

Coniacian Cephalopods from the Gosau Group (Upper Cretaceous, Salzkammergut, Austria)

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26 Text-Figures, 19 Tables, 24 Plates

Österreichische Karte 1:50.000

BMN / UTM

63 Salzburg / NL 32-03-18 Kundl

89 Angath / NL 33-01-07 Kiefersfelden

90 Kufstein / NL 33-01-09 Großmain

93 Bad Reichenhall / NL 33-01-10 Hallein

95 Sankt Wolfgang im Salzkammergut / NL 33-01-11 Bad Ischl

96 Bad Ischl / NL 33-01-13 Kufstein

97 Bad Mitterndorf / NL 33-01-12 Bad Aussee

98 Liezen / NL 33-02-13 Liezen

100 Hieflau / NL 33-02-09 Hieflau

120 Wörgl / NL 33-01-17 Hallstatt

Cephalopods

Coniacian

Late Cretaceous

Northern Calcareous Alps

Gosau Group

Austria

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Abstract

41 taxa of cephalopods are described herein from the middle and upper Coniacian of the Austrian Gosau Group. Barroisiceratinae, Peroniceratidae, Tissotiidae, Baculitidae and Scaphitidae are the most common around Nussenseebach, Fahrenberg and Strobl/Weißenbach, appearing to represent the middle of the Middle Coniacian *Peroniceras tridorsatum* Zone. The *Gauthiericeras margae* Zone occurs south of the city of Salzburg and in the Nussenseebach area. The *Paratexanites serratomarginatus* Zone repeatedly described from the surrounding of the Glanegg castle near Salzburg, occurs also in the road tunnel section north of Bad Ischl, the Nussenseebach and the Edlbachgraben (Gosau area).

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In detail, taxonomy of long neglected Coniacian ammonites from the Gosau Group were re-studied. Of special interest was the Maherndl collection on the construction of the road tunnel north of Bad Ischl (Upper Austria) dominated by *Forresteria alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907). No measurable sections suitable for bed-by-bed collecting are documented from the investigated sites at the tunnel and nearby sections of Strobl/Weißenbach and Nussenseebach. Thus, the chronostratigraphic sequence of ammonite assemblages is based on the one hand upon comparison of the local finds with published reports from well-documented areas such as France, South Africa, and Madagascar. On the other hand, stratigraphic data from calcareous nannofossils (biozones CC13–CC15 and UC9–UC11, respectively) and other microfossils help in stratigraphic correlations. The uneven distribution of Coniacian ammonite assemblages is discussed briefly.

Cephalopoden des Coniaciums der Gosau-Gruppe (Oberkreide, Salzkammergut, Österreich)

Zusammenfassung

Es werden 41 Cephalopodentaxa aus dem mittleren und oberen Coniacium der österreichischen Gosau-Gruppe beschrieben. Barroisiceratinae, Peroniceratidae, Tisottiidae, Baculitidae und Scaphitidae sind die häufigsten Gruppen im Gebiet von Nussenseebach, Fahrenberg und Strobl/Weißenbach und scheinen die *Peroniceras tridorsatum*-Zone des mittleren Mittelconiacums zu repräsentieren. Die *Gauthiericeras margae*-Zone des Oberconiacums tritt im Süden der Stadt Salzburg und im Nussenseebach-Gebiet auf. Die *Paratexanites serratomarginatus*-Zone, wiederholt aus der Umgebung von Schloss Glanegg bei Salzburg beschrieben, tritt auch im Tunnelprofil im Norden von Bad Ischl, im Nussenseebach und im Edlbachgraben bei Gosau-Vordertal auf.

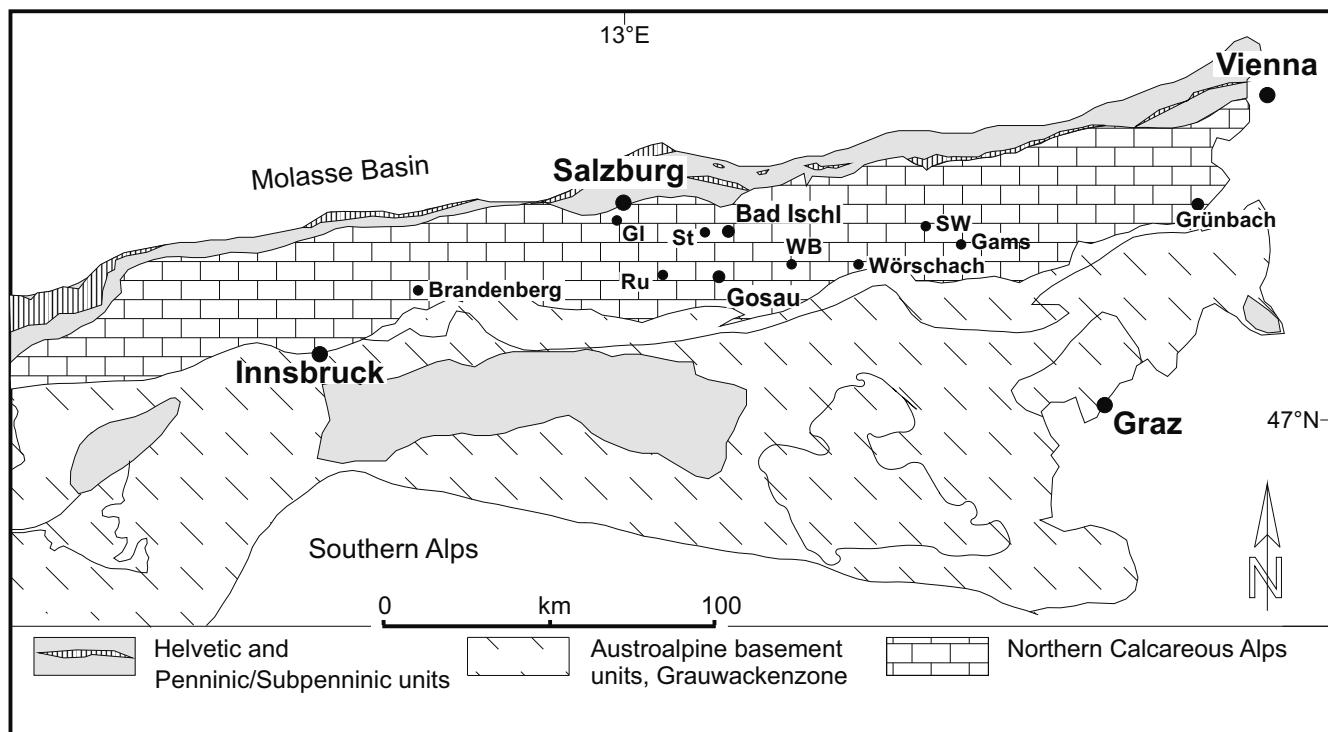
Lang vernachlässigte Cephalopoden aus dem Coniacium der Gosau-Gruppe wurden taxonomisch neu bearbeitet. Von besonderem Interesse war eine neue Aufsammlung (Maherndl Sammlung) aus dem Bau des Straßentunnels nördlich von Bad Ischl, die von *Forresteria alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907) dominiert wird. Messbare kontinuierliche Aufschlüsse, die für eine schichtweise Aufsammlung geeignet sind, gab es weder im Straßentunnel noch im weiteren Untersuchungsbereich von Strobl/Weißenbach und Nussenseebach. Daher fußt die chronostratigrafische Einstufung der Ammonitenfaunen einerseits auf Vergleichen der lokalen Funde mit gut dokumentierten Gebieten wie Frankreich, Südafrika und Madagaskar. Andererseits helfen Daten von kalkigen Nannofossilien (Biozonen CC13–CC15 und UC9–UC11) und anderen Mikrofossilgruppen bei der stratigrafischen Korrelation. Die ungleiche Verteilung der Ammonitenfaunen des Coniaciums wird ebenfalls diskutiert.

Introduction

The Gosau Group of Austria provides classical and long-studied Late Cretaceous ammonite sites and assemblages (HAUER, 1858; REDTENBACHER, 1873; REYMENT, 1958; SUMMESBERGER, 1979, 1980, 1985; SUMMESBERGER et al., 2017a–c). The outcrops of the Lower Gosau Subgroup (WAGREICH & FAUPL, 1994) offer substantial ammonite-bearing extended sections, which allow correlations to other micro- and macrofossil zonations, resulting in an

integrated stratigraphy and significant chronostratigraphic correlations (e.g. WAGREICH, 1992; SUMMESBERGER et al., 1999; WAGREICH et al., 2009).

Turonian to Maastrichtian ammonite assemblages of the Gosau Group were defined and correlated in the last decades, and put into a chronostratigraphic framework (e.g. SUMMESBERGER, 1985). The wealth of ammonite faunas, especially from the Turonian, Coniacian and Santonian, including recent new discoveries and a large amount of material from museum and private collections, was investigat-



Text-Fig. 1.

Overview geological sketch map of the Eastern Alps including the Northern Calcareous Alps (Gosau Group occurrences marked with black dots) and the study area in the Salzkammergut (after WAGREICH et al., 2009). GI – Glanegg, Glanriedel, Untersberg, Ru – Rußbach am Pass Gschütt, St – Strobl am Wolfgangsee, Bürgl, Weissenbachthal, WB – Weissenbachalm, Bad Aussee, SW – Schwarzenbach, Weisswasser, Unterlaussa.

ed in detail in recent years. The Turonian ammonites were largely worked on by the senior author in the 1990s (SUMMERSBERGER, 1992; SUMMERSBERGER & KENNEDY, 1996). More recently, Santonian ammonites were extensively (re-)studied and published from several Austrian localities (SUMMERSBERGER et al., 2017a–c).

The present paper deals with the Coniacian ammonites and their assemblages, based mainly on localities in the Salzkammergut area of central Austria, between Gosau and Bad Ischl. We describe the taxonomy of these Coniacian Lower Gosau Subgroup ammonites, review their occurrences from the Gosau Group in general, provide a stratigraphic evaluation and discuss the chronostratigraphic significance of the assemblages.

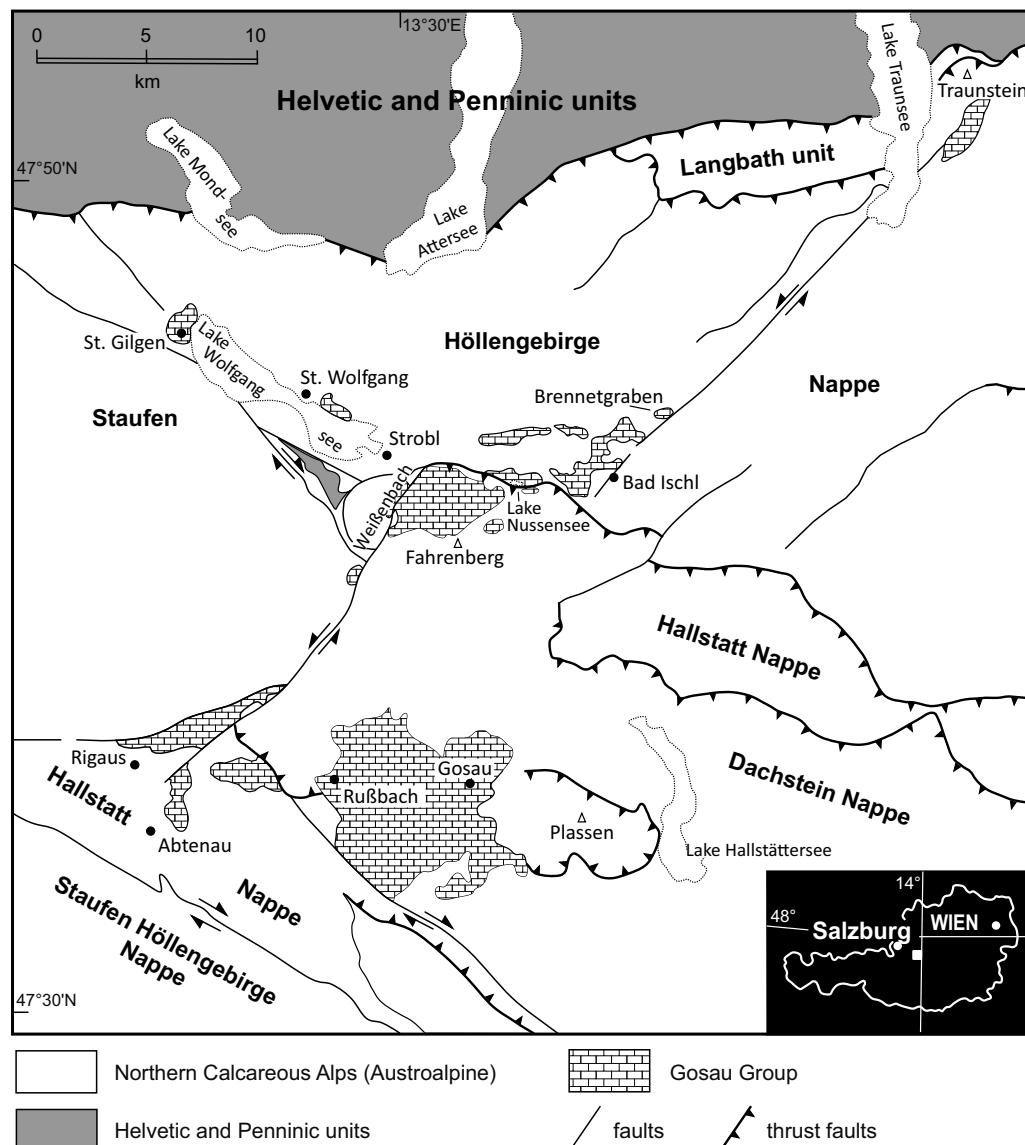
Geological Setting

The studied area with its Upper Cretaceous successions and their ammonites forms geographically part of the Salzkammergut of Austria (Text-Fig. 1). The studied sections at the road tunnel north of Bad Ischl, Nussenseebach and

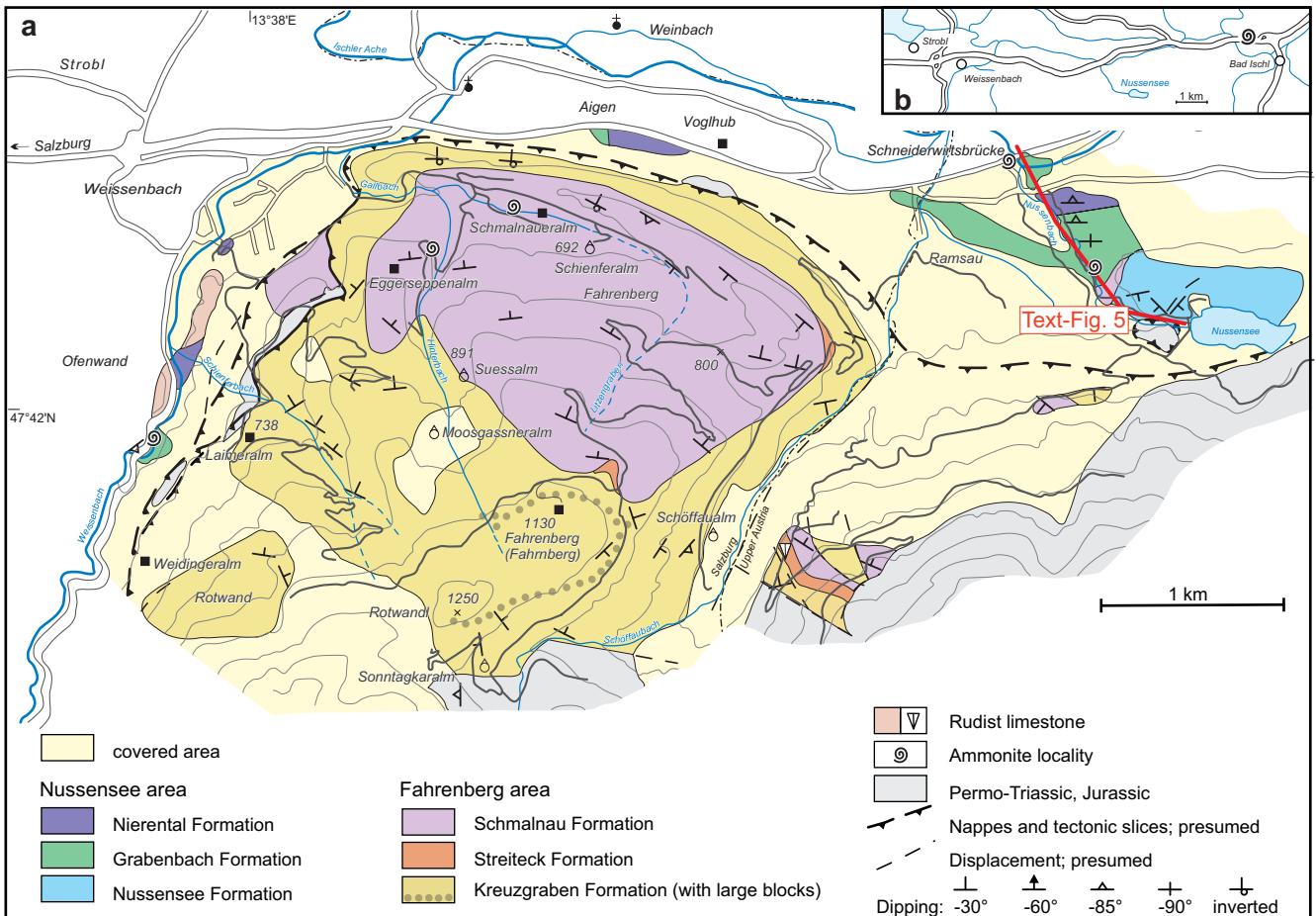
Strobl/Weißenbach are situated at or near the state boundary of Upper Austria and Salzburg, as well as the locality Randobach near Rußbach am Pass Gschütt. Geologically, the studied area forms part of the Northern Calcareous Alps (NCA), a prominent tectonic unit of the Alpine fold-and-thrust belt. The studied outcrops range into the Gosau Group, a Turonian to Eocene package of mixed clastic-carbonate formations, disconformably overlying folded and faulted Permian to Lower Cretaceous rocks (WAGREICH & FAUPL, 1994).

The Gosau Group sediments of the Strobl/Weißenbach area, Nussenseebach and the Bad Ischl road tunnel form part of the Staufen Höllengebirge Nappe of the NCA (Salzburg, see Text-Fig. 2). The studied outcrops and collections are attributed to the Tirolic nappe system, in a similar structural position on top of Permian Haselgebirge, and below the overthrust of the Juvavic Dachstein nappe (PLÖCHINGER, 1982; JARNIK & WAGREICH, 1993; WAGREICH, 1998).

This area was mapped by PLÖCHINGER (1973, 1982). Besides KOLLMANN (1982), these deposits of the Gosau Group were studied by STOJASPAL & LOBITZER (1976) and WAGREICH (1998). Ammonite and inoceramid data were pub-



Text-Fig. 2.
Tectonic sketch map of the Northern Calcareous Alps in the Salzkammergut (with alterations after WAGREICH, 1998: Abb. 1) depicting the main sites of Gosau Group rocks in the wider study area.



Text-Fig. 3.

- a) Detailed geological map of the Fahrenberg and Nussenseebach area (with alterations after WAGREICH, 1998: Abb. 2), including field sampling localities and section from Text-Figs. 5.
 b) Regional overview position map of the nearby ammonite locality of the Bad Ischl road tunnel.

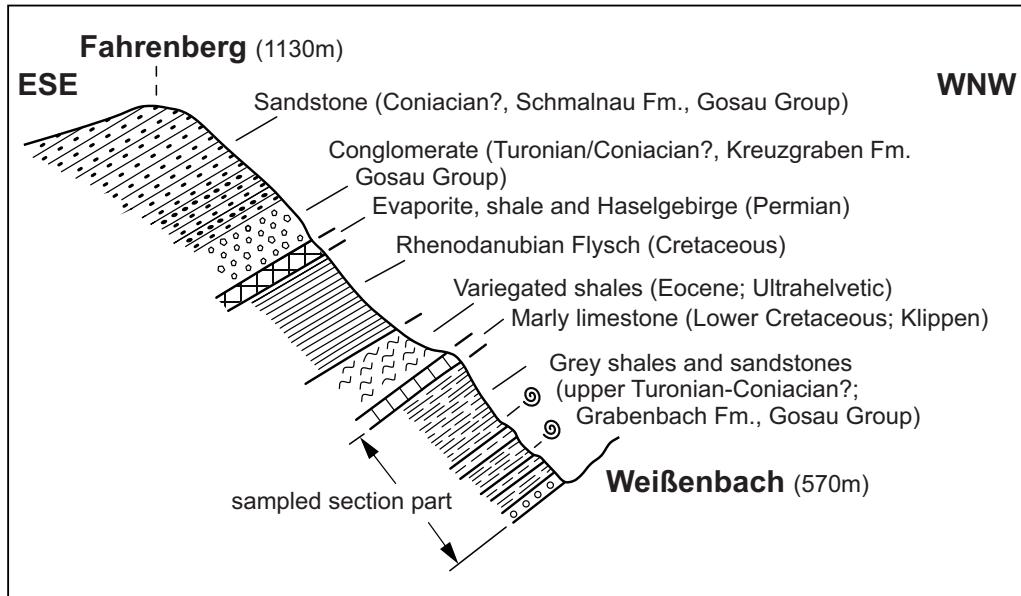
lished by SUMMESBERGER (1979, 1980, 1985), for a detailed geological map see Text-Figure 3.

The Gosau Group deposits of the Strobl/Weißenbach section (Text-Fig. 4) and the Bad Ischl road tunnel comprise mainly grey marlstones and silty to sandy shales (WAGREICH, 1998). Although no sedimentological logs and stratified sampling exist for the Bad Ischl road tunnel, the structural position, the similar marly lithofacies and Coniacian biostratigraphic data give evidence of a correlation to the Grabenbach Formation of the Nussenseebach section (WAGREICH, 1998) and to the grey shales and marls at Strobl/Weißenbach.

The succession at Nussenseebach, a creek to lake Nussensee (WAGREICH, 1998; Text-Fig. 5), comprises reddish and greyish conglomerates at the base (Kreuzgraben and Nussensee Formation of WAGREICH, 1998), overlain by a sandy to marly succession (Grabenbach Formation of WAGREICH, 1998; equivalent to the Grabenbach Formation of the Gosau type area, see KOLLMANN, 1982, and WAGREICH, 1988). The marls provide evidence of mainly Coniacian age, terminated by an increasingly sandy interval of Santonian age.

In contrast, the Gosau Group of the Fahrenberg (Fahrenberg) area is situated on top of the Dachstein Nappe (WAGREICH, 1998), which is part of the Juvavic (= highest) tectonic nappe system of the NCA. This unit overthrusts the

Tirolic units and their Gosau Group sediments of both Nussenseebach and Bad Ischl road tunnel localities (compare Text-Fig. 3). However, the structural position is complicated due to strike-slip movements and possible out-of-sequence-thrusting along the dextral Wolfgangsee fault (PERESSON, 1991; DECKER et al., 1994; JARNIK, 1994; WAGREICH, 1993) and the sinistral Königssee-Lammertal-Traunsee fault system (KLT fault system). The Eocene to Oligocene Wolfgangsee fault system brings up rocks of the underlying units below the several kilometers thick NCA (Rhenodanubian Flysch Zone and Helvetic units; Wolfgangsee tectonic windows of PLÖCHINGER, 1964), interpreted as push-up blocks and/or out-of-sequence thrusting (DECKER et al., 1994). These rocks, including evaporites and shales of the Haselgebirge Formation, crop out in between Gosau Group rocks of the Strobl/Weißenbach area and the overthrusting Fahrenberg Gosau Group. Thus, in this area, a tectonically sliced sequence of conglomerate, Turonian marlstone (SUMMESBERGER & KENNEDY, 1996), variegated shales (Eocene Buntmergelserie, PLÖCHINGER, 1982), Cretaceous Flysch strata, Permian Haselgebirge evaporites and, on top, conglomerate of the Fahrenberg Gosau Group occurs (Text-Fig. 4). The Fahrenberg section comprises conglomerates of the Kreuzgraben Formation at the base, overlain by Streiteck Formation, and the sandy to marly Schmalnau Formation (WAGREICH, 1998) (Text-Fig. 3).



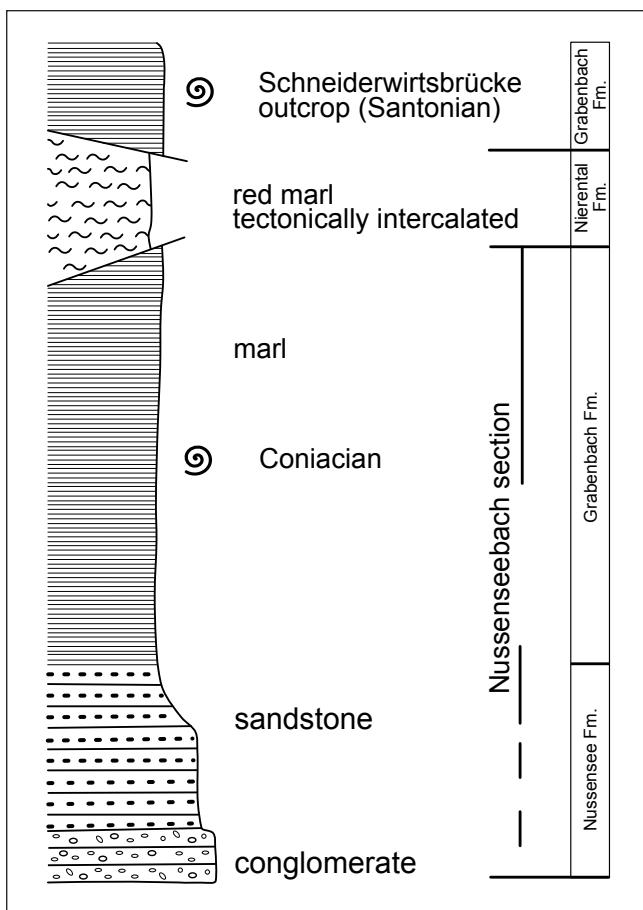
Text-Fig. 4.
Simplified tectonically sliced interpretation of the composite section from the Weissenbach ammonite locality towards the Fahrenberg top (after SUMMESBERGER & KENNEDY, 1996); symbols mark upper Turonian ammonite levels at the base of the section (locality Strobl/Weissenbach – Ofenwand in SUMMESBERGER & KENNEDY, 1996: Fig. 8).

Plankton Biostratigraphy

Planktonic foraminifera and calcareous nannoplankton biostratigraphic zonations are reported from the Nussenseebach section, whereas only nannofossil data are available from samples of Strobl/Weißenbach as well as from

the Fahrenberg (WAGREICH, 1998). For a general correlation of ammonite and nannofossil zonations in the Gosau Group see WAGREICH (1992). The Nussenseebach section provides evidence for the planktonic foraminifera *Marginotruncana schneegansi*, the *Dicarinella concavata* and *Dicarinella asymmetrica* zones (Coniacian–Santonian), and nannofossil zones CC13 (CC zonation of PERCH-NIELSEN, 1985) and UC9 (UC zonation of BURNETT, 1998), CC14–UC10, and CC15/16 to CC16/17–UC11/12. Thus, a late Turonian, Coniacian to mid-Santonian age is proven for the whole section (WAGREICH, 1998). At Strobl/Weißenbach, nannofossil data point to a late Turonian to early Coniacian age (CC13/UC9 zones).

Samples taken from ammonite specimens from Nussenseebach (SK/NU/1983/52) and of the Bad Ischl road tunnel samples provide also nannofossil evidence for CC13 and UC9, similar to the Schmalnau Formation of the Fahrenberg area, where joint occurrence of *Marthasterites furcatus* und *Lithastrinus septenarius* without *Micula staurophora* indicate an early to (early) mid-Coniacian age (WAGREICH, 1998). No biostratigraphically significant planktonic foraminifera could be found both at Fahrenberg and Strobl/Weißenbach.



Text-Fig. 5.
Sketch of the Nussenseebach composite section including the tectonically separated red marls and the Schneiderwirtsbrücke ammonite site. A composite total thickness of ca. 500 m is indicated (Wagreich, 1998).

Cephalopod-bearing Localities of the Coniacian Gosau Group

The following cephalopod-bearing sites of the Coniacian Gosau Group have been taken into account in the following review on Coniacian ammonites:

Upper Austria

Nussenseebach (west of Bad Ischl).

Bürgl, Klausmeister.

Road tunnel north of Bad Ischl (Maherndl collection).

Gosau Valley/Edlbachgraben.

Schwarzenbach/Weißwasser area.

State of Salzburg

Glanegg (near City of Salzburg).
 Glanriedl (near City of Salzburg).
 Morzg (near City of Salzburg).
 Strobl/Weißenbach.
 Fahrenberg – Adventists home (Schmolnauer = Schmalnauer Alpe).
 Fahrenberg – forest road Gallbach.
 Fahrenberg – forest road Hinterbach.
 Randobach (near Rußbach am Pass Gschütt).

Styria

Bad Aussee (Weißenbachalm)
 Gams
 Wörschach

Tyrol

Brandenberg. – All ammonites are of Turonian (SUMMES-BERGER & KENNEDY, 1996) and Santonian age (SUMMES-BERGER et al., 2017a-c) and therefore no Coniacian ammonites can be reported from this site.

Neither in the Bad Ischl road tunnel (during construction work) nor at one of the other collecting sites of the Fahrenberg and Nussenseebach area are measurable sections suitable for bed-by-bed collecting. The chronostratigraphic sequence of the ammonite assemblages is based upon comparison of local findings with well-documented areas elsewhere. Accompanying invertebrates are mainly inoceramids (TRÖGER & SUMMESBERGER, 1994).

Repositories of Specimens

GBA	Geologische Bundesanstalt (Geological Survey of Austria), Vienna, Austria.
NHMW	Naturhistorisches Museum Wien (Natural History Museum), Vienna, Austria.
SK	Skoumal collection, Vienna, Austria.
M	Collection Odo Mader, Rattenberg, Tyrol, Austria.
MA	Maherndl collection, Bad Ischl, Austria.
HNS	Haus der Natur, Salzburg, Austria.
OÖLM	Oberösterreichisches Landesmuseum, Linz, Austria.
GMB	Goldfuss Museum, Bonn, Germany.
PIUW	Paläontologisches Institut der Universität Wien (Department of Palaeontology, University of Vienna), Vienna, Austria.
GPII	Institut für Geologie der Universität Innsbruck (Department of Geology, University of Innsbruck), Innsbruck, Austria.

BSM	Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany
MNP	Muséum National d'Histoire Naturelle, Paris, France.

Abbreviations used herein

A	= Adventive lobe
D	= Diameter
E	= External lobe
E/A	= External lobe/adventive lobe
I	= Internal lobe
L	= Lateral saddle
U	= Umbilical lobe
U %	= Ratio of umbilical diameter to specimen diameter
U ₂	= Internal/lateral lobe
Wb	= Whorl breadth
Wh	= Whorl height

Systematic Palaeontology

Class Cephalopoda CUVIER, 1797

Subclass Nautiloidea AGASSIZ, 1847

Order Nautilida AGASSIZ, 1847

Superfamily Nautilaceae DE BLAINVILLE, 1825

Family Nautilidae DE BLAINVILLE, 1825

Genus *Angulithes* MONTFORT, 1808

Type species: '*Nautilus*' *triangularis* MONTFORT, 1808 by subsequent designation of SPATH (1927: 21).

***Angulithes westphalicus* (SCHLÜTER, 1872)**

(Pl. 1, Figs. 1, 2, Pl. 2, Figs. 3–5)

- 1872 *Nautilus westphalicus* SCHLÜTER: 13.
 1876 *Nautilus westphalicus* SCHLÜTER: 175, Pl. 47, Figs. 1, 2.
 1906 *Nautilus westphalicus* SCHLÜTER; MÜLLER & WOLLEMANN: 1, Pl. 1, Figs. 1, 2.
 1991 *Deltoidonautilus westphalicus* (SCHLÜTER, 1872); RIEGRAF & SCHEER: 426.
 1999 *Deltoidonautilus* [sic!] *westphalicus* (SCHLÜTER, 1872); WITTLER et al.: 37, Figs. 51a, b, 52a, b.
 2001 *Angulithes* cf. *westphalicus* (SCHLÜTER, 1872); FÖZY: 34, Pl. 5.
 2010 *Angulithes westphalicus* (SCHLÜTER, 1872); FRANK: 490, Figs. 3A–N (with additional synonymy).

- 2017a *Angulithes westphalicus* (SCHLÜTER, 1872); SUMMESBERGER et al.: 10–11, Pl. 1, Figs. 1–3, Pl. 2, Figs. 1–3, Pl. 3, Figs. 4–5, Pl. 4, Figs. 1–3, Tab. 1.

Type: The lectotype by the subsequent designation of FRANK (2010: 490) is the original of SCHLÜTER, 1872: Pl. 47, Figs. 1, 2 from the Lower Campanian *Scaphites binosus* Zone of Dülmen, Westphalia, Germany, housed as GMB/97 in the Goldfuss Museum, Bonn (Germany).

Material: Three specimens, NHMW/1992/0144/0002 from Fahrenberg (Strobl/Weißenbach, Salzburg); SK/NU/1999/80–81 from Nussenseebach (Upper Austria).

Description: NHMW/1992/0144/0002 is an internal mould with adherent remains of shell at the umbilicus. The shell is involute, the umbilicus closed, flanks moderately convex.

Measurements: D = 151.5, Wh = 90.4 mm, Wb = 56.4 mm. The umbilical edge is sharp where the shell is preserved. The greatest breadth is at midflank. The outer flanks are converging to the distinctly angular venter. The umbilicus is occluded. The position of the siphuncle cannot be observed. There are no ribs nor growth lines visible. Sutures are visible at the umbilicus only.

Discussion: See SUMMESBERGER et al. (2017a).

Occurrence: In the Austrian Gosau Group *Angulithes westphalicus* (SCHLÜTER, 1872) occurs from the middle Coniacian *Tridorsatum* Zone through the lower and middle Santonian (SUMMESBERGER et al., 2017a). In Germany (Dülmen; SCHLÜTER, 1872) and Hungary (Sümeg; A. cf. *westphalicus*; FÖZY, 2001) it is recorded from the Campanian.

Family Hercoglossinae SPATH, 1927

Genus *Cimomia* CONRAD, 1866

Type species: *Nautilus Burtini* GALEOTTI, 1837 by original designation of CONRAD (1866).

Cimomia gosavica (REDTENBACHER, 1873)

(Pl. 2, Figs. 1, 2)

- 1873 *Nautilus gosavicus* REDTENBACHER: 96, Pl. 22, Figs. 2a, b.
- 1956 *Euterephoceras gosavicus* (REDTENBACHER, 1873); KUMMEL: 382.
- 1960 *Angulithes (Cimomia) gosavicus* (REDTENBACHER, 1873); WIEDMANN: 178, Pl. 20, Fig. M.
- 1975 *Cimomia ? gosavicus* (REDTENBACHER, 1873); SHIMANSKY: 134, Tab. 41.
- 2009 *Angulithes (Cimomia) gosavicus* (REDTENBACHER, 1873); SUMMESBERGER et al.: 167.
- 2012 *Cimomia gosavica* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 104; Pl. 6, Figs. 3a–d.
- 2017a *Cimomia ? cf. gosavica* (REDTENBACHER, 1873); SUMMESBERGER et al.: 12.
- 2017c *Cimomia gosavica* (REDTENBACHER, 1873); SUMMESBERGER et al.: 170, Pl. 6, Figs. 1–3, Pl. 7, Fig. 1, Text-Figs. 12, 13, Tab. 3.

Type: Holotype by monotypy is the original of *Nautilus gosavicus* REDTENBACHER, 1873, preserved in the collections of the Geological Survey of Austria (GBA/1873/001/0003), designated and refigured by SUMMESBERGER et al. (2017c).

Material: A single specimen, SK/FA/1994/34 (Pl. 2, Figs. 1, 2), from Fahrenberg (Strobl/Weißenbach, Salzburg). For description and discussion see SUMMESBERGER et al. (2017c).

Occurrence: Main occurrence is in the Santonian of the Gosau Group. Stratigraphical extension into middle Coniacian is provided by the above described specimen from the Strobl/Weißenbach area.

Subclass Ammonoidea ZITTEL, 1884

Order Ammonitida HYATT, 1889

Suborder Lytoceratina HYATT, 1889

Superfamily Tetragonitoidea HYATT, 1900

Family Tetragonitidae HYATT, 1900

Subfamily Tetragonitinae HYATT, 1900

Genus *Tetragonites* KOSSMAT, 1895

Type species: *Ammonites timotheanus* PICTET, 1848: 295 by original designation.

Tetragonites cf. epigonus KOSSMAT, 1895

(Pl. 3, Fig. 1)

Compare

- 1895 *Lytoceras (Tetragonites) epigonus* KOSSMAT: 135, Pl. 17, Figs. 4a–c, 5a, b, 10.
- 1909 *Lytoceras (Tetragonites) cf. epigonus* KOSSMAT, 1895; KILIAN & REBOUL: 14.
- 1977 *Tetragonites cf. epigonus* KOSSMAT, 1895; KENNEDY & KLINGER: 165, Figs. 7E–G, 9A–C (with synonymy).
- 1995 *Tetragonites cf. epigonus* KOSSMAT, 1895; KENNEDY in KENNEDY et al.: 389, Pl. 3, Figs. 13, 14.

Type: Lectotype by subsequent designation of KENNEDY & KLINGER (1977) is the original of KOSSMAT's (1895: Pl. 17, Figs. 4a–c) figured specimen.

Material: A single fragment (NHMW/1989/0050/0013) from Schmalnauer (= Schmolnauer) Alpe, 30 m north of the Adventist home.

Description: The single fragment (NHMW/1989/0050/0013) of estimated 25 mm in diameter is an internal mould with preserved greyish shell. The coiling is involute. The surface is smooth with a rounded venter and inflated flanks. The umbilical shoulder is abruptly rounded, the umbilical wall – as far as visible – is subvertical.

Discussion: The single occurring *Tetragonites cf. epigonus* KOSSMAT, 1895 (NHMW/1989/0050/0013) differs from *Saghalinites nuperus* (VAN HOEPEN, 1921) in its globular shape and in the absence of the median keel.

Occurrence: *Tetragonites cf. epigonus* KOSSMAT, 1895 occurs in the Coniacian of the Gosau Group.

Genus *Saghalinites* WRIGHT & MATSUMOTO, 1954

Type species: *Ammonites cala* FORBES, 1846 by original designation of WRIGHT & MATSUMOTO (1954: 110).

Saghalinites nuperus (VAN HOEPEN, 1921)

(Pl. 3, Figs. 2–11, Text-Fig. 6)

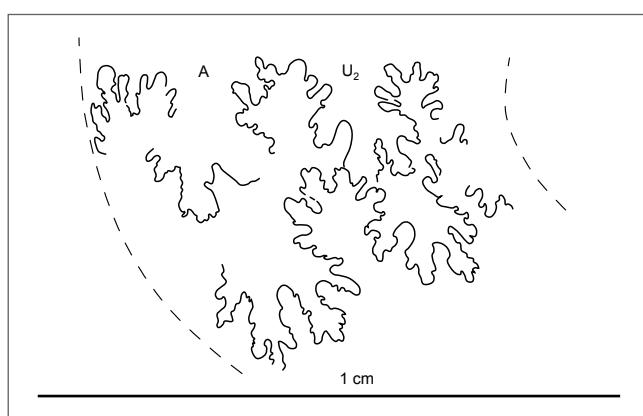
- 1921 *Tetragonites nuperus* VAN HOEPEN: 13, Pl. 3, Figs. 3, 4.
- 1956 *Saghalinites nuperus* VAN HOEPEN; COLLIGNON: 81, 95, Pl. 11, Figs. 1, 1a, 1b.
- 1965 *Saghalinites nuperus* VAN HOEPEN; COLLIGNON: 3, Pl. 456, Fig. 1856, Pl. 463, Fig. 1893.
- 1977 *Saghalinites nuperus* (VAN HOEPEN, 1921); KENNEDY & KLINGER: 177, Figs. 16A–E, 17A, B, 18 (with synonymy).
- 1982 *Saghalinites aff. wrighti* BIRKELUND; IMMEL et al.: 10, Pl. 2, Figs. 1, 2.
- 1982 *Pseudophyllites latus* (MARSHAL, 1926); IMMEL et al.: 10, Pl. 2, Figs. 3, 4.
- 1985 *Saghalinites nuperus* (VAN HOEPEN, 1921); KLINGER: 4, Figs. 2N–S, 3A–C.
- 1987 *Saghalinites wrighti* BIRKELUND; IMMEL: 67.
- 1987 *Pseudophyllites latus* (MARSHALL, 1926); IMMEL: 67.
- 1995 *Saghalinites nuperus* (VAN HOEPEN, 1921); KENNEDY in KENNEDY et al.: 389, Pl. 3, Figs. 3, 4, 10, 11.
- 2009 *Saghalinites nuperus* (VAN HOEPEN, 1921); KLEIN et al.: 255 (with additional synonymy).

Type: The holotype is figured by VAN HOEPEN (1921: Pl. 3, Figs. 3, 4).

Material: GBA/2019/001/0001 from Nussenseebach; NHMW/1989/0050/0015 and SK/FA/1990/30 (two specimens) from Schmalnauer Alpe, 30 m north of the Adventist home; SK/NU/1981/5, 6 and SK/NU/1994/68 from Nussenseebach; furthermore: NHMW/1982/0035/0001 (Edlbachgraben, Gosau; Upper Austria); M 14, M 48, GPII P.8164, GPII. 8178 (lower Santonian, Brandenberger Gosau, Tyrol); NHMW/2013/0015/0004–0005, lower Santonian of Weißwasser (Unterlaussa, Upper Austria); NHMW/2012/0186/0010, Randobach (Salzburg); SK/SB/1989/5, Schneiderwirtsbrücke, Upper Austria.

Description: All specimens are internal moulds partially with adherent whitish shell fragments. All are moderately involute with slowly increasing whorl height and breadth. The whorl section is polygonal with rounded umbilical and rounded ventrolateral shoulders. The flanks are gently inflated. The venter is flat with a distinctly protruding feeble and smooth keel. There is no ornament but weak prorsiradiate constrictions.

Occurrence: *Saghalinites nuperus* (VAN HOEPEN, 1921) occurs in the middle Coniacian of Schmalnauer Alpe. It occurs also in the lower Santonian of Mühlbach (Brandenberg, Tyrol), in the basal Santonian of Edlbachgraben (Gosau, Upper Austria), in the Schwarzenbach/Weißwasser area (Upper Austria), and in the middle Santonian of the Schneiderwirtsbrücke site (Bad Ischl, Upper Austria). There are also records from the lower Santonian of the Corbières in southern France, Eastern Cape Province in South Africa, Madagascar and Japan, as well as a possible record from northern Spain (KENNEDY et al., 1995).



Text-Fig. 6.
External suture of *Saghalinites nuperus* (VAN HOEPEN, 1921), SK/NU/1981/6 from Nussenseebach.

Genus *Pseudophyllites* KOSSMAT, 1895

Type species: *Ammonites Indra* FORBES, 1846 by original designation of KOSSMAT (1895: 137).

Pseudophyllites postremus (REDTENBACHER, 1873)

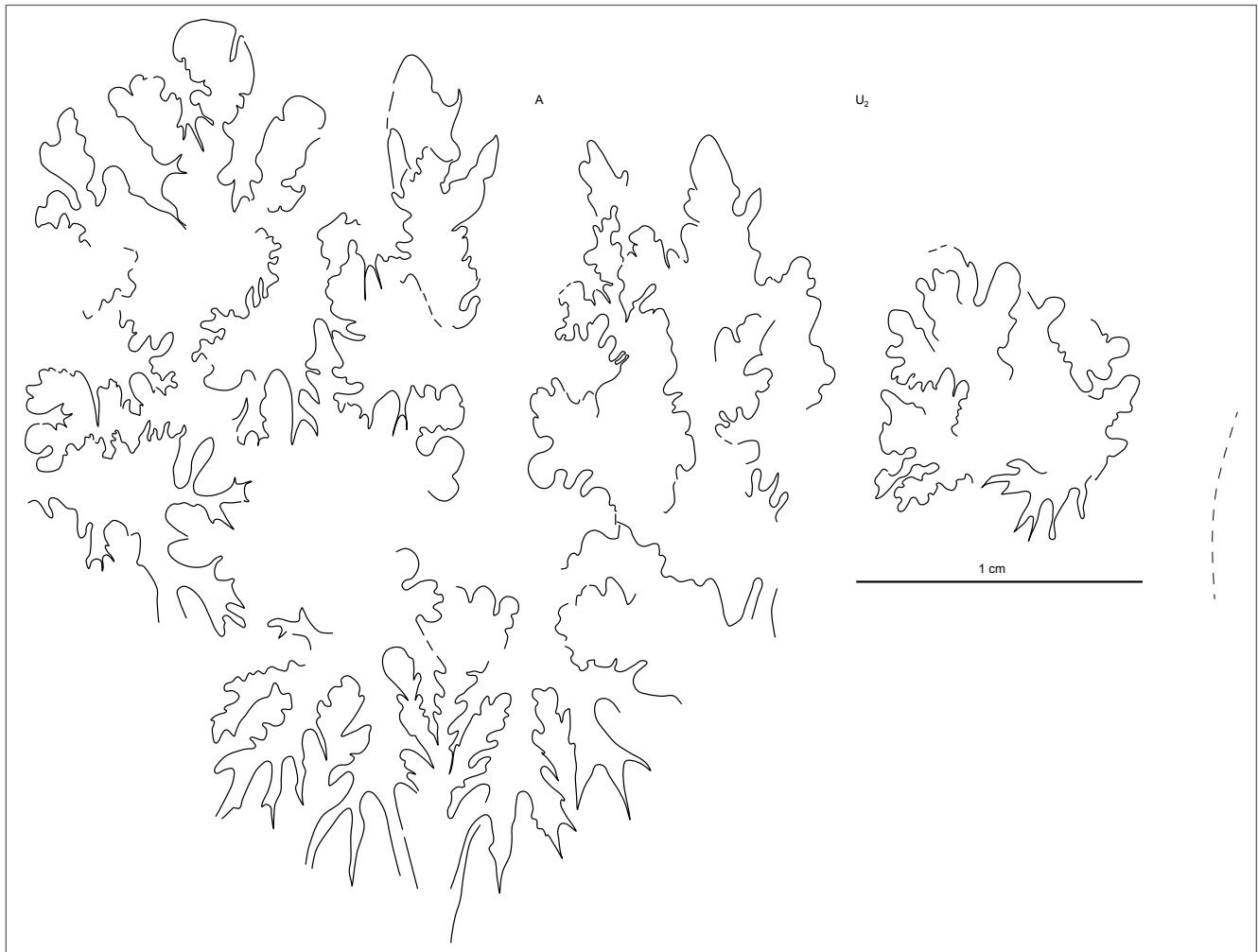
(Pl. 3, Figs. 13, 14, Text-Figs. 7, 8)

- 1873 *Ammonites postremus* REDTENBACHER: 115, Pl. 26, Figs. 3a–d.
- 1895 *Ammonites postremus* REDTENBACHER; KOSSMAT: 140.
- 1977 *Pseudophyllites postremus* (REDTENBACHER, 1873); KENNEDY & KLINGER: 186.
- 1992 *Pseudophyllites postremus* (REDTENBACHER, 1873); SUMMERSBERGER: 100.
- 1996 *Pseudophyllites postremus* (REDTENBACHER, 1873); SUMMERSBERGER & KENNEDY: 114, Pl. 2, Figs. 3, 5, 6, 8 (with synonymy).
- 2009 *Pseudophyllites postremus* (REDTENBACHER, 1873); KLEIN et al.: 248, 252 (with synonymy).
- 2012 *Pseudophyllites postremus* (REDTENBACHER, 1873); SUMMERSBERGER & ZORN: 106, Pl. 14, Figs. 1a–d.

Type: Lectotype is GBA/1873/001/0018, the original of REDTENBACHER (1873: 115, Pl. 26, Figs. 3a–d), subsequently designated and refigured by SUMMERSBERGER & KENNEDY (1996: 114, Pl. 2, Figs. 3, 5, 6, 8) from the upper Turonian Gosau Group of Gams (Styria, Austria).

Material: Besides the lectotype a single specimen (NHMW/1989/0050/0017) from the Schmalnauer Alpe, 30 m north of the Adventist home.

Description: The lectotype of *Pseudophyllites postremus* (REDTENBACHER, 1873) from the Turonian Gosau Group of Gams (Styria, Austria) was described by SUMMERSBERGER & KENNEDY (1996) (cf. Text-Fig. 8). The single occurring specimen from the middle Coniacian Gosau Group of the Schmalnauer Alpe is a large fragment with parts of the body chamber and the phragmocone preserved. The aragonitic shell is well preserved and had to be partially removed for preparation of the suture. Characterising the genus, Wh and Wb are increasing quickly. The umbilical wall is inclined outwards, the umbilical shoulder is smooth,

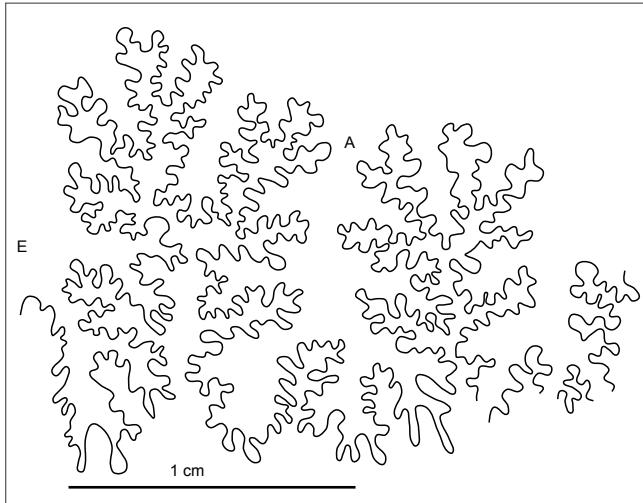


Text-Fig. 7.
External suture of *Pseudophyllites postremus* (REDTENBACHER, 1873), NHMW/1989/0050/0017, Schmalnauer Alpe, Strobl/Weißenbach, Salzburg.

and the flanks are flattened and continuing into the rounded venter without a ventrolateral shoulder. There are no liae nor constrictions visible. The suture is deeply incised (Text-Fig. 7).

Discussion: *Pseudophyllites pyrenaicus* (GROSSOUVRE, 1894) is similar but differs in its feeble striae and incipient constrictions.

Occurrence: See under Material.



Text-Fig. 8.
External suture of GBA/1873/001/0018, the lectotype of *Pseudophyllites postremus* (REDTENBACHER, 1873) from Gams, Styria, (after SUMMESBERGER & KENNEDY, 1996: Fig. 11).

Family Gaudryceratidae SPATH, 1927 Genus *Gaudryceras* GROSSOUVRE, 1894

Type species: *Ammonites mitis* HAUER, 1866 by REDTENBACHER (1873: 119).

Gaudryceras mite (HAUER, 1866)

(Pl. 3, Fig. 18, Pl. 4, Fig. 1)

- 1866 *Ammonites mitis* HAUER: 305, Pl. 2, Figs. 3, 4.
- 1873 *Ammonites glaneggensis* REDTENBACHER: 119, Pl. 27, Figs. 3a, b.
- 1873 *Ammonites mitis* HAUER; REDTENBACHER: 119, Pl. 27, Fig. 4.
- 1979 *Gaudryceras mite* (HAUER); KENNEDY & SUMMESBERGER: 74, Pl. 1, Figs. 1a-d, Pl. 2, Figs. 1a-c, 2a, b, Text-Fig. 1 (with synonymy).

- 1979 *Gaudryceras glaneggense* (REDTENBACHER); KENNEDY & SUMMESBERGER: 76, Pl. 3, Figs. 1a, b, Pl. 4, Figs. 1a, b (with synonymy).
- 1979 *Gaudryceras mite* (HAUER, 1866); SUMMESBERGER: 113, Pl. 1, Fig. 1.
- 1987 *Gaudryceras glaneggense* (REDTENBACHER, 1873); IMMEL: 65.
- 1987 *Gaudryceras mite* (HAUER, 1866); IMMEL: 65.
- 1995 *Gaudryceras mite* (HAUER, 1866); KENNEDY in KENNEDY et al.: 390, Pl. 1, Figs. 20, 21.
- 1996 *Gaudryceras mite* (HAUER, 1866); SUMMESBERGER & KENNEDY: 112, Pl. 1, Figs. 1–4 (with synonymy).
- ? 1996 *Gaudryceras* sp. indet. group of *mite* (HAUER, 1866); SUMMESBERGER & KENNEDY: 114, Pl. 2, Figs. 1, 7.
- 2012 *Gaudryceras mite* (HAUER, 1866); SUMMESBERGER & ZORN: 103, Pl. 4, Figs. 4a, b, Pl. 5, Figs. 1a, b.
- 2017a *Gaudryceras mite* (HAUER, 1866); SUMMESBERGER et al.: 15.
- 2017c *Gaudryceras mite* (HAUER, 1866); SUMMESBERGER et al.: 172.
- 2019 *Gaudryceras mite* (HAUER, 1866); IFRIM et al.: 171, Text-Fig. 4.

Type: Holotype by monotypy is *Ammonites mitis* HAUER, 1866: 305 (GBA/1866/001/0003), refigured by KENNEDY & SUMMESBERGER (1979: Pl. 1, Figs. 1a–d, SUMMESBERGER & KENNEDY (1996: Pl. 1, Fig. 1) and by SUMMESBERGER & ZORN (2012: Pl. 4, Fig. 4a, b).

Material: GBA/1866/001/0003 from Strobl/Weißenbach; NHMW/1978/1963/0021 and SK/1979/4 from the Finstergrabenwandl, Gosau; NHMW/1989/0050/0014 from Schmalnauer Alpe, 30 m north of the Adventist home; HNS/6373 from Glanegg; GBA/unregistered from Gams (Styria).

Description and discussion: *Gaudryceras mite* (HAUER, 1866) is described and discussed at length in the named references (see the synonymies).

Occurrence: The occurrences of *Gaudryceras mite* (HAUER, 1866) in the Austrian Salzkammergut are covering a good deal of its temporal range: GBA/1866/001/0003, the holotype, is from the upper Turonian of the “Ofenwand” which is situated close to Strobl/Weißenbach. REDTENBACHER’s unique specimen of *Ammonites glaneggensis* (HNS/6373) is from the upper Coniacian of Glanegg, south of the City of Salzburg. NHMW/1978/1963/0021 and SK/1979/4 are from the upper Santonian of the Finstergrabenwandl site (Gosau, Upper Austria). NHMW/1989/0050/0014 is from Schmalnauer Alpe, 30 m north of the Adventist home.

Gaudryceras sp.

(Pl. 3, Figs. 16, 17)

Material: SK/NU/not reg., OÖLM/1938/32.

Occurrence: SK/NU/not reg. is from the middle Coniacian of Nussenseebach. OÖLM/1938/32 is from a site at or near Bad Ischl without better information about the exact sample location and age.

Genus *Anagaudryceras* SHIMIZU, 1934

Type species: *Ammonites sacya* FORBES, 1846 by the original designation of SHIMIZU (1934: 67). For occurrence and synonymy see KENNEDY & KLINGER (1979).

Anagaudryceras subtililineatum (KOSSMAT, 1895)

(Pl. 3, Figs. 12, 15, Text-Fig. 9, Tab. 1)

- 1895 *Lytoceras* (*Gaudryceras*) *subtililineatum* KOSSMAT: 123, Pl. 19, Figs. 1a–c, 2a, b.
- 1956 *Anagaudryceras subtililineatum* (KOSSMAT); COLLIGNON: 68.
- 1965 *Anagaudryceras subtililineatum* (KOSSMAT); HOWARTH: 358.
- 1979 *Anagaudryceras subtililineatum* (KOSSMAT); KENNEDY & KLINGER: 155, Pl. 14, Figs. 3, 12, Text-Fig. 3 (with synonymy).
- ? 1982 *Anagaudryceras* cf. *subtililineatum* (KOSSMAT 1895); IMMEL et al.: 9, Pl. 1, Fig. 7.
- 2017a *Anagaudryceras* sp.; SUMMESBERGER et al.: 14, Pl. 5, Fig. 2, Tab. 2.
- 2017a ? *Anagaudryceras* cf. *subtililineatum* (KOSSMAT, 1895); SUMMESBERGER et al.: 14.

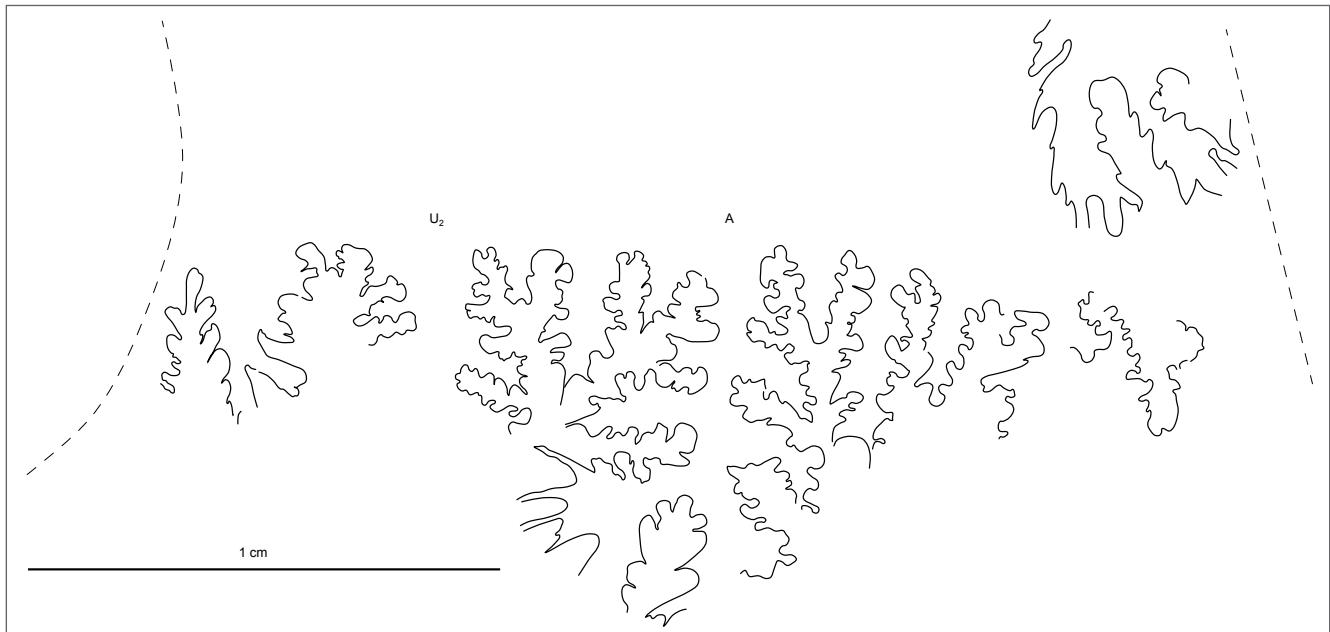
Type: Lectotype designated by KENNEDY & KLINGER (1979: 155) is the original of KOSSMAT (1895: 123, Pl. 19, Figs. 1a–c) from the Ariyalur Group of Southern India.

Material: Two specimens: SK/NU/1981/1 from Nussenseebach; OÖLM/2014/10, no locality details.

Description: SK/NU/1981/1 is a laterally compressed external mould of a phragmocone without adherent shell. The umbilicus is relatively wide, the last whorl covering about 50 % of the penultimate one. The striking feature of this individual are the tight sutures. Visible under oblique light and with a hand lens only are the tight growth lines – at Wh 1.3 cm there are about 48 per cm. They arise at the umbilical seam sweeping over umbilical wall, shoulder and flank in a slight falcoid curve. There are no bifurcations visible and no constrictions. The suture (Text-Fig. 9) is deeply incised with a bifid lateral lobe (L) and a bifid second lateral saddle (L/U₂). The sutures of OÖLM/2014/10 are not exposed (see SUMMESBERGER et al., 2017a: 14, Pl. 5, Fig. 2, Tab. 2).

Discussion: Long-ranging and co-occurring *Gaudryceras mite* (HAUER, 1866; see above) differs in its wider umbilicus and its bifurcating and coarser liration: 6–7 lirae per cm at the ventrolateral shoulder. For details of the ornament of *Gaudryceras mite* (HAUER, 1866) see SUMMESBERGER & KENNEDY (1996: 114). Already KOSSMAT (1895: 124, Pl. 19, Fig. 1c) and later also KENNEDY & KLINGER (1979: 156) emphasized the invisibility of the liration of *A. subtililineatum* for the naked eye. This is also the case in SUMMESBERGER et al. (2017a: 14). For further discussion see KENNEDY & KLINGER (1979: 156).

Occurrence: SK/NU/1981/1 occurs in the middle Coniacian Gosau Group at the Nussenseebach (Text-Fig. 5). A Coniacian age of OÖLM/2014/10 is suggested by the label. Presumably it is from a site near Bad Ischl; the precise location is unknown to the present authors. There are records from Southern India and South Africa (KENNEDY & KLINGER, 1979).



Text-Fig. 9.
External suture of *Anagaudryceras subtililineatum* (KOSSMATT, 1895), SK/NU/1981/1, Nussenseebach, Salzburg.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
SK/NU/1981/1	56	26	19.6	16	29.6
OÖLM/2014/10	93.5	45.2	35 _{est}	4.1	25.8

Tab. 1.
Measurement of *Anagaudryceras subtililineatum* (KOSSMATT, 1895) SK/NU/1981/1 and OÖLM/2014/10; in mm; est = estimated, U (%) of D.

Suborder Ammonitina HYATT, 1889

Superfamily Desmoceratoidea ZITTEL, 1895

Family Desmoceratidae ZITTEL, 1895

Subfamily Puzosiinae SPATH, 1922

(= Hauericeratinae MATSUMOTO, 1938)

Genus *Jimboiceras* MATSUMOTO, 1954

Type species: *Desmoceras planulatiforme* JIMBO, 1894 by the original designation of MATSUMOTO (1954: 95).

Jimboiceras cf. reyi COLLIGNON, 1983

(Pl. 4, Figs. 2, 3, Tab. 2)

Compare

- 1873 *Ammonites* spec. indet. cfr. *Ammonites Sacya* FORBES 1846; REDTENBACHER: 125, Pl. 30, Fig. 4a, b.
- 1983 *Jimboiceras reyi* COLLIGNON: 189, Pl. 2, Fig. 2.
- 1995 *Jimboiceras ? reyi* COLLIGNON; KENNEDY in KENNEDY et al.: 394, Pl. 4, Figs. 8–11, 15, 16, Pl. 6, Figs. 1, 2.
- 2017a *Jimboiceras cf. reyi* COLLIGNON; SUMMERSBERGER et al.: 17, Pl. 6, Figs. 1–4, 6, 7, Text-Fig. 4, Tab. 3.

Type: Holotype designated by BILOTTE & COLLIGNON (1983: 189, Pl. 2, Fig. 2), from the collection of Bilotte, specimen M B 22 PR, lower Santonian, of Corbières (France).

Material: We have six specimens: NHMW/2013/0016/0001 (former Böhm collection) from the Glanegg castle south of the city of Salzburg; NHMW/1990/0050/0016 from the Middle Coniacian of Schmalnauer Alpe, 30 m north of the Adventist home; NHMW/2013/0015/0001–0002 from the early Santonian of Unterlaussa (Weißenwasser, Upper Austria); SK/GR/2015/52 from the Santonian of the Grabenbach section (basin of Gosau), and a not registered specimen of the HNS collection. The original of *Ammonites* spec. indet. cfr. *Ammonites Sacya* FORBES of REDTENBACHER (1873: Pl. 30, Figs. 4a, b) could not be traced in the collections of the Haus der Natur, Salzburg.

Description: NHMW/1990/0050/0016 is a well-preserved internal mould of about 40 mm in diameter. Coiling is involute with a rounded section, narrow umbilicus and a vertical umbilical wall. Ornament is of about 12 marked narrow constrictions accompanied by a weak collar rib. Between the collar ribs are very shallow secondary ribs intercalated and following the slightly curved collar ribs. NHMW/2013/0015/0001–0002 from the early Santonian of Unterlaussa are laterally compressed by *post-mortem* deformation. Similar is NHMW/2013/0016/0001 from the Upper Coniacian of the Glanegg castle near Salzburg with a lower number of constrictions. NHMW/2013/0015/0002 is the only one with a visible suture line.

Discussion: *Jimboiceras planulatiforme* (JIMBO, 1894) from the Turonian of Japan (MATSUMOTO, 1988: 96) differs from *Jimboiceras ? reyi* COLLIGNON, 1983 in its coarser secondary ribs.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
NHMW/1990/0050/0016	38.4	14.8	15.4	13.0	33.8
NHMW/2013/0015/0001	84.0 _{est}	15	8.2	21.4	25.5
NHMW/2013/0016/0001	43.1 _{est}	13.0 _{est}	12.5	14.7 _{est}	34.1

Tab. 2.
Measurements of *Jimboiceras cf. reyi* COLLIGNON, 1983. est = estimated, U (%) of D.

Occurrence: NHMW/2013/0016/0001 and a not registered specimen of the HNS collection, furthermore the original of *Ammonites* spec. indet. cfr. *Ammonites Sacya* FORBES of REDTENBACHER, 1873 (Pl. 30, Figs. 4a, b) are from the upper Coniacian of Glanegg (Salzburg). Further Austrian specimens are from the lower Santonian of Unterlaussa and Breitenberg (Upper Austria) (SUMMESBERGER et al. 2017a). The French examples (see KENNEDY in KENNEDY et al., 1995) are from the middle and upper Coniacian of the Corbières (France) (see SUMMESBERGER et al., 2017a: 18).

Subfamily Hauericeratinae MATSUMOTO, 1938

Genus *Hauericeras* DE GROSSOURE, 1894

Type species: *Ammonites pseudogardeni* SCHLÜTER, 1872 by original designation of DE GROSSOURE (1894: 222).

Hauericeras lagarum (REDTENBACHER, 1873)

(not figured)

- 1873 *Ammonites lagarus* REDTENBACHER: 112, Pl. 25, Figs. 3a, b.
- 1995 *Hauericeras (Gardeniceras) lagarum* (REDTENBACHER, 1873); KENNEDY in KENNEDY et al.: 397 (with synonymy).
- 2012 *Hauericeras (Gardeniceras) lagarum* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 106, Pl. 13, Fig. 2 (with synonymy).
- 2017a *Hauericeras (Gardeniceras) lagarum* (REDTENBACHER, 1873); SUMMESBERGER et al.: 21, Text-Fig. 5.
- 2017c *Hauericeras (Gardeniceras) lagarum* (REDTENBACHER, 1873); SUMMESBERGER et al.: 176, Pl. 8, Figs. 2, 3, Pl. 9, Fig. 7, Text-Fig. 15, Tab. 7.

Types: HNS/6391, the lectotype, designated by SUMMESBERGER et al. (2017c) is from the upper Coniacian of Glanegg (Salzburg), the syntype GBA/1873/001/0015 is from the middle Coniacian of Schmalnauer Alpe.

Material: The lectotype only.

Description and discussion: See SUMMESBERGER et al. (2017c).

Occurrence: Upper Coniacian of Glanegg (Salzburg), middle Coniacian of Schmalnauer Alpe. Other specimens are from the upper Santonian of the Schattaugraben (Rußbach am Pass Gschütt, Salzburg).

Hauericeras schlueteri (REDTENBACHER, 1873)

(Pl. 4, Figs. 5, 6, Text-Fig. 10)

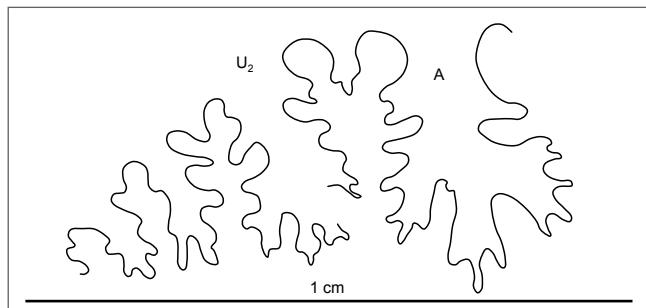
- 1873 *Ammonites Schlüteri* REDTENBACHER: 114, Pl. 26, Fig. 2a–c.
- 1901 *Desmoceras schlüteri* (REDTENBACHER); DE GROSSOURE: 638.
- 1925 *Phylloceras Schlüteri* REDTENBACHER; DIENER: 43.
- 1935 *Phylloceras schlüteri* REDTENBACHER; BRINKMANN: 3.
- 2012 *Hauericeras schlueteri* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 107, Pl. 16, Figs. 2a–c.

Type: Holotype by monotypy is GBA/1873/001/0017 from the Middle Coniacian of the Schmalnauer Alpe (Strobl/Weißenbach, Salzburg).

Material: The holotype only.

Description: The holotype and only specimen available is a crushed individual of 32 mm in diameter, of which the last two thirds of the outer whorl are body chamber. The sutures are crowded, and the specimen may be adult. Coiling is relatively involute, the umbilicus of moderate width (approximately 30 % of diameter) with a low, flat, vertical wall, and an abruptly rounded umbilical shoulder. The whorl section is compressed; however, measurements are meaningless, due to crushing. The flanks appear to have been flat, the ventrolateral shoulders narrowly rounded, and the narrow venter flattened. Ornament is poorly preserved, but in places, gently flexed delicate prosiradiate growth striae are visible, especially towards the aperture. These are markedly concave across the outer flank and sweep forwards to the ventrolateral shoulder, crossing the venter in a shallow convex curve.

The suture line (Text-Fig. 10) includes a large, deep, trifid L and smaller trifid U₂. E/L and L/U₂ are rather simple, with phylloid folioles.



Text-Fig. 10.

External suture of *Hauericeras schlueteri* (REDTENBACHER, 1873), GBA/1873/001/0017, the original of REDTENBACHER (1873: 114, Pl. 26, Figs. 2a–c).

Discussion: The overall features recall the desmoceratid subfamily Hauericeratiniae, especially as the Campanian *Oiophyllites* SPATH, 1953 tends to develop phylloid folioles and as MATSUMOTO & OBATA (1955: 137) note, similar features are seen in juvenile *Hauericeras*.

Occurrence: Middle Coniacian of the Schmalnauer Alpe in the Salzburg part of the Salzkammergut.

Family Pachydiscidae SPATH, 1922

Genus *Nowakites* SPATH, 1922

Type species: *Pachydiscus carezi* DE GROSSOUPRE, 1894 by subsequent designation of SPATH (1922: 124).

Nowakites savini (DE GROSSOUPRE, 1894)

(Pl. 4, Figs. 4, 7)

- 1894 *Sonneratia savini* DE GROSSOUPRE: 152 (pars), Pl. 25, Fig. 4, non Pl. 27, Fig. 4 (= microconch of *Nowakites tallavignesi* (d'ORBIGNY, 1850)).
- 1922 *Nowakites savini* GROSSOUPRE; SPATH: 124.
- 1925 *Nowakites savini* GROSSOUPRE; DIENER: 113.
- 1939 *Nowakites savini* DE GROSS; BASSE: 47.
- 1952 *Nowakites savini* DE GROSSOUPRE; COLLIGNON: 29, 85.
- 1955 *Nowakites savini* DE GROSSOUPRE; COLLIGNON: 30, 78.
- 1982 *Nowakites savini* (DE GROSSOUPRE, 1894); TZANKOV: 35, Pl. 27, Fig. 2.
- 1983 *Nowakites savini* DE GROSSOUPRE; COLLIGNON: 192, Pl. 2, Fig. 6.
- 1983 *Nowakites tallavignesi* (d'ORBIGNY): COLLIGNON: 192 (pars), Pl. 2, Fig. 8.
- 1983 *Nowakites lemarchandi* (DE GROSSOUPRE); COLLIGNON: 193 (pars), Pl. 2, Fig. 9.
- ? 1988 *Nowakites savini thomeli* (COLLIGNON, 1981); THOMEL: 34, Pl. 3, Figs. 1–3; Pl. 4, Fig. 3, Pl. 22, Fig. 1.
- 1995 *Nowakites savini* DE GROSSOUPRE, 1894; KENNEDY in KENNEDY et al.: 402, Pl. 8, Figs. 16–23, Pl. 9, Figs. 1, 6, 7, Pl. 19, Fig. 7, Pl. 22, Figs. 1, 2, 4, Text-Fig. 20 C.
- 2010 *Nowakites savini* (DE GROSSOUPRE, 1894); LUKENEDER et al.: 109, Fig. 1c.
- 2010 *Nowakites savini* (DE GROSSOUPRE, 1894); REMIN: 174, Figs. 13A–G.
- 2017a *Nowakites savini* (DE GROSSOUPRE, 1894): SUMMESBERGER et al.: 25, Pl. 9, Figs. 1, 2, Pl. 10, Fig. 1, Tab. 7.
- 2017c *Nowakites savini* (DE GROSSOUPRE 1894): SUMMESBERGER et al.: 179, Pl. 8, Fig. 9, Tab. 8.

Type: The holotype by original designation is the original of DE GROSSOUPRE (1894: Pl. 25, Fig. 4). It could not be traced by KENNEDY in KENNEDY et al. (1995: 402) and is presumed to be lost.

Material: MA/1982/8 from the upper Coniacian of the tunnel section of Bad Ischl, Upper Austria; NHMW/2010/0082/0001 from the lower Santonian of the Edlbachgraben (Gosau, Upper Austria); NHMW/2010/0081/0001 from the upper Santonian *Micraster* Bed of the Schattaugraben (SUMMESBERGER et al., 2017c); SK/RA/2014/164 from the lower Santonian of Randobach (Rußbach am Pass Gschütt, Salzburg).

nian of the Edlbachgraben (Gosau, Upper Austria); NHMW/2010/0081/0001 from the upper Santonian *Micraster* Bed of the Schattaugraben (SUMMESBERGER et al., 2017c); SK/RA/2014/164 from the lower Santonian of Randobach (Rußbach am Pass Gschütt, Salzburg).

Description: For description and discussion see SUMMESBERGER et al. (2017a: 25) and SUMMESBERGER et al. (2017c: 179).

Occurrence: MA/1982/8 is from the upper Coniacian of the tunnel section north of Bad Ischl. Further individuals occur in the lower Santonian sections of Edlbach and Randobach of Gosau (Gosau Group, Upper Austria; SUMMESBERGER et al., 2017a) and in the upper Santonian of the Schattaugraben section (Salzburg; SUMMESBERGER et al., 2017c). In the Corbières (KENNEDY et al., 1995) it occurs from lower to middle Santonian (Carezi Subzone and Gallicus Subzone of the Polyopsis Zone). The occurrence in the tunnel section of Bad Ischl extends the timespan of occurrence into the late Coniacian.

Superfamily Acanthoceratoidea DE GROSSOUPRE, 1894

Family Collignoniceratidae WRIGHT & WRIGHT, 1951

Subfamily Barroisiceratiniae BASSE, 1947

Genus and Subgenus *Forresteria* REESIDE, 1932

Type species: *Barroisiceras* (*Forresteria*) *forresteri* REESIDE (1932: 17, Pl. 5, Figs. 2–7) by the subsequent designation of WRIGHT (1957: 432) = *Acanthoceras* (*Prionotropis*) *alluaudi* BOULE, LEMOINE & THÉVENIN (1907: 32, Pl. 8, Figs 6–7, Text-Fig. 17).

Forresteria (*Forresteria*) *alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907)

(Pl. 4, Figs. 8–10, Pl. 5, Figs. 1–8, Pl. 6, Figs. 1–11, Text-Fig. 11, Tab. 3)

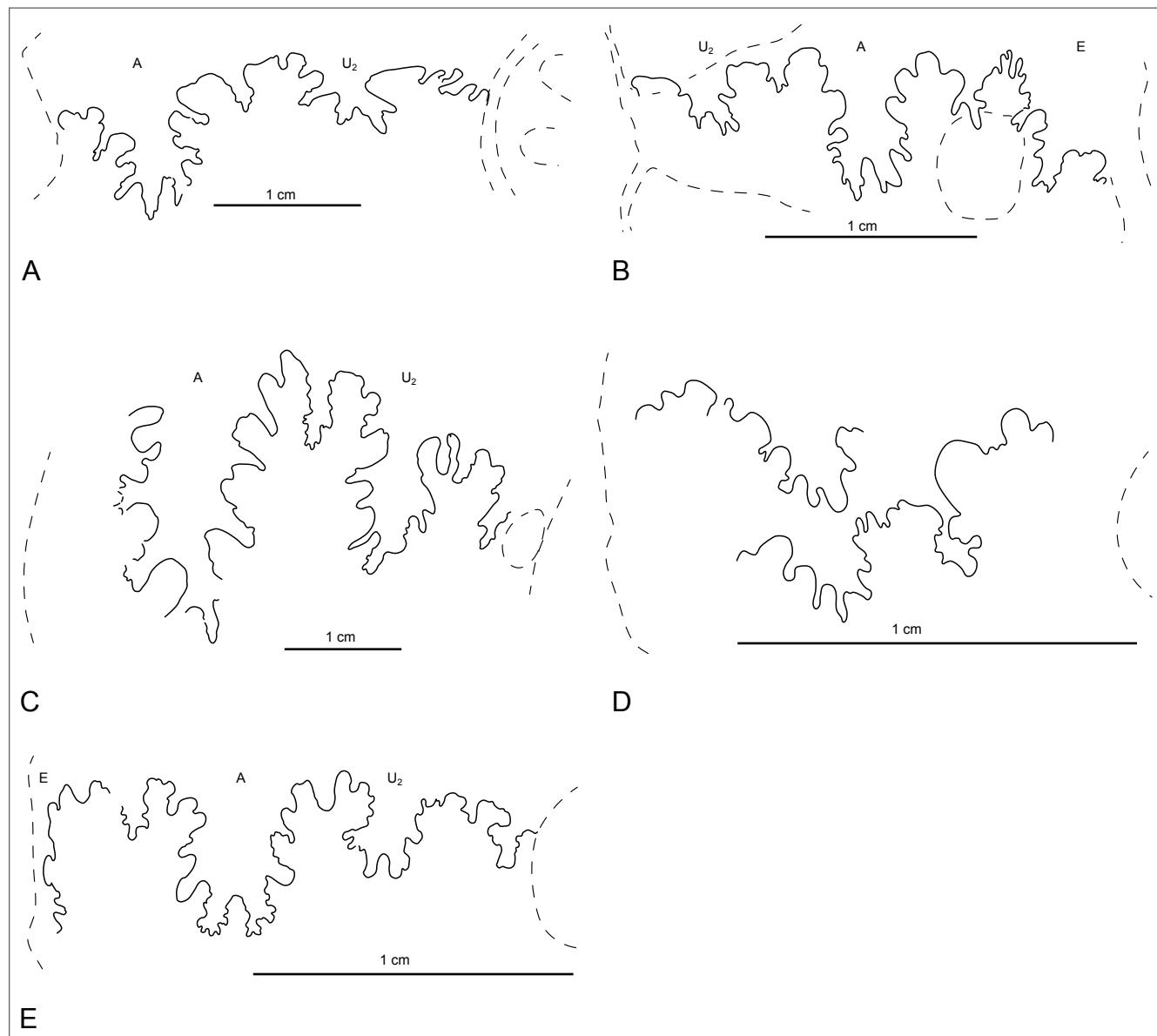
- 1907 *Acanthoceras* (*Prionotropis*) *alluaudi* BOULE, LEMOINE & THÉVENIN: 12, Pl. 1, Figs. 6, 7.
- 1947 *Forresteria alluaudi* BLT.; BASSE: 131.
- 1957 *Forresteria* (*Forresteria*) *alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; WRIGHT: 432, Fig. 551 (2).
- 1965 *Forresteria alluaudi* B. L. TH; COLLIGNON: 76, Pl. 448, Fig. 1828.
- 1969 *Forresteria* (*Forresteria*) *alluaudi* BOULE et al., 1907; MATSUMOTO: 308, Pl. 40, Figs. 1–4, Text-Figs. 5–7.
- 1983 *Forresteria* (*Forresteria*) *alluaudi* BOULE et al., 1907; KENNEDY et al.: 267, Figs. 5–9, 10A, B, E, F, 11–14, 15A, B, 16Z–31, 33–34, 35C–E, 40D, E (with complete synonymy).
- 1984 *Forresteria* (*Forresteria*) *alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; KENNEDY: 46, Pl. 8, Figs. 4–9.
- 1990 *Forresteria* (*Forresteria*) *alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; MATSUMOTO & NEMOTO: 379, Figs. 10A–D.
- 1991 *Forresteria* (*Forresteria*) *alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; KENNEDY & COBBAN: 24, Pl. 4, Figs. 1–11.

- 2011 *Forresteria (F.) alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; JAGT-YAZYKOVA: 19, 27, 53, 55–59, Figs. 2, 8–14.
- 2019 *Forresteria (Forresteria) alluaudi* BOULE, LEMOINE & THÉVENIN, 1907; IFRIM et al.: 178, Text-Figs. 8a–h, 9 (with additional synonymy).

Type: Lectotype, subsequently designated by KENNEDY et al. (1983: 268) is the smaller one of the two syntypes figured by BOULE et al. (1907: Pl. 1, Fig. 7) from Mont Carre, Madagascar.

Material: MA/1982/1–7, 9–15, 19; NHMW/1989/0051/0016–0031 all from the tunnel section north of Bad Ischl.

Description: All specimens are internal moulds with large parts of the shell preserved. Outstanding characteristic is the high variability of the species concerning general shape and ornamentation. It appears, nevertheless, that two morphological groups emerge from the sample:



Text-Fig. 11.

Forresteria (Forresteria) alluaudi (BOULE, LEMOINE & THÉVENIN, 1907). A = MA/1982/1, B = MA/1982/5, C = MA/1982/7, D = MA/1982/14, E = MA/1982/11. All samples are from the tunnel section north of Bad Ischl, Upper Austria.

Group A consists of coarsely ribbed and spinose individuals (MA/1982/1–5, 7, 15, 19; Pl. 4, Figs. 8–10, Pl. 5, Figs. 1–4, 6, 7, Pl. 6, Figs. 2, 4) with small umbilical tubercles fused with massive elongated mediolateral bullae leading to ventrolateral tubercles followed by a depression parallel to the regular siphonal clavi of the keel.

Group B is characterised by high oval section, flattened flanks with falcoid shallow ribs, and absent or very weak mediolateral bullae (MA/1982/6, 9–14; Pl. 5, Figs. 5, 8, Pl. 6, Figs. 1, 3, 5–11). One of them (MA/1982/12: Pl. 6, Fig. 7) is a massive part of a whorl with rib crowding indicating the near end of the adult body chamber; no mediolateral tubercles nor bullae.

Discussion: Earlier workers (BASSE, 1947; VAN HOEPEN, 1968; COLLIGNON, 1965) had only small collections or single individuals at their disposal. This led to a large number of synonymous genera of *Forresteria* (KENNEDY et al., 1983: 253) and synonymous species of *Forresteria* (*Forresteria*) al-

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
MA/1982/1	60.2 _{est}	30.4	18.9	18.9.	31.4
MA/1982/2	55.8	26.2	15.0	12.8	22.9
MA/1982/3	53.2	26.2	--	13.8	25.8
MA/1982/4	60.7	30.1	31.7	16.4	27.0
MA/1982/5	66.8	28.6	--	21.4	32.0
MA/1982/6	101.5 _{est}	42.0	18.3 _{est}	27.8	27.3
MA/1982/7	117.6	52.9	26.6	32.2	27.3
MA/1982/9	84.4	43.6	11.3	--	--
MA/1982/10	69.8	31.3	13.8	13.6	19.5
MA/1982/11	48.4	19.5	8.0	8.6	17.7
MA/1982/12	130 _{est}	54.4	26.0 _{est}	--	--
MA/1982/13	47.8	22.5	--	7.8	16.3
MA/1982/19	65.1	29.4	12.9	14.5	22.3
NHMW/0089/0051/0016	87.4	36.4	--	29.7	34
NHMW/0089/0051/0021	45.0	21.9	--	6.3	14
NHMW/0089/0051/0026	64.6	35.0	15.5	14.8	22.9
NHMW/0089/0051/0027	61.3 _{est}	30.0	20.5	--	--
NHMW/0089/0051/0028	83.4	44.9	17.0	15.0	18.8

Tab. 3.

Measurements of *Forresteria (Forresteria) alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907) from the road tunnel north of Bad Ischl; est = estimated, U (%) of D.

luaudi (BOULE et al., 1907). It was discussed at length by KENNEDY et al. (1983: 267). The authors having more than a hundred specimens from the Coniacian 2 of Zululand (KwaZulu) pointed out the enormous variability of the species. Until 1982, when one of us (W.-P.M.) had the chance to collect during construction work of the road tunnel north of Bad Ischl (Upper Austria), no individual of *Forresteria (Forresteria) alluaudi* (BOULE et al., 1907) was found in the Gosau Group nor elsewhere in the European Cretaceous. We compare cephalopods from the road tunnel with material from South Africa (KENNEDY et al., 1983), France (KENNEDY, 1984) and Madagascar (COLLIGNON, 1965).

Occurrence: *Forresteria (Forresteria) alluaudi* (BOULE et al., 1907) occurs worldwide in the middle Coniacian of Madagascar, Japan, Mexico, US Western Interior, ?Colombia, Peru, ?Israel, in the Coniacian 2 in Kwa Zulu, in the peninsula of Sakhalin and in Austria in the upper Coniacian *Paratexanites serratomarginatus* Zone.

Subfamily Peroniceratinae HYATT, 1900

Genus and subgenus *Peroniceras* DE GROSSOUPRE, 1894

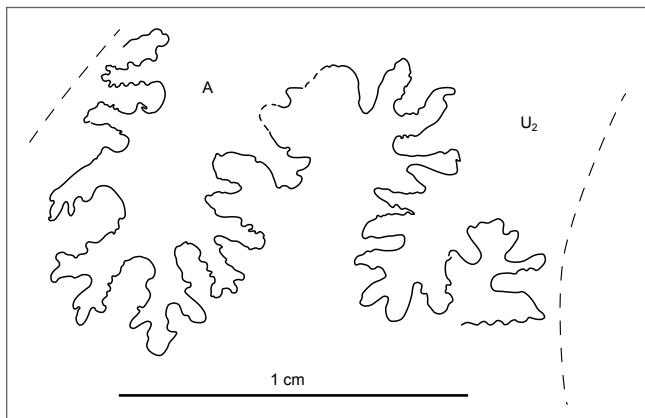
(= *Fraudatoroceras* VAN HOEPEN, 1965, *Cobbanoceras* MATSUMOTO, 1965)

Type species: *Peroniceras moureti* DE GROSSOUPRE, 1894: 100 (= *Ammonites tridorsatus* SCHLÜTER, 1867: 26, Pl. 5, Fig. 1) by original designation.

Peroniceras (Peroniceras) tridorsatum (SCHLÜTER, 1867)

(Pl. 7, Figs. 1–3, Pl. 8, Figs. 1–4, Text-Fig. 12, Tab. 4)

- 1867 *Ammonites tridorsatus* SCHLÜTER: 26, Pl. 5, Fig. 1.
 1873 *Ammonites sp. indet. cfr. Ammonites tridorsatus* SCHLÜTER; REDTENBACHER: 125, Pl. 30b.
 1876 *Ammonites cf. tridorsatus* SCHLÜTER; SCHLÜTER: 129, Pl. 41, Figs. 3–5.
 1894 *Peroniceras subtricarinatum* D'ORBIGNY var. *tridorsatum* SCHLÜTER, 1867; DE GROSSOUPRE: 96, Pl. 10, Figs. 2, 3, Pl. 11, Figs. 1a, b.
 1894 *Peroniceras moureti* A. DE GROSSOUPRE, n. sp.: 100, Pl. 11, Figs. 3–4, Text-Figs. 37, 39.
 1894 *Peroniceras rousseauxii* A. DE GROSSOUPRE, n. sp.: 102, Pl. 11, Fig. 5.
 1984 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); KLINGER & KENNEDY: 39, Figs. 3–15, 16D, E (with full synonymy).
 1984 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); KENNEDY: 62, Pl. 11, Figs. 3–6, Pl. 12, Figs. 1–5, Pl. 13, Figs. 5–11, Pl. 14, Figs. 1, 4, Text-Figs. 13G, L, 18C–E, 19.
 1987 *P (Peroniceras) tridorsatum*; IMMEL: 108, 146, Tab. 16.
 1987 *Peroniceras (Zuluiceras) zulu* VAN HOEPEN, 1965; IMMEL: 109, Pl. 10, Fig. 6.
 1988 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); SZÁSZ & ION: 119, Pl. 7, Figs. 4–6, Pl. 8, Figs. 5–7.



Text-Fig. 12.
External suture of *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); SK/NU/1999/82.

- 1989 *Peroniceras tridorsatum* (SCHLÜTER, 1867); KÜCHLER & ERNST, Pl. 2, Fig. 6.
- 1991 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); KENNEDY & COBBAN: 36, Pl. 6, Figs. 3, 4.
- 1992 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); VAŠÍČEK: 171, Pl. 4, Fig. 1, Pl. 5, Figs. 1, 2, Text-Figs. 4–6.
- 1994 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); KAPLAN & KENNEDY: 45, Pl. 14, Figs. 4, 5, Pls. 18, 19, Pl. 20, Figs. 2–4, 6, Pls. 18, 19, Pl. 20, Figs. 2, 3, 6, 8, Pl. 21, Figs. 1–5, Pl. 22, Figs. 2, 3, Pl. 28, Figs. 1, 3, 4.
- 1995 *Peroniceras tridorsatum* (SCHLÜTER, 1867); KENNEDY in KENNEDY et al.: 415.
- 2011 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); IFRIM et al.: 526, Text-Figs. 4.1–4.3.
- 2019 *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); IFRIM et al.: 175, Text-Figs. 5b, d, 6, 7.

Type: The holotype (SCHLÜTER, 1867: 26, Pl. 5, Fig. 1) from Osterfeld (Westphalia) is lost (KENNEDY in KENNEDY et al., 1995: 415).

Material: SK/NU/1981/17, SK/NU/1997/77, SK/NU/1999/82 from Nussenseebach; MA/1982/22 from the tunnel section north of Bad Ischl; NHMW/1990/0730/0000, NHMW/1992/0144/0001 from Fahrenberg, NHMW/2019/0055/0001 from Weißenbachalm, Bad Aussee.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
SK/NU/1981/17	103.5	36.0	22.5	48.5	46.8
SK/NU/1999/82	89.0 _{est}	25.0	14.9	35.0 _{est}	39.3
NHMW/1990/0730/0000	105.9	35.5	20.56	43.2	42.2
NHMW/1992/0144/0001	124.1	37.8	13.7	41.0	39.8
NHMW/2019/0055/0001	200.0	60.0 _{est}	37.0	80.0	40.0
MA/1982/22	143.0	45.0	--	63.0	44.05
SK/NU/1997/77	82.0	30.0	19.0	30.0	36.6

Tab. 4.
Measurements of *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867); est = estimated, U (%) of D.

Description: Coiling is very evolute. Measuring is difficult as all the specimens available are crushed. The umbilicus measures about 40–50 % of the diameter. Whorl section varies from slightly depressed to slightly compressed, greatest breadth is at the umbilicolateral bullae. The umbilical wall is inclined towards the centre. The ribs are mostly undivided in contrast to the bifurcating and intercalated ribs of (*P.*) *subtricarinatum*, 23–30 ribs per whorl arise in larger specimens at the umbilical shoulder. Ribs are straight to slightly rursiradiate, even concave, bearing a strong bulla at the umbilical shoulder. At the ventrolateral shoulder ribs are ending in a distinct clavus. There are three entire keels in ventral position, the median one being the strongest.

Discussion: *Peroniceras (Peroniceras) subtricarinatum* differs from *P. (P.) tridorsatum* in its frequently bifurcating broad ribs. *Peroniceras czoernigi* differs by its undercut umbilical wall and its smaller umbilicus. *P. (P.) westphalicum* (v. STROMBECK, 1859) is laterally compressed and has occasionally bifurcating ribs. *P. (K.) dravidicum* KOSSMATT (see KLINGER & KENNEDY, 1984) has more and broader ribs of which those on the inner whorls tend to bifurcate. *Ishikariceras* differs by its strong and pointed umbilical tubercles and *Gauthiericeras* by its median undulated or entire keel along with weak parallel sulci and low broad ribs. For differences to *Peroniceras moureti* DE GROSSOURE, 1894 see KLINGER & KENNEDY (1984: 139).

Occurrence: *Peroniceras (Peroniceras) tridorsatum* (SCHLÜTER, 1867) occurs widespread in the Coniacian of France and Germany, North Africa, Madagascar and Mexico. Its occurrence in the Coniacian of the Gosau Group is described herewith for the first time.

Peroniceras (Peroniceras) eugnamtum (REDTENBACHER, 1873)

(Pl. 9, Figs. 1–12, Text-Fig. 13, Tab. 5)

- 1873 *Ammonites eugnamtus* REDTENBACHER: 117, Pl. 27, Figs. 1a–c.
- 1935 *Prionotropis propoetida* (REDTENBACHER); BRINKMANN: 3.
- 1935 *Peroniceras subtricarinatum* (d'ORBIGNY); BRINKMANN: 2 et sequ. (partim).
- 1935 *Prionotropis eugnamta* (REDTENBACHER); BRINKMANN: 3, 4, 7.
- 1958 *Protexanites eugnamtus* (REDTENBACHER); REYMENT: 45, Pl. 2, Fig. 2, Text-Fig. 5/3.

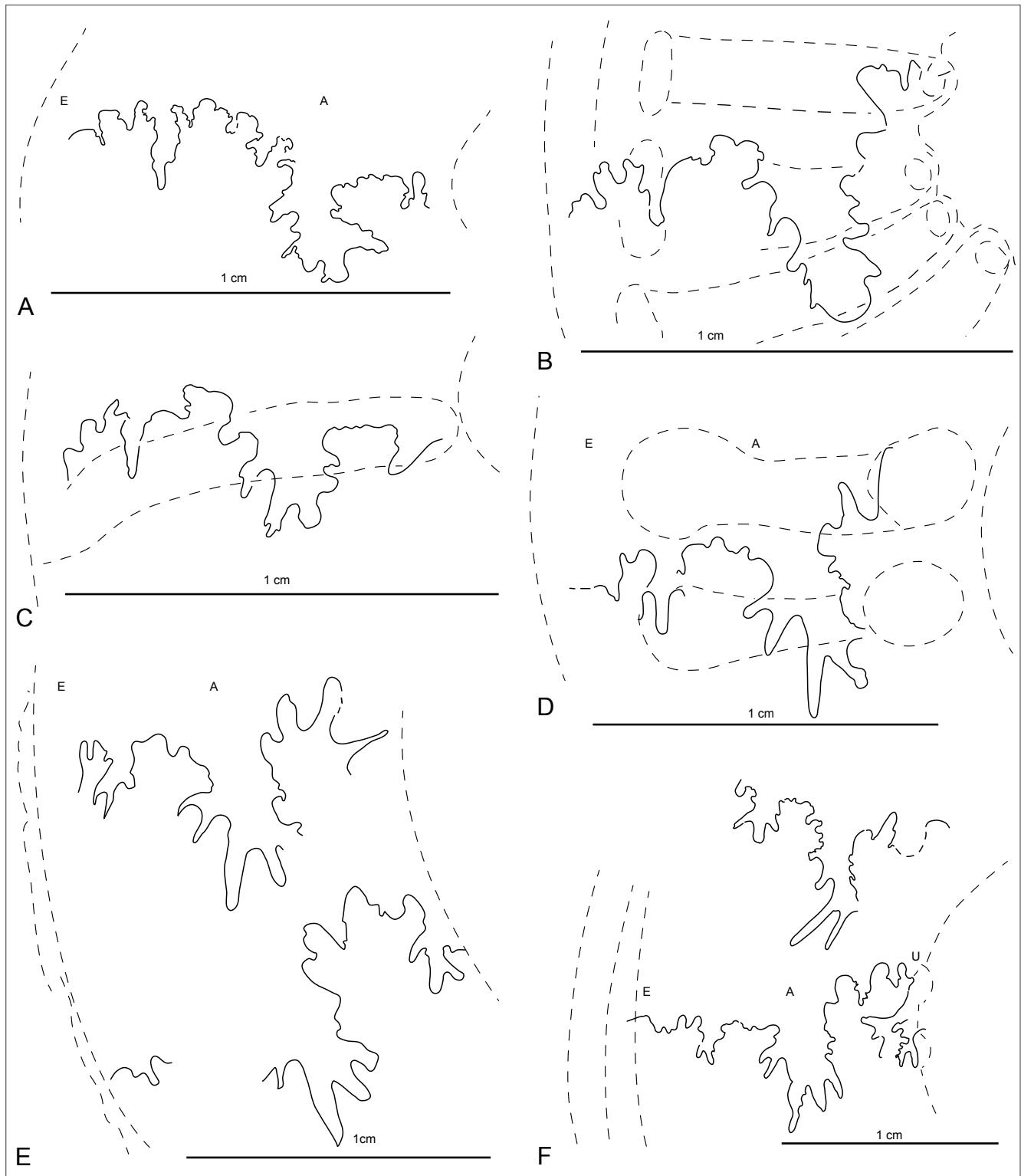
- 1978 *Peroniceras moureti* GROSSOUPRE, 1894; WIEDMANN: 669, Pl. 2, Figs. 4, 5.
- 1982 *Fraudatoceras eugnamtus* (REDTENBACHER); KOLL-MANN & SUMMESBERGER: 42.
- 1987 *Protexanites (Protexanites) eugnamtus* (REDTENBACHER, 1873); IMMEL: 110.
- 2012 *Protexanites (Protexanites) eugnamtus* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 105, 132, Pl. 12, Figs. 3A, B.

Type: The holotype by monotypy is the original of *Ammonites eugnamtus* (REDTENBACHER, 1873: Pl. 27, Figs. 1a–c).

Material: Besides the holotype GBA/1873/001/0021 from the Schmalnauer Alpe, figured by REDTENBACHER (1873: Pl. 27, Figs. 1a–c), the following specimens are at our dis-

Text-Fig. 13.

External sutures of *Peroniceras (Peroniceras) eugnamtum* (REDTENBACHER, 1873): A–C = GBA/1873/001/0021 from the Schmalnauer Alpe, Salzburg; D = SK/FA/1994/35 (rotated by 180°); E, F = SK/FA/1994/35. ▼



Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
GBA/1873/001/0021	41.3	14.2	12.3	18.9	45.7
SK/FA/1994/35	76.8	26.1	23.4	35.0	39.06
GBA/1935/001/0022/02	45.8 _{est}	12.9	13.7	27.7	60.5
NHMW/1981/0004/0000	68.45 _{est}	19.4	14.6	36.25	52.9
OÖLM/1938/29	41.3	12.0	9.0	22.6	54.7
PIUW/not reg.	43.8	9.7	9.4	18.8	43.7
BSM/1878/XI.519	36	10	10.5	19.5	54.0

Tab. 5.

Measurements of *Peroniceras (Peroniceras) eugnamtum* (REDTENBACHER, 1873). Measures of BSM/1878/XI.519 after WIEDMANN (1978: 670); not reg. = not registered, est = estimated, U (%) of D.

posal: SK/FA/1994/35 from the Schmalnauer Alpe, 30 m north of the Adventist home; GBA/1935/001/0022/02 from Nussenseebach; NHMW/1981/0004/0000 (Hochstetter collection) from Nussenseebach; OÖLM/1938/0029, unknown locality details; PIUW/not registered (from the Kronprinz Rudolf collection) from Nussenseebach; BSM/1878/XI.519 from Nussenseebach.

Description: The holotype is a crushed and distorted internal mould with a maximum diameter of 41.3 mm. Coiling is very evolute with a broad shallow outwards inclined umbilicus. There are no shell remains.

There are an estimated 20 ribs on the outer half whorl. These arise at the umbilical seam in a sharp, distinct bulla, which declines markedly, however, over the last quarter whorl. They are crowded and separated by deep, narrow interspaces, the ribs are strong, widen towards the venter, and become wider than the interspaces over most part of the shell, although they narrow and crowd towards the aperture. From sharp ventrolateral tubercles the ribs broaden sweeping forwards across the ventrolateral shoulder. The badly crushed siphonal area appears to have had in places three keels, the median one prominent and flanked by sulci, whilst elsewhere, there appear to have been two keels by post mortem crushing, flanking a deep siphonal groove.

The modestly incised external suture (Text-Fig. 13) shows a broad, asymmetrically bifid E/L, narrower L, and a rather simple bifid L/U2.

Additional material at our disposal provides further information: All specimens are tricarinate bisulcate, the median keel is more prominent than the lateral ones. None of the additional specimens shows rib crowding towards the aperture. The largest and apparently adult specimen, SK/FA/1994/35, has about 33 ribs on the last whorl. None is bifurcate, and there are narrow intercalatories. All additional specimens have a regularly increasing height and width and regularly spaced ribs. SK/FA/1994/35 shows an additional bullate swelling on the prorsiradiate ventral part of the ribs. BSM/1878/XI.519 (*Peroniceras moureti* GROSSOUIRE, 1894) after WIEDMANN's (1978: 670) interpretation from the Nussenseebach area is a further typical *P. (P.) eugnamtum*.

Discussion: Rib crowding on the adapertural end of the holotype seems to be an irregular growth stadium which should not be included in the description of the species. Comparison with better preserved individuals indicate that

they were also tricarinate/bisulcate. WIEDMANN (1978: 670) figured an individual (BSM/1878/XI.519) from Nussenseebach in the opinion, it were a typical Coniacian *Peroniceras moureti* GROSSOUIRE, 1894. Several other individuals from the Nussenseebach area give evidence that they are *Peroniceras (Peroniceras) eugnamtum* (REDTENBACHER, 1873).

Occurrence: All specimens are of middle Coniacian age and all are from the Schmalnauer Alpe and Nussenseebach area of Salzburg and Upper Austria.

Peroniceras (Peroniceras) czoernigi (REDTENBACHER, 1873)

(Pl. 10, Figs. 1–10, Pl. 11, Figs. 1, 2, Text-Fig. 14, Tab. 6)

- 1873 *Ammonites Czörnigi* REDTENBACHER: 105, Pl. 23, Figs. 4a–e.
- ? 1885 *Ammonites (Schloenbachia) Czörnigi* REDTENBACHER; FALLOT: 229, Pl. 1, Fig. 1.
- Non 1894 *Peroniceras Czörnigi* REDTENBACHER sp., var.; DE GROSSOUIRE: 103, Pl. 11, Figs. 2a, b (= *Peroniceras (Peroniceras) aff. lepeei* (FALLOT, 1885)).
- ? 1897 *Peroniceras Czörnigi* REDTENBACHER; PERON: 53, Pl. 11, Figs. 7, 8.
- 1920 *Peroniceras Czörnigi* REDTENBACHER; DESIO: 210, Pl. 14, Fig. 5.
- 1925 *Peroniceras Czörnigi* REDTENBACHER; DIENER: 150.
- Non 1933 *Peroniceras czörnigi* REDTENBACHER; RIEDEL: 143, Pl. 30, Figs. 5, 5a.
- 1935 *Peroniceras czörnigi* REDT.; BRINKMANN: 3.
- Non 1955 *Peroniceras czörnigi* (REDTENBACHER); REYMENT: 90, Text-Fig. 46d.
- 1958 *Peroniceras czoernigi* (REDTENBACHER); REYMENT: 38, Pl. 4, Figs. 1a, b, 2, Pl. 5, Fig. 2, Abb. 5, Fig. 1.
- 1965 *Peroniceras czoernigi* (REDTENBACHER); MATSUMOTO: 217.
- 1974 *Peroniceras czoernigi* (REDTENBACHER); SZÁSZ & LACATU-SU: 208, Pl. 6, Figs. 1a, b, Pl. 7, Fig. 1.
- 1987 *Peroniceras (Zuluiceras) czoernigi* (REDTENBACHER, 1873); IMMEL, 108.
- 2012 *Peroniceras (Peroniceras) czoernigi* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 105, Pl. 11, Figs. 1a–d, Figs. 2a–c.

Type: Lectotype is GBA/1873/001/0010/01 (REDTENBACHER, 1873: Pl. 23, Figs. 4a–c) from the Schmalnauer Alpe (Salzburg, Austria) designated and refigured by REYMENT (1958: 39, Pl. 4, Figs. 1a, b), refigured again by SUMMESBERGER & ZORN (2012: Pl. 11, Figs. 1a–d). Paralectotype is GBA/1873/001/0010/02 (REDTENBACHER, 1873: Pl. 23, Figs. 4d–e) designated and refigured by SUMMESBERGER & ZORN (2012: Pl. 11, Figs. 2a–c).

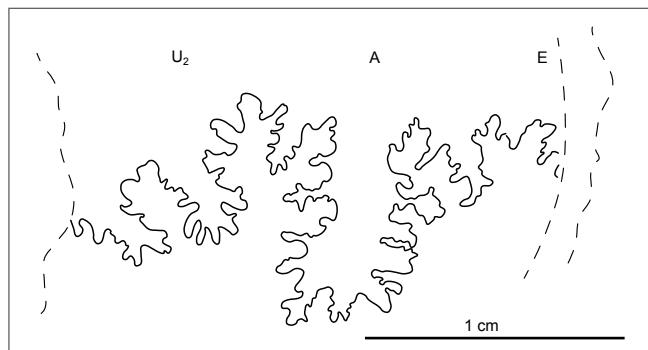
Material: GBA/1873/001/0010/01, 02 (both from Schmalnauer Alpe near Strobl/Weißenbach); NHMW/1935/0003/0029, 0030, 0032 from Nussenseebach, NHMW/1989/0050/0023, 0026 from the Schmalnauer Alpe, 30 m north of the Adventist home; HNS/7489 from Morzg next Glanegg (Salzburg) may also belong here; SK/NU/2002/83 from Nussenseebach.

Description: The holotype is a distorted internal mould with well over half a whorl of body chamber preserved. Coiling is relatively involute with approximately 35 % of the previous whorl being covered.

The umbilicus is of moderate diameter, with an undercut umbilical wall. The whorl section appears to have been almost rectangular with gently swollen flanks and the greatest breadth low on the flank.

There are twelve ribs per half-whorl. Most arise from weak umbilical bullae but a few are intercalated. The ribs are strong, coarse and were probably straight to slightly concave and feebly prorsiradiate before *post mortem* deformation. Each rib terminates in a well-developed ventrolateral tubercle which may be markedly clavate; from this tubercle a broader and flatter rib extends across the ventrolateral shoulder. The venter is tricarinate-bisulcate, the siphonal keel being higher and stronger than the lateral ones. The suture is deeply incised, with an asymmetrically bifid E/L, a narrow and deep L and large asymmetrically bifid L/U2 (Text-Fig. 14).

Discussion: As already REYMENT (1958) and MATSUMOTO (1965) have noted, several of the references to *Peroniceras (P.) czoernigi* in the literature refer to a much more densely ribbed form, with, as in the case of DE GROSSOURE (1894: Pl. 11, Figs. 2a, b) almost twice as many ribs. The Japanese example described by MATSUMOTO (1965: 216) is intermediate in rib density, a similar specimen is discussed below. The poor material described by RIEDEL (1931) and REYMENT (1955) also belongs to different species. *Peroniceras moureti* DE GROSSOURE, 1894 (199, Pl. 11, Figs. 3, 4a–c, Text-Fig. 39 (= *Peroniceras (P.) tridorsatum* SCHLÜTER, 1867)), is more densely ribbed; all the ribs are long, convex and have a radially elongated bulla well out from the umbilical shoulder. The umbilicus is wider and the expansion rate lower than in *Peroniceras (P.) czoernigi* (REDTENBACHER, 1873). *Peroniceras (P.) subtricarinatum* (D'ORBIGNY, 1850) (see:



Text-Fig. 14.
External suture of the lectotype of *Peroniceras (Peroniceras) czoernigi* (REDTENBACHER, 1873), GBA/1873/001/0010/01.

DE GROSSOURE, 1894: 94, Pl. 10, Figs. 1a, b, and Pl. 11, Figs. 3–5 in this volume) has a more serpenticone coiling, much wider umbilicus, and coarser umbilical bullae some way out of the umbilical shoulder, from which the ribs arise commonly in pairs. *P. tridorsatum* (SCHLÜTER, 1867: 26, Pl. 5, Fig. 1; DE GROSSOURE, 1894: 94, Pl. 10, Figs. 2–3) is much more evolute, and has numerous (40–42) ribs per whorl, most of them are long. *P. westphalicum* (VON STROMBECK, 1859; SCHLÜTER, 1867: 30, Pl. 6, Fig. 2; DE GROSSOURE, 1894: 98, Pl. 12, Figs. 1, 4a, b) is more evolute, with strong, comma-shaped umbilical bullae, ribs are weak at midflank, and strong towards the ventrolateral shoulder with markedly clavate ventral nodes. *P. dravidicum* (KOSSMAT, 1895: 190, Pl. 23, Figs. 3a–d) discussed by MATSUMOTO (1965: 213) and by KLINGER & KENNEDY (1984: 170, Text-Figs. 29–42) is more evolute, with a low expansion rate and a greater tendency of the ribs to arise in pairs from the umbilical bullae. Other species also obviously distinct from *Peroniceras (P.) czoernigi* are described by YOUNG (1963), COLIGNON (1965) and VAN HOEPEN (1965).

Occurrence: *Peroniceras (Peroniceras) czoernigi* (REDTENBACHER, 1873) occurs in the type area of Schmalnauer Alpe and Nussenseebach and is limited to Coniacian occurrences.

Peroniceras (Peroniceras) subtricarinatum (D'ORBIGNY, 1850)

(Pl. 11, Figs. 3–5, Pl. 12, Figs. 1–10, Text-Fig. 15, Tab. 7)

- 1841 *Ammonites tricarinatus* D'ORBIGNY: 307, Pl. 91, Figs. 1, 2.
1850 *Ammonites subtricarinatus* D'ORBIGNY: 212.
1872 *Ammonites tricarinatus* D'ORBIGNY; SCHLÜTER: 44, Pl. 13, Figs. 1–4.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
NHMW/1989/0050/0023	71.1	27.8	14.4	29.8	41.9
NHMW/1989/0050/0026	45.0 _{est}	14.9	12.0	22.2	49.3
GBA/1873/001/0010/01	79.4	29.6	23.7 _{est}	32.0	40.3
NHMW/1935/0003/0029	93.4	30.5	14.8	36.1	38.6

Tab. 6.

Measurements of *Peroniceras (Peroniceras) czoernigi* (REDTENBACHER, 1873); est = estimated, U (%) of D.



Text-Fig. 15.
External suture of *Peroniceras (P.) subtricarinatum*; SK/NU/1981/18, from Nussenseebach.

- | | | | |
|------|---|------|--|
| 1889 | <i>Ammonites (Schloenbachia) subtricarinatus</i> D'ORBIGNY;
FRITSCH: 70. | 1995 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY 1850); KENNEDY in KENNEDY et al.: 415, Pl. 20, Figs. 3–5, Pl. 20, Figs. 3–5, 9, 11, 12, Text-Fig. 23 (with additional synonymy). |
| 1894 | <i>Peroniceras subtricarinatum</i> D'ORBIGNY; DE GROSSOURE: 94 (pars), Pl. 10, Fig. 1 (non 2, 3). | 2000 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY 1850); WIESE: 134, Pl. 3, Fig. 1 (with additional synonymy). |
| 1907 | <i>Schloenbachia (Peroniceras) subtricarinata</i> D'ORBIGNY; BOULE et al.: 22. | 2006 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY 1850); KENNEDY & JUIGNET in FISCHER & GAUTHIER: 111, Pl. 63, Figs. 3, 4. |
| 1925 | <i>Peroniceras tricarinatum</i> D'ORBIGNY; DIENER: 151. | | |
| 1965 | <i>Peroniceras subtricarinatum</i> D'ORBIGNY; COLLIGNON: 58, Pl. 439, Fig. 1804. | | |
| 1979 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY); COLLIGNON et al.: 390, Pl. 1, Fig. 1. | | |
| 1984 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY 1850); KLINGER & KENNEDY: 157, Figs. 19A, B, D, E, 20–23 (with synonymy). | | |
| 1984 | <i>Peroniceras (Peroniceras) subtricarinatum</i> (D'ORBIGNY 1850); KENNEDY: 71, Pl. 12, Figs. 6–9, Text-Fig. 21. | | |

Type: The lectotype is Catalogue Number 7183 in the D'ORBIGNY collection in the Muséum National d'Histoire Naturelle in Paris, refigured by KLINGER & KENNEDY (1984: Figs. 19A, B, D, E).

Material: SK/NU/1981/7a, SK/NU/1981/18 from Nussenseebach; SK/FA/1990/27, 38 from the Schmalnau-

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
SK/NU/1981/7a	43.3	21.1	7.5	19.0	43.8
SK/NU/1981/18	53	20	15 _{est}	20.2	38,1
SK/FA/1990/27	89.7	25.9	14.5	46.6	51.9
SK/FA/2018/38	55.2	17.4	15.4 _{est}	24.6	44.5
NHMW/1989/0050/0018	95.5	25.0	18.8	42.5	44.5
NHMW/1989/0050/0020	26.1	9.4	4.5	10.6	40.6
NHMW/1989/0050/0023	73.7	27.8	16.9	32.2	43.7
NHMW/1989/0050/0025	26.4	8.8	7.6	12.0	45.45
MA/1982/17	160.0	42.0	20.0 _{est}	87.8	54.9
GBA/1935/001/0022/01	46.0	15.5	10.0	20.6	44.8

Tab. 7.
Measurements of *Peroniceras (P.) subtricarinatum*; est = estimated, U (%) of D.

er Alpe; NHMW/1989/0050/0018, 0020, 0023, 0025 from Schmalnauer Alpe, 30 m north of the Adventist home, NHMW/1989/0051/0032 from the tunnel section north of Bad Ischl; GBA/1935/001/0022/01 from Nussenseebach; MA/1982/17 from the tunnel section north of Bad Ischl.

Description: The general shape is serpenticonic with four or five whorls of an individual of 9–12 cm in diameter (e.g. SK/FA/1990/27). The subsequent whorls cover the preceding ones until the previous row of ventrolateral tubercles. Ribs arise singly or in pairs from the umbilical bulla (e.g. about 17). Some are dichotomous – splitting in median flank position and leading to (e.g. about 22) ventrolateral tubercles. Adequate data of the lectotype (KLINGER & KENNEDY, 1984: 160, Figs. 19A–D) from the environs of Sougraines (Rennes-les-Bains) are: 24 umbilical bullae/38 ventrolateral tubercles (KENNEDY, 1984: 71). Ornament consists of broad low ribs, arising slightly prorsiradiate from coarse umbilical bullae, ending in ventrolateral more or less clavate tubercles. Intercostal rib valleys are as wide as the ribs or even wider. There are three distinct entire or softly undulated keels in ventral position. The median one being the most prominent.

Discussion: The typical ribbing of (*P.*) *subtricarinatum* makes separation from co-occurring (*P.*) *tridorsatum* (SCHLÜTER, 1867) easy. (*P.*) *czoernigi* has a much narrower umbilicus.

Occurrence: *Peroniceras* (*P.*) *subtricarinatum* (D'ORBIGNY, 1850) is widely known in the middle Coniacian *Tridorsatum* Zone of Europe, North Africa, South Africa, Madagascar and Mexico (KENNEDY, 1984). For the first time it is now described from the *Tridorsatum* Zone of the Austrian Gosau Group. It does not occur in the area of Gosau itself, where Coniacian sediments are rare.

Peroniceras sp. indet.

(Pl. 12, Fig. 11)

- 1873 *Ammonites* sp. indet. REDTENBACHER 1873: 126, Pl. 30, Fig. 7.
1958 *Peroniceras* ? sp. indet.; REYMENT: 40, Pl. 8, Fig. 1.

Material: A single individual, GBA/1873/001/0029, REDTENBACHER (1873: Pl. 30, Fig. 7).

Description: GBA/1873/001/0029 is a fragment of a whorl of about 45 mm length and an estimated 27 mm of whorl height. Only a few observations seem to indicate an entire narrow keel accompanied by narrow grooves. About four strong radial ribs with equally large rib distances can be observed. Spiral ornamentation crosses the ribs but disappears in the rib valleys. This is best visible where the outer shell is broken away and the nacreous layer is visible. The faint grid was already described by REDTENBACHER (1873: 126).

Discussion: The fragment is too poor to be confidently identified.

Occurrence: The unique specimen is from the Schmalnauer Alpe (Strobl/Weißenbach, Salzburg).

Subgenus Peroniceras (Zuluiceras) VAN HOEPEN, 1965

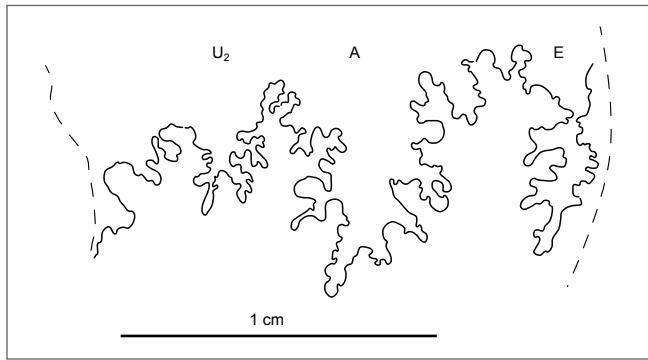
Type species: *Peroniceras (Zuluiceras) zulu* VAN HOEPEN, 1965: 23 by original designation.

Peroniceras (Zuluiceras) bajuvaricum (REDTENBACHER, 1873)

(Pl. 13, Figs. 1–7, Text-Fig. 16, Tab. 8)

- 1873 *Ammonites bajuvaricus* REDTENBACHER: 107, Pl. 24, Figs. 2a–c.
1894 *Gauthiericeras bajuvaricum* REDTENBACHER; DE GROS-SOUVRE: 88, Pl. 9, Fig. 1, Pl. 12, Figs. 2a, b, 3a, b, Text-Fig. 35.
1895 *Gauthiericeras bajuvaricum* REDTENBACHER; JAHN: 136, Text-Figs. 1, 2.
Non 1907 *Schloenbachia* (*Gauthiericeras*) *bajuvarica* REDTENBACHER; BOULE, LEMOINE & THÉVENIN: 232, Pl. 12, Fig. 1.
? 1913 *Peroniceras westphalicum* D'ORBIGNY; SCUPIN: 94, Pl. 4, Fig. 8.
? 1920 *Peroniceras (Gauthiericeras) bajuvaricum* REDTENBACHER; DESIO: 217, Pl. 16, Figs. 3, 6, Pl. 17, Fig. 3.
1925 *Gauthiericeras bajuvaricum* (REDTENBACHER); DIENER: 152 (with synonymy).
1936 *Gauthiericeras bajuvaricum* (REDTENBACHER) var. *schoenbergerensis* VENZO: 105, Pl. 9, Fig. 5, Pl. 11, Fig. 7.
1958 *Gauthiericeras bajuvaricum* (REDTENBACHER); REYMENT: 43, Pl. 11, Fig. 1, Text-Figs. 6/3a, b.
? 1963 *Sornayceras bajuvaricum* (REDTENBACHER); FABRE-TAXY: 112, Pl. 4, Fig. 4.
1965 *Sornayceras bajuvaricum* (REDTENBACHER); MATSUMOTO: 226ff.
1965 *Sornayceras* sp. cf. *S. propoetidum* (REDTENBACHER); MATSUMOTO: 233, Pl. 39, Figs. 2, 3, Text-Fig. 16.
1965 *Sornayceras omorii* MATSUMOTO: 230, Pl. 42, Figs. 1, 2, Text-Figs. 13–15.
1971 *Peroniceras (Zuluiceras) wadae* MATSUMOTO: 143, Pl. 24, Fig. 1, Text-Fig. 8.
? 1972 *Sornayceras* cf. *bajuvaricum* REDTENBACHER, 1873; ATABEKIAN & AKOPIAN: 10, Pl. 3, Figs. 4, 5.
1984 *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); KLINGER & KENNEDY: 235, Figs. 92b, c, 93.
1984 *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); KENNEDY: 80, Pl. 16, Figs. 1–3, 6–11, Pl. 17, Figs. 1–3, Text-Figs. 13k, 20b, c, e, 23, 24, 25.
1987 *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); IMMEL, 108.
2012 *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); SUMMERSBERGER & ZORN, 105, 126, Pl. 8, Figs. 3a–d.

Type: Lectotype designated by REYMENT (1958: 43) is the original of REDTENBACHER (1873: Pl. 24, Figs. 2a–c), GBA/1873/001/0012 from the Middle Coniacian of the Leiner Alpe near Strobl/Weißenbach, Salzburg.



Text-Fig. 16.
Suture of the lectotype of *Peroniceras (Zuluiceras) bajuvaricum*, GBA/1873/001/0012; see also KLINGER & KENNEDY (1984: Text-Fig. 93).

Material: GBA/1873/001/0012, the lectotype, and GBA/1935/001/0005, both from the Leiner Alpe, GBA/1935/001/0013 from the Schmalnauer Alpe, all near Strobl/Weißenbach; furthermore SK/NU/1999/78 from Nussenseebach and MA/1975/5 from Eggerseppenalpe near Schmalnauer Alpe (Strobl/Weißenbach, Salzburg); NHMW/1935/0003/0043, unknown locality.

Description: The lectotype of *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873), GBA/1873/001/0012, was described in detail by KENNEDY (1984: 81): ‘a damaged, wholly septate internal mould, 59 mm in diameter’. GBA/1935/001/0013 shows a ‘distinctly serrated keel at similar dimensions to the lectotype, whilst NHMW/1935/0003/0043, a large fragment tentatively referred to the species, shows an apparently blunter keel at a whorl height of 24 mm.

Discussion: KENNEDY (1984: 81, table ‘dimensions’) drew attention to the fact that many French representants of *Peroniceras (Zuluiceras) bajuvaricum* are larger than the type-specimen and other ones from the type area (Strobl/Weißenbach; Austrian Gosau Group). KLINGER & KENNEDY (1984: 237) discuss the possibility that similar representants of the subgenus like *P. (Z.) omorii* (MATSUMOTO, 1965: 230, Pl. 42, Figs. 1a, b, 2a, b) or *P. (Z.) isamberti* (FALLOT, 1885: 232, Pl. 2, Fig. 1) might be variants or subspecies only (see also the discussion of MATSUMOTO, 1965: 232).

Occurrence: *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873) occurs in Austria (type area Strobl/Weißenbach), in France (KENNEDY, 1984), in South Africa (KLINGER & KENNEDY, 1984), as well as in Madagascar (COLLIGNON, 1965) and is limited to the Coniacian.

Peroniceras (Zuluiceras) propoetidum (REDTENBACHER, 1873)

(Pl. 13, Figs. 8–13, Text-Fig. 17, Tab. 9)

- 1873 *Ammonites propoetidum* REDTENBACHER: 116, Pl. 26, Figs. 6a–c.
1935 *Prionotropis propoetida* REDT.; BRINKMANN: 3.
1958 *Gauthiericeras propoetidum* (REDTENBACHER, 1873); REYMENT: 41, Pl. 5, Figs. 1a, b, Text-Fig. 2, Figs. 3, 4, Text-Fig. 4, Figs. 1–3.
1965 *Sornayceras* sp. cf. *S. propoetidum* (REDTENBACHER); MATSUMOTO: 233, Pl. 39, Figs. 2, 3, Text-Fig. 16.
1984 *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); KENNEDY: 84.
1984 *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); KLINGER & KENNEDY: 235.
1985 *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); SUMMESBERGER: 151.
1987 *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); IMMEL, 109.
2012 *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); SUMMESBERGER & ZORN: 106, Pl. 14, Figs. 2a–d.

Type: Holotype by monotypy is GBA/1873/001/0020, revised and refigured by REYMENT (1958: 41, Pl. 5, Figs. 1a, b, Text-Fig. 2, Figs. 3, 4, Text-Fig. 4, Figs. 1, 2) under *Gauthiericeras propoetidum* (REDTENBACHER, 1873), refigured again by SUMMESBERGER & ZORN (2012: 106, Pl. 14, Figs. 2a–d).

Material: GBA/1873/001/0020, a specimen from Schmalnauer Alpe was described by REDTENBACHER (1873: 116, Pl. 26, Figs. 6a–c) and refigured by REYMENT (1958). MA/1975/20, 21 were collected by one of us (W.-P.M.) at Nussenseebach. A plaster cast of the former is under care of the National History Museum in Vienna (NHMW/2016/0279/0001); NHMW/2017/0176/0001 (leg. et ded. JEKEL) and SK/NU/1981/21 are from Nussenseebach.

Description: Redtenbacher’s individual is a phragmocone with a quarter of the last whorl being the remaining part of the body chamber. It is an internal mould with large areas of whitish shell preserved. Coiling is moderately involute, with a shallow umbilicus. The whorl section seems to have been compressed, which is enhanced by lateral *post-mortem* stress. Measurements are partially still useful. Ornament consists of about 22 umbilical bullae radially elongated into prosiradiate narrow and dichotomous ribs connected with about 44 ventrolateral tubercles which are terminating the ribs on the preserved last whorl. Characteristic is the distinctly undulose ventral keel accompanied by shallow grooves on either side.

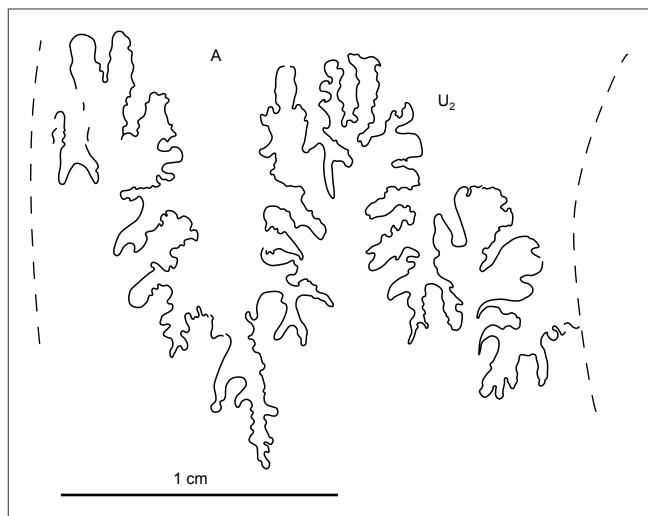
Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
GBA/1873/001/0012	58.0	22.1	10.9	16.4	28.2
GBA/1935/001/0013	37.2	14.8	8.2	12.3	26.9
MA/1975/5	25.9	11.1	5.1	9.26	35.7
SK/NU/1999/78	36.6 _{est}	11.2	9.9	7.8	21.3

Tab. 8.

Measurements of *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); GBA/1873/001/0012, the type specimen; est = estimated, U (%) of D.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
GBA/1873/001/0020	84.6	33.7	19.2	27.1	32.0
SK/NU/1981/21	67.8	23.1	8.5	26.6	39.0
NHMW/2017/0176/0001	56.1	21.3	10.7	20.2	36.0

Tab. 9.

Measurements of *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873). U (%) of D.

Text-Fig. 17.

External suture of the holotype of *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873), GBA/1873/001/0020.

Discussion: *P. (Zuluiceras) propoetidum* (REDTENBACHER, 1873), is a close ally of *P. (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873) differing by more delicate ribbing of the latter and feeble rather than strong crenulations of the ventral keel. *P. (Zuluiceras) aberlei* (REDTENBACHER, 1873) is much more sparsely ribbed with more ribs arising in pairs from umbilical bullae.

Occurrence: *P. (Z.) propoetidum* occurs in the middle Coniacian Gosau Group of the Strobl/Weißenbach (Salzburg, Austria) and Nussenseebach area (Upper Austria) and is described under cf. from Japan (MATSUMOTO, 1965).

Peroniceras (Zuluiceras) aberlei (REDTENBACHER, 1873)

(Pl. 14, Figs. 4–9, Text-Fig. 18, Tab. 10)

- 1873 *Ammonites Aberlei* nov. sp.; REDTENBACHER: 111, Pl. 25, Figs. 4a–e.
 1873 *Ammonites* sp. indet.; REDTENBACHER: 125, Pl. 30, Figs. 5a, b.
 1894 *Ammonites Aberlei* REDTENBACHER; DE GROSSOURE: 89.
 1920 *Peroniceras (Gauthiericeras) aberlei* (REDTENBACHER); DESIO: 219, Pl. 12, Fig. 5.
 1925 *Gauthiericeras aberlei* (REDTENBACHER); DIENER: 152.
 1935 *Gauthiericeras aberlei* (REDTENBACHER); BRINKMANN: 2 et seq.
 ? 1935 *Prionotropis borealis* GROSS.; BRINKMANN: 2, 7.
 1984 *Peroniceras (Zuluiceras) cf. aberlei* (REDTENBACHER, 1873); KLINGER & KENNEDY: 234, Text-Fig. 90.
 1984 *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); KLINGER & KENNEDY: 237, Text-Fig. 92A.
 1987 *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER 1873); IMMEL, 109.

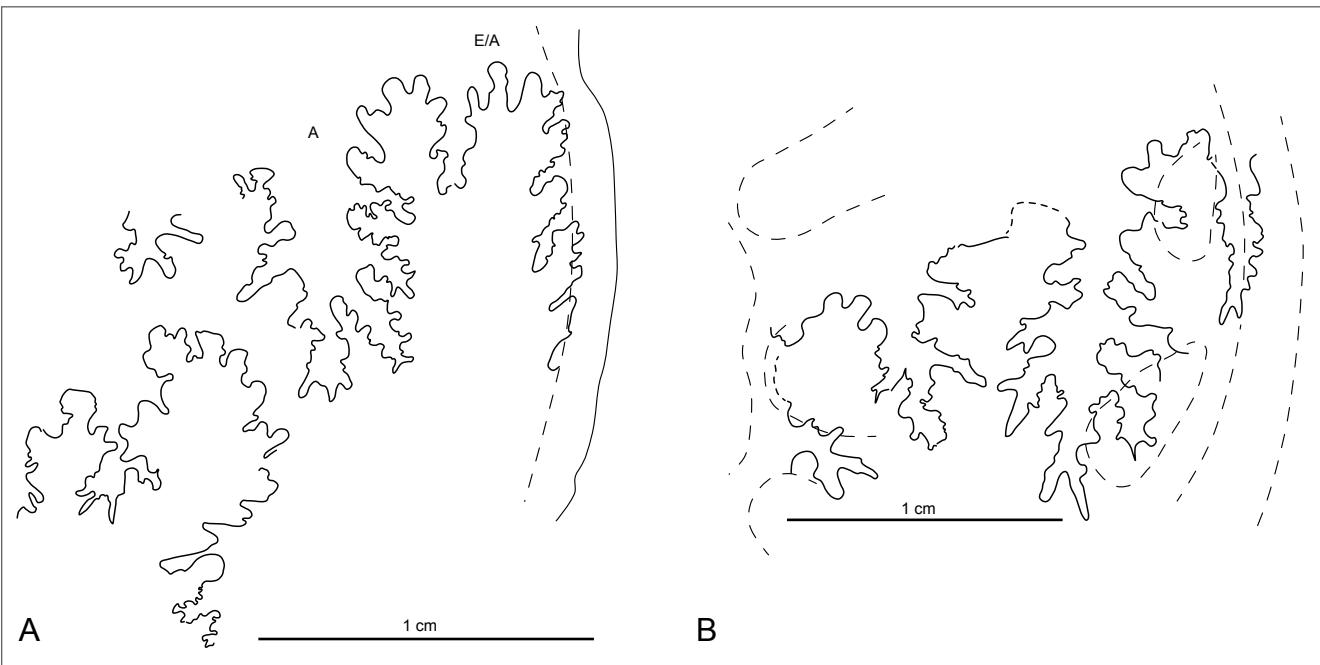
Type: The lectotype of the species announced in 1984 (KLINGER & KENNEDY, 1984: 234) and designated by KENNEDY (1984: 82) is ÖÖLM/1938/31, the original of *Ammonites Aberlei* REDTENBACHER, 1873: Pl. 25, Figs. 4a–c from the Coniacian of Strobl/Weißenbach.

Material: From Glanegg are: HNS/6374, an external mould, the original of *Ammonites* sp. indet. REDTENBACHER, 1873: Pl. 25, Figs. 4d, e; HNS/6398, *Ammonites* sp. indet., the original of REDTENBACHER 1873: Pl. 30, Fig. 5a, b; further NHMW/2017/0130/0001 (former collection Eberle). HNS/6369 is probably also from Glanegg;

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	Wb/Wh	U (mm)	U (%)
OÖLM/1938/31	55.3	21.7	11.7	0.54	20.6	38.9
MA/1977/01	38.4	14.6	8.1	0.55	14.8	38.5
HNS/6369	55.9	23.0	15.8	0.68	12.1	21.6
HNS/6374	44.3	14.7	--	--	16.9	38.1
HNS/6398	17.7	7.1	4.6	0.65	5.0	28.2
NHMW/1992/0146/0001	31.7	13.3	8.8	0.66	10.0	31.5
NHMW/2017/0130/0001	51.0 _{est}	22.2	15.6 _{est}	0.68	20.4	40.0

Tab. 10.

Measurements of the Austrian representatives of *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); est = estimated, U (%) of D.



Text-Fig. 18.
External suture of *Peroniceras (Z.) aberlei* (REDTENBACHER, 1873); A is OÖLM/1938/31, the lectotype, B is MA/1977/01 from the Hinterbach forest road, Fahrenberg (Strobl/Weißenbach, Salzburg).

NHMW/1992/0146/0001 is from the middle Coniacian *Trigonia* bed of the Schönfer Alm, Fahrenberg; MA/1975/4 is from Edlbach (Gosau, OÖ), SK/NU/1993/66 from Nusserseebach; MA/1977/01 is from the Fahrenberg, Salzburg.

Description: The lectotype is described in detail by KENNEDY (1984: 82). The suture of the lectotype is deeply incised.

Discussion: *Peroniceras (Z.) aberlei* (REDTENBACHER, 1873) differs from *Peroniceras (Z.) bajuvanicum* and *Peroniceras (Z.) propoetidium* in its lower number of low, broad and flat ribs which arise singly or in pairs at the umbilical bullae. *Prionotropis boreau* GROSSOURE was listed by BRINKMANN (1935: 2, 7) and identifiable by the label with Brinkmann's handwriting. We believe that the minute specimen, the original of REDTENBACHER's Pl. 30, Figs. 5a, b belongs rather to *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873).

Occurrence: *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873) occurs in the middle Coniacian of Strobl/Weißenbach and in the upper Coniacian of Glanegg near Salzburg. Of interest is the co-occurrence (NHMW/1992/0146/0001) with a local mass occurrence of *Trigonia* sp. near the Schmalnauer Alpe (Strobl/Weißenbach, Salzburg).

Peroniceras (Zuluiceras) sp. indet. 1

(Pl. 14, Figs. 2, 3, Tab. 11)

Material: A single individual, NHMW/1992/0143/0001, from the Schmalnauer Alpe near Strobl/Weißenbach, Salzburg.

Description: The specimen is a peroniceratid with one part of the body chamber preserved. Narrow slightly prorsiradiate ribs (about 30) occur at the umbilical edge in prorsiradiate nodes fading out midflanks and rising again ventrolaterally into prorsiradiate tubercles and ending at the ventral groove which accompanies the entire sharp keel. Ornament is fading out at the final part of the body chamber, leaving an almost smooth flank.

Discussion: Loss of sculpture on the body chamber makes the specimen different from other peroniceratids. Pathological deformation at lifetime seems to be a possible explanation for this phenomenon.

Occurrence: NHMW/1992/0143/0001, *Peroniceras (Zuluiceras) sp. indet. 1*, is a unique specimen which occurs in the middle Coniacian of the Schmalnauer Alpe (Salzburg).

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
NHMW/1992/0143/0001	90.15	30.3	21.0	22.8	25.3

Tab. 11.
Measurement of NHMW/1992/0143/0001, *Peroniceras (Zuluiceras) sp. indet. 1* from Schmalnauer Alpe (Strobl/Weißenbach, Salzburg). U (%) of D.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	Wb/Wh (%)	U (mm)	U (%)
SK/NU/1981/19	63.4	20.2	17.1	84	23.0	36.3
SK/NU/1999/79	83.4	23.2	13.5	58	37.2	44.6
SK/NU/2005/88	30.0	13.0	7.7	59	11.0 _{est}	36.7
GBA/2019/001/0002/01	51.6	19.0	15.0	79	26.6 _{rest}	51.5

Tab. 12.

Measurements of *Ishikariceras* sp. indet. from the Nussenseebach area (Upper Austria). est = estimated, rest = restored, U (%) of D.

Genus *Ishikariceras* MATSUMOTO, 1965

Type species: *Ishikariceras binodosum* MATSUMOTO, 1965: 235, Pl. 43, Fig. 1, Text-Figs. 17, 18.

Ishikariceras sp. indet.

(Pl. 17, Figs. 1–7, Text-Fig. 19, Tab. 12)

Compare

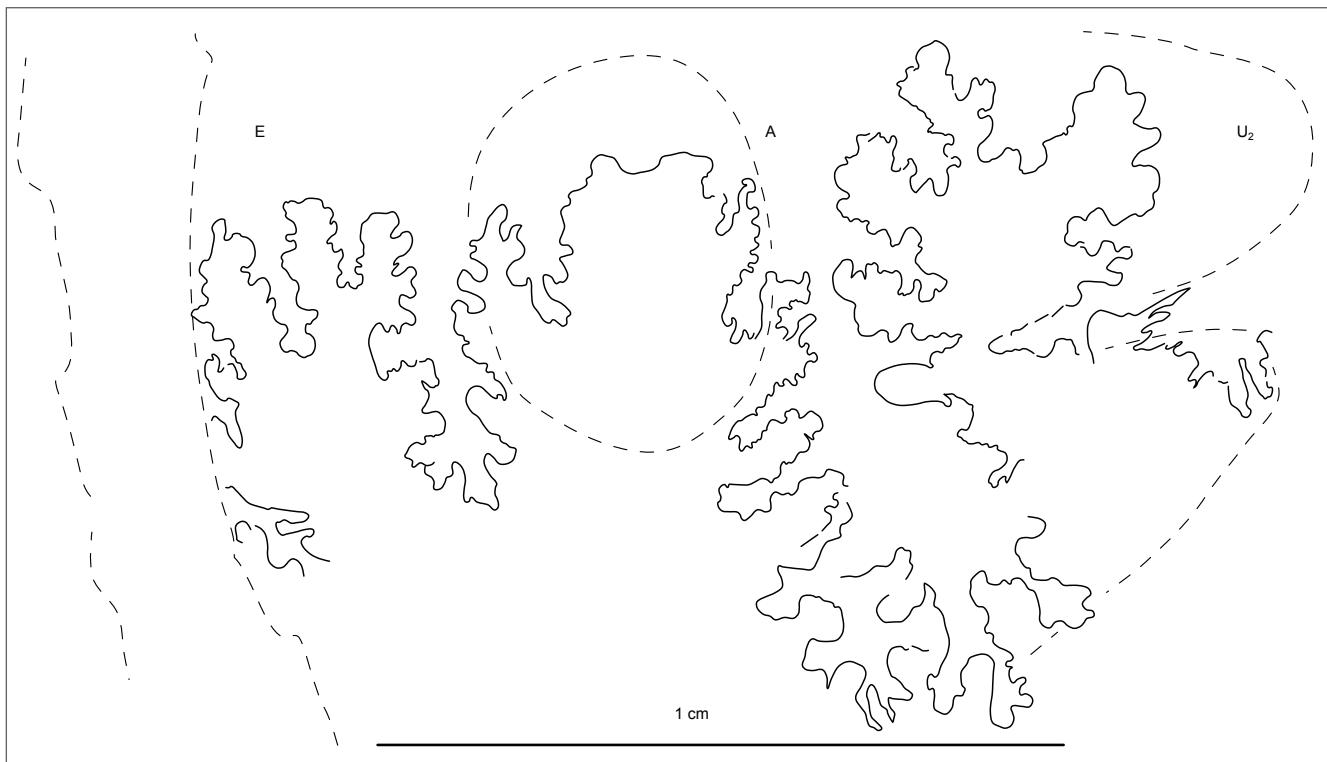
- 1873 *Ammonites* sp. indet. cfr. *Ammonites tridorsatus* SCHLÜTER; REDTENBACHER: 125, Pl. 30, Fig. 3a.
 1935 *Peroniceras subtricarinatum* D'ORB.; BRINKMANN: 2, 4.

Material: GBA/1873/001/0026 from Strobl/Weißenbach, unknown locality details; GBA/2019/001/0002/01, 02 from Nussenseebach; SK/NU/1981/19, SK/NU/1999/79, SK/NU/2005/88 from Nussenseebach.

Description: All five specimens at our disposal are internal moulds with adherent remains of whitish shell substance. The coiling is evolute with less than one quarter of the previous whorl being covered. The umbilicus is moderately deep and wide. Ornament consists of approximately ten distant broad ribs per half whorl. Rib direction is slightly rursiradiate. The ribs bear strong and pointed umbilical bullae and massive, outward directed ventral pointed clavi, the ventral clavi being housed in notches in the umbilical wall of the succeeding whorl. The venter is tricarinate/bisulcate with dominating entire siphonal keel. The suture is moderately incised. E/A is asymmetrically bifid. A is narrow, with a smaller, narrower A/U₂, and two quite large auxiliaries.

Discussion: The *Ishikariceras* specimens from the Coniacian of the Gosau Group are very close to *I. binodosum* MATSUMOTO 1965 from Japan.

Occurrence: Its distribution in the middle Coniacian is from Nussenseebach (Upper Austria) to the Strobl/Weißenbach area (Salzburg).



Text-Fig. 19.

External suture of *Ishikariceras* sp. indet. GBA/2019/001/0002/01, from Nussenseebach (Upper Austria).

Genus *Gauthiericeras* DE GROSSOURE, 1894

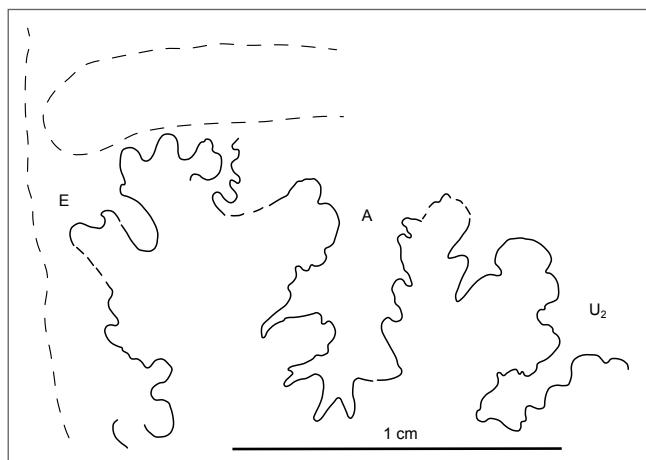
Type species: *Ammonites margae* SCHLÜTER, 1867: 29, Pl. 5, Fig. 2 by original designation of DE GROSSOURE (1894: 87).

Gauthiericeras margae (SCHLÜTER, 1867)

(Pl. 14, Fig. 1, Pl. 15, Fig. 1, Pl. 16, Figs. 1, 2, Text-Fig. 20, Tab. 13)

- 1867 *Ammonites margae* SCHLÜTER: 29, Pl. 5, Fig. 2.
- 1871 *Ammonites margae* SCHLÜTER: 43, Pl. 12, Fig. 4.
- 1873 *Ammonites margae* SCHLÜTER; REDTENBACHER: 109, Pl. 25, Figs. 1a–c.
- 1894 *Gauthiericeras margae* (SCHLÜTER); DE GROSSOURE: 90, Pl. 15. Figs. 1, 2, Text-Fig. 36.
- 1935 *Gauthiericeras margae* SCHLÜTER.; BRINKMANN: 2, 4, 7.
- ? 1958 ? 1873 *Ammonites* sp. indet. REDTENBACHER: 127, Pl. 30, Fig. 8; REYMENT: 43 (= *Tissotiodes haplophyllus*, REDTENBACHER, 1873, see below under *T. haplophyllus*).
- 1979 *Gauthiericeras margae* DE GROSSOURE [sic!]; COLLIGNON et al.: 390, Pl. 2, Fig. 4.
- 1982 *Gauthiericeras margae* (SCHLÜTER); MARTINEZ: 109, Pl. 16, Figs. 2–4.
- 1983 *Gauthiericeras margae* (SCHLÜTER, 1867); KENNEDY: 104, Pl. 1, Figs. 8, 9.
- 1984 *Gauthiericeras margae* (SCHLÜTER, 1867); KLINGER & KENNEDY: 238, Figs. 94, 95, 96.
- 1984 *Gauthiericeras margae* (SCHLÜTER, 1867); KENNEDY: 88, Pl. 18, Figs. 1–3, Pl. 20, Figs. 3–4, 8–10, Pl. 21, Figs. 1, 5, Pl. 22, Figs. 13–17, Text-Figs. 27, 28, 29A, B, 30A, B, 31 (with complete synonymy).
- 1987 *Gauthiericeras margae* (SCHLÜTER, 1867); IMMEL: 110.
- 1994 *Gauthiericeras margae* (SCHLÜTER, 1867); KAPLAN & KENNEDY: 44, Pl. 10–13, Pl. 14, Figs. 1, 6; ??, 3; Pl. 15–17, Pl. 28, Fig. 2.
- 1995 *Gauthiericeras margae* (SCHLÜTER, 1867); KENNEDY in KENNEDY et al.: 412, Pl. 19, Figs. 10, 11, Text-Fig. 22.

Type: The holotype, by monotypy, is the original of SCHLÜTER (1867: Pl. 5, Fig. 2), refigured by KLINGER & KENNEDY (1984: Text-Fig. 95) and by KAPLAN & KENNEDY (1994: Pls. 11, 12). A cast of the holotype was figured by KENNEDY (1984: Text-Fig. 28).



Text-Fig. 20.
External suture of *Gauthiericeras margae* (SCHLÜTER, 1867), HNS/6375, from Glanegg.

Material: HNS/6375, the original of REDTENBACHER (1873: Pl. 25, Figs. 1a–c); four fragments: HNS/6388, HNS/6403, HNS/26596, NHMW/1943/0001/0001 from the upper Coniacian Gosau Group of Glanegg (Salzburg); NHMW/1935/0002/0019 is from Nussenseebach.

Description: Redtenbacher's original specimen of *Ammonites margae* SCHLÜTER, 1867 (REDTENBACHER, 1873: 109, Pl. 25, Figs. 1a–c; HNS/6375) is a well-preserved internal mould of a throughout chambered phragmocone without adherent shell fragments. Coiling is evolute with a broad, moderately deep umbilicus and an outward inclined umbilical wall. The umbilical shoulder is rounded, the whorl section is compressed with rounded flanks between the ribs, the greatest breadth between the ribs being below midflank. The costal section is much more inflated on the inner flank region, the venter is fastigate. Fourteen blunt, coarse, broad, markedly convex ribs arise from narrow bullae at the umbilical shoulder to produce an incipient lateral node. The ribs weaken and broaden across the outer flank and terminate in a blunt clavus. The ventral area bears a robust entire keel flanked by shallow grooves.

NHMW/1943/0001/0001 is an adult individual with nineteen ribs on the outer whorl. These are recti- to feebly rursiradiate. NHMW/1935/0002/0019 is a very large adult individual with about ten coarse undivided ribs per half whorl, terminating in a very coarse ventrolateral tubercle. The entire coarse keel is flanked by shallow grooves and weak ventrolateral keels. The sutures are poorly visible but comprise little divided bifid saddles and narrow lobes.

Discussion: *Gauthiericeras margae* was discussed at length by KENNEDY (1984: 93–95); KLINGER & KENNEDY (1984: 238–243) compared the German and Austrian representatives with the rich South African material.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	Wb/Wh	U (mm)	U (%)
HNS/6375	108.8	33.7	31.2	0.926	43.2	39.7
NHMW/1943/0001/0001	170.0	58.4	48.1	0.82	69.8	41.0
NHMW/1935/0002/0019	340.0	120.0	80.0	0.67	139.5	41.0

Tab. 13.
Measurements of the Austrian representatives of *Gauthiericeras margae* (SCHLÜTER, 1867). U (%) of D.

Occurrence: HNS/6375 and NHMW/1943/0001/0001 and a number of fragments are from the Upper Coniacian of Glanegg (Glanneck by authors), whereas the largest specimen NHMW/1935/0002/0019 is from the Upper Coniacian of Nussenseebach. Elsewhere it is widespread in the Late Coniacian of Europe, North Africa and North America (see KAPLAN & KENNEDY, 1994). In France KENNEDY (1984) introduced the Upper Coniacian *Gauthiericeras margae* Zone above the beds with representatives of the *Tridorsatum* fauna.

Subfamily Texanitinae COLLIGNON, 1948

Genus and Subgenus *Protexanites* MATSUMOTO, 1955

Type species: *Ammonites bourgeoisi* d'ORBIGNY, 1850 by original designation of MATSUMOTO (1955: 38).

Protexanites (Protexanites) cf. bourgeoisi (d'ORBIGNY, 1850)

(Pl. 17, Figs. 8, 9)

Compare

- 1850 *Ammonites bourgeoisi* d'ORBIGNY, 1850: 212.
- 1894 *Mortoniceras bourgeoisi* d'ORBIGNY; DE GROSSOUIRE: 73, Pl. 13, Fig. 2, Pl. 14, Figs. 2–5.
- 1968 *Protexanites bourgeoisi* d'ORBIGNY; JANOSCHEK: 140.
- 1970 *Protexanites (Protexanites) bourgeoisi* (d'ORBIGNY, 1850); MATSUMOTO: 228, 234, 238, 240.
- 1980 *Protexanites (Protexanites) bourgeoisi* (d'ORBIGNY, 1850); KLINGER & KENNEDY: 7–8.
- 1984 *Protexanites bourgeoisi* (d'ORBIGNY, 1850); KENNEDY: 105, Pl. 23, Figs. 1–4, 7–9, Pl. 24, Figs. 1–8, Pl. 26, Figs. 4–5 (with synonymy).
- 1987 *Protexanites (Protexanites) cf. bourgeoisi* (d'ORBIGNY, 1850); IMMEL: 110, Pl. 11, Fig. 4.
- 1991 *Protexanites (Protexanites) bourgeoisi* (d'ORBIGNY, 1850); KENNEDY & COBBAN: 44, Pl. 7, Figs. 18, 19, 22–37, Pl. 8, Figs. 1–4, 6–9, 11–13, Pl. 12, Fig. 12, Text-Figs. 17–21, 22_B.
- 1994 *Protexanites (Protexanites) bourgeoisi* (d'ORBIGNY, 1850); KAPLAN & KENNEDY: 49, Pl. 27, Fig. 2, Pl. 28, Figs. 6, 7.
- 1995 *Protexanites (Protexanites) cf. bourgeoisi* (d'ORBIGNY, 1850); KENNEDY in KENNEDY et al.: 417, Pl. 19, Fig. 5, Pl. 21, Figs. 12, 15.

Type: The lectotype subsequently designated by MATSUMOTO (1955: 202) is no. 7181a1 at the Muséum National d'Histoire Naturelle, Paris.

Material: A single specimen NHMW/1968/0777/0000 from the Coniacian of Wörschach/Steiermark (= Styria).

Description: The single fragment NHMW/1968/0777/0000 has an estimated diameter of 50 mm. Wb is 15 mm, Wh is estimated 15.6 mm. Coiling is wide, section is squarish, the median keel is weak and accompanied on both sides by shallow grooves. Umbilical bullae give rise to very

strong prorsiradiate ribs which are widening towards the ventrolateral clavi which are connected by short broad ribs with the outermost strong clavi at the venter.

Discussion: *Protexanites (Protexanites) cf. bourgeoisi* (d'ORBIGNY, 1850) from the Austrian Upper Coniacian differs by its much coarser sculpture from the Late Coniacian German examples (KAPLAN & KENNEDY, 1994: 49, Pl. 27, Fig. 2, Pl. 28, Figs. 6, 7). *Protexanites (Protexanites) cf. bontanti* (DE GROSSOUIRE, 1894) differs by its narrower width and its narrow and sharp keel.

Occurrence: *Protexanites (Protexanites) bourgeoisi* (d'ORBIGNY, 1850) occurs widespread in France, Spain, Algeria, Tunisia, and in the United States. The figured example *Protexanites (P) cf. bourgeoisi* (d'ORBIGNY, 1850) is from Wörschach, Enns Valley, Styria.

Protexanites (Protexanites) cf. bontanti (DE GROSSOUIRE, 1894)

(Pl. 17, Figs. 12–14, Pl. 18, Figs. 1–7)

Compare

- 1894 *Mortoniceras bontanti* DE GROSSOUIRE: 77, Pl. 17, Fig. 2, Text-Fig. 23.
- 1970 *Protexanites (Protexanites) bontanti* (DE GROSSOUIRE, 1894); MATSUMOTO: 235, Text-Fig. 5.
- 1984 *Protexanites (Protexanites) bontanti* (DE GROSSOUIRE, 1894); KENNEDY: 112, Pl. 25, Figs. 1–4.
- 1991 *Protexanites (Protexanites) bontanti* (DE GROSSOUIRE, 1894); KENNEDY & COBBAN: 50, Pl. 7, Figs. 38–41, Pl. 8, Figs. 5, 10.
- 1995 *Protexanites (Protexanites) bontanti* (DE GROSSOUIRE, 1894); KENNEDY et al.: 418, Pl. 21, Figs. 1, 4, 5, 10, 11, 16.

Type: The holotype, by original designation, is the original of DE GROSSOUIRE (1894: 77, Pl. 17, Fig. 2) in the collections of the Muséum National d'Histoire Naturelle, Paris, from the upper Coniacian of Loir-et-Cher, France. It was figured again by KENNEDY (1984: Pl. 25, Figs. 1–3).

Material: SK/NU/1997/76, SK/NU/1997/76a, b, SK/NU/1981/26, 28, 29, SK/NU/2019/94 from the Nussenseebach; MA/1982/16 from the tunnel section north of Bad Ischl; NHMW/1935/0003/0025 from Nussenseebach

Description: Some fragments are preserved as internal moulds with remaining parts of white shell. Only SK/NU/1997/76 (Pl. 17, Fig. 12) and MA/1982/16 (Pl. 18, Figs. 6, 7) give information of the whole shell: it is evolute, with more than 30 % of the diameter being covered by the next whorl. The umbilical wall is very short and rounded and continues into the umbilical shoulder. Mid-flanks is feebly convex. The outer flanks converge. The venter is fastigate. Approximately 26 more or less straight primary ribs occur at the umbilical seam and strengthen into narrow bullae. These give rise to low broad primary ribs with a sharp conical tubercle at the umbilical shoulder. At the inner flank they are straight and narrow and slightly convex and widening at the median part of the flank. In ventrolateral position the ribs bend to prorsiradiate bullate swellings which are topped by a weak conical tubercle. After

a short interruption, the ribs end at the sharp undulated keel. There are no intercalaries and no bifurcations. SK/NU/2019/94 (Pl. 17, Figs. 13, 14) shows best the relations of the sharp and undulose siphonal keel accompanied by shallow furrows.

Discussion: *Protexanites (Protexanites) bourgeoisiensis* (D'ORBIGNY, 1850) differs by wider ribs and wider rib distances (KAPLAN & KENNEDY, 1994: 49, Pl. 27, Fig. 2, Pl. 28, Figs. 6, 7). *Protexanites (P.) bourgeoisiensis* (D'ORBIGNY, 1850) from the Austrian upper Coniacian (Pl. 17, Figs. 8, 9) differs by its soft undulose keel.

Occurrence: Where precisely dated *Protexanites (Protexanites) bontanti* (DE GROSSOUIRE, 1894) occurs in the Upper Coniacian *Paratexanites serratomarginatus* Zone. Its main distribution in Europe is in the French Upper Coniacian (KENNEDY, 1984: 112). *Protexanites (Protexanites) cf. bontanti* (DE GROSSOUIRE, 1894) is herewith described for the first time from the Austrian Gosau occurrences.

Protexanites (Protexanites) sp. indet. juv.

(Pl. 17, Figs. 10, 11)

Compare

- 1873 *Ammonites* spec. indet. cfr. *tridorsatus* SCHLÜTER; REDTENBACHER: 125, Pl. 30, Fig. 3a.
 1935 *Peroniceras subtricarinatum* D'ORBIGNY; BRINKMANN: 2, 3.

Material: A single specimen: HNS/6401 from the Late Coniacian of Glanegg.

Description: The specimen was figured by REDTENBACHER (1873: Pl. 30, Fig. 3a). BRINKMANN (1935) understood it as a species of *Peroniceras*. The venter (Pl. 17, Fig. 11) reveals an undulating siphonal keel flanked by elongate siphonal clavi, linked by low ridges. Small umbilical tubercles give rise to strong ribs, which appear to be rursiradiate in most cases. In ventrolateral position they continue in a marked clavus, beyond the end in ventral clavi building an undulating sharp secondary keel.

Discussion and occurrence: Overall ornament is that of a *Protexanites*. Small size, juvenile age and bad preservation preclude specific identification. Late Coniacian age fits well for the identification as *Protexanites (Protexanites) sp. indet. juv.*

Genus *Paratexanites* COLLIGNON, 1948

Type species: *Mortoniceras zeilleri* DE GROSSOUIRE, 1894: 67, Pl. 14, Fig. 1 by original designation of COLLIGNON (1948).

***Paratexanites serratomarginatus* (REDTENBACHER, 1873)**

(Pl. 18, Figs. 8–16)

- 1873 *Ammonites serrato-marginatus* REDTENBACHER: 110, Pl. 25, Figs. 2a–d.
 1894 *Mortoniceras serrato-marginatum* (REDTENBACHER); DE GROSSOUIRE: 69, Pl. 16, Figs. 1a, b.

- 1948 *Bevahites (Parabevahites) serrato-marginatus* (REDTENBACHER); COLLIGNON: 84.
 1970 *Paratexanites (Parabevahites) serratomarginatus* (REDTENBACHER); MATSUMOTO: 260, Pl. 36, Figs. 1–3, Text-Fig. 16.
 1970 *Paratexanites (Parabevahites) serratomarginatus grossouvrei* MATSUMOTO: 263.
 1976 *Paratexanites (Parabevahites) serratomarginatus* (REDTENBACHER); MATSUMOTO & HIRANO: 337, Text-Fig. 3.
 1977 *Paratexanites (Parabevahites) cf. serratomarginatus* (REDTENBACHER); KENNEDY & KOLLMANN: 414, Pl. 1, Figs. 1a–c.
 1979 *Parabevahites serrato-marginatus* (REDTENBACHER), COLLIGNON et al.: 392.
 1980 *Paratexanites serratomarginatus* (REDTENBACHER, 1873); KLINGER & KENNEDY: 15.
 1980 *Paratexanites* sp. aff. *serratomarginatus* (REDTENBACHER, 1873); KLINGER & KENNEDY: 59, Figs. 45–47A.
 1981 *Paratexanites serratomarginatus* (REDTENBACHER, 1873); KENNEDY et al.: 117, Figs. 1–7 (with synonymy).
 1987 *Paratexanites serratomarginatus* (REDTENBACHER, 1873); IMMEL: 111.
 1995 *Paratexanites serratomarginatus* (REDTENBACHER, 1873); KENNEDY et al.: 419, Pl. 21, Fig. 14.

Type: Lectotype designated by KENNEDY et al. (1981: 117) is HNS/6381, the original of REDTENBACHER (1873: 110, Pl. 25, Figs. 2a, b) from the upper Coniacian of Glanegg (Salzburg).

Material: Besides the lectotype and six paratypes (KENNEDY et al., 1981: 117) from the collections of the Haus der Natur (HNS) we have HNS/7489 from Morzg near Glanegg, further HNS/6382, 6384, 6387, 18453, 26590, 26598, 18427 and 18428 (part and counterpart), all from the upper Coniacian of Glanegg; NHMW/1978/2029/0003 from Glanriedl near Glanegg and MA/1982/18 from the tunnel north of Bad Ischl; SK/EB/1985/8 from Edlbach (Gosau, Upper Austria) and a fragment SK/NU/2019/91 of upper Coniacian age from Nussenseebach.

Description and discussion: Detailed description and discussion of *Paratexanites serratomarginatus* (REDTENBACHER, 1873) was given by KENNEDY et al. (1981: 117–122).

Occurrence: Following KENNEDY (1984: 5) there are two upper Coniacian zones represented in the area of Glanegg, the *Gauthiericeras margae* Zone below and the *Paratexanites serratomarginatus* Zone above, unfortunately nowhere in the area in a measurable profile. *Paratexanites serratomarginatus* (REDTENBACHER, 1873) occurs also in the upper Coniacian of the tunnel section north of Bad Ischl. Furthermore, it occurs in the Edlbachgraben (Gosau, Upper Austria) indicating a Coniacian part of the Edlbachgraben section (SK/EB/1985/8), endorsed by a Peroniceratid (MA/1975/4) from the same locality.

Family Tissotiidae HYATT, 1900

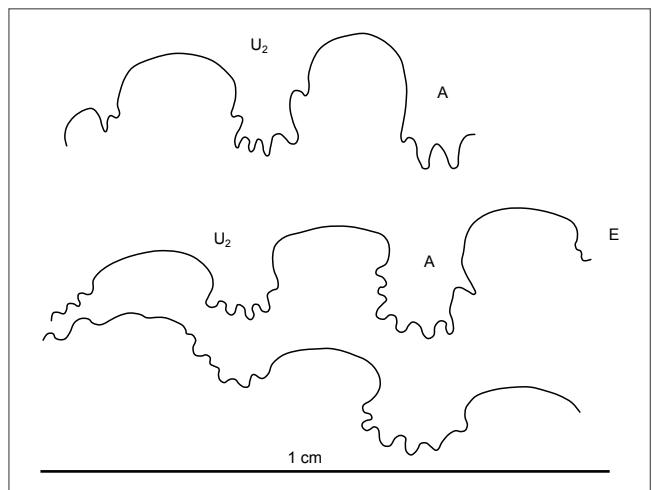
Genus and Subgenus *Tissotiooides* REYMENT, 1958

Type species: *Ammonites haplophyllus* REDTENBACHER, 1873: 100, Pl. 23, Figs. 1a–c.

***Tissotiooides (Tissotiooides) haplophyllus*
(REDTENBACHER, 1873)**

(Pl. 19, Figs. 1, 2, 4, 5, Pl. 20, Figs. 1–9, Pl. 21, Figs. 10, 11, Text-Fig. 21, Tab. 14)

- 1873 *Ammonites haplophyllus* REDTENBACHER: 100, Pl. 23, Figs. 1a–c.
- 1873 *Ammonites spec. indet.*; REDTENBACHER: 127, Pl. 30, Fig. 8.
- 1885 *Buchiceras ewaldi* DE BUCH; FALLOT: 237, Pl. 3, Figs. 1, 3.
- 1903 *Metatissotia haplophylla* (REDTENBACHER); HYATT: 48.
- 1925 *Tissotia haplophylla* REDTENBACHER; DIENER: 222.
- 1935 *Tissotia haplophylla* REDTENBACHER; BRINKMANN: 3.
- 1958 *Tissotiooides haplophyllus* (REDTENBACHER, 1873); REYMENT: 48, Pl. 3, Fig. 1, Text-Fig. 2/1.
- 1976 *Tissotiooides haplophyllus* (REDTENBACHER, 1873); STOJASPAK & LOBITZER: A 116.
- 1984 *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); KENNEDY: 123, Pl. 28, Figs. 2, 3, Pl. 29, Figs. 3, 4, Text-Figs. 38A–C (with synonymy).
- 1987 *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); IMMEL: 113.
- 1995 *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); KENNEDY in KENNEDY et al.: 423, Pl. 24, Figs. 3, 4, Text-Fig. 27.
- 1996 *Tissotiooides haplophyllus* (REDTENBACHER, 1873); WRIGHT in WRIGHT et al.: 198, Text-Figs. 3a–c.
- 2012 *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); SUMMERSBERGER & ZORN: 106, Pl. 13, Figs. 1a–d.



Text-Fig. 21.

Partial external suture of GBA/1873/001/0007, the holotype of *Tissotiooides (T.) haplophyllus* (REDTENBACHER, 1873).

Type: Holotype by monotypy is REDTENBACHER's original specimen (1873: Pl. 23, Figs. 1a–c) GBA/1873/001/0007, refigured by KENNEDY (1984: Text-Fig. 38), from the Middle Coniacian *Tridorsatum* Zone of the Schmalnauer Alpe near Strobl/Weißenbach (Salzburg).

Material: Besides the holotype we have the following specimens: GBA/1873/001/0031, NHMW/1989/0050/0021, 0027, 0028, 0029, 0049 from the Schmalnauer Alpe, 30 m north of the Adventist home; SK/FA/1990/28, 29 from the Schmalnauer Alpe, 30 m north of the Adventist home; MA/1978/1 from the forest road Hinterbach close to the Schmalnauer Alpe.

Description: The holotype is a somewhat distorted internal mould. Half of the last whorl is body chamber. Depending on deformation, measurements (Tab. 14) vary greatly. Nevertheless, the relations are still useful. Coiling is involute, with a small deep umbilicus, the umbilical wall being vertical. All specimens are internal moulds, none of them have remnants of the shell preserved. The whorl height increases rapidly, the whorl breadth increases more slowly, leading to a slender shell form. The greatest whorl breadth

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	U (mm)	U (%)
GBA/1873/001/0007	51.7	33.4	29.0 _{rest}	9.5	18.4
GBA/1873/001/0008	70 _{rest}	39.5 _{rest}	--	16.6	23.7 _{rest}
NHMW/1989/0050/0021	73.4	30.4	17.4	9.9	13.5
NHMW/1989/0050/0027	50.7	22.2	14.8	8.0	15.8
NHMW/1989/0050/0028	76.4	39.2	19.4	10.0	13.1
NHMW/1989/0050/0029	48.7	25.3	10.8	5.0	10.27
NHMW/1989/0050/0049	--	61.8	27.0	12.2	--
SK/FA/1990/28	126.1	63.8	31.9	17.6	13.4
SK/FA/1990/29	45.5	19.2	11.2	5.1	11.2
MA/1978/1	47.7	29.0	16.5	5.5	8.6

Tab. 14.

Measurements of *Tissotiooides (T.) haplophyllus* (REDTENBACHER, 1873); rest = restored, U (%) of D.

is at the prominent umbilical bullae, and the flanks are slightly convex at the internal half of the shell, but concave at the outer third, slightly convergent towards the ventrolateral shoulder. The venter is fastigate. Ornament consists of seven spinose umbilical tubercles. These give rise to strong but shallow prorsiradiate ribs. Occasionally additional ones are intercalated. Each rib is terminating in a strong laterally elongate ventrolateral clavus. From there a broad oblique rib extends forwards to strong, highly asymmetric siphonal clavi. In bigger specimens the ornament weakens. Large body chambers are almost smooth. The sutures (Text-Fig. 21) expose denticulate lobes and essentially entire saddles. E is broad with a squat median saddle. E/L has a minor incision and is asymmetrically bifid.

Discussion: In contrast to members of the Barroisiceratidae (upper Turonian; SUMMERSBERGER & KENNEDY, 1996) and the Santonian Muniericeratidae (SUMMERSBERGER et al., 2017a) the variability of *Tissotiooides* is very low.

Occurrence: Besides middle Coniacian occurrences in the type area of Schmalnauer Alpe (Salzburg) *Tissotiooides* (*T.*) *haplophyllus* (REDTENBACHER, 1873) was recorded from France and Spain (KENNEDY in KENNEDY et al., 1995: 423).

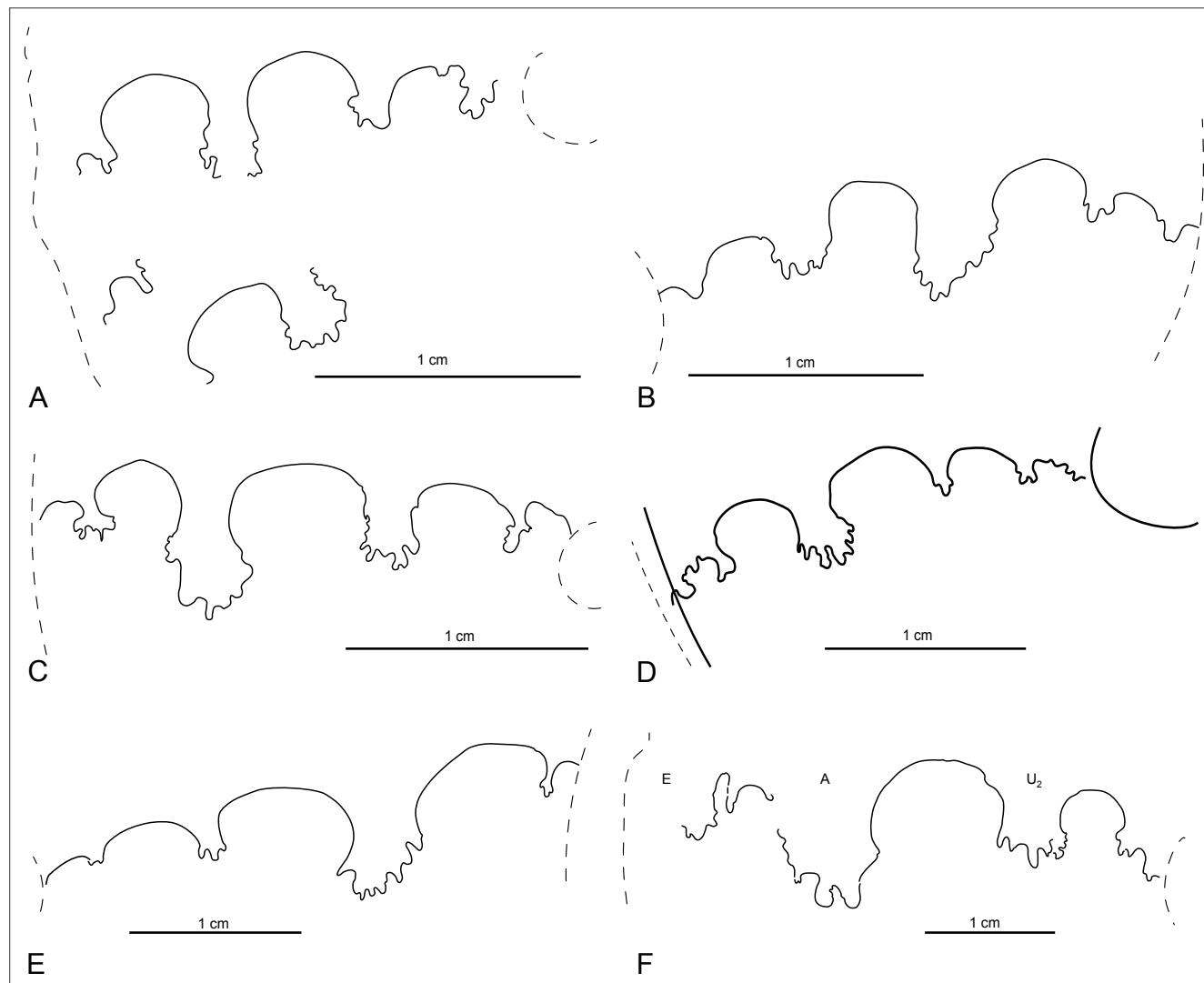
Genus *Metatissotia* HYATT, 1903

Type species: *Buchiceras founieri* BAYLE, 1878: Pl. 40, Fig. 3 by subsequent designation of ROMAN (1938: 479).

Metatissotia ewaldi (VON BUCH, 1848)

(Pl. 19, Fig. 3, Pl. 20, Figs. 10, 11, Pl. 21, Figs. 1–9, 12–14, Text-Fig. 22, Tab. 15)

- 1848 *Ammonites ewaldi* VON BUCH: 221, Pl. 1, Fig. 4.
- 1848 *Ammonites ewaldi* VON BUCH: 26, Pl. 6, Figs. 6, 7, Pl. 7, Fig. 4.
- 1848 *Ammonites robini* THIOLLIÈRE; VON BUCH: 28, Pl. 6, Fig. 5.
- 1849 *Ammonites Robini* THIOLLIÈRE: 744, Pl. 1.
- 1873 *Ammonites cfr. Ewaldi* VON BUCH; REDTENBACHER: 98, Pl. 22, Fig. 5.
- 1885 *Buchiceras ewaldi* DE BUCH; FALLOT, 237, Pl. 3, Figs. 1, 2.



Text-Fig. 22.

External suture of *Metatissotia ewaldi* (VON BUCH, 1848): A = ÖÖLM/2021/82, B = SK/FA/1982/13, C = PIUW/1873, not registered, D = SK/FA/1990/23, E = SK/NU/1983/52, F = External suture of *Tissotiooides haplophyllus* (REDTENBACHER, 1873), SK/FA/1990/28.

Inventory No.	D (mm)	Wh (mm)	Wb (mm)	Wb/Wh	U (mm)	U (%)
NHMW/1873/0014/0008	36.4	22.7	6.8	0.29	--	--
NHMW/1978/1954/0002	13.6	6.3	--	--	1.9	14.0
NHMW/1983/0036/0001	44.4	23.2	8.5 _{est}	0.37	4.7 _{est}	10.7
NHMW/1989/0050/0030	19.4	13.6	6.8	0.5	3.1	15.9
NHMW/1992/0141/0001	34.9	18.1	6.8	0.37	3.4	9.7
NHMW/1992/0141/0002	13.5	6.5	4.6	0.7	1.7	12.6
NHMW/1992/0142/0001	33.3	18.3	6.6	0.36	5.3	15.9
NHMW/2018/0134/0003	28.4	14.7	6.6	0.45	4.2	14.7
NHMW/2018/0134/0004	55.5	31.8	10.8	0.34	2.9	5.22
SK/FA/1980/1	59.3	33.1	10.4	0.31	4.3	7.3
SK/FA/1980/2	41.4	20.1	8.2	0.47	3.4	8.2
SK/FA/1981/4	45.7	23.3	9.1	0.39	4.1	8.9
SK/FA/1981/5	66.1	40.9	--	--	5.0	7.1
SK/FA/1981/6	38.1	21.4	8.0	0.37	2.5	6.6
SK/FA/1981/7	42.2	23.9	5.6	0.23	4.2	9.9
SK/FA/1982/15	50.0	27.0	--	--	4.4	8.8
SK/FA/1982/16	36.6	15.9	9.7	0.61	2.1	5.7
SK/FA/1989/20	26	14.4	4.3	0.29	3.1	11.9
SK/FA/1989/21	20.7	10.7	4.4	0.41	3.0	14.5
SK/FA/1989/22	26.6	15.7	5.9	0.37	1.8	6.7
SK/FA/1990/23	75.2	34.6	15.3	0.44	6.2	8.24
SK/FA/1990/24	--	23.2	22.0	0.94	4.2	--
SK/NU/1981/3	38.7	20.0	6.0	0.3	3.5	9.0
SK/NU/1981/34	35.7	19.1	3.5	0.18	--	--
SK/NU/1983/52	109.1	57.2	13.6	0.23	3.4	3.11
SK/NU/1983/54	70.1	41.2	13.8	0.33	5.0	7.1
SK/NU/1992/64	59.7	34.3	7.0	0.20	4.0	6.7
OÖLM/2021/80	53.4	33.6	11.4	0.34	5.2	9.7
OÖLM/2021/81	46.4	25.5	10.0	0.39	3.6	8.06
OÖLM/2021/82	52.8	29.5	12.1	0.41	4.2	7.8
OÖLM/1938/35	38.3	22.1	7.9	0.35	4.4	11.4
PIUW/1873/not reg.	38.8	19.4	6.9	0.35	4.7	12.1
PIUW/not reg.	56.3	33.8	16.0	0.47	6.2	11.0
GBA/1873/001/0006/04	81.4	43.5	17.3	0.39	5.8	7.12
GBA/1873/001/0006/03	56.8	31.9	--	--	3.6	6.3
GBA/1873/001/0006/02	42.4	24.6	9.9	0.40	2.6	6.13
GBA/1873/001/0006/05	55.6	33.9	16.0	0.47	5.7	10.2
GBA/1873/001/0006/01	24.8	14.3	6.6	0.46	3.3	13.3

Tab. 15.

Measurements of *Metatissotia ewaldi* (VON BUCH, 1848); not reg. = not registered, est = estimated, U (%) of D.

- 1894 *Tissotia robini* THIOLLIÈRE sp. emend. A. DE GROSSOUVRE; DE GROSSOUVRE: 37, Pl. 4, Figs. 1, 2.
- 1894 *Tissotia ewaldi* L. DE BUCH sp.; DE GROSSOUVRE: 40, Pl. 4, Fig. 6, Pl. 9, Fig. 5.
- 1903 *Metatissotia robini* (THIOLLIÈRE); HYATT: 46.
- 1903 *Metatissotia ewaldi* (VON BUCH); HYATT: 48.
- 1925 *Tissotia Ewaldi* v. BUCH; DIENER: 221.
- 1925 *Tissotia Robini* THIOLLIÈRE; DIENER: 222.
- 1935 *Tissotia ewaldi* v. B.; BRINKMANN: 3.
- 1937 *Tissotia robini* THIOLLIÈRE; SENESSE: 35, Pl. 10, Fig. 2., Pl. 11, Fig. 3.
- 1958 *Tissotia ewaldi* (VON BUCH); REYMENT: 36, Pl. 1, Figs. 1–3, Pl. 2, Fig. 1, Pl. 8, Fig. 3, Abb. 1, Text-Figs. 1–5, Abb. 2, Text-Fig. 2.
- 1973 *Tissotia cf. ewaldi* (DE BUCH); KERCKHOVE & THIEULOUY: 53, Text-Fig. 1.
- 1984 *Metatissotia ewaldi* (VON BUCH, 1848); KENNEDY: 127, Pl. 28, Figs. 4–5, Pl. 29, Figs. 9–11, Pl. 30, Figs. 1, 2, 5, 6, 8, 9, 12, Pl. 32, Figs. 1–3, Text-Fig. 40B, E.
- 1987 *Metatissotia ewaldi* (v. BUCH 1848); IMMEL: 113.
- 1995 *Metatissotia ewaldi* (VON BUCH, 1848); KENNEDY in KENNEDY et al.: 423, Pl. 18, Fig. 5, Pl. 24, Fig. 5, Pl. 25, Figs. 12–16, Pl. 26, Figs. 5, 6, Text-Fig. 28.

Types: Type specimens of *T. ewaldi* and *T. robini* from Dieulefit (France) could not be traced (KENNEDY, 1984: 127).

Material: GBA/1873/001/0006/04 (Original of REDTENBACHER, 1873: Pl. 22, Figs. 5c–i); GBA/1873/001/0006/01, 02, 03, 05; Original of Reymont, Pl. 1, Fig. 3; Text-Fig. 1, Figs. 1–3; Text-Fig. 2, Fig. 2; Reymont, Pl. 2/1 a, b; Pl. 8, Fig. 3; Original of Reymont, Pl. 1, Figs. 1a, b; Reymont, Pl. 1, Fig. 2; PIUW/1873/not registered; NHMW/1873/0014/0008, NHMW/1978/1954/0002, NHMW/1989/0050/0030 NHMW/1992/0141/0001,0002, NHMW/1992/0142/0001, NHMW/1983/0036/0001 (5 individuals), NHMW/2018/01 34/0003, 0004, 0007; SK/FA/1980/1, 2; SK/FA/1981/4–9, SK/FA/1982/12–16, SK/FA/1989/20–22, SK/FA/1990/23–25, SK/FA/2018/36, 37, SK/FA/2018/39, SK/NU/1981/2, 3, SK/NU/1981/34, SK/NU/1983/52, 54, SK/NU/1992/64, 64a; OÖLM/2021/80, 81, 82; OÖLM/1938/35.

Most of the above specimens are from the forest road Gallbach and the Schmalnauer Alpe (Salzburg). Only eight are from Nussenseebach (Upper Austria).

Description: We have numbers of specimens at our disposal. Most of them are internal moulds, some are preserved with remnants of whitish or yellowish shell, most are crushed and distorted to a certain degree. Nevertheless, measurements are still useful. Coiling is oxycone with a small umbilicus and a low vertical wall. The umbilical shoulder is abruptly rounded, the flanks moderately inflated and convergent to a high and sharp keel. In the smallest specimens of 25 mm in diameter ornament consists of prominent umbilical bullae which give rise to well-developed narrow prossiradiate ribs. These branch low on the flank into pairs of broader, lower ribs which flex across the outer flank to terminate in ventral clavi on either side of the continuous ventral keel. As size increases the umbilical bullae weaken and ornament consists of low bifurcating, flexed and sometimes rursiradiate ribs that are most obvi-

ous on the outer flank, where they terminate in blunt clavi. From 76.0 mm in diameter onwards the ribs efface whilst the clavi tend to merge onto low, semi-continuous ridges so that at larger diameters preserved, the venter is fastigate with low lateral keels and a strong siphonal keel. In the largest specimens available, the flanks are almost smooth, and ornament is reduced to a strong serrated to undulous keel flanked by a continuous row of ventrolateral clavi. The suture line is well displayed in several specimens and shows typical simplified tissotiid elements.

Discussion: We follow FALLOT (1885: 237) and KENNEDY (1984: 128) interpreting «ewaldi» and «robini» conspecific and different sizes of co-occurring “species” in French samples as a case of dimorphism. For comparison with *Metatissotia slizewiczi* (FALLOT, 1885), *Metatissotia nodosa* HYATT, 1903, *Metatissotia redtenbacheri* (DE GROSSOUVRE, 1894) and *Metatissotia desmoulini* (DE GROSSOUVRE, 1894) see KENNEDY (1984: 128–133).

Occurrence: *Metatissotia ewaldi* (VON BUCH, 1848) is a middle Coniacian species co-occurring with Peroniceratids of the *Tridorsatum*-Zone in France and Spain. A mass occurrence is described herein from Austria.

Suborder Ancyloceratina WIEDMANN, 1966

Superfamily Turrilitacaeae GILL, 1871

Family Nostoceratidae HYATT, 1894

Genus *Eubostrychoceras* MATSUMOTO, 1967

Type species: *Eubostrychoceras indopacificum* MATSUMOTO, 1967 by original designation.

Eubostrychoceras species 1

(not figured)

Compare

1996 *Eubostrychoceras* species 1; SUMMESBERGER & KENNEDY: 133, Pl. 17, Fig. 4.

Material: A single specimen (OÖLM/2021/77) with doubtful labelling: Strobl/Weißenbach.

Description: The specimen is a crushed body chamber fragment of Wh = 38.5 mm. The section appears to have been round. Ornament consists of narrow, sharp ribs with occasional bifurcations (4–5 per cm) and two broad constrictions parallel to the ribs.

Occurrence: SUMMESBERGER & KENNEDY (1996: 133) took Turonian to middle Coniacian age into consideration.

Family Diplomoceratidae SPATH, 1926
Subfamily Diplomoceratiniae SPATH, 1926
Genus *Glyptoxoceras* SPATH, 1925

Type species: *Hamites rugatus* (FORBES, 1846) by original designation of SPATH (1925: 30).

***Glyptoxoceras crispatum* (MOBERG, 1885)**

(Pl. 22, Fig. 6)

- 1885 *Anisoceras (Hamites ?) crispatum* MOBERG: 32, Pl. 3, Figs. 12, 13.
- 1995 *Glyptoxoceras crispatum* (MOBERG, 1885); KENNEDY in KENNEDY et al.: 430, Pl. 27, Figs. 16, 24, Pl. 29, Figs. 1, 8, 11, 19, 20.
- 1997 *Glyptoxoceras crispatum* (MOBERG, 1885); KENNEDY & CHRISTENSEN: 207, Fig. 24a, b.
- 2000 *Glyptoxoceras crispatum* (MOBERG, 1885); KENNEDY & KAPLAN: 96, Pl. 34, Fig. 2.
- 2017b *Glyptoxoceras crispatum* (MOBERG, 1885); SUMMESBERGER et al.: 108, Pl. 1, Figs. 11–13, Pl. 2, Fig. 5.
- 2017c *Glyptoxoceras crispatum* (MOBERG, 1885); SUMMESBERGER et al.: 189, Pl. 12, Figs. 6–13 (with synonymy).

Type: Lectotype subsequently designated by KENNEDY & CHRISTENSEN (1997: 107) is SGU type 3877 in the collections of the Geological Survey of Sweden (Sveriges geologiska undersökning).

Material: Following the label with some doubt OÖLM/1938/37 is from Bürgl at Klausmeister, Strobl (Upper Austria). We presume a small occurrence of marlstone west of the Bürglstein as the locality of its origin. Following the geological map 1:50.000 (PLÖCHINGER, 1982) it should belong to the Hochmoos Formation of Coniacian to Santonian age.

Description: OÖLM/1938/37 is a U-shaped fragment of an internal mould without shell preservation. The total length around the curvature is about 120 mm. Wh increases from 12 to 16 mm towards the aperture. Ornament consists of fine oblique, rursiradiate and undivided ribs (18 ribs per whorl height). They are coarsening a little towards the aperture. There are no constrictions nor tuberculation. Sutures are not visible.

Discussion: Regular and fine ribbing make sure that OÖLM/1938/37 is *Glyptoxoceras crispatum* (MOBERG, 1885). Comparable ornament can be seen in the Santonian occurrences of the Schattaugraben and the Finstergrabenwandl (SUMMESBERGER et al., 2017b, c).

Occurrence: Occurrences described are of Santonian age (Sweden, Germany, France, Corbières and Gosau; SUMMESBERGER et al., 2017b, c). Its occurrence at Bürgl/Klausmeister in the neighbourhood of Strobl leads to the assumption that this local occurrence is also of Santonian age.

Genus and subgenus *Neocrioceras (Neocrioceras)* SPATH, 1921

Type species: *Neocrioceras cf. spinigerum* JIMBO, 1894 by original designation of SPATH (1921).

***Neocrioceras (Neocrioceras) gosaviense* SUMMESBERGER, KENNEDY & SKOUMAL, 2017**

(Pl. 22, Fig. 7, Pl. 23, Figs. 3, 4)

- 2017b *Neocrioceras (Neocrioceras) gosaviense* SUMMESBERGER, KENNEDY & SKOUMAL: 111, Pl. 3, Figs. 4, 5.

Type: Holotype by original designation is MA/1973/1 the original of SUMMESBERGER et al. (2017b: Pl. 3, Figs. 4, 5).

Material: In addition to the holotype (MA/1973/1) from the Santonian of Tiefengraben (Gosau, Upper Austria) we have a second specimen from the upper Santonian of the Schattaugraben (Rußbach am Pass Gschütt) (MA/1976/17). Two more specimens (SK/NU/1994/69, SK/NU/1995/72) from the Coniacian of Nussenseebach (Salzburg) are described below.

Description: SK/NU/1995/72 is a single fragment of a juvenile, 75 mm long, of an internal mould, loosely coiled in a spiral in an even plane with adherent remains of shell. Parts of the mould are preserved in a rusty substance, possibly iron oxide. The whorl height enlarged by lateral compaction is from about 2 to 9 mm, whorl breadth cannot be measured. The original section might have been rounded. The original shape of the shell has been a loose spire in an even plane. The diameter of the whorl is 27.4 mm, the umbilicus measures 15 mm. Ornament consists of narrow – 4–5 per 10 mm – slightly prorsiradiate ribs without bifurcations. A few millimeters from the venter there is a single row of heavily corroded tubercles in distances of several ribs. The aperture is not preserved, and no sutures are visible. SK/NU/1994/69 is a laterally compressed fragment of 70 mm in length, Wh from 19–22 mm, loosely coiled in an even plane. Rib index is of about ten slightly convex narrow and undivided ribs. Single tubercles in distances of about ten ribs occur in a row in the external third of the flank.

Discussion: SK/NU/1995/72 – apparently a juvenile – and SK/NU/1994/69 differ from *Schlüterella* aff. *compressa* KLINGER, 1976 by their single row of tubercles. SK/NU/1994/69 closely resembles the specimens from the Santonian of the Gosau Group of the Grabenbach (SUMMESBERGER et al., 2017b) in the basin of Gosau.

Occurrence: *Neocrioceras (Neocrioceras) gosaviense* SUMMESBERGER, KENNEDY & SKOUMAL, 2017 occurs in the Santonian Gosau Group of Gosau (Upper Austria) and is present in the middle Coniacian of Nussenseebach (Salzburg) too.

Genus *Schlueterella* WIEDMANN, 1962

Type species: *Ancyloceras pseudoarmatum* SCHLÜTER, 1872 by original designation of WIEDMANN (1962). See also the discussion of KLINGER & KENNEDY (2003: 312).

Schlueterella aff. *compressa* KLINGER, 1976

(Pl. 22, Fig. 10, Pl. 23, Figs. 1, 2)

Compare

- 1873 *Hamites* spec. indet.; REDTENBACHER: 131, Pl. 30, Fig. 16.
- 1935 *Hamites* sp.; BRINKMANN: 3.
- ? 1952 *Ancyloceras* cf. *pseudoarmatum* SCHLÜT.; SCHULZ: 10.
- 1958 *Neocrioceras* aff. *pseudoarmatum* (SCHLÜTER); REYMENT: 33, Pl. 6, Fig. 2.
- 1976 *Neocrioceras* (*Schlueterella*) *compressus* KLINGER: 74, Pl. 33, Fig. 5, Text-Figs. 8j, 10g.
- 1982 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER 1976; IMMEL et al.: 25, Pl. 9, Fig. 3, Pl. 10, Figs. 1–4, Pl. 11, Fig. 3.
- 1987 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER 1976; IMMEL: 134.
- 1991 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER, 1976; KENNEDY & COBBAN: 65, Pl. 10, Figs. 1, 2, Pl. 12, Figs. 4–7, Text-Fig. 25c.
- 1995 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER, 1976; KENNEDY in KENNEDY et al.: 430, Pl. 27, Figs. 13–15, 17, Pl. 29, Figs. 4–7.
- 2003 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER, 1976; KLINGER & KENNEDY: 315, Text-Figs. 59, 60A–C, 61.
- 2005 *Neocrioceras* (*Schlueterella*) *compressum* KLINGER, 1976; KAPLAN et al.: 114, Pl. 52, Fig. 4.
- 2007 *Schlueterella compressum* KLINGER, 1976; KLINGER et al.: 109, Text-Figs. 9C, 18C, D.
- 2017b *Schlueterella compressa* KLINGER, 1976; SUMMESBERGER et al.: 112, Pl. 2, Figs. 2, 3, Pl. 5, Figs. 1, 3, 5, Pl. 6, Figs. 1–10, Tab. 3.

Type: The holotype by original designation is the original of *Neocrioceras* (*Schlueterella*) *compressus* KLINGER, 1976: 74, Pl. 33, Fig. 5, Text-Figs. 8j, 10g.

Material: Two individuals, GBA/1873/001/0037 and SK/FA/1990/26, from the Schmalnauer Alpe.

Description: GBA/1873/001/0037 is a small fragment of 23 mm length and 14.6 mm diameter with a characteristic ornament: ribs connected in pairs by tiny and sharp tubercles. Between the paired ribs are single smaller intercalatories. The specimen shows three regular rows of tubercles, the formerly existing fourth row is apparently broken away. SK/FA/1990/26 is an individual of about 50 mm length, and has a section of 15–17 mm (restored). It is a curved fragment indicating a three-dimensional original shape of the complete shell. Ribs are slightly curved, rib index is about nine somewhat crowding at the internal side of the curve. There are four bases of coarse tubercles, the tubercles themselves are broken away.

Discussion: Both specimens recall the decoration of the Santonian *Schlueterella compressa* KLINGER, 1976 (IMMEL et al., 1982: 25), which has arranged its tubercles in four rows. The kind of preservation and the stratigraphical distance limits the possibilities of identification.

Occurrence: The specimens are from the Coniacian of the Schmalnauer Alpe. An additional one (NHMW/1935/0003/0024) is from the Coniacian of Gams. Santonian examples occur in the early Santonian of Brandenberg (Tyrol), and in the early to middle Santonian of Rußbach am Pass Gschütt (Salzburg; SUMMESBERGER et al., 2017b: 112).

Subfamily Polyptychoceratinae MATSUMOTO, 1938

Genus and subgenus *Pseudoxybeloceras* WRIGHT & MATSUMOTO, 1954

Pseudoxybeloceras sp.

(not figured)

Compare

- 1996 *Pseudoxybeloceras* sp.; SUMMESBERGER & KENNEDY: 134, Pl. 18, Fig. 1.

Material: A single specimen OÖLM 2021/83 from Strobl/Weißenbach or from the Nussenseebach area (Salzburg, Austria) described and figured by SUMMESBERGER & KENNEDY (1996: 134, Pl. 18, Fig. 1).

Description and discussion: *Pseudoxybeloceras* sp. is apparently from the Middle Coniacian of Strobl/Weißenbach or the Nussenseebach area. The specimen is a U-shaped body chamber fragment with two parallel shafts. The aperture appears to be preserved. The Wh on the shorter shaft is 18.5 mm. On the smaller shaft the ornament consists of ten ribs in distance of the whorl height. The narrow ribs are straight on the longer shaft, and separated by somewhat wider intercalatories. There are four rows of transversely elongated tubercles on every rib. On the shorter and apparently terminal shaft ribs are somewhat oblique and rur-siradiate. Some of the ribs bifurcate on the curved part, some intercalate.

Occurrence: The labelling “Strobl, Wolfgangsee” is imprecise, therefore the location is unclear, and a Turonian age cannot be excluded. Elsewhere the genus ranges from Turonian to Maastrichtian (MATSUMOTO, 1977: 345).

Subgenus *Parasolenoceras* COLLIGNON, 1969

Type species: *Parasolenoceras splendens* COLLIGNON, 1969: 44 by original designation.

***Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969**

(Pl. 22, Figs. 8, 9, 11–13, Tab. 16)

- 1969 *Parasolenoceras splendens* COLLIGNON, nov. gen., nov. sp.: 44, Pl. 530, Fig. 2087.
- ? 1995 *Pseudoxybeloceras (Parasolenoceras) aff. splendens* COLLIGNON, 1969; KENNEDY in KENNEDY et al.: 431, Pl. 29, Figs. 2, 3.
- 1996 *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; WRIGHT et al.: 263, Figs. 196, 4a, b.
- 2005 *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; KAPLAN et al.: 122, Pl. 52, Figs. 3, 5, Pl. 53, Figs. 1–3, Pl. 54., Figs. 1, 2.
- 2014 *Parasolenoceras splendens* COLLIGNON, 1969; KENNEDY in WALASZCZYK et al.: 122, Figs. 32D, E.
- 2017b *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; SUMMESBERGER et al., 114, Pl. 6, Figs. 12–15.

Type: Lectotype by subsequent designation of KAPLAN et al. (2005: 122, Pl. 52, Figs. 3, 5, Pl. 53, Figs. 1–3, Pl. 54, Figs. 1, 2) is the original of COLLIGNON (1969: 44, Pl. 530, Fig. 2087).

Material: Four fragments: SK/NU/1981/35, SK/NU/1989/58 and SK/NU/1996/75; NHMW/2018/0156/0001 all from Nussenseebach.

Description: SK/NU1981/35, SK/NU/1989/58 and SK/NU/1996/75 are small fragments of internal moulds with remaining shell remnants. They have two partially preserved parallel shafts connected by a U-bend. The surface is ornamented by regular more or less straight non-bifurcating ribs. Rib index is 4–5, every rib topped on either side by a tiny tubercle in narrow distance to the venter. SK/NU/1989/58 has two collar ribs. NHMW/2018/0156/0001 is similar with a single collar rib. SK/NU/1996/75 and SK/NU/1981/35 have coarser ribs and analogously wider rib distances. The latter has square tubercles (Pl. 22, Fig. 8). NHMW/2018/0156/0001 has two parallel shafts, and the U-turn is not preserved.

Inventory No.	L (mm)	Wh (mm)	Wb (mm)
SK/NU/1981/35	52.0 _{est}	10.0 _{est}	7.0 _{est}
SK/NU/1989/58	22.0	0.4–0.6	0.4 _{est}
SK/NU/1996/75	38.0 _{est}	11.4	7.0 _{est}
NHMW/2018/0156/0001	85.0 _{est}	18.9 _{est}	11.0 _{est}

Tab. 16.

Measurements of *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; all specimens are crushed. L of NHMW/2018/0156/0001 is estimated including the U-turn, Wh is measured across both shafts; L = Length; est = estimated.

Discussion: The Santonian to Lower Campanian *Pseudoxybeloceras (Pseudoxybeloceras) quadrinodosum* (JIMBO, 1894) differs by quadriribulate ribbing. *Pseudoxybeloceras (Pseudoxybeloceras) matsumotoi* COLLIGNON, 1965 from the Coniacian of South Africa and Madagascar differs by two rows of spathulate tubercles on either side (KLINGER & KENNEDY, 2003).

Occurrence: The Coniacian occurrence expands the stratigraphical range from Coniacian (this paper) to Lower Campanian (COLLIGNON, 1969).

Family Baculitidae GILL, 1871

Genus *Baculites* LAMARCK, 1799

Type species: *Baculites vertebraialis* LAMARCK, 1801 by subsequent designation of MEEK (1876: 391).

***Baculites incurvatus* DUJARDIN, 1837**

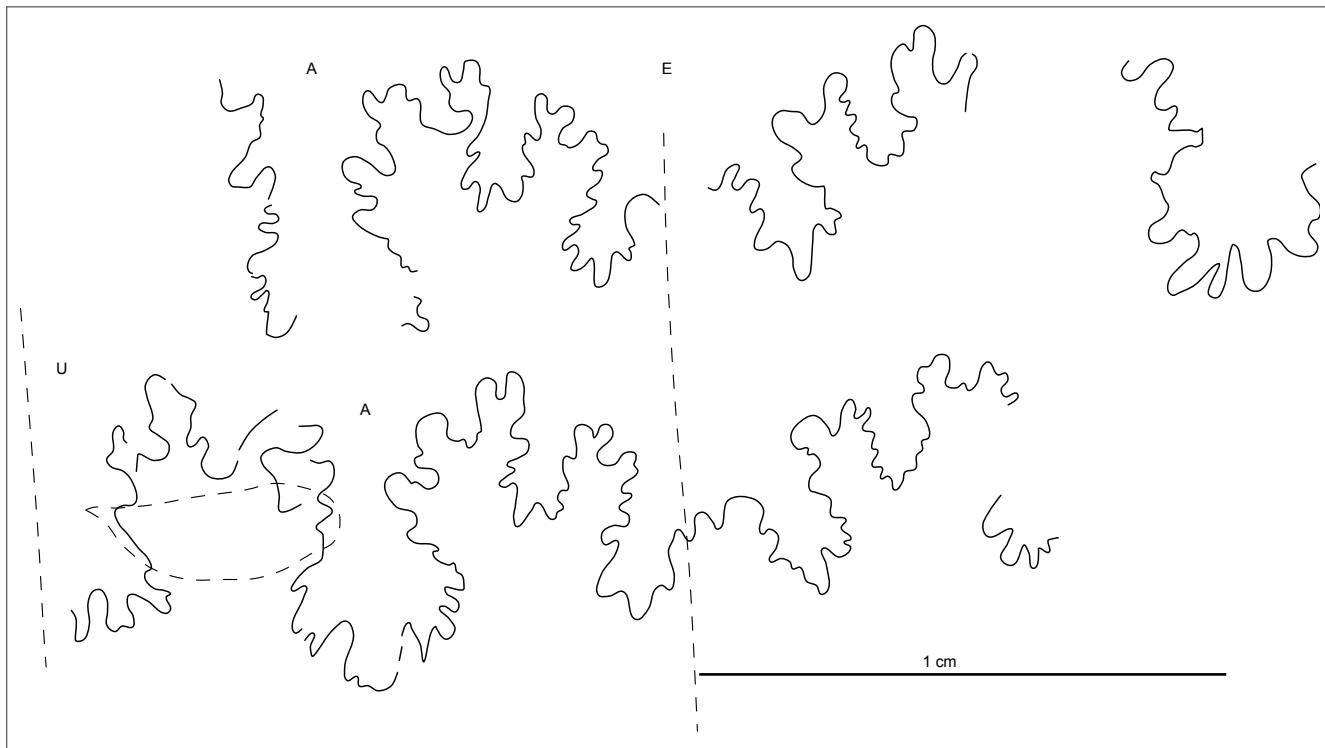
(Pl. 22, Figs. 1, 2, 4, 5, Text-Fig. 23, Tab. 17)

- 1837 *Baculites incurvatus* DUJARDIN: 232, Pl. 17, Figs. 13a–d.
- 1873 *Baculites Faujassi* LAMARCK; REDTENBACHER: 132, Pl. 30, Figs. 13a, b.
- 1882 *Baculites incurvatus* DUJARDIN 1837; IMMEL et al.: 27, Pl. 11, Figs. 5–7 (with additional synonymy).
- 1984 *Baculites incurvatus* DUJARDIN, 1837; KENNEDY: 143, Pl. 32, Figs. 12, 15–19, Pl. 33, Figs. 1–22, Text-Figs. 41, 42 (with additional synonymy).
- 1996 *Baculites incurvatus* DUJARDIN, 1837; WRIGHT et al.: 256, Figs. 199, 3d, e.
- 1997 *Baculites incurvatus* DUJARDIN, 1837; KLINGER & KENNEDY: 92, Fig. 56.
- 2000 *Baculites incurvatus* DUJARDIN, 1837; KENNEDY & KAPLAN: 106, Pl. 35, Fig. 6, Pl. 38, Figs. 1–3.
- 2001 *Baculites incurvatus* DUJARDIN, 1837; KLINGER & KENNEDY: 169, Figs. 128A–P (with synonymy).
- 2017b *Baculites incurvatus* DUJARDIN, 1837; SUMMESBERGER et al.: 115, Pl. 8, Figs. 1, 2, 4–13, Pl. 9, Figs. 1–10, Text-Figs. 3, 4, Tab. 4 (with synonymy).

Type: Lectotype by subsequent designation of IMMEL, KLINGER & WIEDMANN (1982) is the original of DUJARDIN (1837: Pl. 17, Fig. 13a), refigured by KENNEDY (1984: Pl. 33, Figs. 4–6) and again by KLINGER & KENNEDY (1997: Fig. 56).

Material: Five fragments: GBA/1873/001/0038, the original of REDTENBACHER (1873: Pl. 30, Fig. 13a, b); SK/FA/1994/32 from the Schmalnauer Alpe; SK/NU/2017/90, SK/NU/2019/92; NHMW/2018/0156/0002 (ex Skoumal collection) from Nussenseebach.

Description: All specimens are internal moulds with adherent parts of whitish shell. All are straight and crushed. All had a low tapering angle and no curved parts of the shell. The original section of the shell has been oval with a narrower dorsum. Ornament consists of concave crescentic ribs in the dorsal third of the flanks. The sutures (GBA/1873/001/0038, Text-Fig. 23) are well visible in REDTENBACHER's specimen from 1873.



Text-Fig. 23.
Baculites incurvatus DUJARDIN 1837. External suture of GBA/1873/001/0038 (REDTENBACHER's original, 1873: Pl. 30, Figs. 13a, b.) x 8.7.

Inventory No.	L (mm)	Wh (mm)	Wb (mm)
GBA/1873/001/0038	86.9	12.5	9.0
SK/FA/1994/32	138.8	17.3	11.0
SK/NU/2017/90	110.3	13.5	9 _{est}
SK/NU/2019/92	206.0	20.3	--
NHMW/2018/0156/0002	52.7	15.5	9 _{est}

Tab. 17.
Measurements of *Baculites incurvatus* DUJARDIN, 1837 from the Coniacian of the Nussenseebach and the Schmalnauer Alpe. All specimens are crushed fragments. L = Length; est = estimated.

Discussion: *Baculites incurvatus* DUJARDIN, 1837 was discussed at length by KLINGER & KENNEDY (1997, 2001) and by SUMMESBERGER et al. (2017b). Curved specimens occur in the Santonian, the Coniacian individuals of Strobl/Weißenbach are straight.

Occurrence: *Baculites incurvatus* DUJARDIN, 1837 occurs in the middle and upper Coniacian of France, Germany, Czech Republic and in the Santonian of France, the Münster Basin and in the Santonian of the Austrian Gosau Group (SUMMESBERGER et al., 2017b) and is herewith described from the middle Coniacian Gosau Group of the Strobl/Weißenbach and Nussenseebach area.

Baculites sp. (Pl. 22, Fig. 3)

Material: SK/FA/1981/10 (two fragments) from the forest road Gallbach, NHMW/1989/0050/0052, 0057 from Schmalnauer Alpe, 30 m north of the Adventist home, NHMW/2018/0209/0003 (three fragments), NHMW/2019/0056/0002 (four fragments) from Nussenseebach.

Description: All specimens are fragments of internal moulds with adherent parts of whitish shell, all are flattened by *post mortem* deformation, and all have narrow tapering angles and smooth surface but very faint growth lines on the dorsum.

Discussion: *Baculites* sp. is very close to *Baculites* sp. indet. 1 (SUMMESBERGER et al., 2017c: 194, Pl. 15, Fig. 1–3) from the Santonian of the Schattaugraben (Gosau, Rußbach am Pass Gschütt, Salzburg).

Superfamily Scaphitaceae GILL, 1871**Family Scaphitoidea GILL, 1871****Subfamily Scaphitinae GILL, 1871****Genus *Scaphites* PARKINSON, 1811**

Type species: *Scaphites equalis* J. SOWERBY, 1813 subsequently designated by MEEK (1876).

***Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891**

(Pl. 24, Figs. 6–25, Text-Figs. 24, 25, Tab. 18)

- 1872 *Scaphites Geinitzii* D'ORBIGNY; SCHLÜTER: 75, pars, Pl. 23, Figs. 12, 13, 14–16, 23–25 only, Pl. 27, Fig. 9.
- 1873 *Scaphites* sp. indet. cfr. *Scaphites constrictus* Sow.; REDTENBACHER: 130, Pl. 30, Fig. 12.
- 1891 *Scaphites Kieslingswaldensis* LANGENHAN & GRUNDEY: Pl. 1, Fig. 1.

- 1894 *Scaphites Meslei* DE GROSSOURE: 239, Pl. 32, Figs. 4, 7.
- 1894 *Scaphites Lamberti* DE GROSSOURE: 241, Pl. 32, Figs. 1, 5.
- 1894 *Scaphites Potieri* DE GROSSOURE: 242, Pl. 22, Fig. 3.
- 1897 *Scaphites binodosus* RÖMER; FRITSCH: 37, Fig. 20.
- 1901 *Scaphites Kieslingswaldensis* LANGENHAN & GRUNDEY; STURM: 61, Pl. 3, Fig. 8.
- ? 1907 *Scaphites Lamberti* DE GROSSOURE; BOULE, LEMOINE & THÉVENIN: 31, Pl. 6, Figs. 7, 8.
- 1913 *Scaphites Kieslingswaldensis* LANGENHAN & GRUNDEY; SCUPIN: 101.
- 1934 *Scaphites Kieslingswaldensis* LANGENHAN & GRUNDEY; ANDERT: 402, Pl. 19, Fig. 5.
- 1956 *Scaphites* cf. *meslei* GROSS.; GERTH: 433, Text-Fig. 1.
- 1958 *Scaphites* aff. *lamberti* DE GROSSOURE; REYMENT: 33, Pl. 6, Fig. 1.
- 1961 *Scaphites* cf. *meslei* GROSS.; GERTH: 191, Pl. 24.

Inventory No	tL (mm)	tW (mm)	Wsh (mm)	Dsp (mm)	U (mm)	U (%)
SK/NU/1981/7	41.4	32.5	17.1	--	--	--
SK/NU/1981/8	24.6	22.8	12.3	12.8 _{est}	--	--
SK/NU/1981/12	36.6	27.1	24.8	--	--	--
SK/NU/1981/15	28.5	33.3	15.8 _{est}	--	--	--
SK/NU/1981/23	40.0	29.6	17.6	23.1	4.1.	17.7
SK/NU/1981/27	34.6	27.6	15.6	16 _{est}	--	--
SK/NU/1981/31	33.8	21.1	12.1	--	--	--
SK/NU/1981/38	45.2	--	16.8	--	--	--
SK/NU/1981/40c	30.0	21.0	11.5	16.0	3.1	19.3
SK/NU/1981/43	32.5	22.5	--	--	--	--
SK/NU/1983/53	39.8	29.7	16.8	21.9	3.4	15.5
SK/NU/1983/55	39.6	29.8	21.3	21.2	3.1	14.6
SK/NU/1990/61	41.0	30.6	15.0	19.6	3.0	15.3
SK/NU/1992/63	39.0	27.0	15.2	19.2	3.7	19.2
SK/NU/1995/70	38.3	32.8	15.8	18.5	4.6	25.0
SK/NU/1995/71	35.0	27.4	15.6	18.1	3.1	17.1
SK/NU/2002/84	41.7	26.5	15.4	23.6	3.4	14.4
SK/NU/2002/85	40.0	26.7	15.6	25.2	--	--
NHMW/1935/0003/0042	40.3	30.4	15.2	27.7	3.3	11.9
NHMW/1978/1956/0001	34.0	--	14.9	--	2.2	--
NHMW/2018/0176/0001	35.0	31.0	17.8	20.0	3.2	16.0
NHMW/2018/0176/0002	39.4	33.0	15.0	22.9	4.0	17.5
NHMW/2018/0176/0003	40.4	26.6	14.2	19.8	2.8	14.1

Tab. 18.

Measurement of the Middle Coniacian *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; Dimensions in mm. tL = total length, tW = total width, Wsh = shaft width, Dsp = diameter spire, U = umbilicus spire, U % spire = % of Dsp., est = estimated.

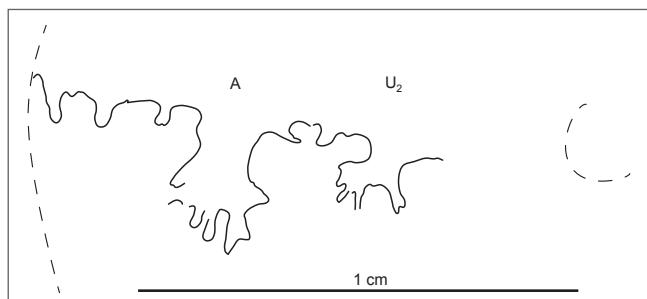
- 1965 *Scaphites meslei* DE GROSSOUIRE var. *masiaposensis* COLLIGNON: 16, Pl. 420, Fig. 1739.
- 1965 *Scaphites arnaudiformis* COLLIGNON: 17, Pl. 420, Fig. 1743.
- Non 1979 *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY; WRIGHT: 303, Pl. 3, Figs. 10–12 (= *Sc. geinitzii*).
- 1984 *Scaphites (Scaphites) meslei* DE GROSSOUIRE; KENNEDY: 148, Pl. 31, Figs. 1–13, 15–19 (non 14 = *Scaphites compressus* D'ORBIGNY, 1842).
- 1987 *Scaphites (Scaphites) meslei* DE GROSSOUIRE; IMMEL: 137, Pl. 14, Figs. 13, 14.
- 1987 *Scaphites kieslingswaldensis kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; KAPLAN et al.: 14, Pl. 4, Figs. 3–6, Pl. 5, Figs. 1–5 (with synonymy).
- 1991 *Scaphites kieslingswaldensis kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; KENNEDY & CHRISTENSEN: 222, Pl. 3, Fig. 2, Pl. 4, Figs. 2, 6, Pl. 6, Fig. 1.
- 1992 *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; VAŠÍČEK: 185, Pl. 8, Figs. 1–3, Text-Figs. 12, 13.
- 1994 *Scaphites (Scaphites) kieslingswaldensis kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; KAPLAN & KENNEDY: 60, Pl. 40, Figs. 9–14, Pl. 41, Figs. 1–13.
- 2013 *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; KENNEDY & KLINGER: 529, Pl. 1, Figs. 1–29, Pl. 2, Figs. 1–9, 14–17, Pl. 3, Figs. 1–17, Fig. 6c (with additional synonymy).
- 2016 *Scaphites geinitzii intermedius* SCUPIN, 1913; KLEIN: 54–70 (with additional synonymy).
- 2016 *Scaphites kieslingswaldensis kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; KLEIN: 54, 80 (with additional synonymy).
- Xxxx *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; ČECH et al.: in prep.

Type: Holotype by monotypy is the original of LANGENHAN & GRUNDEY (1891: Pl. 1, Fig. 1) refigured by FRITSCH (1897: Fig. 20) and again by STURM (1901: Pl. 3, Fig. 8).

Material: SK/NU/1981/4, 7, 8, 10, 12, 15, 23, 27, 30, 31, 37, 38, 40c, 43; SK/NU/1983/53, 55, 56; SK/NU/1989/59; SK/NU/1990/61; SK/NU/1991/62; SK/NU/1992/63; SK/NU/1995/70, 71; SK/NU/2002/84, 85; SK/NU/2005/86; SK/NU/2017/89; SK/NU/2019/93, 95, 96; NHMW/1935/0003/0033a, b, 0034, 0042; NHMW/1978/1956/0001; NHMW/1989/0050/0066;



Text-Fig. 24.
Scaphites kieslingswaldensis LANGENHAN & GRUNDEY, 1891, SK/NU/2019/95, Nussenseebach. Specimen with distinctly visible spines, prolongations of the neighbouring "tubercles".



Text-Fig. 25.

External suture of *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891, SK/NU/1981/7, Nussenseebach, Strobl/Weißenbach, Salzburg.

NHMW/2018/0176/0001 (ex JEKEL collection); NHMW/2018/0176/0002, 0003; GBA/1873/001/0035; GBA/1935/001/0021; numerous unregistered individuals. Except for two specimens from the Fahrenberg area and one fragment from the tunnel section north of Bad Ischl are all from Nussenseebach.

Description and discussion: A detailed revision of *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891 was given by KAPLAN et al. (1987) and again by KAPLAN & KENNEDY (1994) on the base of German and English material. The Austrian material from the Gosau Group is in general flattened by *post mortem* deformation. Ribbing and tuberculation leaves no doubt about the identification of the Austrian specimens. Practically all specimens are internal moulds with preserved shell or shell fragments.

Occurrence: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891 is limited to the Coniacian of Europe and Madagascar. First appearance is at the base of the lower Coniacian *Petrocoriensis* Zone, main occurrence in the middle Coniacian. In Austria it is a mass occurrence in a grey marlstone of the Grabenbach Formation (Gosau Group, Nusseenseebach; WAGREICH, 1998). Further individuals are from separated middle Coniacian localities at Strobl/Weißenbach and one fragment from the tunnel section north of Bad Ischl.

Scaphites sp. (not figured)

Compare

2017b *Scaphites* sp.; SUMMERSBERGER et al.: 120, Pl. 7, Figs. 9–11, Tab. 7.

Material: Two specimens described in SUMMERSBERGER et al. (2017b): SK/EB/1985/7 from Edlbachgraben (Upper Austria) and SK/RA/1996/130 from Randobach (Salzburg).

Occurrence and discussion: The occurrence of *Scaphites* sp. is said (SUMMERSBERGER et al., 2017b: 120) to be of early Santonian age. Both individuals occur in the lowest part of the sections in the Randobach (Rußbach am Pass Gschütt, Salzburg) and in the Edlbachgraben (Gosau, Upper Austria), in the latter together with *Peroniceras* sp. and *P. serratomarginatus*. This leads to the idea, that possibly both individuals belong to the uppermost Coniacian. Also *Scaphites* cf. *meslei* GROSSOUIRE, 1894 (GERTH, 1956, 1961) from the lowest part of the Nefgraben (Rußbach am Pass Gschütt, Salzburg) might be upper Coniacian.

Subfamily Otoscaphitinae WRIGHT, 1953

Type species: *Ammonites ? bladenensis* SCHLÜTER, 1871: 30, Pl. 10, Figs. 5, 6 subsequently designated by WRIGHT (1953: 475).

Genus *Yezoites* YABE, 1910

Type species: *Scaphites perrini* ANDERSON, 1902 subsequently designated by DIENER (1925: 213).

Yezoites arnaudi (DE GROSSOUIRE, 1894)

- (Pl. 23, Figs. 5–22, Pl. 24, Figs. 1–5, Text-Fig. 26, Tab. 19).
- 1872 *Scaphites auritus* FRITSCH & SCHLÖNBACH; FRITSCH: 44, Pl. 13, Figs. 9, 11, 13–15.
 - 1873 *Scaphites* sp. indet. cfr. *auritus* SCHLÜTER; REDTBACHER: 30, Pl. 30, Figs. 11a, b.
 - 1894 *Scaphites Arnaudi* DE GROSSOUIRE: 242, Pl. 32, Figs. 8a, b.
 - 1894 *Scaphites Fritschi* DE GROSSOUIRE: 243.
 - 1909 *Scaphites arnaudi* DE GROSSOUIRE; SCHMIDT: 244.
 - 1911 *Hoploscaphites Arnaudi* DE GROSSOUIRE; NOWAK: 66.
 - 1925 *Discoscaphites Arnaudi* GROSSOUIRE 1894; DIENER: 209.
 - 1927 *Scaphites arnaudi* DE GROSSOUIRE; REESIDE: 28.
 - 1934 *Scaphites auritus* SCHLÜTER; ANDERT: 401.
 - 1935 *Scaphites auritus* FRITSCH & SCHLÖNBACH; BRINKMANN: 2, 3 (= *Scaphites fritschi* DE GROSSOUIRE, 1894).
 - ? 1979 *Scaphites* cf. *arnaudi* DE GROSSOUIRE; COLLIGNON et al.: 387, 389.
 - 1984 *Otoscaphites arnaudi* (DE GROSSOUIRE, 1894); KENNEDY: 150, Pl. 31, Figs. 20–24, Text-Figs. 42A, B.

- 1987 *Scaphites (Scaphites) arnaudi* DE GROSSOUIRE 1894; IM-MEL: 137, Pl. 14, Fig. 10.
- 1994 *Yezoites arnaudi* (DE GROSSOUIRE, 1894); KAPLAN & KENNEDY: 62.
- ? 1994 *Yezoites* sp. KAPLAN & KENNEDY: 62, Pl. 40, Figs. 1–4.
- 2016 *Yezoites arnaudi* (DE GROSSOUIRE, 1894); KLEIN: 10, 12 (with additional synonymy).

Type: Lectotype subsequently designated by KENNEDY (1984: 150) is the original of DE GROSSOUIRE (1894: Pl. 32, Figs. 8a, b).

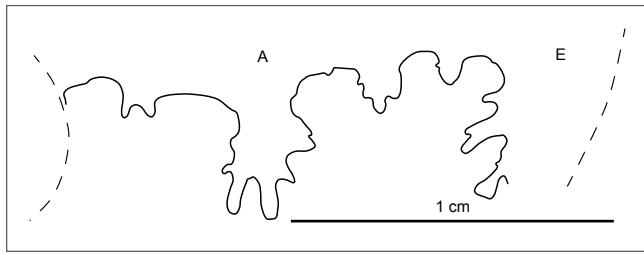
Material: SK/NU/1981/6, 9, 11, 14, 24, 42a, b, d, 44, SK/NU/1982/49, SK/NU/1983/57, SK/NU/1993/65, 67, SK/NU/1996/74, SK/NU/2005/87; SK/FA/1989/19, SK/FA/1993/31, SK/FA/1994/33; HNS/6408/9; GBA/1935/001/0004, GBA/1935/001/0009; NHMW/1935/0003/0035, NHMW/1978/1956/0002, NHMW/1983/0071/0001, NHMW/1989/0050/0061, 0062, 0064, 0065, NHMW/2018/0161/0001; PIUW/not registered; numerous unregistered individuals; ten specimens are from the Fahrenberg area (Salzburg), all others are from Nussenseebach (Upper Austria).

Description: As the whole material is crushed to a certain degree, whorl breadth cannot be measured with certainty. All individuals are internal moulds with adherent shell remains. In some cases the suture line (Text-Fig. 26) can be observed. In a few individuals the aperture is preserved, sometimes with bulge and lappets (Pl. 23, Figs. 18, 20; SK/NU/1981/42b, d). Three distinct parts are building up the shell: the chambered spire consisting of several whorls. It measures 10–20 mm in diameter, the umbilicus is 20–30 % of the diameter. Ornament on the coiled portion of the phragmocone comprises closely spaced comma-shaped umbilical bullae which give rise to pairs of delicate flexuous prorsiradiate ribs, convex at midflank, concave across the outer flank and passing over the venter with a shallow

Inventory No.	tL (mm)	tW (mm)	Wsh (mm)	Dsp (mm)	U (mm)	U (%)
SK/NU/1981/9	22	16.4	6.3	8.2	2.8	34
SK/NU/1981/14	32.5	24.1	9.9	10.6	4.8	30
SK/NU/1981/24	25.6	23.9	10.1	13.9	4.4	31.65
SK/NU/1981/42b	21.0	19.3	9.5	18.4	4.1	22.3
SK/NU/1981/42d	24.4	18.5	8.6	13.4	3.1	23.13
SK/NU/1981/44	23.8	16.6	6.0	--	--	--
SK/NU/1982/49	31.7	21.2	10.8	14.9	3.7	24.8
SK/NU/1983/57	21.6	19.5	7.8	11.9	2.6	21.8
SK/NU/1993/67	----	--	--	16.0	3.3	20.6
SK/NU/1996/74	27.4	19.9	8.3	19.7	4.1	20.8
NHMW/1989/0050/0061	20.0	20.5	7.9	12.5	3.6	28.9
NHMW/1989/0050/0062	21.9	16.8	7.9	11.0	3.7	33.6
NHMW/2018/0161/0001	25.4	20.4	9.3	13.3	4.1	30.8

Tab. 19.

Measurement of the Middle Coniacian *Yezoites arnaudi* (DE GROSSOUIRE, 1894); dimensions in mm. tL = total length, tW = total width, Wsh = shaft width, Dsp = diameter spire, U = umbilicus spire, U % spire = % of Dsp.



Text-Fig. 26.
Suture of *Yezoites arnaudi* (DE GROSSOURE, 1894), SK/NU/1981/42d, Nussenseebach, Strobl/Weißenbach, Salzburg.

convexity. Single short intercalated ribs arise on the outer flank between the pairs of long ribs. The body chamber consists of the straight to slightly concave shaft and the final hook. The restored whorl section is round, with flattened flanks and an arched venter. The initial part of the body chamber bears the same style of dense flexuous ribbing, somewhat weakened on the inner flank, and strengthened across ventrolateral shoulders and venter. Ornament on the shaft and final hook consists of straight, short and distant coarse ribs on the flank ending abruptly in a ventrolateral tubercle, which is the splitting point for the straight dichotomous ventrolateral ribs. Short ribs are intercalated. Towards the aperture a constriction and a subsequent bulge are finishing the ornamentation. The lateral lappets are in most cases damaged or broken away.

Discussion: *Yezoites arnaudi* (DE GROSSOURE, 1894) is smaller and slimmer than the co-occurring *Scaphites* (*Scaphites*) *kieslingswaldensis* *kieslingswaldensis* LANGENHAN & GRUNDEY, 1891. *Yezoites puerulus* (JIMBO, 1894) is very similar in its general shape and its ornamentation at the shaft. It differs by loss of ornament at the last part of the hook. *Y. perini* (ANDERSON, 1902) is also smooth from the U-turn of the body chamber to the aperture. Its flank ribs are bullate and radially elongated. *Yezoites planus* (YABE, 1910) differs in its scarcely occurring radial umbilical elongated bullae and a slight dorsal inflation of the shaft. *Yezoites* sp. (KAPLAN & KENNEDY, 1994: 62, Pl. 40, Figs. 1–4) differs in its distant prorsiradiate flank ribs on the hook, which are widening towards the external margin. *Yezoites arnaudi* (DE GROSSOURE, 1894) differs from *Yezoites orbignyi* KENNEDY in KENNEDY et al., 1995 from the upper Coniacian to lower Santonian of the Corbières renamed after *Scaphites compressus* D'ORBIGNY, 1842 (see KENNEDY in KENNEDY et al., 1995: 433) in its distinct tuberculation until the end of the body chamber.

Occurrence: *Yezoites arnaudi* (DE GROSSOURE, 1894) occurs in the Coniacian of the Charente inférieure, and is for the first time described from the upper Coniacian of the Austrian Gosau Group.

Discussion

Chronostratigraphic Significance of Ammonite Assemblages

The Coniacian ammonite assemblages investigated in this study give evidence for the presence of ammonite-defined biozones of the middle and upper Coniacian in the Austrian Gosau Group sections.

Barroisiceratininae, Peroniceratidae, Tissotiidae, Baculitidae and Scaphitidae are the most common taxa in the ammonite sites at Nussenseebach, Fahrenberg and Strobl/Weißenbach, appearing to represent the lower to middle part of the middle Coniacian *Peroniceras tridorsatum* Zone, including the presence of the eponymous species. Nannofossil assemblages still indicate CC13/UC9, below the first occurrence of *Micula* spp. (WAGREICH, 1992, 1998). The base of *Micula staurophora* (first occurrence defines UC10 of BURNETT, 1998) was reported by WAGREICH (1998) from the Nussenseebach section.

The lower part of the upper Coniacian *Gauthiericeras margae* Zone occurs both in the Nussenseebach section and south of the City of Salzburg. The nannofossil *Lithastrinus grillii* (first occurrence defines the late Coniacian UC11 of BURNETT, 1998) seems to have its first occurrence within this zone, above the first occurrence of *Micula staurophora* (= *Micula decussata* of WAGREICH, 1992, 1998).

The upper part of the upper Coniacian *Paratexanites serrato-marginatus* Zone, repeatedly described from the surrounding of the Glanegg castle near Salzburg, occurs also in the road tunnel section north of Bad Ischl, the Nussenseebach and the Edlbachgraben of the Gosau area. According to nannofossil data, these section parts range into nannofossil zone UC11 (WAGREICH, 1998).

Local Distribution of Coniacian Ammonite Faunas

Coniacian ammonite faunas in the Strobl/Weißenbach and Nussensee area and the tunnel section north of Bad Ischl are irregularly distributed. There are mass occurrences of single taxa, which are otherwise scarcely found or not at all present in nearby sites.

- Metatissotia ewaldi* (VON BUCH, 1848) appears in a local mass occurrence at the embankment of the forest road Gallbach and is frequently found at other locations in the Fahrenberg area.
- Tissotiodes haplophyllus* (REDTENBACHER, 1973) is concentrated at a single site 30 m north of the Adventist home at Schmalnauer Alpe. Only one specimen is from the Hinterbach forest road. *Metatissotia ewaldi* (VON BUCH, 1848) was not recorded from this locality. A co-occurrence of *Tissotiodes* and *Metatissotia* seems unlikely. *Tissotiodes haplophyllus* does not occur in the Nussenseebach area nor at the tunnel section north of Bad Ischl.
- Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891 occurs together with *Yezoites arnaudi* (DE GROSSOURE, 1894) in large numbers at the Nussenseebach. Both occur infrequently at the Fahrenberg area, *Yezoites arn-*

audi being the dominant one there. We have only two specimens of *Scaphites kieslingswaldensis* from Fahrenberg and one fragment from the tunnel section north of Bad Ischl.

- d. *Forresteria (Forresteria) alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907) appears frequently and exclusively in the tunnel section north of Bad Ischl. Neither *Tissotiooides haplophyllus* (REDTENBACHER, 1973) nor *Metatissotia ewaldi* (VON BUCH, 1848) occur at this locality. Scaphitidae are very rare.

The fact of a very uneven distribution of several taxa, with mass occurrences at one site, and missing representatives at nearby sites of nearly the same age is striking and needs explanation. However, due to the outcrop situation, the status of collections, and the strong regional faulting, continuous sections and continuous ammonite assemblage evolution could not be documented at all. The uneven distribution may be mainly due to the primary differences in sedimentary environments and the strong topographic changes induced by synsedimentary faulting and differential subsidence and uplift of the Gosau basins (WAGREICH & DECKER, 2001). Also, syndepositional local erosion and reworking may have played a role as evidenced by common mass flows and slumps in deeper-water settings (WAGREICH & FAUPL, 1994). Due to the pronounced topography on this tectonically active margin along the northwestern Tethyan ocean as represented by the Northern Calcareous Alps there may have also existed different water masses fostering palaeoecological niches, and different seaway connections leading to intermittent cooler and warmer currents. In addition, the poor outcrop situation may have contributed to the patchy distribution of ammonite-rich strata, and overthrusting and strike-slip faulting may have also played a role in juxtaposing originally separated depositional subbasins.

Conclusions

A review and reassessment of the Coniacian ammonite assemblages and collections from the Northern Calcareous Alps, including new and revised data (e.g. *Forresteria (Forresteria) alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907) from the road tunnel north of Bad Ischl) resulted in a total of 41 taxa of cephalopods. Middle and upper Coniacian ammonite assemblages of the Gosau Group in the Salzkammergut are dominated by Barroisiceratinae, Peroniceratidae, Tissotiidae, Baculitidae and Scaphitidae. Thirteen ammonite taxa date back to the tremendous work of REDTENBACHER (1873). The mass occurrence of Scaphitidae in the Nussenseebach section may indicate a short time interval of cooler temperature in the middle Coniacian. Further Ancyloceratina are rather scarce. Upper Coniacian ammonites (e.g. *Gauthiericeras*) of the Gosau Group occur south of the City of Salzburg (Glanegg).

List of Taxa

- Angulithes westphalicus* (SCHLÜTER, 1872)
- Cimomia gosavica* (REDTENBACHER, 1873)
- Tetragonites cf. epigonus* KOSSMAT, 1895
- Saghalinites nuperus* (VAN HOEPEN, 1921)
- Pseudophyllites postremus* (REDTENBACHER, 1873)
- Gaudryceras mite* (HAUER, 1866)
- Gaudryceras sp.*
- Anagaudryceras subtililineatum* (KOSSMAT, 1895)
- Jimboiceras cf. reyi* COLLIGNON, 1983
- Hauericeras lagarum* (REDTENBACHER, 1873)
- Hauericeras schlueteri* (REDTENBACHER, 1873)
- Nowakites savini* (DE GROSSOUIRE, 1894)
- Forresteria (F.) alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907)
- Peroniceras (P.) tridorsatum* (SCHLÜTER, 1867)
- Peroniceras (P.) eugnamtum* (REDTENBACHER, 1873)
- Peroniceras (P.) czoernigi* (REDTENBACHER, 1873)
- Peroniceras (P.) subtricarinatum* (D'ORBIGNY, 1850)
- Peroniceras sp. indet.*
- Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873)
- Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873)
- Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873)
- Peroniceras (Zuluiceras) sp. indet. 1*
- Ishikariceras sp. indet.*
- Gauthiericeras margae* (SCHLÜTER, 1867)
- Protexanites (P.) cf. bourgeoisianus* (D'ORBIGNY, 1850)
- Protexanites (P.) cf. bontanti* (DE GROSSOUIRE, 1894)
- Protexanites (P.) sp. indet. juv.*
- Paratexanites serratomarginatus* (REDTENBACHER, 1873)
- Tissotiooides (T.) haplophyllus* (REDTENBACHER, 1873)
- Metatissotia ewaldi* (VON BUCH, 1848)
- Eubostrychoceras species 1*
- Glyptoxoceras crispatum* (MOBERG, 1885)
- Neocrioceras (N.) gosaviense* SUMMESBERGER, KENNEDY & SKOUMAL, 2017
- Schlüterella aff. compressa* KLINGER, 1976
- Pseudoxybeloceras sp.*
- Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969
- Baculites incurvatus* DUJARDIN, 1837
- Baculites sp.*
- Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891
- Scaphites sp.*
- Yezoites arnaudi* (DE GROSSOUIRE, 1894)

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References

- AGASSIZ, A. (1847): Nomenclatoris zoologici index universalis continens nomina systematica classium, ordinum, familiarum et generum animalium omnium, tam viventium quam fossilium. – 1155 pp., Solodurum.
- ANDERSON, F.M. (1902): Cretaceous Deposits of the Pacific Coast. – Proceedings of the California Academy of Sciences, Series 3, Geology, **2/1**, 1–154, San Francisco.
- ANDERT, H. (1934): Die Kreideablagerungen zwischen Elbe und Jeschen. 3. Die Fauna der obersten Kreide in Sachsen, Böhmen und Schlesien. – Abhandlungen der Preußischen Geologischen Landesanstalt, Neue Folge, **159**, 1–477, Berlin.
- ATABEKIAN, A.A. & AKOPIAN, V.T. (1972): Late Cretaceous ammonites from the Armenian SSR (Collignoniceratinae, Peroniceratinae). – Izvestiya Akademii Nauk Armyanskoy SSR, **2**, 3–12, Erevan. [in Russian]
- BASSE, E. (1939): Sur quelques mollusques crétacés des Corbières méridionales. – Bulletin de la Société géologique de France (series 5), **9**, 35–58, Paris.
- BASSE, E. (1947): Paléontologie de Madagascar – 26. Les peuplements Malgaches de *Barroisiceras* (Révision du genre *Barroisiceras* DE GROSS.). – Annales de Paléontologie, **33**, 99–190, Paris.
- BAYLE, E. (1878): Fossiles principaux des terrains. – Explication de la Carte géologique de la France, **4/1**, 1–158, Paris.
- BUCH, L.v. (1848): Über Ceratiten. – Physikalisch Mathematische Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin, 1–33, Berlin.
- BIOLLET, M. & COLLIGNON, M. (1983): Biostratigraphie et paléontologie des ammonites du Sénonien inférieur de Rennes-les-Bains – Sougraigne (Aude) (zone sous-pyrénéenne orientale). Documents des Laboratoires de géologie de Lyon, **H.S. 6 (1981)**, 175–223
- BLAINVILLE, D. DE (1825): Manuel de malacologie et de conchyliologie. – 664 pp., Paris.
- BOULE, M., LEMOINE, P. & THÉVENIN, A. (1907): Paléontologie de Madagascar – III. Céphalopodes crétacés des environs de Diego-Suarez. – Annales de Paléontologie, **1**, 173–192 (1–299), Pls. 14–20 (1–7); **2**, 1–56 (21–76), Paris.
- BRINKMANN, R. (1935): Die Ammoniten der Gosau und des Flysch in den nördlichen Ostalpen. – Mitteilungen des Geologischen Staatsinstituts Hamburg, **15**, 1–14, Hamburg.
- BURNETT, J.A. with contributions from GALLAGHER, L.T. & HAMPTON, M.J. (1998): Upper Cretaceous. – In: Bown, P.R. (Ed.): *Calcareous Nannofossil Biostratigraphy*. – British Micropalaeontological Society Publications Series, 132–199, London (Chapman and Hall).
- ČECH, S., KENNEDY, W.J. & SUMMESBERGER, H. (in prep.): On some Upper Turonian, Lower and Middle Coniacian ammonites from the Czech Republic. – Acta Geologica Polonica, Warszawa.
- COLLIGNON, M. (1948): Ammonites néocrétacées du Menabe (Madagascar), 1. Les Texanitidae. – Annales Géologiques du Service des Mines de Madagascar, **13**, 7–60 (63–116), Paris.
- COLLIGNON, M. (1952): Ammonites néocrétacées du Menabe (Madagascar). II. Les Pachydiscidae. – Travaux du Bureau Géologique du Haut Commissariat de Madagascar et Dépendances, **41**, 1–114, Tananarive.
- COLLIGNON, M. (1955): Ammonites néocrétacées du Menabe (Madagascar). II. Les Pachydiscidae. – Annales Géologiques du Service des Mines de Madagascar, **21**, 98 pp., Paris.
- COLLIGNON, M. (1956): Ammonites néocrétacées du Menabe (Madagascar). IV. Les Phylloceratidae. V. Les Gaudryceratidae. VI. Les Tetragonitidae. – Annales Géologiques du Service des Mines de Madagascar, **23**, 106 pp., Paris.
- COLLIGNON, M. (1965): Atlas des fossiles caractéristiques de Madagascar (Ammonites), XIII (Coniacien). – 88 pp., Tananarive Service Géologique, Tananarive.
- COLLIGNON, M. (1969): Atlas des fossiles caractéristiques de Madagascar (Ammonites), XV (Campanien inférieur). – xi + 216 pp., Tananarive Service Géologique, Tananarive.
- COLLIGNON, M. (1983): Les faunes d'ammonites du Santonien. – In: BIOLLET, M. & COLLIGNON, M., Biostratigraphie et paléontologie des Ammonites du Sénonien inférieur de Rennes-les-Bains-Sougraigne (Aude). Zone sous-Pyrénéenne orientale. – Documents Laboratoire Géologique Faculté Scientifique Lyon, **H.S. 6 (1981)**, 184–223, Lyon.
- COLLIGNON, M., CREGUT, S., FABRE-TAXY, J., PHILIP, J. & TRONCHETTI, G. (1979): Ammonites du Coniacien de Provence. – Géologie méditerranéenne, **6/3**, 385–394, Marseille.
- CONRAD, T.A. (1866): Observations on recent and fossil shells, with proposed new genera and species. – American Journal of Conchology, **2**, 101–103, Philadelphia.
- CUVIER, G. (1797): Second Mémoire sur l'organisation et les rapports des animaux à sang blanc, dans lequel on traite de la structure des Mollusques et de leur division en ordre, lu à la société d'Histoire Naturelle de Paris, le 11 prairial an troisième [30 May 1795]. – Magasin Encyclopédique, ou Journal des Sciences des Lettres et des Arts, **1795/2**, 433–449, Paris.
- DECKER, K., PERESSON, H. & FAUPL, P. (1994): Die miozäne Tektonik der Östlichen Kalkalpen: Kinematik, Paläospannungen und Deformationsaufteilung während der „lateralen Extrusion“ der Zentralalpen. – Jahrbuch der Geologischen Bundesanstalt, **137**, 5–18, Wien.
- DESIO, A. (1920): La creta nel Bacino di Firenze. – Paleontographica Italica, **26**, 189–241, Pisa.
- DIENER, C. (1925): Ammonoidea neocretacea. – Fossilium Catalogus I: Animalia, pars 29, 244 pp., Berlin.

- DUJARDIN, F. (1837): Mémoire sur les couches du sol en Touraine et description des coquilles de la craie et des Faluns. – Mémoires de la Société Géologique de France, **2/2**, 211–311, Paris.
- FABRE-TAXY, S. (1963): Faunes du Coniacien et du Santonien de Provence. 12. Les ammonites du Basin du Beausset (Var). – Annales de Paléontologie, **49**, 100–126, Paris.
- FALLOT, M. (1885): Étude géologique sur les étages moyens et supérieurs du terrain Crétacé dans le sud-est de la France. – Thèse, Annales des Sciences Géologiques, **18**, 1–263, Paris.
- FISCHER, J.-C. & GAUTHIER, H. (2006): Révision critique de la Paléontologie française d'Alcide d'Orbigny. Volume IV: Céphalopodes crétacés. – 292 pp., Paris.
- FÖZY, I. (2001): Campanian (Late Cretaceous) cephalopods from Sümeg (Transdanubian Central Range, Hungary). – Fragmenta Palaeontologica Hungarica, **19**, 25–37, Budapest.
- FRANK, J. (2010): Taxonomy and palaeoecology of Cretaceous nautilids *Angulithes galea* (FRITSCH in FRITSCH & SCHLÖNBACH, 1872) and *Angulithes westphalicus* (SCHLÜTER, 1872). – Bulletin of Geosciences, **85/3**, 487–496, Prague.
- FRITSCH, A. (1872): Cephalopoden der Böhmisches Kreideformation. (Unter Mitwirkung des † Dr. URBAN SCHLÖNBACH). – 124 pp., Prague.
- FRITSCH, A. (1889): Studien im Gebiete der Böhmisches Kreideformation. Paläontologische Untersuchungen der einzelnen Schichten. IV. Die Teplitzer Schichten. – Archiv der naturwissenschaftlichen Landesdurchforschung von Böhmen (Geologische Abtheilung), **7/2**, 1–119, Prague.
- FRITSCH, A. (1897): Studien im Gebiet der Böhmisches Kreideformation. Paläontologische Untersuchungen der einzelnen Schichten. VI. Die Chlomeker Schichten. – Archiv der naturwissenschaftlichen Landschaftsdurchforschung von Böhmen (Geologische Abtheilung), **10/4**, 5–83, Prague.
- GALEOTTI, M.H. (1837): Mémoire sur la constitution géognostique de la province de Brabant, en reponse a la question suivante: décrire la constitution géologique de la province de Brabant, déterminer avec soin les espèces minérales et les fossiles que les divers terrains renferment et indiquer la synonymie des auteurs qui en ont déjà traité. – Mémoires couronnés de l'Academie Royale de Science de Belgique, **12**, 1–192, Bruxelles.
- GERTH, H. (1956): Ein neuer Fund eines Scaphiten aus den unteren Gosaumergeln der Gosau und seine stratigraphische Bedeutung. – Neues Jahrbuch für Geologie und Paläontologie: Monatshefte, **1956**, 433–438, Stuttgart.
- GERTH, H. (1961): Neue Ammonitenfunde in den Gosauschichten der Gosau und ihre stratigraphische Bedeutung. – Neues Jahrbuch für Geologie und Paläontologie: Abhandlungen, **112**, 119–142, Stuttgart.
- GILL, T. (1871): Arrangement of the families of mollusks. – Smithsonian Miscellaneous Collections, **227**, i–xvi, 1–49, Washington, D.C.
- GROSSOUDRE, A. DE (1894): Recherches sur la Craie supérieure, 2. Paléontologie. Les ammonites de la Craie supérieure. – Mémoires du Service de la Carte Géologique détaillée de France, 264 pp., Paris.
- GROSSOUDRE, A. DE (1901): Recherches sur la craie supérieure, part 1, no. 2: Stratigraphie générale. – Mémoires du Service de la Carte Géologique détaillée de France, 1013 pp., Paris.
- HAUER, F. v. (1858): Über die Cephalopoden der Gosauschichten. – Beiträge zur Palaeontographie von Österreich, **1**, 7–14, Wien.
- HAUER, F. v. (1866): Neue Cephalopoden aus den Gosaubildern der Alpen. – Sitzungsberichte der mathematisch-naturwissenschaftlichen Classe der kaiserlich-königlichen Akademie der Wissenschaften Wien, I. Abtheilung, **53**, 300–308, Wien.
- HOEPEN, E.C.N. VAN (1921): Cretaceous Cephalopoda from Pondoland. – Annals of the Transvaal Museum, **8/1**, 1–48, Cambridge.
- HOEPEN, E.C.N. VAN (1965): The Peroniceratinae and allied forms of Zululand. – Geological Survey of South Africa, Memoir **55**, 1–70, Pretoria.
- HOEPEN, E.C.N. VAN (1968): New and little known Zululand and Pondoland ammonites. – Annals of the Geological Survey of South Africa, **4**, 157–181, Pretoria. dated 1965
- HOWARTH, M.K. (1965): Cretaceous ammonites and nautiloids from Angola. – Bulletin of the British Museum (Natural History), Geology, **10**, 335–412, London.
- HYATT, A. (1889): Genesis of the Arietidae. – Smithsonian Contributions to Knowledge, **673**, 238 pp., Washington, D.C.
- HYATT, A. (1894): Phylogeny of an acquired characteristic. – Proceedings of the American Philosophical Society, **32**, 349–647, Philadelphia.
- HYATT, A. (1900): Cephalopoda. – In: ZITTEL, K.A.: Textbook of Palaeontology, 502–592, London.
- HYATT, A. (1903): Pseudoceratites of the Cretaceous. – Monographs of the United States Geological Survey, **44**, 351 pp., Washington, D.C.
- IFRIM, C., VEGA, F.J. & STINNESBECK, W. (2011): Epizoic stramentid cirripedes on ammonites from late Cretaceous platy limestones. – Journal of Paleontology, **85**, 526–538, Lawrence.
- IFRIM, C., MÚZQUIZ, H.P. & STINNESBECK, W. (2019): Ammonoids, their biozonation and their palaeobiogeographic relation across the Turonian-Coniacian boundary in northern Coahuila, Mexico. – Cretaceous Research, **102**, 170–195, London.
- IMMEL, H. (1987): Die Kreideammoniten der Nördlichen Kalkalpen. – Zitteliana, Reihe B, **8**, 3–32, München.
- IMMEL, H., KLINGER, H.C. & WIEDMANN, J. (1982): Die Cephalopoden des Unteren Santon der Gosau von Brandenberg/Tirol, Österreich. – Zitteliana, Reihe B, **8**, 3–32, München.
- JAGT-YAZYKOVA, E.A. (2011): Palaeobiogeographical and palaeobiological aspects of Mid- and Late Cretaceous ammonite evolution and bio-events in the Russian Pacific. – Scripta Geologica, **143**, 15–121, Leiden.
- JAHN, J.J. (1895): Einige Beiträge zur Kenntniss der böhmischen Kreideformation. – Jahrbuch der k. k. Geologischen Reichsanstalt, **45**, 125–218, Wien.
- JANOSCHEK, W. (1968): Oberkreide und Alttertiär im Bereich von Wörschach (Ennstal, Steiermark) und Bemerkungen über das Alttertiär von Radstadt (Pongau, Salzburg). – Verhandlungen der Geologischen Bundesanstalt, **1968**, 138–155, Wien.
- JARNIK, M. (1994): Zur Sedimentologie, Stratigraphie und Tektonik der Gosau von Rigaus/Abtenau (Salzburg/Österreich). – Diplomarbeit, Formal- und Naturwissenschaftliche Fakultät der Universität Wien, 178 pp., Wien.
- JARNIK, M. & WAGREICH, M. (1993): The Lower Gosau Complex of Rigaus – Reconstruction of a Late Cretaceous sedimentary facies sequence (Northern Calcareous Alps/Salzburg/Austria). – Terra Abstracts, **5/1** (EUG VII Strasbourg), 676, Oxford.
- JIMBO, K. (1894): Beiträge zur Kenntniss der Fauna der Kreideformation von Hokkaido. – Paläontologische Abhandlungen, N.F. **2/3**, 140–194, Jena.
- KAPLAN, U. & KENNEDY, W.J. (1994): Ammoniten des westfälischen Coniac. – Geologie und Paläontologie von Westfalen, **31**, 155 pp., Münster.
- KAPLAN, U., KENNEDY, W.J. & WRIGHT, C.W. (1987): Turonian and Coniacian Scaphitidae from England and North-Western Germany. – Geologisches Jahrbuch, **A 103**, 5–39, Hannover.

- KAPLAN, U., KENNEDY, W.J. & Hiss, M. (2005): Stratigraphie und Ammonitenfaunen des Campan im nordwestlichen und zentralen Münsterland. – Geologie und Paläontologie von Westfalen, **64**, 171 pp., Münster.
- KENNEDY, W.J. (1983): Ammonite faunas of the Coniacian, Santonian and Campanian stages in the Aquitaine basin. – Géologie Méditerranéenne, **10**/3–4, 103–113, Marseille.
- KENNEDY, W.J. (1984): Systematic Palaeontology and Stratigraphic Distribution of the Ammonite Faunas of the French Coniacian. – Special Papers in Palaeontology, **31**, 160 pp., London.
- KENNEDY, W.J. & CHRISTENSEN, W.K. (1991): Coniacian and Santonian ammonites from Bornholm, Denmark. – Bulletin of the Geological Society of Denmark, **38**, 203–226, Copenhagen.
- KENNEDY, W.J. & CHRISTENSEN, W.K. (1997): Santonian to Maastrichtian ammonites from Scania, southern Sweden. – Fossils & Strata, **44**, 75–128, Oslo.
- KENNEDY, W.J. & COBBAN, W.A. (1991): Coniacian Ammonite faunas from the United States Western Interior. – Special Papers in Palaeontology, **45**, 96 pp., London.
- KENNEDY, W.J. & KAPLAN, U. (2000): Ammonitenfaunen des hohen Oberconiac und Santon in Westfalen. – Geologie und Paläontologie in Westfalen, **57**, 131 pp., Münster.
- KENNEDY, W.J. & KLINGER, H.C. (1977): Cretaceous faunas from Zululand and Natal, South Africa. The ammonite family Tetragoniidae HYATT, 1900. – Annals of the South African Museum, **73**/7, 149–197, Cape Town.
- KENNEDY, W.J. & KLINGER, H.C. (1979): Cretaceous Faunas from Zululand and Natal, South Africa. The ammonite family Gaudryceratidae. – Bulletin of the British Museum of Natural History (Geology), **31**/2, 121–174, London.
- KENNEDY, W.J. & KLINGER, H.C. (2013): Scaphitid ammonites from the Upper Cretaceous of KwaZulu-Natal and Eastern Cape Province, South Africa. – Acta Geologica Polonica, **63**, 527–543, Warszawa.
- KENNEDY, W.J. & KOLLMANN, H.A. (1977): Ammoniten aus den Klementer Schichten. – In: KOLLMANN, H.A., BACHMAYER, F., NIEDERMAYR, G., SCHMID, M.E., KENNEDY, W.J., STRADNER, H., PRIEWALDER, H., FUCHS, R. & WESSELY, G.: Beiträge zur Stratigraphie und Sedimentation der Oberkreide des Festlandssockels im nördlichen Niederösterreich. – Jahrbuch der Geologischen Bundesanstalt, **120**, 411–417, Wien.
- KENNEDY, W.J. & SUMMESBERGER, H. (1979): A revision of *Ammonites mitis* HAUER and *Ammonites glaneggensis* REDTENBACHER from the Gosau Beds (Upper Cretaceous) of Austria. – Beiträge zur Paläontologie von Österreich, **6**, 71–87, Wien.
- KENNEDY, W.J., KLINGER, H.C. & SUMMESBERGER, H. (1981): Cretaceous Faunas from Zululand and Natal, South Africa. Additional Observations on the Subfamily Texanitinae COLLIGNON, 1948. – Annals of the South African Museum, **86**, 115–155, Cape Town.
- KENNEDY, W.J., WRIGHT, C.W. & KLINGER, H.C. (1983): Cretaceous Faunas from Zululand and Natal, South Africa. The Ammonite Subfamily Barroisiceratinae BASSE, 1947. – Annals of the South African Museum, **90**/6, 241–324, Cape Town.
- KENNEDY, W.J., BILOTE, M. & MELCHIOR, P. (1995): Ammonite faunas, biostratigraphy and sequence stratigraphy of the Coniacian-Santonian of the Corbières (NE Pyrénées). – Bulletin des Centres de Recherche et d'Exploration-Production Elf-Aquitaine, **19**/2, 377–499, Pau.
- KERCKHOVE, C. & THIEULOY, J. (1973): Sur deux ammonites Sénoniennes découvertes dans la province néritique de l'arc de Castellane (Sud-Est de la France). – Géologie Alpine, **49**, 51–56, Grenoble.
- KILIAN, W. & REBOUL, P. (1909): Les Céphalopodes Néocrétacés des îles Seymour et Snow-Hill d'après les matériaux reçus par l'Expédition antarctique Suédoise. Wissenschaftliche Ergebnisse der Schwedischen Südpolar-Expedition 1901 – 1903, Band III, Lieferung 6, 75 p., Stockholm.
- KLEIN, J. (2016): Lower Cretaceous Ammonites X Scaphitoidea, including Upper Cretaceous representatives. – Fossilium Catalogus I: Animalia, **157** (pars), 203 pp., Leiden.
- KLEIN, J., HOFFMANN, R., JOLY, B., SHIGETA, Y. & VAŠIČEK, Z. (2009): Lower Cretaceous Ammonites IV Boreophylloceratoidea, Phylloceratoidea, Lytoceratoidea, Tetragonitoidea, Haploceratoidea including the UPPER CRETACEOUS representatives. – Fossilium Catalogus I: Animalia, **146**, 416 pp., Leiden.
- KLINGER, H.C. (1976): Cretaceous heteromorph ammonites from Zululand. – Memoirs of the Geological Survey of the Republic of South Africa, **69**, 1–142, Pretoria.
- KLINGER, H.C. (1985): Upper Cretaceous Cephalopoda from Offshore Deposits off the Natal South Coast, South Africa. – Palaeontologia Africana, **26**/1, 1–12, Johannesburg.
- KLINGER, H.C. & KENNEDY, W.J. (1980): Cretaceous faunas from Zululand and Natal, South Africa. The ammonite subfamily Texanitinae COLLIGNON, 1948. – Annals of the South African Museum, **80**/1, 357 pp., Cape Town.
- KLINGER, H.C. & KENNEDY, W.J. (1984): Cretaceous faunas from Zululand and Natal, South Africa. The ammonite subfamily Peroniceratinae, HYATT, 1900. – Annals of the South African Museum, **92**/3, 294 pp., Cape Town.
- KLINGER, H.C. & KENNEDY, W.J. (1997): Cretaceous faunas from Zululand and Natal, South Africa. The ammonite family Baculitidae GILL, 1871 (excluding the genus *Eubaculites*). – Annals of the South African Museum, **105**/1, 1–206, Cape Town.
- KLINGER, H.C. & KENNEDY, W.J. (2001): Stratigraphic and geographic distribution, phylogenetic trends and general comments on the ammonite family Baculitidae GILL, 1871 (with an annotated list of species referred to the family). – Annals of the South African Museum, **107**/1, 290 pp., Cape Town.
- KLINGER, H.C. & KENNEDY, W.J. (2003): Observations on *Pseudoxbyloceras matsumotoi* COLLIGNON, 1965 (Cephalopoda: Ammonoidea). Ontogeny, shell structure, differential preservation and intraspecific variation. – Annals of the South African Museum, **110**, 171–198, Cape Town.
- KLINGER, H.C., KENNEDY, W.J. & GRULKE, W.E. (2007): New and little known Nostoceratidae and Diplomoceratidae (Cephalopoda: Ammonoidea) from Madagascar. – African Natural History, **3**, 89–115, Cape Town.
- KOLLMANN, H.A. (1982): Gosauablagerungen im Becken von Gosau. – In: PLÖCHINGER, B.: Erläuterungen zur Geologischen Karte der Republik Österreich 1:50.000, Blatt 95 St. Wolfgang im Salzkammergut, 30–34, Wien.
- KOLLMANN, H.A. & SUMMESBERGER, H. (1982): Excursions to Coniacian-Maastrichtian in the Austrian Alps. – WGCM, 4th Meeting (Gosau Basins in Austria), 105 pp., Wien.
- KOSSMAT, F. (1895): Untersuchungen über die südindische Kreideformation. – Beiträge zur Paläontologie und Geologie Österreich-Ungarns, **9**/3–4, 97–203, Wien.
- KÜCHLER, T. & ERNST, G. (1989): Integrated biostratigraphy of the Turonian-Coniacian transition interval in Northern Spain in comparison to NW Germany. – In: WIEDMANN, J. (Ed.): Cretaceous of the Western Tethys – Proceedings of the 3rd International Cretaceous Symposium, Tübingen, 1987, 161–190, Stuttgart.
- KUMMEL, B. (1956): Post-Triassic Nautiloid Genera. – Bulletin of the Museum of Comparative Zoology, **114**/7, 324–494, Cambridge.
- LAMARCK, J.P.B.A. DE M. DE (1799): Prodrome d'une nouvelle classification des coquilles. – Mémoires du Muséum national d'histoire naturelle, 63–90, Paris.
- LAMARCK, J.P.B.A. DE M. DE (1801): Système des Animaux sans vertèbres. – vii + 432 pp., Paris.
- LANGENHAN, A. & GRUNDEY, M. (1891): Das Kieslingswalder Gestein und seine Versteinerungen. – Jahrbuch Glatzer Gebirgs-Verein, **10**, 12 pp., Breslau.

- LUKENERD, A., HARZHAUSER, M., MÜLLECKER, S. & PILLER, W.E. (2010): Ontogeny and habitat change in Mesozoic cephalopods revealed by stable isotopes ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$). – Earth and Planetary Science Letters, **296**, 103–114, Amsterdam.
- MARTINEZ, R. (1982): Ammonoideos neocretacicos del Prepireneo de la Provincia de Lleida. – Publicaciones geologicas de la Universidad Autonoma de Barcelona, **17**, 197 pp., Barcelona.
- MATSUMOTO, T. (1938): A biostratigraphic study on the Cretaceous deposits of the Naibuchi Valley, South Karahuto. – Proceedings of the Imperial Academy, **14**, 190–194, Tokio.
- MATSUMOTO, T. (1954): Family Puzosiidae from Hokkaido and Saghalien. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **5/2**, 69–118, Fukuoka.
- MATSUMOTO, T. (1955): Evolution of Peroniceratidae. – Transactions and Proceedings of the Palaeontological Society of Japan, **18**, 37–44, Tokyo.
- MATSUMOTO, T. (1965): A Monograph of the Collignoniceratidae from Hokkaido. Part 2. Studies of the Cretaceous Ammonites from Hokkaido and Saghalien, XX. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **16/3**, 207–243, Fukuoka.
- MATSUMOTO, T. (1967): Evolution of the Nostoceratidae (Cretaceous Heteromorph Ammonoids). – Memoirs of the Faculty of Science, Kyushu University (Serie D, Geology), **18/2**, 331–347, Fukuoka.
- MATSUMOTO, T. (1969): A Monograph of the Collignoniceratidae from Hokkaido, Part V. – Studies of the Cretaceous Ammonites from Hokkaido and Saghalien, XX. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **19/3**, 297–330, Fukuoka.
- MATSUMOTO, T. (1970): A Monograph of the Collignoniceratidae from Hokkaido, Part IV. Studies of the Cretaceous Ammonites from Hokkaido and Saghalien, XX. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **20/2**, 225–304, Fukuoka.
- MATSUMOTO, T. (1971): A Monograph of the Collignoniceratidae from Hokkaido, Part V. Studies of the Cretaceous Ammonites from Hokkaido Part V. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **21/2**, 129–162, Fukuoka.
- MATSUMOTO, T. (1977): Some heteromorph ammonites from the Cretaceous of Hokkaido. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **23**, 303–366, Fukuoka.
- MATSUMOTO, T. (1988): A Monograph of the Puzosiidae (Ammonoidea) from the Cretaceous of Hokkaido. – Palaeontological Society of Japan, Special Papers, **30**, 179 pp., Tokyo.
- MATSUMOTO, T. & HIRANO, H. (1976): Colour patterns on some Cretaceous ammonites from Hokkaido. – Transactions and Proceedings of the Palaeontological Society of Japan, **102**, 334–342, Tokyo.
- MATSUMOTO, T. & NEMOTO, M. (1990): An ammonite referable to *Forresteria* from the Futaba Group. – In: MATSUMOTO, T., NEMOTO, M. & SUZUKI, C.: Gigantic ammonites from the Cretaceous Futaba Group of Fukushima Prefecture. – Transactions and Proceedings of the Palaeontological Society of Japan, new series, **157**, 366–381, Tokyo.
- MATSUMOTO, T. & OBATA, I. (1955): Some Upper Cretaceous desmoceeratids from Hokkaido and Saghalien. – Memoirs of the Faculty of Science, Kyushu University (Series D, Geology), **5/3**, 119–151, Fukuoka.
- MEEK, F.B. (1876): A report on the invertebrate Cretaceous and Tertiary fossils of the Upper Missouri Country. – In: HAYDEN, F.V.: Report of the United States Geological and Geographical Surveys of the Territories, **9**, 629 pp., Washington.
- MOBERG, J.C. (1885): Cephalopoderna i Sveriges Kristsystem, II. Artbeskrifning. – Sveriges Geologiska Undersökning, Serie C, Afhandlingar och uppsatser, **73**, 3–64, Uppsala (in Swedish).
- MONTFORT, D. (1808): Conchyliologie systématique et classification méthodique des coquilles; offrant leurs figures, leur arrangement générique, leurs descriptions caractéristiques, leur noms; ainsi que leur synonymie en plusieurs langues. – Conchyliologie systématique, Tome premier, 409 pp., Paris.
- MÜLLER, G. & WOLLEMANN, A. (1906): Die Molluskenfauna des Unterseitens von Braunschweig und Ilseide. II. Cephalopoden. – Abhandlungen der Königlich Preussischen Geologischen Landesanstalt, Neue Folge, **47**, 30 pp., Berlin.
- NOWAK, J. (1911): Untersuchungen über die Cephalopoden der oberen Kreide in Polen II. Die Scaphiten. – Bull. int. Acad. Sci. Cracovie, Cl. Sci. math. natur., Sér. B, Sci. naturwiss., Jg. **1911**, 547–589; Cracovie.
- ORBIGNY, A.D' (1840–1842): Paléontologie française: Terrains crétacés. I. Céphalopodes. – 662 pp., Paris.
- ORBIGNY, A.D' (1850): Prodrome de Paléontologie stratigraphique universelle des animaux mollusques et rayonnés faisant suite au cours élémentaire de Paléontologie et de Géologie stratigraphiques. – 427 pp., Paris (Masson).
- PARKINSON, J. (1811): On the organic remains of a former world. – 3 volumes, xvi + 479 pp., London.
- PERCH-NIELSEN, K. (1985): Mesozoic calcareous nannofossils. – In: BOLLI, H.M., SAUNDERS, J.B. & PERCH-NIELSEN, K. (Eds.): Plankton Stratigraphy, 329–426, Cambridge.
- PERESSON, H. (1991): Kinematische Analyse von Störungsflächen und Folgerungen für die Strike-Slip Tektonik an der Wolfgangsee-Störung (Salzburg). – Diplomarbeit, Formal- und Naturwissenschaftliche Fakultät der Universität Wien, 116 pp., Wien.
- PERON, A. (1897): Les ammonites du Cretace Supérieur de l'Algérie. – Mémoires de la Société Géologique de France **17/6** (1896), 1–24, Paris.
- PICTET, F.J. (1848): Description des Mollusques fossiles qui se trouvent dans les Grès Verts des environs de Genève. 1. Céphalopodes. Mémoires de la Société de physique et d'histoire naturelle de Genève, **vol. 11**, 257–412, pls. 1–15.
- PLÖCHINGER, B. (1964): Die tektonischen Fenster von St. Gilgen und Strobl am Wolfgangsee (Salzburg, Österreich). – Jahrbuch der Geologischen Bundesanstalt, **107**, 11–69, Wien.
- PLÖCHINGER, B. (1973): Erläuterungen zur Geologischen Karte des Wolfgangseegebietes (Salzburg, Oberösterreich) 1:25.000. – 92 S., Geologische Bundesanstalt, Wien.
- PLÖCHINGER, B. (1982): Geologische Karte der Republik Österreich, 1:50.000, 95 Sankt Wolfgang im Salzkammergut. – 1 Blatt, Geologische Bundesanstalt, Wien.
- REDTENBACHER, A. (1873): Die Cephalopodenfauna der Gosau-Schichten in den nordöstlichen Alpen. – Abhandlungen der k. k. Geologischen Reichsanstalt, **5**, 91–140, Wien.
- REESIDE, J.B.JR. (1927): The Cephalopods of the Eagle sandstone and related Formations in the Western Interior of the United States. – U.S. Geological Survey Professional Paper, **151**, 1–87, Washington.
- REESIDE, J.B. JR. (1932): The Upper Cretaceous ammonite genus *Barroisiceras* in the United States. – U. S. geol. Surv., Prof. Paper, **170-B**, 9–29, Washington.
- REMIN, Z. (2010): Upper Coniacian, Santonian, and lowermost Campanian ammonites of the Lipnik-Kije Section, central Poland – taxonomy, stratigraphy, and palaeogeographic significance. – Cretaceous Research, **31**, 154–180, London.
- REYMENT, R. (1955): The Cretaceous Ammonoidea of southern Nigeria and the southern Cameroons. – Bulletin of the Geological Survey of Nigeria, **25**, 1–112, Abuja.

- REYMENT, R. (1958): Neubeschreibung der Redtenbacher'schen Ammonitenoriginale aus den Gosauschichten. – Stockholm Contributions to Geology, **2/3**, 31–49, Stockholm.
- RIEGRAF, W. & SCHEER, U. (1991): Cephalopoden der oberen deutschen Kreide. – Reprint of: SCHLÜTER, C.A. (1871–1876), 454 pp., Korb.
- RIEDEL, L. (1931): Zur Stratigraphie und Faciesbildung im Oberemscher und Unterenon am Südrande des Beckens von Münster. – Jahrbuch der Preußischen geologischen Landesanstalt, **51**, 605–713, Berlin.
- RIEDEL, L. (1933): Die Oberkreide vom Mungofluß in Kamerun und ihre Fauna. – Beiträge zur Geologischen Erforschung der Deutschen Schutzgebiete, **16**, 1–154, Berlin.
- ROMAN, F. (1938): Les ammonites jurassique et crétacées. – 554 pp., Paris (Masson).
- SCHLÜTER, C. (1867): Beitrag zur Kenntniss der jüngsten Ammonien Deutschlands. – 36 S., Bonn.
- SCHLÜTER, C. (1871–1876): Cephalopoden der oberen deutschen Kreide. – Palaeontographica, **21**, 1–24; **21**, 25–120; **24**, 1–144 (121–264), Stuttgart.
- SCHMIDT, W. (1909): Die Kreidebildungen der Kainach. – Jahrbuch der k. k. Geologischen Reichsanstalt, **58/2** (1908), 223–246, Wien.
- SCHULZ, O. (1952): Neue Beiträge zur Geologie der Gosauschichten des Brandenberger Tales (Tirol). – Neues Jahrbuch für Geologie und Paläontologie: Abhandlungen, **95/1**, 1–98, Stuttgart.
- SCUPIN, H. (1912–1913): Die Löwenberger Kreide und ihre Fauna. – Palaeontographica, Supplement **6**, 276 pp., Stuttgart.
- SENESSE, P. (1937): Contribution à l'étude du Crétacé supérieur des Corbières méridionales. – 182 pp., Toulouse (Les Frères de Douladoure).
- SHIMANSKY, V.N. (1975): Cretaceous Nautiloids. – Trudy paleontologicheskogo Instituta Akademii Nauk SSSR, **150**, 1–208, Moscow.
- SHIMIZU, S. (1934): Ammonites. – In: SHIMIZU, S. & OBATA, T.: Ammonites: Iwanami's lecture series of Geology and Palaeontology, 137 pp., Tokyo.
- SOWERBY, J. (1813): The mineral conchology of Great Britain. – **v.1**, 33–96, Pls. 10–44, London.
- SPATH, L.F. (1921): On Upper Cretaceous Ammonoidea from Pondoland. – Annals of the Durban Museum, **3**, 39–57, Durban.
- SPATH, L.F. (1922): On the Senonian Fauna of Pondoland. – Transactions of the Royal Society of South Africa, **10**, 113–147, Cape Town.
- SPATH, L.F. (1925): On Senonian Ammonoidea from Jamaica. – Geological Magazine, **62**, 28–32, London.
- SPATH, L.F. (1926): On new ammonites from the English Chalk. – Geological Magazine, **63**, 77–83, London.
- SPATH, L.F. (1927): Revision of the Jurassic Cephalopod fauna of Kachh (Cutch). – Memoirs of the Geological Survey of India, Palaeontologica Indica, **11**, 1–71, Calcutta.
- STOJASPAL, F. & LOBITZER, H. (1976): Bericht 1975 über stratigraphische Untersuchungen in der Gosau des Wolfgangsee-, Ischl- und Traungebietes auf Blatt 95 St. Wolfgang. – Verhandlungen der Geologischen Bundesanstalt, **1976/1**, A 115–A 116, Wien.
- STROMBECK, A. VON (1859): Über die Kreide am Zeltberg bei Lüneburg. – Zeitschrift der Deutschen geologischen Gesellschaft, **15/1**, 97–187; Berlin.
- STURM, F. (1901): Der Sandstein von Kieslingswalde in der Grafschaft Glatz und seine Fauna. – Jahrbuch der Königlich Preussischen geologischen Landesanstalt und Bergakademie zu Berlin, **21**, 39–98, Berlin.
- SUMMESBERGER, H. (1979): Eine obersantone Ammonitenfauna aus dem Becken von Gosau (Oberösterreich). – Annalen des Naturhistorischen Museums in Wien, **82 A**, 109–176, Wien.
- SUMMESBERGER, H. (1980): Neue Ammoniten aus der Sandkalkbank der Hochmoossschichten (Obersanton; Gosau, Österreich). – Annalen des Naturhistorischen Museums in Wien, **83 A**, 275–283, Wien.
- SUMMESBERGER, H. (1985): Ammonite Zonation of the Gosau Group (Upper Cretaceous, Austria). – Annalen des Naturhistorischen Museums in Wien, **87 A**, 145–166, Wien.
- SUMMESBERGER, H. (1992): Ammoniten aus dem Turon (Oberkreide) der Nördlichen Kalkalpen (Österreich). – Annalen des Naturhistorischen Museums in Wien, **94 A**, 103–133, Wien.
- SUMMESBERGER, H. & KENNEDY, W.J. (1996): Turonian Ammonites from the Gosau Group (Upper Cretaceous; Northern Calcareous Alps; Austria) with a revision of *Barroisiceras haberfellneri* (HAUER, 1866). – Beiträge zur Paläontologie Österreichs, **21**, 105–177, Wien.
- SUMMESBERGER, H. & ZORN, I. (2012): A catalogue of the type specimens of Late Cretaceous Cephalopods housed in the Collections of the Geological Survey of Austria in Vienna. – Jahrbuch der Geologischen Bundesanstalt, **152/1–4**, 101–144, Wien.
- SUMMESBERGER, H., WAGREICH, M., TRÖGER, K.-A. & JAGT, J.W.M. (1999): Integrated biostratigraphy of the Santonian/Campanian Gosau Group of the Gams area (Late Cretaceous; Styria, Austria). – Beiträge zur Paläontologie, **24**, 155–205, Wien.
- SUMMESBERGER, H., WAGREICH, M. & BRYDA, G. (2009): Upper Maastrichtian cephalopods and the correlation to calcareous nanoplankton and planktic foraminifera zones in the Gams Basin (Gosau Group, styria, Austria). – Dr. Ortwin Schultz zum 65. Geburtstag gewidmet. – Annalen des Naturhistorischen Museums in Wien, Serie A, **111**, 159–182, Wien.
- SUMMESBERGER, H., KENNEDY, W.J. & SKOUMAL, P. (2017a): Early and middle Santonian Cephalopods from the Gosau Group (Upper Cretaceous, Austria) 1. Nautiloidea and non-heteromorph Ammonoidea. – Abhandlungen der Geologischen Bundesanstalt, **71**, 5–99, Wien.
- SUMMESBERGER, H., KENNEDY, W.J. & SKOUMAL, P. (2017b): Early and middle Santonian Cephalopods from the Gosau Group (Upper Cretaceous, Austria), 2. Heteromorph Ammonoidea. – Abhandlungen der Geologischen Bundesanstalt, **71**, 101–149, Wien.
- SUMMESBERGER, H., KENNEDY, W.J., WOLFGRING, E., WAGREICH, M., TRÖGER, K.-A. & SKOUMAL, P. (2017c): Integrated stratigraphy of the Upper Santonian (Upper Cretaceous) Hochmoos and Bibereck Formations of the Schattaugraben section (Gosau Group; Northern Calcareous Alps, Austria). – Abhandlungen der Geologischen Bundesanstalt, **71**, 151–247, Wien.
- SZÁSZ, L. & ION, J. (1988): Crétacé supérieur du bassin de Babadag (Roumanie). Biostratigraphie intégrée (ammonites, inocerames, foraminifères planctoniques). – Memorilele Institutului de Geologie et Geofizica, **33**, 91–149, Bucureşti.
- SZÁSZ, L. & LACATUSU, A. (1974): Contributii la studiul amonitilor din Neocretacicul basinului Babadag (Dobrogea de Nord). – Dari Seama, 205–215, Bucarest.
- THIOLLIÈRE, V. (1849): Note sur une nouvelle espèce d'ammonite provenant des grès verts supérieurs du département de la Drôme. – Annales de la Société impériale d'agriculture, d'histoire naturelle et des arts utiles de Lyon, **1/11**, Lyon.
- THOMEL, G. (1988): Les ammonites néocrétacées (Coniacien – Santonien – Campanien) des Chaînes Subalpines Méridionales (Alpes-Maritimes et Alpes-de-Haute-Provence). – Memoirs de la Société Géologique de France, Nouvelle Série, **153**, 79 pp., Paris.
- TRÖGER, K.-A. & SUMMESBERGER, H. (1994): Coniacian and Santonian inoceramid bivalves from the Gosau-Group (Cretaceous, Austria) and their biostratigraphic and biogeographic significance. – Annalen des Naturhistorischen Museums in Wien, **96 A**, 161–197, Wien.
- TZANKOV, V. (1982): Les fossiles de Bulgarie du Crétacé supérieur. – 136 pp., Bulgarian Academy of Sciences, Sofia.

- VAŠIČEK, Z. (1992): Coniacian ammonites from Štít in Moravia (Czechoslovakia). – *Sborník geologických věd. Paleontologie*, **32**, 163–195, Praha.
- VENZO, S. (1936): Cefalopodi del Cretaceo medio-superiore dello Zululand. – *Palaeontographia Italica*, **36**, 59–133, Siena.
- WAGREICH, M. (1988): Sedimentologie und Beckenentwicklung des tieferen Abschnitts (Santon – Untercampan) der Gosauschichtgruppe von Gosau und Rußbach (Oberösterreich – Salzburg). – *Jahrbuch der Geologischen Bundesanstalt*, **131/4**, 663–685, Wien.
- WAGREICH, M. (1992): Correlation of Late Cretaceous calcareous nannofossil zones with ammonite zones and planktonic foraminifera: the Austrian Gosau sections. – *Cretaceous Research*, **13**, 505–516, London.
- WAGREICH, M. (1993): Subcrustal tectonic erosion in orogenic belts – A model for the Late Cretaceous subsidence of the Northern Calcareous Alps (Austria). – *Geology*, **21**, 941–944, Boulder.
- WAGREICH, M. (1998): Lithostratigraphie, Fazies und Sequenzstratigraphie der Gosau Gruppe von Bad Ischl und Strobl am Wolfgangsee (Oberturon-Maastricht, Nördliche Kalkalpen, Österreich). – *Jahrbuch der Geologischen Bundesanstalt*, **141**, 209–234, Wien.
- WAGREICH, M. & DECKER, K. (2001): Sedimentary tectonics and subsidence modelling of the type Upper Cretaceous Gosau basin (Northern Calcareous Alps, Austria). – *International Journal of Earth Sciences*, **90**, 714–726, Berlin–Heidelberg.
- WAGREICH, M. & FAUPL, P. (1994): Palaeogeography and geodynamic evolution of the Gosau Group of the Northern Calcareous Alps (Late Cretaceous, Eastern Alps, Austria). – *Palaeogeography, Palaeoclimatology, Palaeoecology*, **110**, 235–254, Amsterdam.
- WAGREICH, M., SUMMESBERGER, H. & KROH, A. (2009): Late Santonian bioevents in the Schattau section, Gosau Group of Austria – Implications for the Santonian–Campanian boundary stratigraphy. – *Cretaceous Research*, **31**, 181–191, London.
- WALASZCZYK, I., KENNEDY, W.J., DEMBICZ, K., GALE, A.G., PRASZKIER, T., RASOAMIARAMANANA, A.H. & RANDRIANALY, H. (2014): Ammonite and inoceramid biostratigraphy and biogeography of the Cenomanian through basal Middle Campanian (Upper Cretaceous) of the Morondava Basin, western Madagascar. – *Journal of African Earth Sciences*, **89**, 79–132, Oxford.
- WIEDMANN, J. (1960): Zur Systematik jungmesozoischer Nautiliden unter besonderer Berücksichtigung der iberischen Nautilinae d'Orbigny. – *Palaeontographica*, **115 A**, 144–206, Stuttgart.
- WIEDMANN, J. (1962): Ammoniten aus der Vascogotischen Kreide (Nordspanien). Phylloceratina, Lytoceratina. – *Palaeontographica*, **118 A**, 119–237, Stuttgart.
- WIEDMANN, J. (1966): Stammesgeschichte und System der posttriadischen Ammonoideen, ein Überblick. – *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **125/1–3**, 49–79; **127**, 13–81, Stuttgart.
- WIEDMANN, J. (1978): Eine paläogeographisch interessante Ammonitenfaunula aus der alpinen Gosau (Santon, Becken von Gosau, Oberösterreich). – *Eclogae geologicae Helvetiae*, **71/3**, 663–675, Basel.
- WIESE, F. (2000): Coniacian (Upper Cretaceous) ammonites from the North Cantabrian Basin (Cantabria, northern Spain). – *Acta Geologica Polonica*, **50/1**, 125–142, Warszawa.
- WITTLER, F.A., ROTH, R. & LEGANT, J. (1999): Die Nautiliden der oberen Kreide (Cenoman–Campan) vom Süd- und Westrand des Münsterländer Beckens. – *Arbeitskreis Paläontologie Hannover*, **27**, 1–52, Hannover.
- WRIGHT, C.W. (1953): Notes on Cretaceous Ammonites. I. Scaphitidae. – *Annals and Magazine of Natural History, serie 12*, **6**, 473–476, London.
- WRIGHT, C.W. (1957): Cretaceous ammonites. – In: MOORE, R.C. (Ed.): *Treatise on Invertebrate Paleontology*, Part L, Mollusca 4, xxii + 490 pp., New York–Lawrence.
- WRIGHT, C.W. (1979): The ammonites of the English Chalk Rock (Upper Turonian). – *Bulletin of the British Museum of Natural History (Geology)*, **31**, 281–332, London.
- WRIGHT, C.W. & MATSUMOTO, T. (1954): Some doubtful Cretaceous ammonite genera from Japan and Saghalien. – *Memoirs of the Faculty of Science, Kyushu University (Series D, Geology)*, **8/4**, 107–134, Fukuoka.
- WRIGHT, C.W. & WRIGHT, E.V. (1951): A survey of the fossil Cephalopoda of the Chalk of Great Britain. – *Palaeontographical Society, Monographs*, 1–40, London.
- WRIGHT, C.W., CALLOMON, J.H. & HOWARTH, M.K. (1996): Cretaceous Ammonoidea. – In: KAESLER, R.L. (Ed.): *Treatise on Invertebrate Paleontology*, Part L, Mollusca 4, revised, **4**, 362 pp., New York–Lawrence.
- YABE, H. (1910): Die Scaphiten aus der Oberkreide von Hokkaido. – *Beiträge zur Paläontologie und Geologie Österreich-Ungarns und des Orients*, **23**, 159–174, Wien.
- YOUNG, K. (1963): Upper Cretaceous ammonites from the Gulf Coast of the United States. – *Bulletin of the University of Texas*, **6304**, xx + 373 pp., Austin.
- ZITTEL, K.A. v. (1884): *Handbuch der Paläontologie*, **1**, Abteilung 2: Cephalopoda, 329–522, München–Leipzig.
- ZITTEL, K.A. v. (1895): Grundzüge der Paläontologie (Paläozoologie). – vii + 972 pp., München–Leipzig.

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Plates

Plate 1

Angulithes westphalicus (SCHLÜTER, 1872).

Figs. 1, 2: NHMW/1992/0144/0002; Fahrenberg, Strobl/Weißenbach, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.



Plate 2

Figs. 1, 2: *Cimomia gosavica* (REDTENBACHER, 1873); SK/FA/1994/34; Fahrenberg, Strobl/Weißenbach, Salzburg.

Fig. 3: *Angulithes westphalicus* (SCHLÜTER, 1872); SK/NU/1999/80; Nussenseebach, Upper Austria.

Figs. 4, 5: *Angulithes westphalicus* (SCHLÜTER, 1872); SK/NU/1999/81; Nussenseebach, Upper Austria.

All figures are natural size, Figs. 1, 2 are coated with ammonium chloride.

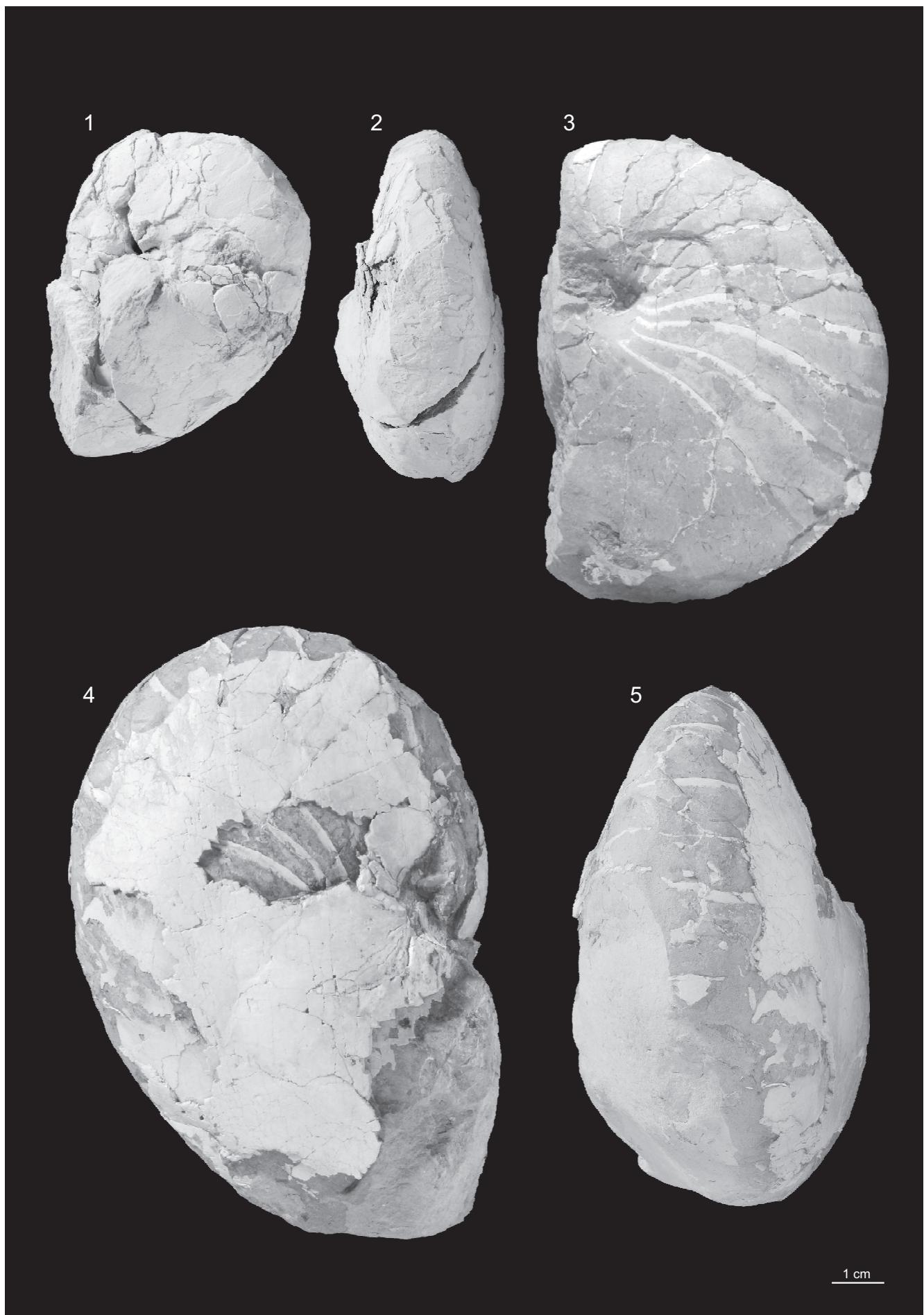


Plate 3

- Fig. 1: *Tetragonites cf. epigonus* KOSSMAT, 1895; NHMW/1989/0050/0013; Schmalnauer Alpe, Salzburg.
- Figs. 2, 3: *Saghalinites nuperus* (VAN HOEPEN, 1921); NHMW/1989/0050/0015; Schmalnauer Alpe, Salzburg.
- Figs. 4, 5: *Saghalinites nuperus* (VAN HOEPEN, 1921); SK/FA/1990/30; Schmalnauer Alpe, Salzburg.
- Figs. 6, 7: *Saghalinites nuperus* (VAN HOEPEN, 1921); SK/NU/1981/6; Nussenseebach, Upper Austria.
- Fig. 8: *Saghalinites nuperus* (VAN HOEPEN, 1921); SK/NU/1981/5; Nussenseebach, Upper Austria.
- Figs. 9–11: *Saghalinites nuperus* (VAN HOEPEN, 1921); SK/NU/1994/68; Nussenseebach, Upper Austria.
- Figs. 12, 15: *Anagaudryceras subtililineatum* (KOSSMAT, 1895); SK/NU/1981/1; Nussenseebach, Upper Austria.
- Figs. 13, 14: *Pseudophyllites postremus* (REDTENBACHER, 1873); NHMW/1989/0050/0017; Schmalnauer Alpe, Salzburg.
- Fig. 16: *Gaudryceras* sp.; SK/NU/not registered; Nussenseebach, Upper Austria.
- Fig. 17: *Gaudryceras* sp.; OÖLM/1938/32; unknown locality.
- Fig. 18: *Gaudryceras mite* (HAUER, 1866); NHMW/1989/0050/0014; Schmalnauer Alpe, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.

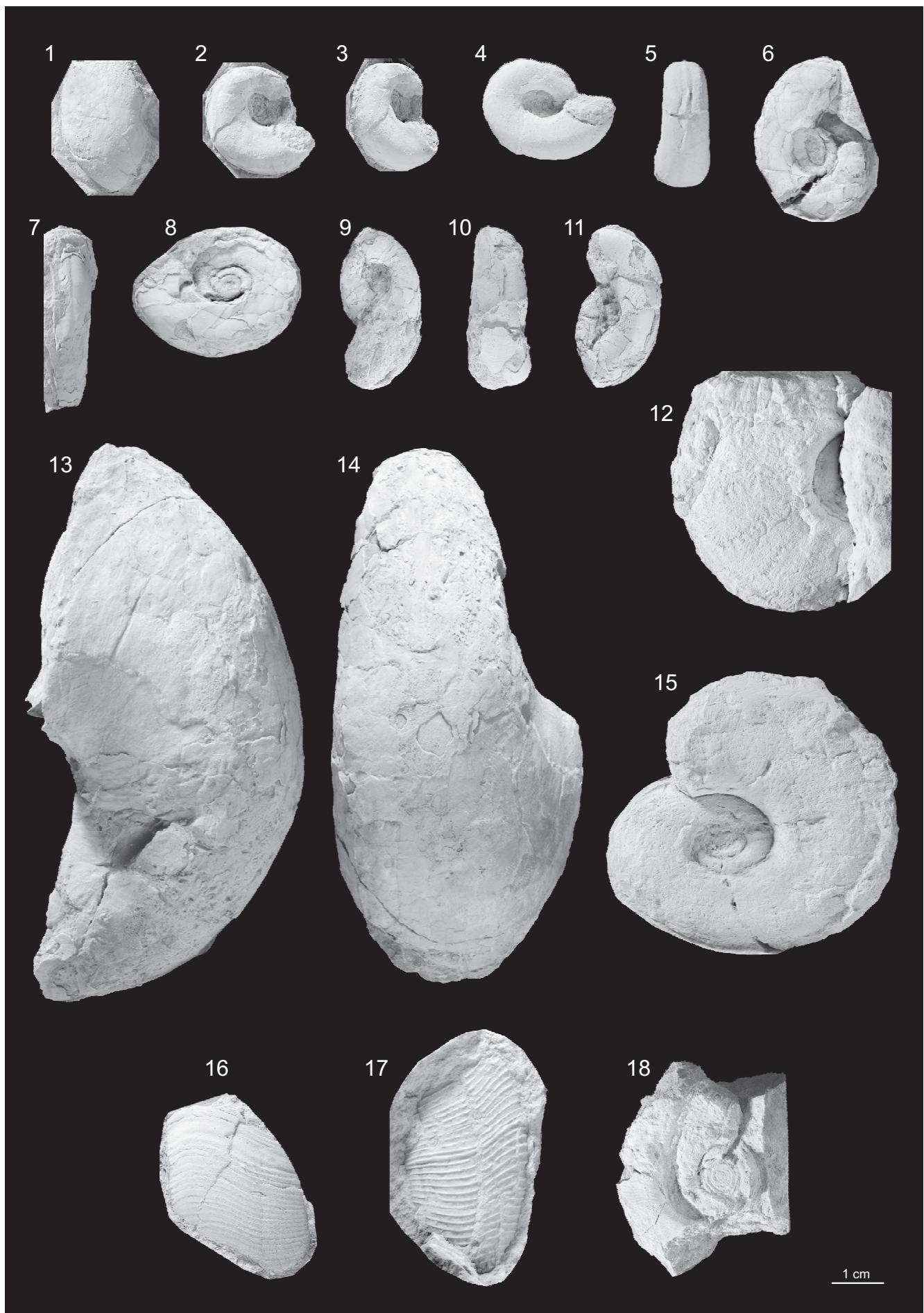


Plate 4

Fig. 1: *Gaudryceras mite* (HAUER, 1866); HNS/6373, the original of *Ammonites glaneggensis* REDTENBACHER, 1873: Pl. 27, Fig. 3a, b; Glanegg, Salzburg.

Figs. 2, 3: *Jimboiceras cf. reyi* COLLIGNON, 1983; NHMW/1990/0050/0016; Schmalnauer Alpe, Salzburg.

Figs. 4, 7: *Nowakites savini* (DE GROSSOUPRE, 1894); MA/1982/8; tunnel section of Bad Ischl, Upper Austria.

Figs. 5, 6: *Hauericeras schlueteri* (REDTENBACHER, 1873); GBA/1873/001/0017, the holotype; Schmalnauer Alpe, Salzburg.

Figs. 8–10: *Forresteria (Forresteria) alluaudi* (BOULE, LEMOINE & THÉVENIN, 1907); MA/1982/7; tunnel section of Bad Ischl, Upper Austria.

Figs. 2–10 are natural size, Fig. 1 is x 0.9, and all figures are coated with ammonium chloride.

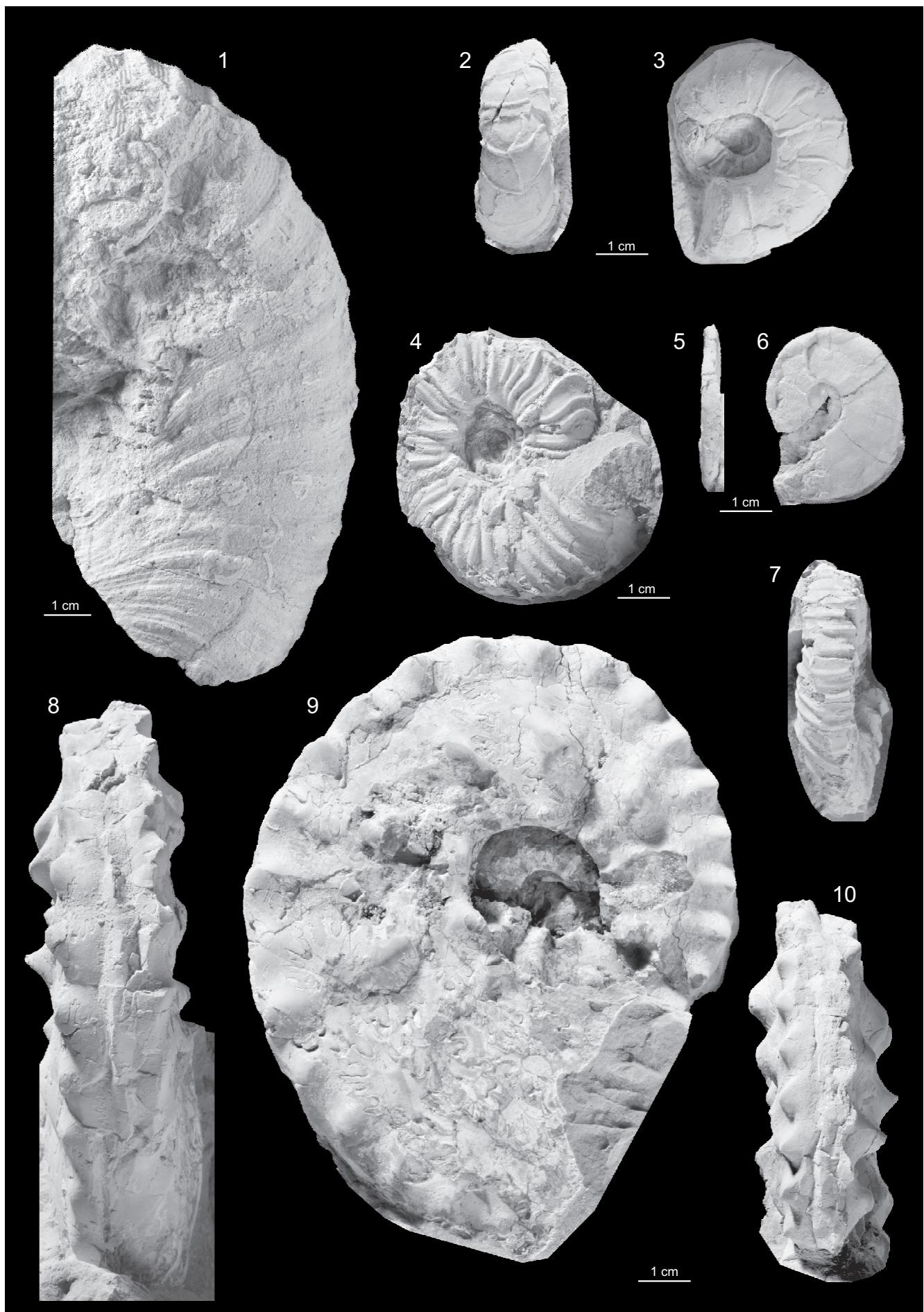


Plate 5

Forresteria (Forresteria) alluaudi (BOULE, LEMOINE & THÉVENIN, 1907).

Figs. 1, 2: MA/1982/1.

Fig. 3: MA/1982/2.

Fig. 4: MA/1982/5.

Figs. 5, 8: MA/1982/6.

Fig. 6: MA/1982/4.

Fig. 7: MA/1982/19.

All figures are natural size, all are coated with ammonium chloride, and all are from the tunnel section north of Bad Ischl, Upper Austria.



Plate 6

Forresteria (Forresteria) alluaudi (BOULE, LEMOINE & THÉVENIN, 1907).

- Figs. 1, 9: MA/1982/11.
- Fig. 2: MA/1982/15.
- Fig. 3: MA/1982/13.
- Fig. 4: MA/1982/19.
- Fig. 5: MA/1982/14.
- Figs. 6, 10: MA/1982/10.
- Fig. 7: MA/1982/12.
- Figs. 8, 11: MA/1982/9.

All figures are natural size, all are coated with ammonium chloride, and all are from the tunnel section north of Bad Ischl, Upper Austria.

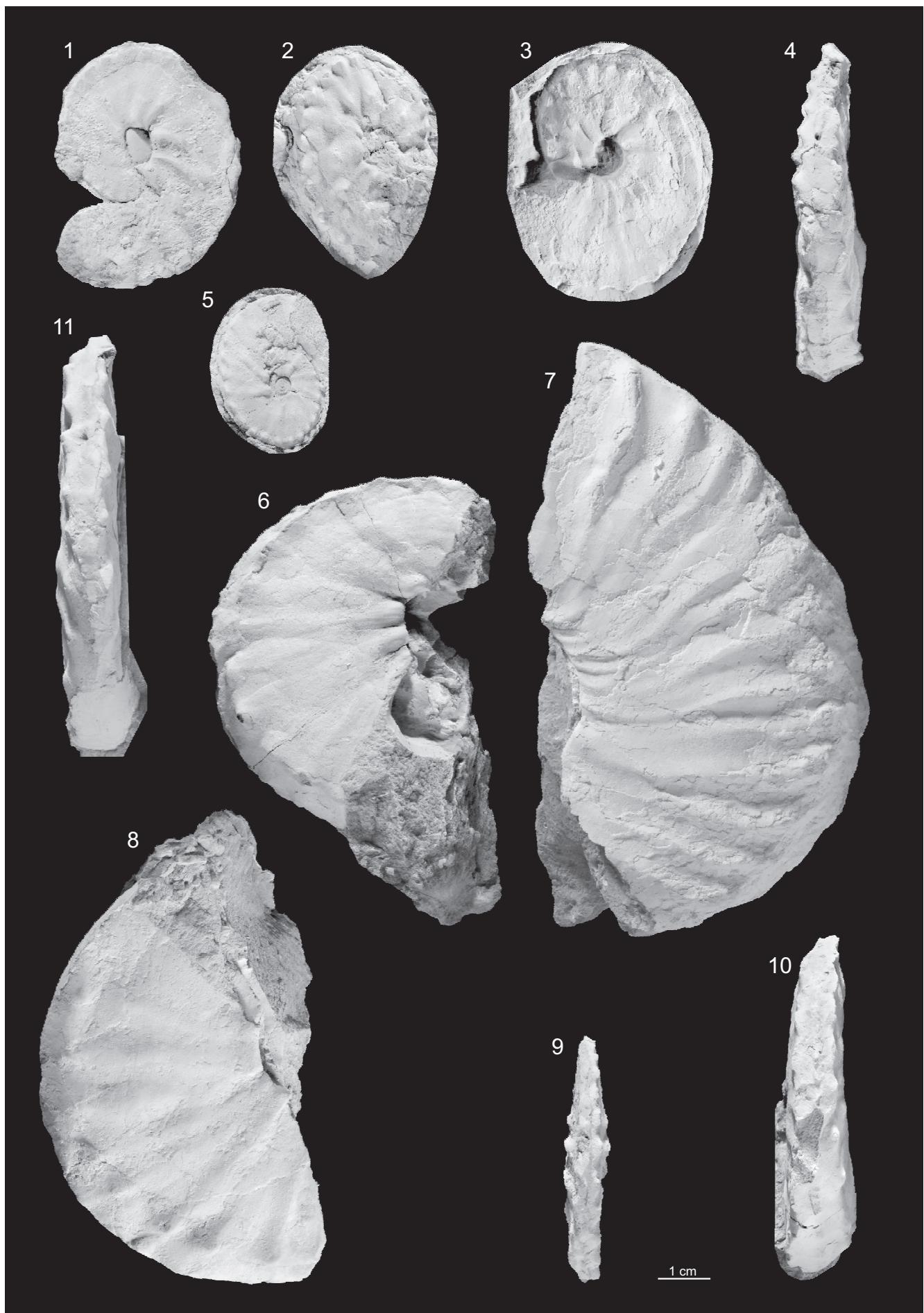


Plate 7

Peroniceras (Peroniceras) tridorsatum (SCHLÜTER, 1867).

Fig. 1: NHMW/2019/0055/0001; Bad Aussee, Styria.

Figs. 2, 3: NHMW/1992/0144/0001; Fahrenberg, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.

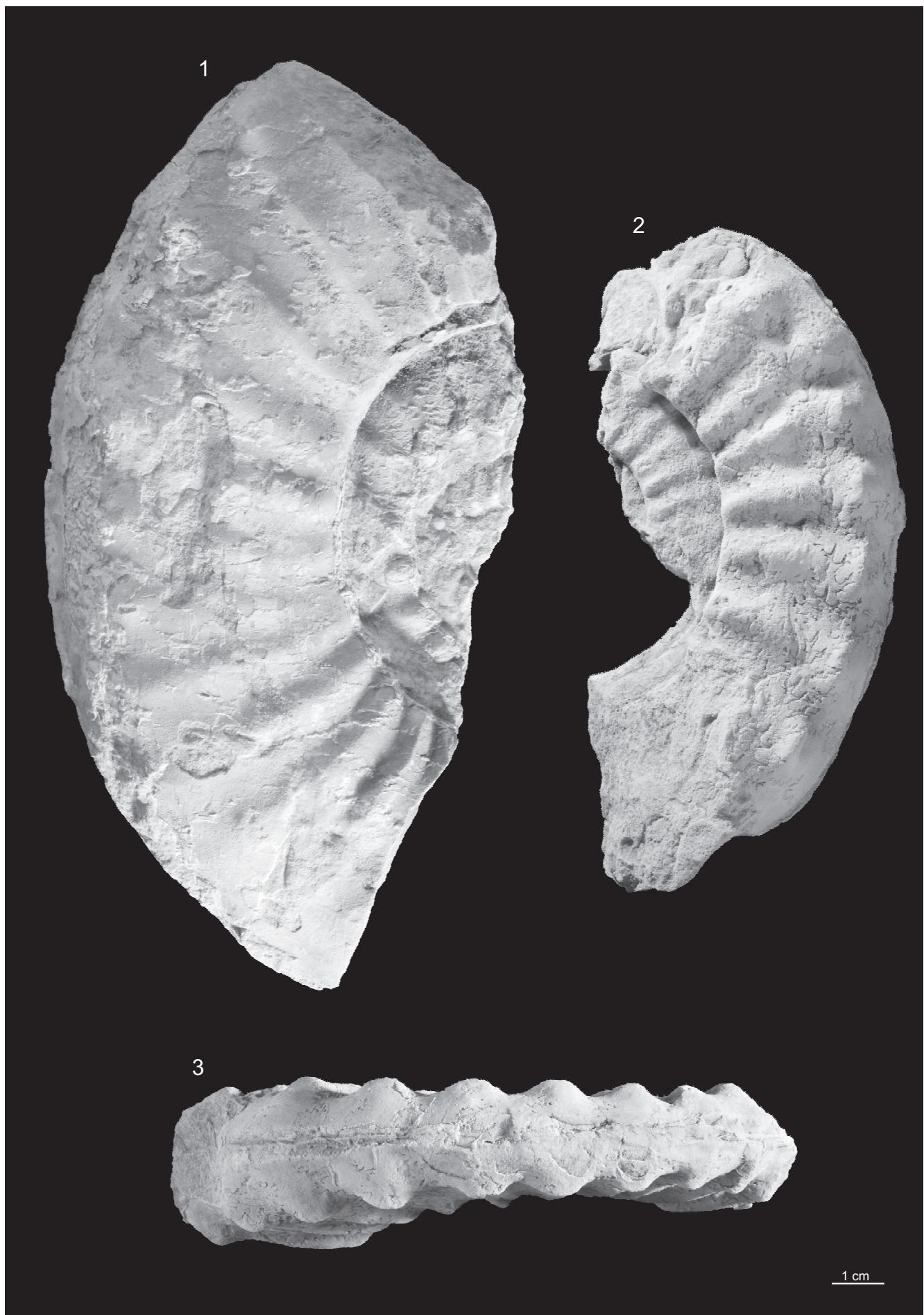


Plate 8

Peroniceras (Peroniceras) tridorsatum (SCHLÜTER, 1867).

Figs. 1, 2: SK/NU/1999/82; Nussenseebach, Upper Austria.

Figs. 3, 4: NHMW/1990/0730/0000; Fahrenberg, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.



Plate 9

Peroniceras (Peroniceras) eugnamtum (REDTENBACHER, 1873).

- Figs. 1, 2: OÖLM/1938/29; Bad Ischl, unknown locality details.
Figs. 3, 4: GBA/1935/001/0022/02; Nussenseebach, Upper Austria.
Fig. 5: PIUW/not reg.; Kronprinz Rudolf collection; Nussenseebach, Upper Austria.
Fig. 6: GBA/1873/001/0021, holotype; Schmalnauer Alpe, Salzburg.
Figs. 7, 8: NHMW/1981/0004/0000; Nussenseebach, Upper Austria.
Figs. 9–12: SK/FA/1994/35; Schmalnauer Alpe, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.

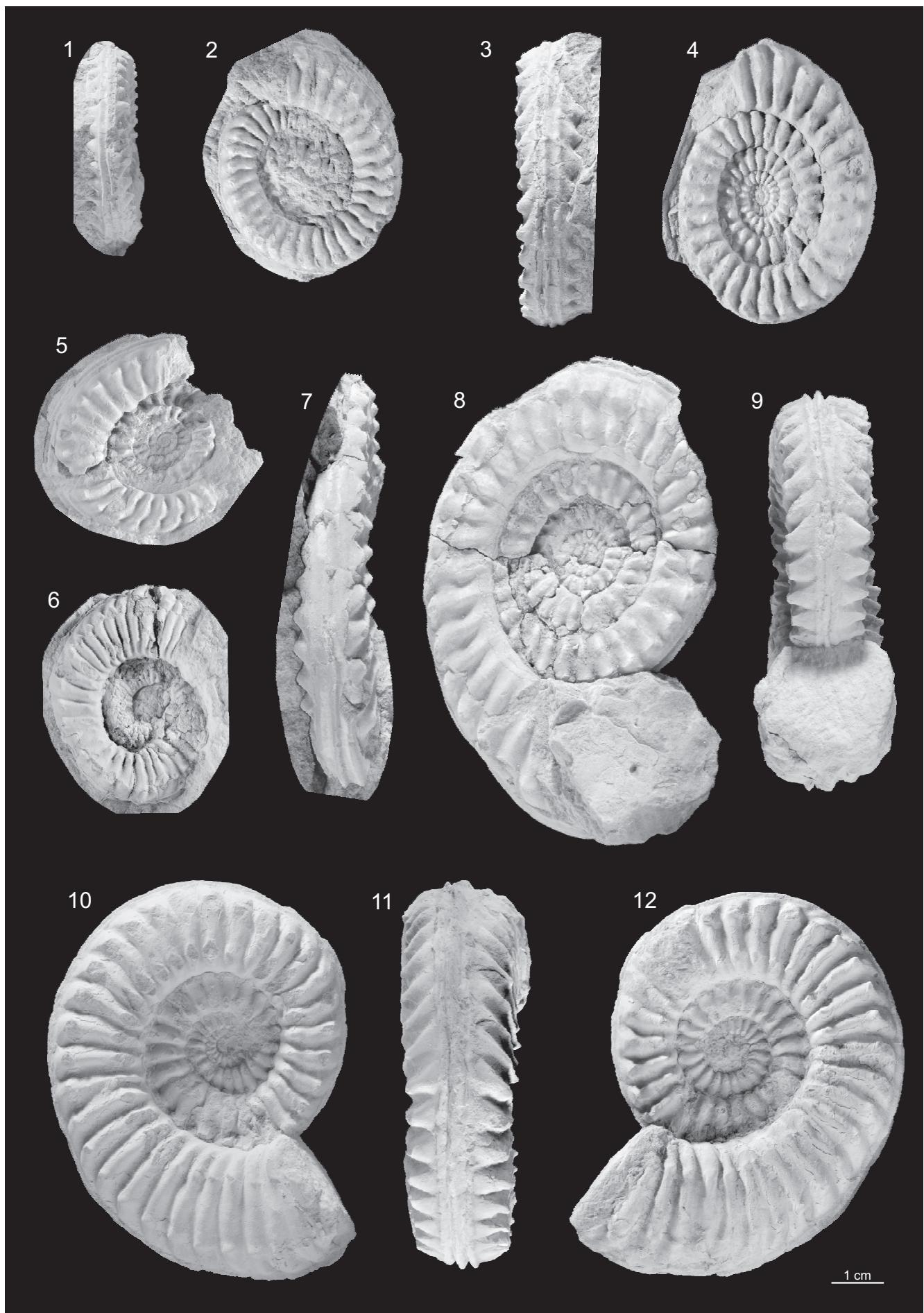


Plate 10

Peroniceras (Peroniceras) czoernigi (REDTENBACHER, 1873).

Figs. 1, 2: GBA/1873/001/0010/01, lectotype; Schmalnauer Alpe, Salzburg.

Figs. 3, 4: NHMW/1935/0003/0032; Nussenseebach, Upper Austria.

Figs. 5, 6: GBA/1873/001/0010/02, paralectotype; Schmalnauer Alpe, Salzburg.

Figs. 7, 8: NHMW/1989/0050/0023; Schmalnauer Alpe, Salzburg.

Figs. 9, 10: NHMW/1989/0050/0026; Schmalnauer Alpe, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.



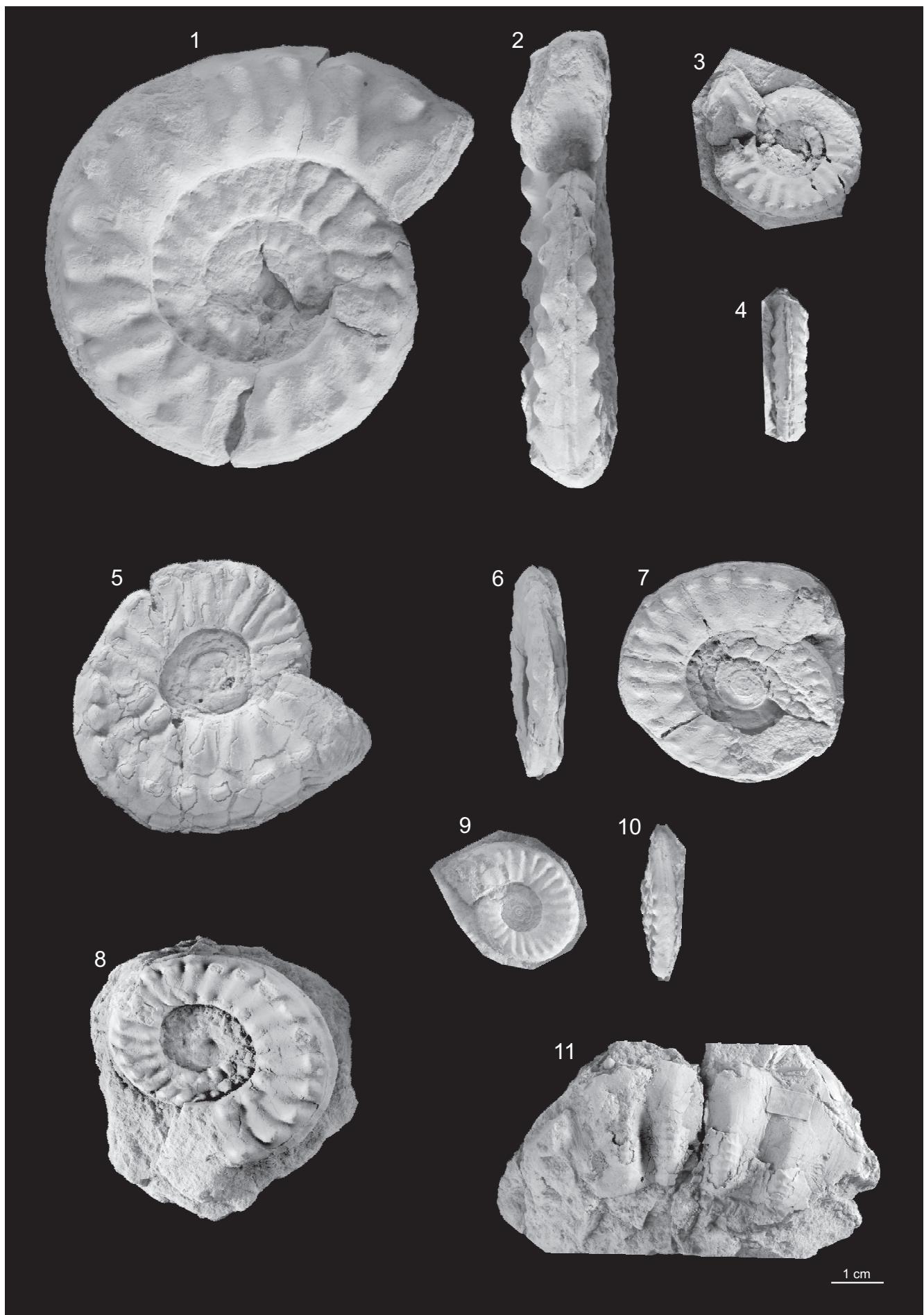
Plate 11

- Figs. 1, 2: *Peroniceras (Peroniceras) czoernigi* (REDTENBACHER, 1873); NHMW/1935/0003/0029; Nussenseebach, Salzburg.
- Figs. 3, 4: *Peroniceras (Peroniceras) subtricarinatum* (D'ORBIGNY, 1850); NHMW/1989/0050/0018; Schmalnauer Alpe, Salzburg.
- Fig. 5: *Peroniceras (Peroniceras) subtricarinatum* (D'ORBIGNY, 1850); MA/1982/17; tunnel section north of Bad Ischl; Upper Austria; x 0.9.
- Figs. 1–4 are natural size, and all figures are coated with ammonium chloride.



Plate 12

- Figs. 1, 2: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); SK/FA/1990/27; Schmalnauer Alpe, Salzburg.
- Figs. 3, 4: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); NHMW/1989/0050/0025; Schmalnauer Alpe, Salzburg.
- Fig. 5: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); SK/NU/1981/18; Nussenseebach, Upper Austria.
- Figs. 6, 7: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); SK/NU/1981/7a; Nussenseebach, Upper Austria.
- Fig. 8: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); GBA/1935/001/0022/01; Nussenseebach, Upper Austria.
- Figs. 9, 10: *Peroniceras (Peroniceras) subtricarinatum* (d'ORBIGNY, 1850); NHMW/1989/0050/0020; Schmalnauer Alpe, Salzburg.
- Fig. 11: *Peroniceras* sp. indet.; GBA/1873/001/0029, original of REDTENBACHER, 1873: 126, Pl. 30, Fig. 7; Schmalnauer Alpe, Salzburg.
- All figures are natural size, and all are coated with ammonium chloride.



1 cm

Plate 13

- Figs. 1, 2: *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873): 107, Pl. 24, Figs. 2a, b, lectotype, original of REDTENBACHER, 1873; GBA/1873/001/0012; Leiner Alpe, Salzburg.
- Figs. 3, 4: *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); GBA/1935/001/0013; Schmalnauer Alpe, Salzburg.
- Fig. 5: *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); GBA/1935/001/0005; Leiner Alpe, Salzburg.
- Figs. 6, 7: *Peroniceras (Zuluiceras) bajuvaricum* (REDTENBACHER, 1873); SK/NU/1999/78; Nussenseebach; Upper Austria.
- Figs. 8, 9: *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); GBA/1873/001/0020, holotype, original of REDTENBACHER, 1873; Schmalnauer Alpe, Salzburg.
- Figs. 10, 11: *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); SK/NU/1981/21; Nussenseebach, Upper Austria.
- Fig. 12: *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); NHMW/2017/0176/0001; Nussenseebach, Upper Austria.
- Fig. 13: *Peroniceras (Zuluiceras) propoetidum* (REDTENBACHER, 1873); MA/1975/21; Nussenseebach, Upper Austria.

All figures are natural size, all are coated with ammonium chloride.

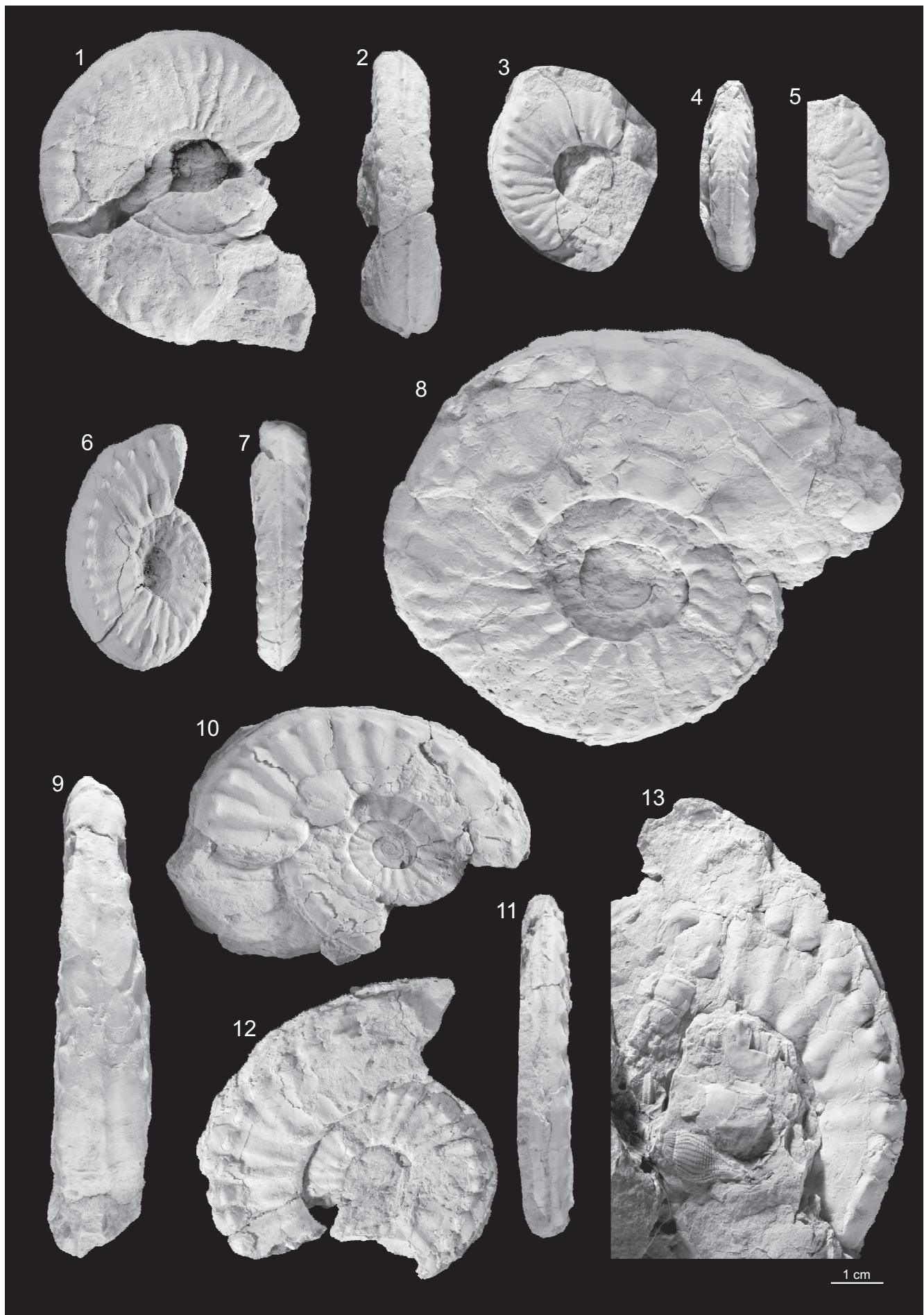


Plate 14

- Fig. 1: *Gauthiericeras margae* (SCHLÜTER, 1867); NHMW/1935/0002/0019; Nussenseebach, Upper Austria; x 0.6.
- Figs. 2, 3: *Peroniceras (Zuluiceras)* sp. indet. 1; NHMW/1992/0143/0001, pathologic; Schmalnauer Alpe, Salzburg.
- Figs. 4, 5: *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); OÖLM/1938/31, original of REDTENBACHER, 1873: Pl. 25, Figs. 4a–c; Lectotype (KENNEDY, 1984: 82); unknown locality.
- Fig. 6: *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); NHMW/1992/0146/0001; Schönfer Alm, Fahrenberg, Salzburg.
- Fig. 7: *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); HNS/6398; Glanegg, Salzburg; x 1.5.
- Figs. 8, 9: *Peroniceras (Zuluiceras) aberlei* (REDTENBACHER, 1873); HNS/6369; Glanegg; Salzburg.
- Figs. 2–6, 8, 9 are natural size, and all figures are coated with ammonium chloride.

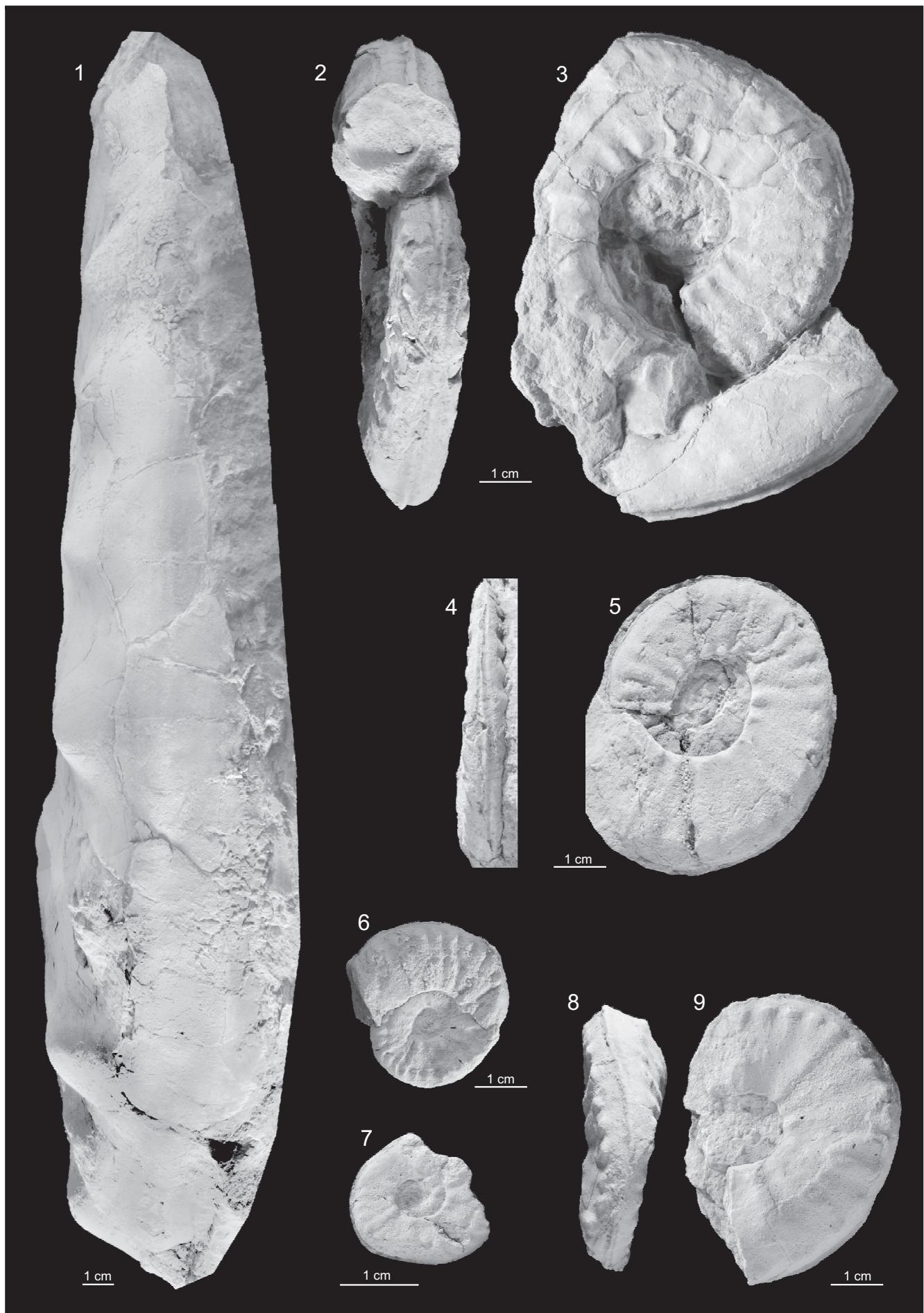


Plate 15

Gauthiericeras margae (SCHLÜTER, 1867).

Fig. 1: NHMW/1935/0002/0019; Nussenseebach, Upper Austria; x 0.676.

Specimen coated with ammonium chloride.



Plate 16

Gauthiericeras margae (SCHLÜTER, 1867).

Figs. 1, 2: NHMW/1943/0001/0001; Glanegg, Salzburg; leg. et ded. O. KÜHN, 1937.

All figures are coated with ammonium chloride, reduced size x 0.88.

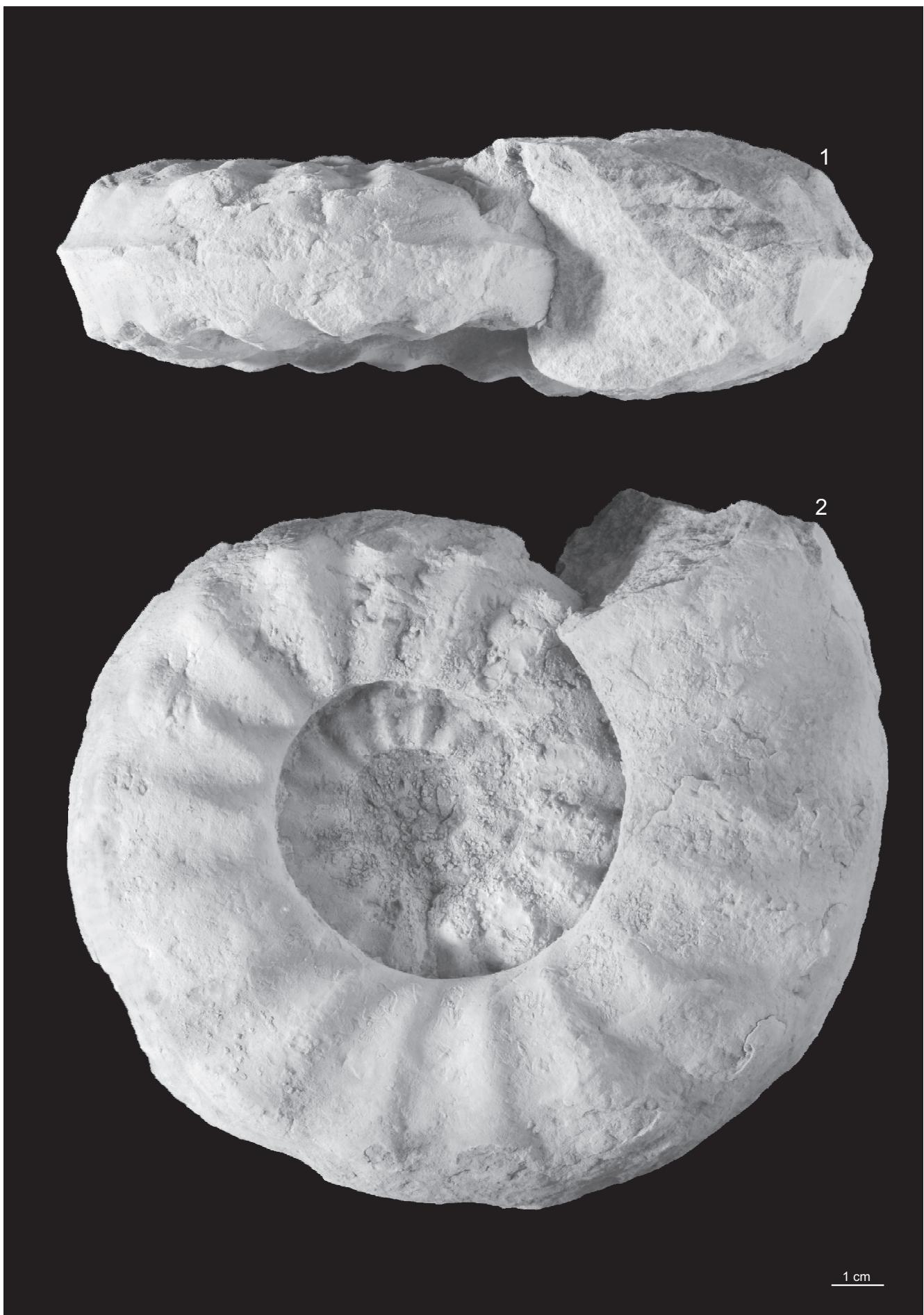


Plate 17

- Fig. 1: *Ishikariceras* sp. indet.; GBA/2019/001/0002/01; Nussenseebach, Upper Austria.
- Figs. 2, 3: *Ishikariceras* sp. indet.; SK/NU/2005/88; Nussenseebach, Upper Austria.
- Figs. 4, 5: *Ishikariceras* sp. indet.; GBA/1873/001/0026; Strobl/Weißenbach, Salzburg, no locality details.
- Fig. 6: *Ishikariceras* sp. indet.; SK/NU/1999/79; Nussenseebach, Upper Austria.
- Fig. 7: *Ishikariceras* sp. indet.; SK/NU/1981/19; Nussenseebach, Upper Austria.
- Figs. 8, 9: *Protexanites (Protexanites) bourgeoisianus* (d'ORBIGNY, 1850); NHMW/1968/0777/0000; Wörschach, Styria.
- Figs. 10, 11: *Protexanites (Protexanites)* sp. indet. juv.; HNS/6401, original of REDTENBACHER, 1873: Pl. 30, Fig. 3a; Glanegg, Salzburg; x 2.
- Fig. 12: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOUVRE, 1894); SK/NU/1997/76; Nussenseebach, Upper Austria.
- Figs. 13, 14: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOUVRE, 1894); SK/NU/2019/94; Nussenseebach, Upper Austria.
- Figs. 1–9 and 12–14 are natural size, and all figures are coated with ammonium chloride.

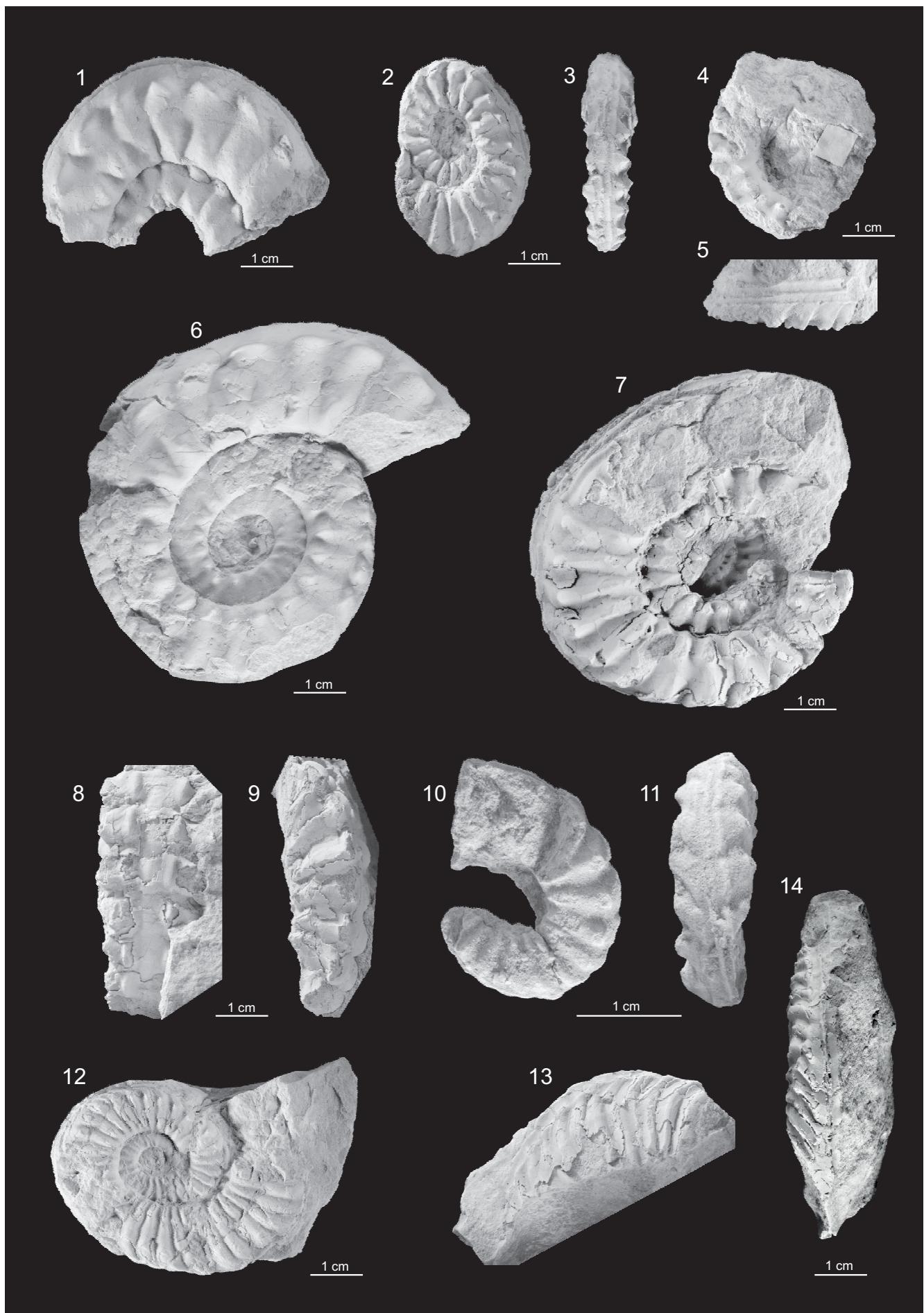


Plate 18

- Fig. 1: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOURE, 1894); SK/NU/1997/76b; Nussenseebach, Upper Austria; x 1.
- Figs. 2, 3: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOURE, 1894); SK/NU/1997/76a; Nussenseebach, Upper Austria; x 1.
- Figs. 4, 5: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOURE, 1894); SK/NU/1981/28; Nussenseebach, Upper Austria; x 2.
- Figs. 6, 7: *Protexanites (Protexanites) cf. bontanti* (DE GROSSOURE, 1894); MA/1982/16; tunnel section north of Bad Ischl, Upper Austria; x 1.
- Figs. 8–10: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); HNS/6381; Lectotype; Glanegg, Salzburg; x 1.
- Figs. 11, 12: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); NHMW/1978/2029/0003, Original of KENNEDY et al. (1981: Figs. 4A–H); Glanriedl, Salzburg; x 1.
- Fig. 13: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); HNS/6384; Glanegg, Salzburg; x 1.5.
- Fig. 14: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); MA/1982/18; tunnel section north of Bad Ischl, Upper Austria; x 1.
- Fig. 15: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); SK/EB/1985/8; Edlbachgraben, Gosau, Upper Austria; x 1.
- Fig. 16: *Paratexanites serratomarginatus* (REDTENBACHER, 1873); SK/NU/2019/91, fragment of a whorl; Nussenseebach, Upper Austria; x 1.

All figures are coated with ammonium chloride.

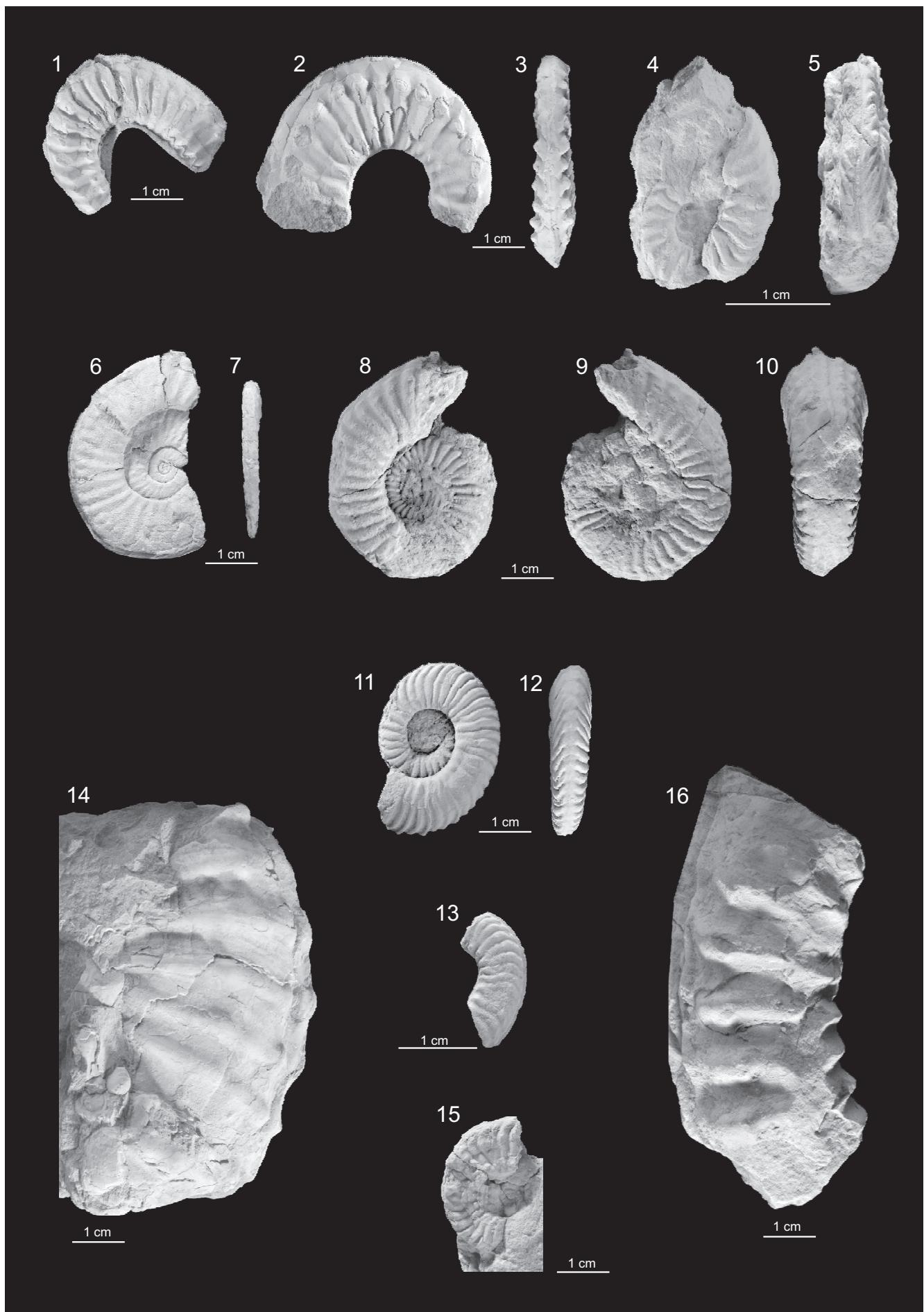


Plate 19

- Figs. 1, 2: *Tissotioides (Tissotioides) haplophyllus* (REDTENBACHER, 1873); NHMW/1989/0050/0049; Schmalnauer Alpe, Salzburg.
- Fig. 3: *Metatissotia ewaldi* (VON BUCH, 1848); SK/NU/1983/52; Nussenseebach, Upper Austria.
- Fig. 4: *Tissotioides (Tissotioides) haplophyllus* (REDTENBACHER, 1873); GBA/1873/001/0031 fragmented and distorted, original of REDTENBACHER (1873: PI. 30, Fig. 8); Schmalnauer Alpe, Salzburg.
- Fig. 5: *Tissotioides (Tissotioides) haplophyllus* (REDTENBACHER, 1873); SK/FA/1990/28; Schmalnauer Alpe, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.



Plate 20

Figs. 1, 2: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873: 100, Pl. 23, Fig. 1a–c), holotype; GBA/1873/001/0007; Schmalnauer Alpe, Salzburg.

Figs. 3, 4: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); NHMW/1989/0050/0028; Schmalnauer Alpe, Salzburg.

Figs. 5, 6: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); NHMW/1989/0050/0021; Schmalnauer Alpe, Salzburg.

Figs. 7, 8: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); NHMW/1989/0050/0027; Schmalnauer Alpe, Salzburg.

Fig. 9: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); NHMW/1989/0050/0029; Schmalnauer Alpe, Salzburg.

Fig. 10: *Metatissotia ewaldi* (VON BUCH, 1848); SK/NU/1983/52; Nussenseebach, Upper Austria.

Fig. 11: *Metatissotia ewaldi* (VON BUCH, 1848); GBA/1873/001/0006/05; Schmalnauer Alpe, Salzburg.

All figures are natural size, and all are coated with ammonium chloride.

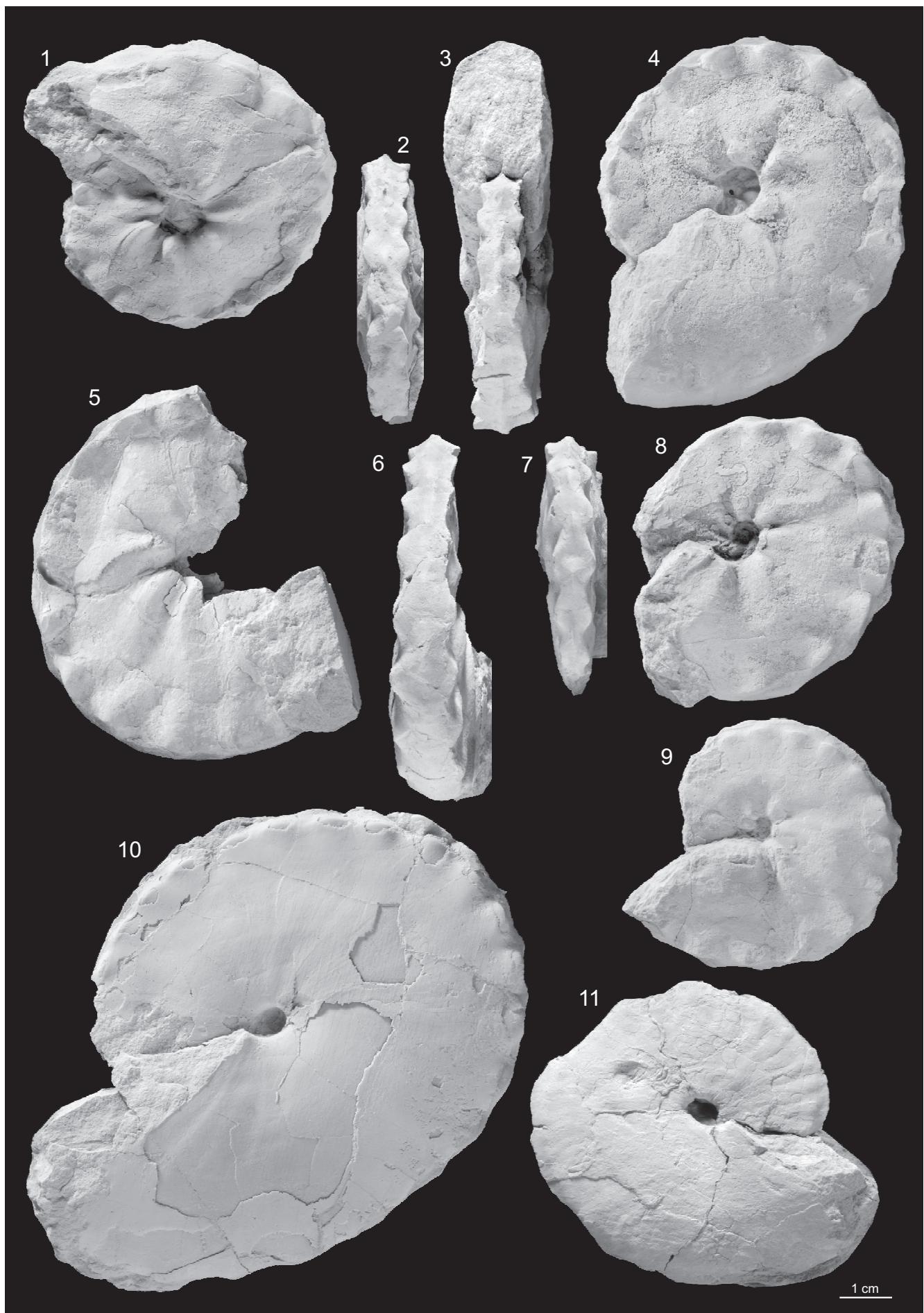


Plate 21

- Figs. 1, 2: *Metatissotia ewaldi* (VON BUCH, 1848); SK/NU/1983/54; Nussenseebach, Upper Austria.
- Figs. 3, 4: *Metatissotia ewaldi* (VON BUCH, 1848); GBA/1873/001/0006/04; Schmalnauer Alpe, Salzburg.
- Fig. 5: *Metatissotia ewaldi* (VON BUCH, 1848); PIUW, not reg., ex coll. Kronprinz Rudolf; unknown locality.
- Fig. 6: *Metatissotia ewaldi* (VON BUCH, 1848); PIUW, not reg., ex coll. Kronprinz Rudolf; unknown locality.
- Fig. 7: *Metatissotia ewaldi* (VON BUCH, 1848); SK/FA/1990/23; Schmalnauer Alpe, Salzburg.
- Fig. 8: *Metatissotia ewaldi* (VON BUCH, 1848); OÖLM/2021/81; unknown locality.
- Fig. 9: *Metatissotia ewaldi* (VON BUCH, 1848); OÖLM/2021/82; unknown locality.
- Figs. 10, 11: *Tissotiooides (Tissotiooides) haplophyllus* (REDTENBACHER, 1873); SK/FA/1990/29; Schmalnauer Alpe, Salzburg.
- Fig. 12: *Metatissotia ewaldi* (VON BUCH, 1848); SK/FA/1982/12; Fahrenberg, Salzburg.
- Figs. 13, 14: *Metatissotia ewaldi* (VON BUCH, 1848); SK/FA/1990/24; Fahrenberg, Salzburg.

All figures are natural size, all are coated with ammonium chloride.



Plate 22

- Fig. 1: *Baculites incurvatus* DUJARDIN, 1837; SK/NU/2019/92; Nussenseebach, Upper Austria; x 1.
- Fig. 2: *Baculites incurvatus* DUJARDIN, 1837; SK/FA/1994/32; Schmalnauer Alpe, Salzburg; x 1.
- Fig. 3: *Baculites* sp.; NHMW/1989/0050/0052; Schmalnauer Alpe, Salzburg; x 1.
- Fig. 4: *Baculites incurvatus* DUJARDIN, 1837; GBA/1873/001/0038, the original of REDTENBACHER 1873: Pl. 30, Fig. 13; Schmalnauer Alpe, Salzburg; x 1.
- Fig. 5: *Baculites incurvatus* DUJARDIN, 1837; NHMW/2018/0156/0002; Nussenseebach, Upper Austria; x 1.1.
- Fig. 6: *Glyptoxoceras crispatum* (MOBERG, 1885); OÖLM/1938/37; Klausmeister next Strobl, Salzburg; x 1.
- Fig. 7: *Neocrioceras (Neocrioceras) gosavicense* SUMMESBERGER, KENNEDY & SKOUMAL, 2017b; SK/NU/1995/72; Nussenseebach, Upper Austria; x 1.5.
- Fig. 8: *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; SK/NU/1981/35; Nussenseebach, Upper Austria; x 1.
- Fig. 9: *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; NHMW/2018/0156/0001; Nussenseebach, Upper Austria; x 1.
- Fig. 10: *Schlüterella aff. compressa* KLINGER, 1976; GBA/1873/001/0037, the original of REDTENBACHER, 1873: Pl. 30, Fig. 16; Schmalnauer Alpe, Salzburg; x 1.
- Fig. 11: *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; SK/NU/1989/58; Nussenseebach, Upper Austria; x 1.5.
- Figs. 12, 13: *Pseudoxybeloceras (Parasolenoceras) splendens* COLLIGNON, 1969; SK/NU/1996/75; Nussenseebach, Upper Austria; x 1.

All figures are coated with ammonium chloride.



Plate 23

- Figs. 1, 2: *Schlüterella aff. compressa* KLINGER, 1976; SK/FA/1990/26; Schmalnauer Alpe, Salzburg.
- Figs. 3, 4: *Neocrioceras (Neocrioceras) gosaviense* SUMMERSBERGER, KENNEDY & SKOUMAL, 2017b; SK/NU/1994/69; Nussenseebach, Upper Austria.
- Fig. 5: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1982/49; Nussenseebach, Upper Austria.
- Fig. 6: *Yezoites arnaudi* (DE GROSSOURE, 1894); NHMW/1989/0050/0061; Schmalnauer Alpe, Salzburg.
- Figs. 7, 10, 11: *Yezoites arnaudi* (DE GROSSOURE, 1894); NHMW/1989/0050/0064; Schmalnauer Alpe, Salzburg.
- Fig. 8: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1983/57; Nussenseebach, Upper Austria.
- Fig. 9: *Yezoites arnaudi* (DE GROSSOURE, 1894); NHMW/1935/0003/0035; Nussenseebach, Upper Austria.
- Fig. 12: *Yezoites arnaudi* (DE GROSSOURE, 1894); HNS/6408/9; unknown locality.
- Fig. 13: *Yezoites arnaudi* (DE GROSSOURE, 1894); NHMW/1983/0071/0001; Nussenseebach, Upper Austria.
- Fig. 14: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1981/14; Nussenseebach, Upper Austria.
- Fig. 15: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1996/74; Nussenseebach, Upper Austria.
- Fig. 16: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1981/24; Nussenseebach, Upper Austria.
- Fig. 17: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1981/44; Nussenseebach, Upper Austria.
- Fig. 18: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1981/42b; Nussenseebach, Upper Austria.
- Fig. 19: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1993/65; Nussenseebach, Upper Austria.
- Fig. 20: *Yezoites arnaudi* (DE GROSSOURE, 1894); SK/NU/1981/42d; Nussenseebach, Upper Austria.
- Fig. 21: *Yezoites arnaudi* (DE GROSSOURE, 1894); NHMW/1989/0050/0062; Nussenseebach, Upper Austria.
- Fig. 22: *Yezoites arnaudi* (DE GROSSOURE, 1894); PIUW, not reg., collection A. Tollmann; Weißenbach next Bad Aussee, Styria.

Figs. 1–4 are natural size, Figs. 5–22 are x 1.5, and all are coated with ammonium chloride.

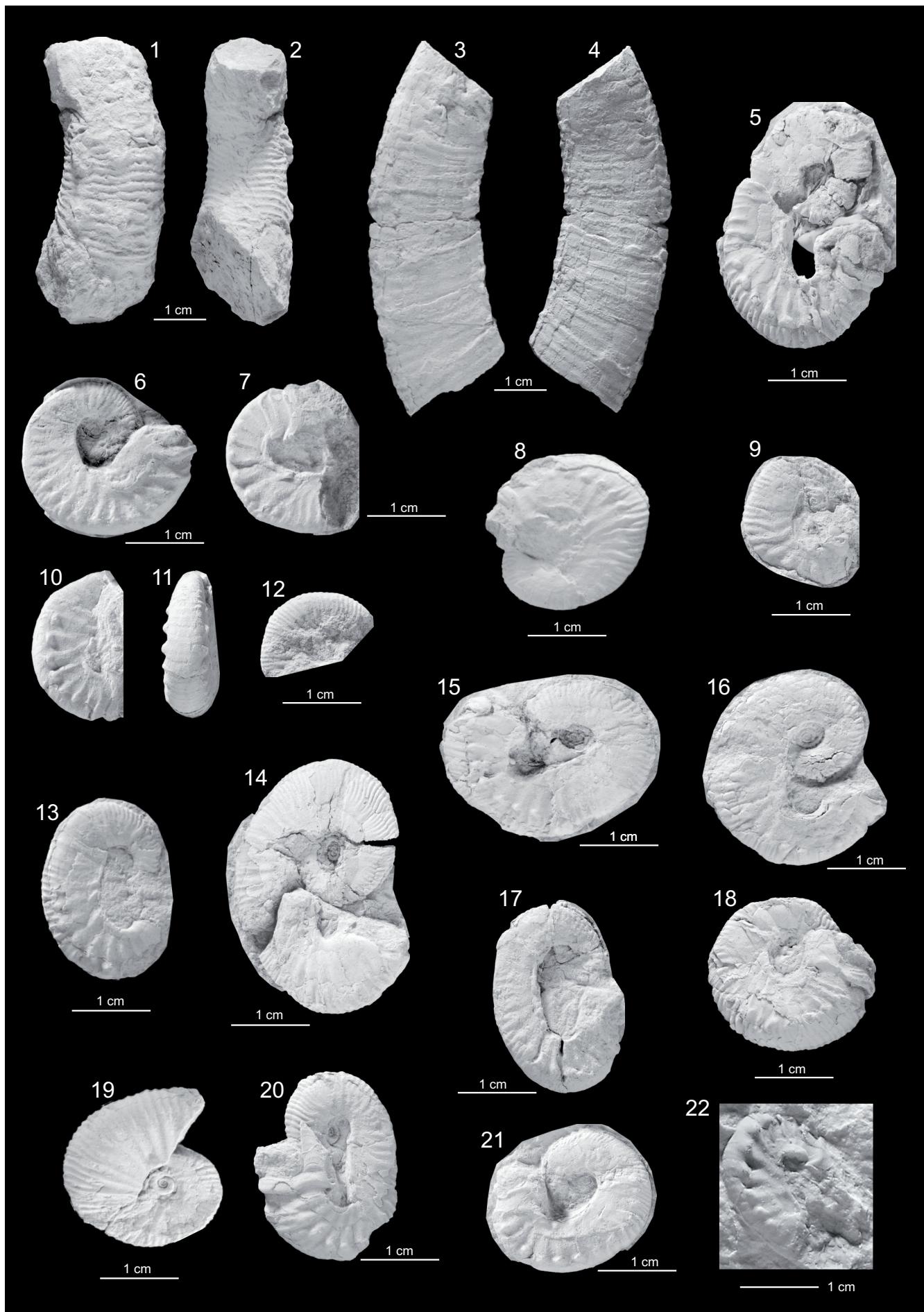


Plate 24

- Figs. 1, 2: *Yezoites arnaudi* (DE GROSSOUIRE, 1894); NHMW/1989/0050/0065; Schmalnauer Alpe, Salzburg.
- Figs. 3, 4: *Yezoites arnaudi* (DE GROSSOUIRE, 1894); GBA/1935/001/0004; Leiner Alpe, Salzburg.
- Fig. 5: *Yezoites arnaudi* (DE GROSSOUIRE, 1894); PIUW not reg.; Kronprinz Rudolf collection.
- Fig. 6: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/1989/0050/0066.
- Fig. 7: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1995/71.
- Fig. 8: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/1935/0003/0034.
- Fig. 9: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1990/61.
- Fig. 10: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/1978/1956/0001.
- Fig. 11: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1981/7.
- Fig. 12: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1995/70.
- Fig. 13: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/2018/0176/0001.
- Fig. 14: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1983/53.
- Fig. 15: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/2002/85.
- Fig. 16: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/1935/0003/0033b.
- Fig. 17: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/2018/0176/0002.
- Figs. 18, 19: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/1935/0003/0042.
- Fig. 20: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; GBA/1873/001/0035; Schmalnauer Alpe
- Fig. 21: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; NHMW/2018/0176/0003.
- Fig. 22: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1983/55.
- Fig. 23: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1992/63.
- Fig. 24: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/2002/84.
- Fig. 25: *Scaphites kieslingswaldensis* LANGENHAN & GRUNDEY, 1891; SK/NU/1981/15.
- Figs. 1–5 and 8 are x 1.5, all other figures are natural size (x 1). All figures but 1–4, 20 are from Nussenseebach, Upper Austria, and all figures are coated with ammonium chloride.

