	–	31,0
114,4	20,0,	22,0	76,0

Remarks: In their whorl section (Text-Fig. 18) and type of costation the specimens from the locality Steinplatte are most similar to *P.coregonense* (SOW.). The exact determination was not possible due to poor preservation of the specimens.

Stratigraphic range and distribution: This Alpine form was already mentioned by HAHN (1919). It occurs in the assemblage with *A. marmoreum* (OPP.) at the localities Steinplatte II and III.



Text-Fig. 18.
Paracaloceras gr. *coregonense* (SOW.).
Cross-section of an adult specimen.
Late Hettangian – Early Sinemurian.
Steinplatte II.

4. Conclusions

The study of the Rhaetian/Liassic boundary at the locality Steinplatte yields the following results:

- There exists a stratigraphic hiatus between the Late Rhaetian reef limestone and Hettangian biomicritic limestones. As a result of palaeogeomorphology the hiatus increases from the north to the south, i.e. towards the top part of the reef. No arguments point to an existence of Rhaeto-Liassic reef limestone (Rhätolias-Riffkalk) sensu FABRICIUS (1962).
- The Hettangian sediments show all the characteristics of condensed sedimentation. It is also evidenced by subsolution, ferrolitic crusts and cyanobacterial concretions (deep water stromatolites and *Frutexites* sensu BÖHM & BRACHERT, 1993).

- Detailed stratigraphical studies have proved that the Late Hettangian–Early Sinemurian is the only confirmed stratigraphical interval at the localities Steinplatte I - III. The interval may also be denoted as the "Marmorea" zone in the sense of WÄHNER (1886) or as the "Canadense" zone in the sense of TAYLOR (1990).
- So far we cannot prove the earlier Hettangian zones, although their existence is indicated by fauna, quoted by HAHN (1910).
- The fauna comprises two rare genera, so far unknown from the Alps: *Bouhamidoceras* DUBAR, 1961 and *Badouxia* GUEX & TAYLOR, 1976.

The genus *Bouhamidoceras* DUBAR, 1961 is mainly known from the North-African Lotharingian (Tunisia, Morocco). The presence of this genus on Steinplatte represents the first and stratigraphically earliest finding.

The occurrence of the genus *Badouxia* GUEX & TAYLOR, 1976 represents the first finding in the Tethyan region at all. It might be a significant correlation element between the North-American faunal province and the Alpine region.

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Plate 1

Figs. 1,2: ***Geyeroceras cylindricum* (SOW.).**
Magnified 0,8×.
GBA 1992/1/1.

Fig. 3: ***Paradasyceras stella* (SOW.).**
Natural size.
GBA 1992/1/2.

Fig. 4: ***Badouxia* cf. *columbiae* (FREBOLD).**
Natural size.
GBA 1992/1/3.

Fig. 5: ***Paracaloceras* gr. *coregonense* (SOW.).**
Natural size.
GBA 1992/1/4.

Figs. 6,7,8,9: ***Kammerkaroceras guidonii* (SOW.).**
Natural size.
GBA 1992/1/5.

Fig. 10: ***Bouhamidoceras* sp.**
Slightly diminished.
GBA 1992/1/6.

Fig. 11: ***Paracaloceras* gr. *coregonense* (SOW.).**
Natural size.
GBA 1992/1/4.

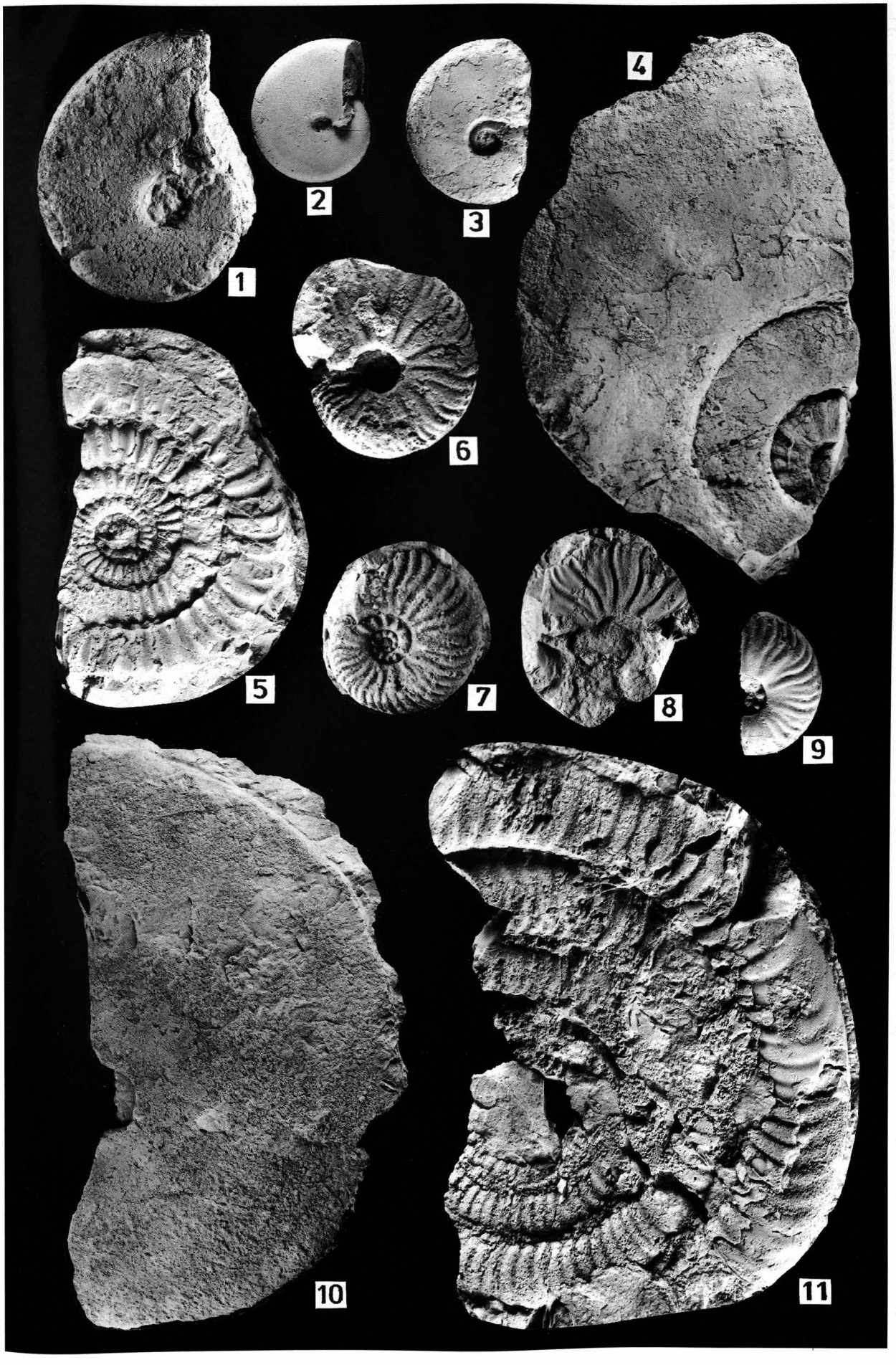
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Plate 2

Fig. 1: ***Geyeroceras cylindricum*** **(SOW.).**
Natural size.
GBA 1992/1/1.

Fig. 2: ***Angulaticeras marmoreum*** **(OPPEL).**
Natural size.
GBA 1992/1/7.

Fig. 3: ***Angulaticeras marmoreum*** **(OPP.).**
0,5×.
GBA 1992/1/7.

Fig. 4: ***Schlotheimia*** **sp. juv.**
Natural size.
GBA 1992/1/8.

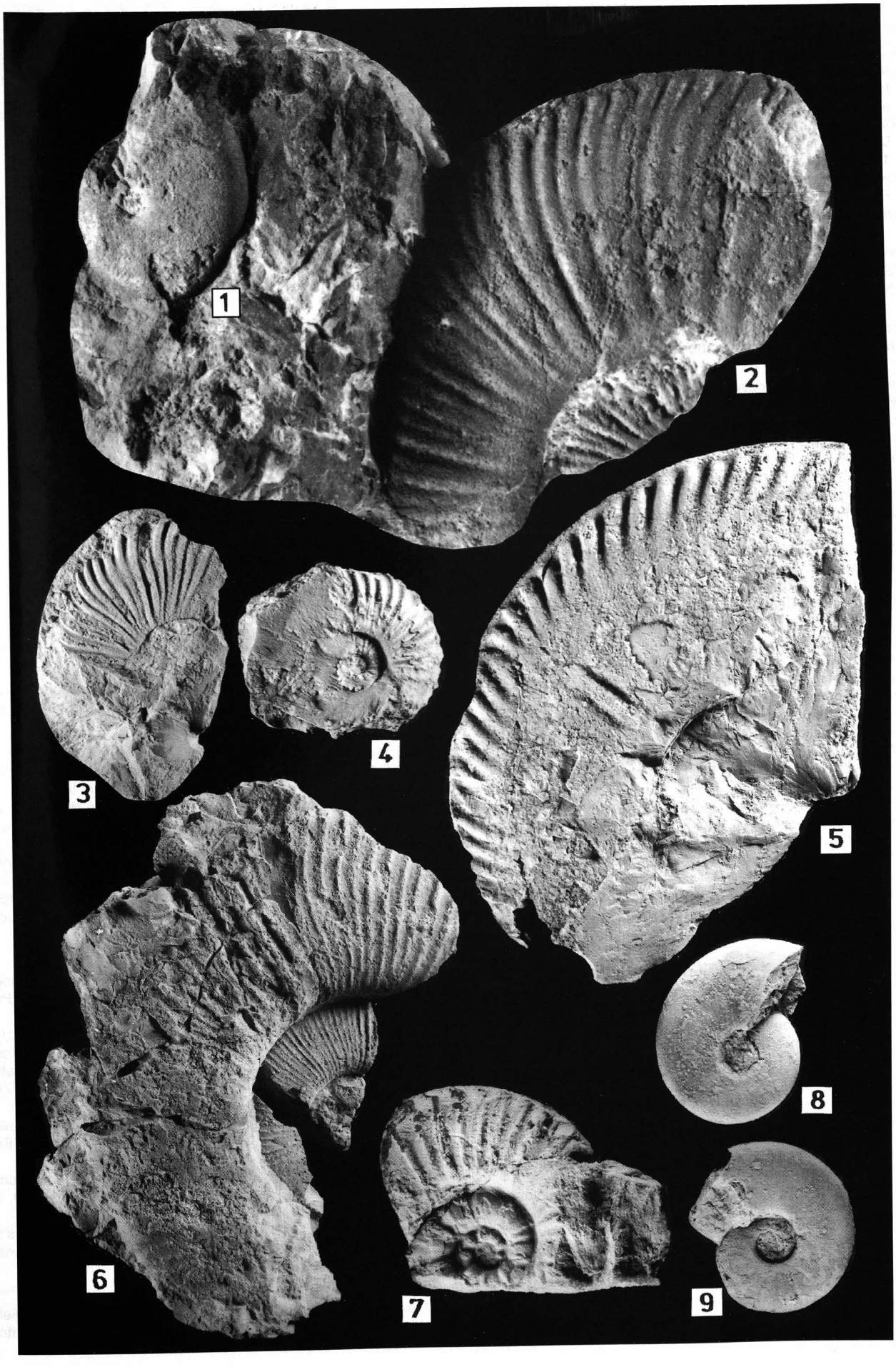
Fig. 5: ***Sulciferites ventricosus*** **(SOW.).**
0,3×.
GBA 1992/1/9.

Fig. 6: ***Ectocentrites petersi*** **(HAUER).**
Diminished 0,3×.
GBA 1992/1/10.

Fig. 7: ***Ectocentrites*** **sp. juv.**
1,5×.
GBA 1992/1/10.

Fig. 8: **?** ***Paradasyceras stella*** **(SOW.).**
0,3×.
GBA 1992/1/2.

Fig. 9: ***Nevadaphyllites*** **sp.**
0,3×.
GBA 1992/1/12.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