New information on the Early Bajocian types of sonniniids and hammatoceratids (Ammonitina) described by W. Waagen (1867) from Gingen/Fils (SW Germany)

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Abstract. The type specimens of the species of sonniniids and hammatoceratids (Ammonitina) from the Lower Bajocian of Gingen/Fils (SW Germany) described by Waagen in 1867, and deposited in the Bavarian State Collection for Palaeontology and Geology in Munich, are revised. They are referred to the morphogenera *Euhoploceras*, *Shirbuirnia*, *Papilliceras*, *Sonninia*, *Witchellia,* and *Fissilobiceras*: *E. adicrum* (Waagen, 1867), *E. polyacanthum* (Waagen, 1867), *E. mayeri* (Waagen, 1867), *S. gingensis* (Waagen, 1867), *P. mesacanthum* (Waagen, 1867), *S. patella* (Waagen, 1867), *W. jugifera* (Waagen, 1867), and *F. fissilobatum* (Waagen, 1867). A lectotype is designated for *E. mayeri* (Waagen, 1867).
Keywords: Sonniniidae ▪ Hammatoceratidae ▪ Ammonitina ▪ Middle Jurassic ▪ Lower Bajocian ▪ W. Waagen ▪ Southwest Germany.

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Resumen. ***Nueva información sobre los tipos de sonniníidos y hammatocerátidos (Ammonitina, Cephalopoda) del Bajociano Inferior de Gingen/Fils (SO de Alemania) descriptos por W. Waagen (1867).*** Los especímenes tipo de sonniníidos y hammatocerátidos (Ammonitina) del Bajociano Inferior de Gingen/Fils (SO de Alemania) descriptos por Waagen en 1867, actualmente depositados en el Bayerischen Staatssammlung für Paläontologie und Geologie in München, son revisados y referidos a los morfogéneros *Euhoploceras*, *Shirbuirnia*, *Papilliceras*, *Sonninia*, *Witchellia,* y *Fissilobiceras*: *E. adicrum* (Waagen, 1867), *E. polyacanthum* (Waagen, 1867), *E. mayeri* (Waagen, 1867), *S. gingensis* (Waagen, 1867), *P. mesacanthum* (Waagen, 1867), *S. patella* (Waagen, 1867), *W. jugifera* (Waagen, 1867), y *F. fissilobatum* (Waagen, 1867). Un lectotipo es designado para *E. mayeri* (Waagen, 1867).
Palabras clave: Sonniniidae ▪ Hammatoceratidae ▪ Ammonitina ▪ Jurásico Medio ▪ Bajociano inferior ▪ W. Waagen ▪ Sudoeste de Alemania.

Zusammenfassung. ***Neues über die von W. Waagen (1867) aus dem frühen Bajocium von Gingen/Fils (SW Deutschland) beschriebenen Typen von Sonninien und Hammatoceraten (Ammonitina, Cephalopoda).*** Die von Waagen (1867) publizierten Typen von Sonninien und Hammatoceraten (Ammonitina) des Unteren Bajocium von Gingen/Fils, aufbewahrt in der Bayerischen Staatssammlung für Paläontologie und Geologie in München, werden revidiert und den Morphogattungen *Euhoploceras*, *Shirbuirnia*, *Papilliceras*, *Sonninia*, *Witchellia* und *Fissilobiceras* zugeordnet: *E. adicrum* (Waagen, 1867), *E. polyacanthum* (Waagen, 1867), *E. mayeri* (Waagen, 1867), *S. gingensis* (Waagen, 1867), *P. mesacanthum* (Waagen, 1867), *S. patella* (Waagen, 1867), *W. jugifera* (Waagen, 1867) und *F. fissilobatum* (Waagen, 1867). Für *E. mayeri* (Waagen, 1867) wird ein Lectotypus designiert.
Schlüsselwörter: Sonniniidae ▪ Hammatoceratidae ▪ Ammonitina ▪ Mitteljura ▪ Bajocium ▪ W. Waagen ▪ Südwestdeutschland.

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INTRODUCTION

In 1867 Wilhelm Heinrich Waagen, in a study on the zone of *Ammonites sowerbyi,* erected eight species belonging to the families Sonniniidae and Hammatoceratidae (Ammonitina) from the Lower Bajocian (Middle Jurassic) of the Eastern Swabian Alb in SW Germany. Some of the ammonites figured by Waagen (1867) were later refigured by Dorn (1935) and Schlegelmilch (1985).

The aims of this work are (1) to present a review of the type material of sonniniids and hammatoceratids (Ammonitina) described by Waagen (1867) with good illustrations of the type-specimens together with a drawing of the section. (2) to define more precise type-horizons for these ammonites (see Dietze et al. 2005: Tab.1).

Many modern workers, starting with Oechsle (1958) have tried to review the taxonomy of these type specimens, to specify their exact stratigraphic position and to reconstruct their palaeogeographic distribution (Westermann 1966, 1969, Westermann & Riccardi 1972, Parsons 1974, Morton 1975, Dietl & Haag 1980, Ohmert 1988, 2004, Hall 1989, Galácz 1991, Sadki 1994, 1996, 2010, Sandoval & Chandler 2000, Dietze et al. 2003, 2005, 2006, 2007, Chandler et al. 2006, de Baets et al. 2008, Sadki et al. 2015, Chandler 2019, Sandoval 2019).

GEOGRAPHICAL AND GEOLOGICAL FRAMEWORK

The original specimens described by Waagen (1867) come from the locality of Gingen/Fils in the Eastern Swabian Alb (SW Germany; Figs. 1-2). He bought some of these ammonites from the private collector Wittlinger (Waagen 1867: 510); which of

the figured ammonites were collected by Wittlinger and which by Waagen himself is not known. The sources of all the ammonites described from Gingen/Fils were quarries opened for extracting gravel during the building of the railway line some years earlier through the Fils valley to Geislingen an der Steige. The area around Gingen an der Fils (Figs. 2-3) - Lauterstein-Nenningen - Donzdorf-Winzingen (Fig. 2, 4) is well known for its rich sonniniid faunas in the Sowerbyioolith Member (Waagen 1867, Quenstedt 1886, Dorn 1935, Oechsle 1958, Dietl & Haag 1980; Dietze et al. 2003, 2005).

The historical sections north of Gingen an der Fils are now overgrown and no longer accessible, so that we must refer to descriptions in the literature.

Waagen (1867) described the section from top to bottom as below. He used as a measurement Fuß (′), which was at that time in Bavaria about 29 cm.

(e) Yellow claystones with belemnites.
(d) grey, not very hard, sandy limestone (*Ammonites sauzei, A. polyschides*) [= Blaukalk Member; c. 4′ (c. 0.75–0.8 m)]
(c) dark, somewhat sandy claystones with rare pyritized fossils [= "γ-Tone" (20′) (c. 5.5-6 m)]:
(b) yellow, sandy claystone with many larger and smaller nodules of sandy limestone and masses of fossils (*Ammonites sowerbyi* among others) 2–3′ [c. 55-80 cm]:
(a) Thick beds of "Eisensandstein"

Engel (1908) described above the "*Sowerbyi*-Bank" some meters of dark clay without fossils and 0.5-0.8 m "Blaue Kalke" on top.

Oechsle (1958) described as section number 10 «Gingen (über der Bahn)»:

- Mittel-γ-Tone [= "γ-Tone"; = (c) Waagen)]
- sowerbyi-Bank: not massive bed, but comprising a nodular facies containing ooids and bored pebbles, small nodules on top [= Sowerbyoolith Member, 0.17 m; = (b) Waagen)].
- sandy, yellow to brown bed [= Oberer Donzdorf-Sandstein (more than 1.5 m); = (a) of Waagen]

Weber (1964) described from section number 16 (creek east of the Gingen railway station) the thickness of the nodular "*sowerbyi*-Bank" with 0.15 m [= Sowerbyoolith Member; = (b) of Waagen].

Borngraeber (1993) described the Sowerbyioolith Member [0.15-0.25 m; = (b) of Waagen] of the area as grey, marly limestones, often nodular and more or less sandy. The thickness of the Blaukalk Member [= (d) of Waagen] in the area is, according to Borngraeber (1993) about 0.5 m.

Compared to the sections described by Dietze et al. (2005) from the nearby Lauter valley (Donzdorf-Winzingen, Weißenstein-Nenningen), the section of Gingen/Fils is extremely reduced in thickness.

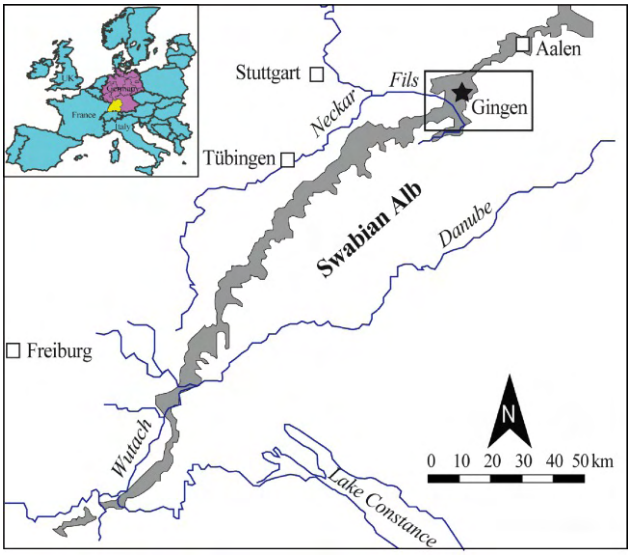

Figure 1. Locality map for Gingen/Fils (E Swabian Alb, SW Germany) within Europe.

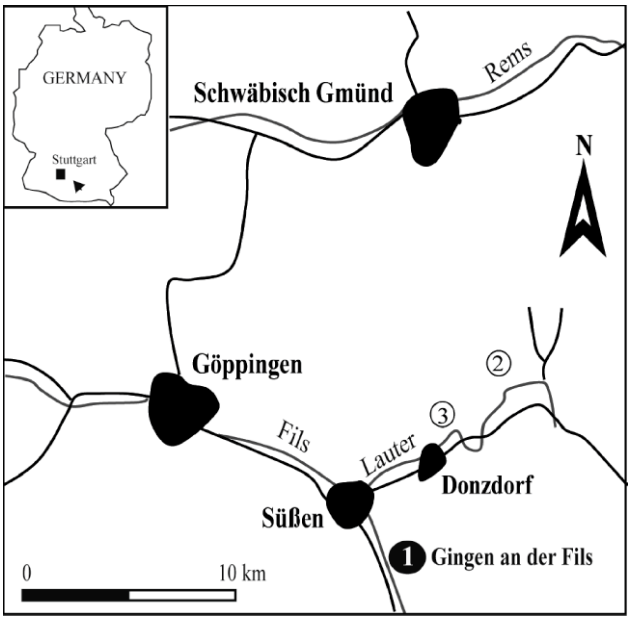

Figure 2. **[1]**- Gingen/Fils: Locality from which the original specimens described by Waagen (1867) come. **[2]**- Lauterstein-Nenningen, **[3]**- Donzdorf-Winzingen (modified from Dietze et al. 2005).

MATERIAL

The ammonoids figured by Waagen (1867) are deposited in the Bavarian State Collection for Palaeontology and Geology of Munich (Staatliche Naturwissenschaftliche Sammlungen Bayerns, SNSB). Many ammonites, which were only mentioned in the text, but not figured by Waagen, were destroyed in World War II. A large part of his collection, with many syntypes and paralectotypes, is now stored in the collection of the Geoscience Museum of the University of Göttingen. Obviously Waagen sold a large part of his (ammonite) collection to the University of Göttingen. Only the figured type-material of Waagen (1867) is now stored in Munich. Some ammonites from Gingen/Fils are also in the collections of the Staatliches Museum für Naturkunde in Stuttgart (SMNS) and of the University of Tübingen.

Abbreviations. *D*: maximum diameter, *H*: whorl-height, *W*: whorl-width, *U*: umbilical-width, *h*: *H/D*, *w*: *W/D*, *u*: *U/D*, *N*/2: number of primary ribs per half whorl. Measurements are given in millimetres. HT: holotype, LT: lectotype, ST: syntype; SNSB: Staatliche Naturwissenschaftliche Sammlungen Bayerns.

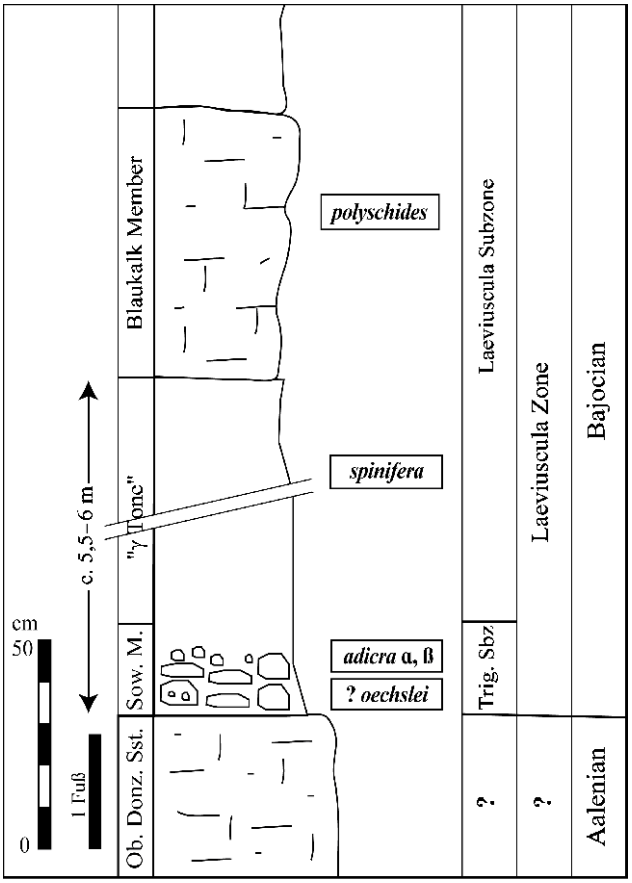

Figure 3. Lithostratigraphy and biostratigraphy of the section at Gingen/Fils (after Waagen 1867, Oechsle, 1958, Weber 1964, Borngraeber 1993).

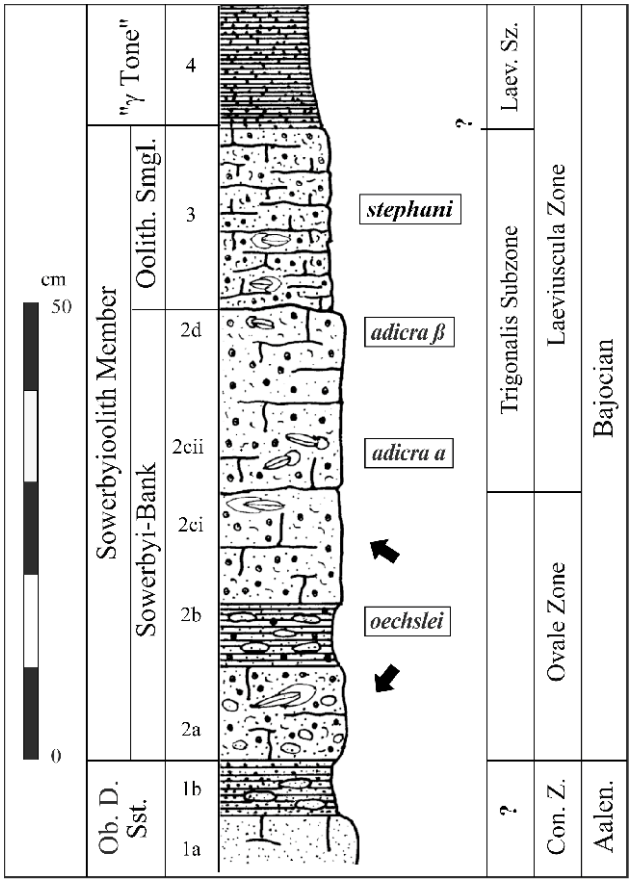

Figure 4. Litho- and biostratigraphy of the Sowerbyioolith Member at the Gefällholz section, near Donzdorf-Winzingen, E Swabia (after Dietze et al. 2005). Strata of the Discites Zone are missing in this section. The arrows mark the beds of the *oechslei* horizon.

SYSTEMATIC PALAEONTOLOGY

Class Cephalopoda Cuvier, 1798
Order Ammonitida Fischer, 1882
Suborder Ammonitina Fischer, 1882
Superfamily Hildoceratoidea Hyatt, 1867

Family Sonniniidae Buckman, 1892
(Subfamilies Sonniniinae Buckman, 1892 and Witchelliinae Callomon & Chandler 2006)

Remarks. The family Sonniniidae includes a great variety of forms, always keeled, but with diverse whorl sections, usually decorated with ribs and tubercles on at least one stage of their development. It shows a variety of (morpho)genera with macroconchiate and microconchiate forms (Fig. 5), which span from the Upper Aalenian Concavum Zone to the top of the Lower Bajocian Humphriesianum Zone (Sadki 2010, Howarth 2013). The acme of the group is in the Ovale, Laeviuscula and Sauzei (= Propinquans) zones. Although all the sonniniids are phylogenetically closely related (Dietze et al. 2005), we here use morphogenera for the description of the type-specimens from which Waagen erected species within the Sonniniidae and Hammatoceratidae.

Many species of this family are used as zonal indices (*Witchellia laeviuscula*, *Sonninia propinquans*, formerly *Sonninia sowerbyi*), or subzone indices (*Euhoploceras acanthodes, E. dominans*, *E. modestum*, *Shirbuirnia trigonalis*, *Witchellia laeviuscula*, *Sonninia patella*, *Dorsetensia hebridica*, *Dorsetensia romani*) and sometimes as horizon index-species (e.g. *Pseudoshirbuirnia oechslei*, see Fig. 4). This fact shows clearly that the biostratigraphic division of the Lower Bajocian is essentially based on the representatives of the Sonniniidae, which, furthermore, constitute the bulk of the Ammonitina.

From the Concavum/Discites zones to near the top of the Laeviuscula Zone the morphogenus *Euhoploceras* is the dominant group. Reviews were given by Sandoval & Chandler (2000), Dietze et al. (2005), and by Chandler (2019).

In the Ovale Zone the morphogenus *Witchellia* occurs, with triangular whorl section, and several other genera coexist: *Euhoploceras adicrum* group, *Papilliceras*, *Shirbuirnia* and *Pseudoshirbuirnia*.

In the Sauzei (=Propinquans) Zone the morphogenus *Sonninia* is the dominant group among the sonniniids.

In the Humphriesianum Zone the genus *Dorsetensia* occurs (Dietze et al. 2011).

Subfamily Sonniniinae Buckman, 1892

Genus *Euhoploceras* Buckman, 1913

Type species. *Sonninia acanthodes* Buckman, 1889

Remarks. The genus *Euhoploceras* constitutes the first representatives of the family Sonniniidae. It is known from the

Concavum to the Laeviuscula zones. In the figured material of Waagen there are two species represented: *Euhoploceras adicrum* and *Euhoploceras polyacanthum*. The naming of zones and sub-zones in the following descriptions refers to the occurrence of the type specimens.

***Euhoploceras adicrum* (Waagen, 1867) [M]**
Fig. 6

Synonymy
v 1867 *Ammonites adicrus* Waagen n. sp. – Waagen: 591, pl. 25: 1 [LT]
v 1935 *Sonninia adicra* Waagen – Dorn: 37, text-fig. 3, figs. 1-2; pl. 10: 1, 7 [refiguration of the LT]
1966 *Sonninia adicra* (Waagen, 1867) – Géczy: 124, pl. 35: 1-2, pl. 44: 3
1973 *Sonninia* (*Euhoploceras*) *adicra* (Waagen) – Imlay: 65, pl. 13: 5-12, pls. 14-17
v 1985 *Sonninia adicra* (Waagen 1867) – Schlegelmilch: 60, pl. 17: 1 [re-figuration of the LT]
1985 *Euhoploceras adicrum* (Waagen 1867) – Fernández-López: 23, pl. 2: 1
v 2005 *Sonninia* (*Euhoploceras*) *adicra* (Waagen, 1867) [M] – Dietze et al.: 25, text-figs. 7-10 [with extensive synonymy]
v 2015 *Euhoploceras* gr. *adicrum* (Waagen, 1867) – Sadki et al.: 60, pls. 11-12, pl. 14: D
2015 *Sonninia* (*Euhoploceras*) *adicra* (Waagen, 1867) – Galácz et al.: 8, pl. 2: 5-6
v 2017 *Sonninia adicra* (Waagen, 1867) – Dietze et al.: 54, pl. 2: 1-2
v 2019 *Sonninia adicra* (Waagen, 1867) – Dietze et al.: 58, pl. 5: 1, 4, pl. 6: 2

Material (in SNSB)**:** Lectotype (SNSB-BSPG AS XXII33).

Measurements. Lectotype: *D* = 126 mm, *H* = 48 mm, *W* = 37 mm, *U* = 48 mm, *H/D*(%) = 38, *W/D*(%) = 29, *U/D*(%) = 38, *N/2* = 11.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone
Subzone: Trigonalis Subzone
Type Horizon: *adicra* α or *adicra* β horizon
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII33

Description. Sonniniid with a wide umbilicus, a subrectangular whorl-section and oval ventral edge bearing a strong keel. Umbilical wall steep with rounded umbilical edge. The ribs are simple, strong, non-bifurcating and slightly tuberculate on the inner whorls becoming unevenly spaced, fold-like and slightly protruding, then sickle-like on the external whorls. As in most sonniniids, *Euhoploceras adicrum* has highly variable ribbing (Westermann 1966, Dietze et al. 2005).

Remarks. The lectotype is an internal mould and has rather poorly preserved inner whorls. It is difficult to assess the strength of the spinose stage, but it is clear that if the shell was intact, the spines would be more prominent. Descriptions of chorotypes of *E. adicrum* from around Nenningen (Lauter valley) in southern Germany were given by Oechsle (1958) and Dietze et al. (2005; as chronospecies). The *Euhoploceras* faunas from the Concavum/Discites zones from Bradford Abbas (Dorset, S England) were described by Buckman (1887-1907) with many specific names not conspecific with *E. adicrum* as supposed by Westermann (1966).

Records. S Germany, N Germany, S England, France, Spain (Cordillera Ibérica, Cordillera Subbética), Morocco, USA (Eastern Oregon).

***Euhoploceras polyacanthum* (Waagen, 1867) [M]**
Fig. 7

Synonymy
v 1867 *Ammonites polyacanthus* n. sp. – Waagen: 592, pl. 29: 1 [HT by monotypy]
v 1935 *Sonninia polyacantha* Waagen – Dorn: 44, pl. 9: 1 [refiguration of the HT]
1973 *Sonninia* (*Euhoploceras*) *polyacantha* (Waagen) – Imlay: 64, pls. 18-19 [= HT of *Euhoploceras tuberculatum* Taylor, 1988], pl. 20: 1, 5–7, pl. 21: 8-9
v 1985 *Sonninia polyacantha* (Waagen, 1867) – Schlegelmilch: 61, pl. 17: 2 [refiguration of the HT]
v 2005 *Sonninia* (*Euhoploceras*) *adicra* (Waagen), var. *polyacantha* ex Waagen, 1867 sp. [M] – Dietze et al.: 32, text-figs. 13-14 [with synonymy]

Material (in SNSB): Holotype (SNSB-BSPG AS XXII40).

Measurements. Holotype: *D* = 260 mm, *H* = 83 mm, *W* = 56 mm, *U* = 112 mm, *H/D*(%) = 32, *W/D*(%) = 22, *U/D*(%) = 43, *N/2* = 13.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone
Subzone: Trigonalis Subzone
Type Horizon: *adicra* α or *adicra* β horizon
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII40

Description. HT large-sized, with oval and widely umbilicate whorls. The venter is weakly convex with a moderately strong keel. Ornamentation consists of single strong and widely spaced ribs.

Remarks. Dietl & Haag (1980) gave a list of fossils in which they identified *E. polyacanthum* in the Laeviuscula Subzone of the nearby Nenningen section. Recently, Dietze et al. (2005) gave a more accurate stratigraphic position: Lower Bajocian, Laeviuscula Zone, Trigonalis Subzone, *adicra* α/β horizons. *E. polyacanthum* (Waagen) resembles *E. spinosum* (Buckman) in Dorn (1935: 33, pl. 11: 1); *Sonninia* cf. *crassiformis* Buckman in Dorn (1935: 41, pl. 4: 2), *S. mayeri* (Waagen) in Dorn (1935: 42, pl. 3: 1) and *S. costosa* (Quenstedt) in Dorn (1935: 40, pl. 4: 1). The latter two have been included in the synonymy of *E. polyacanthum* (Waagen) by Oechsle (1958). *E. polyacanthum* (Waagen) is also similar to *Sonninia* cf. *acanthodes* Buckman in Maubeuge (1951: 18, pl. 2: 1) and to *Sonninia pseudoirregularis* n. sp. in Maubeuge (1951: 13, pl. 9: 4) both assigned to *E. polyacanthum* (Waagen) by Oechsle (1958: 88–89).

Records. S Germany, Eastern Oregon.

Genus *Shirbuirnia* Buckman, 1910

Type species. *Shirbuirnia trigonalis* Buckman, 1910

Remarks. *Shirbuirnia* differs from *Fissilobiceras* by an oxyconic shape and subtriangular section, by an almost sharp ventral border, with nearly no ventro-lateral edges and by a rather simple suture line. *Shirbuirnia* is confined in the lower part of the Laeviuscula Zone. In the material of Waagen we have only one species: *Shirbuirnia gingensis*. According to Waagen (1867) and Dietze et al. (2005) this species is by far the most

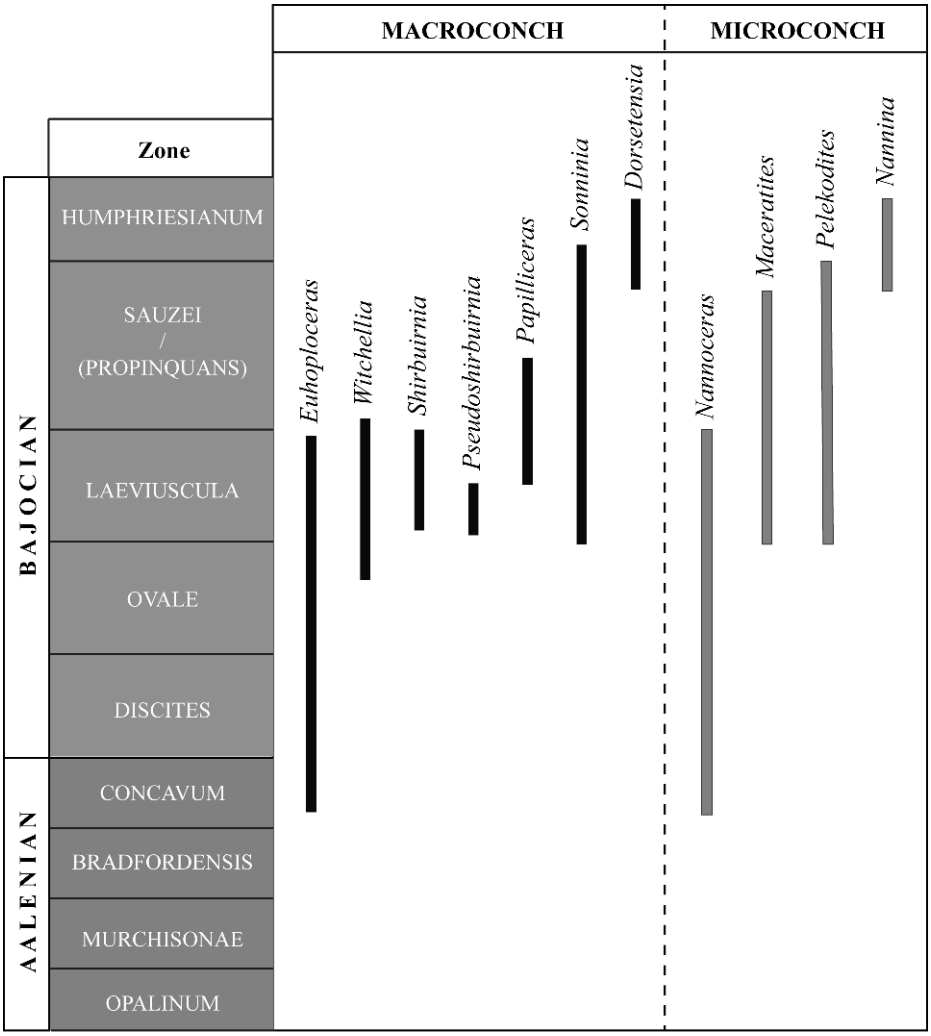

Figure 5. Distribution of genera of the family Sonniniidae in the Upper Aalenian and Lower Bajocian (modified from Sadki 1996, 2010).

common sonniniid in the Trigonalis Subzone of the Fils and Lauter valleys.

***Shirbuirnia gingensis* (Waagen, 1867) [M]**
Fig. 8

Synonymy

1856 *Ammonites jugosus* Sowerby, 1815 – Oppel: 489 (pars)
v 1867 *Ammonites gingensis* Waagen n. sp. – Waagen: 595, pl. 26: 2 [LT]
v 1935 *Sonninia gingensis* (Waagen) – Dorn: 52, pl. 11: 2 [refiguration of the LT]
1955 *Sonninia gingensis* Waagen – Maubeuge: 36, pl. 8: 1a-c
1985 *Fissilobiceras gingense* (Waagen) 1867 – Fernández-López: 30, fig. 3A, pl. 4: 1-2
1988 *Sonninia gingensis* (Waagen) – Branger: pl. 2: 2, fig. 97.9
v 2005 *Shirbuirnia gingensis* (Waagen, 1867) [M] – Dietze et al: 43, figs. 23-26
v 2017 *Shirbuirnia gingensis* (Waagen, 1867) – Dietze et al: 54, pl. 2: 3-4
v 2019 *Shirbuirnia gingensis* (Waagen) – Dietze et al.: 56, pl. 2

Material (in SMNS): Lectotype (SNSB-BSPG AS XXII 503).

Measurements. Lectotype: $D = 92$ mm, $H = 46$ mm, $W = 29$ mm, $U = 20$ mm, $H/D(\%) = 50$, $W/D(\%) = 32$, $U/D(\%) = 22$.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone
Subzone: Trigonalis Zone
Type horizon: probably from the *adicra* α/β horizons
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII 503

Description. The LT shows a whorl section typically ovate and moderately evolute. The umbilicus is quite narrow and deep, becoming quite broad in an advanced stage of growth. The venter is rounded with a low keel. The internal whorls are typically ribbed, while the middle and outer ones are smooth.

Records. S Germany, France, S England, Spain (Cordillera Ibérica).

Genus *Papilliceras* Buckman, 1920

Type species. *Papilliceras papillatum* Buckman, 1920

Figure 6. *Euhoploceras adicrum* (Waagen, 1867) [M]**,** lectotype (SNSB-BSPG n° AS XXII33), lateral and ventral views. Gingen/Fils. Laeviuscula Zone, Trigonalis Subzone, *adicra* α/β horizons. - Natural size (x1).

Remarks. The range of the genus *Papilliceras* spans from the Laeviuscula Zone to the lower part of the Sauzei (Propinquans) Zone. The genus *Papilliceras* is characterized by a row of mid-lateral tubercles persisting until the end of the body chamber.

In the material of Waagen there is one species: *Papilliceras mesacanthum.*

***Papilliceras mesacanthum* (Waagen, 1867) [M]**
Fig. 9

Synonymy

v 1867 *Ammonites mesacanthus* Waagen n. sp. – Waagen: 594, pl. 28: 1 [ST]
1925 *Papilliceras mesacanthum* Waagen sp., 1867 – Buckman: pl. 557A-B
v 1935 *Sonninia mesacantha* Waagen – Dorn: 43, pl. 8: 4 [re-figuration of the ST figured by Waagen]
1958 *Sonninia mesacantha* (Waagen) – Oechsle: 83, pl. 10: 3
1975 *Sonninia* (*Papilliceras*) *mesacantha* (Waagen) – Morton: 76, pl. 13: 1-3, pl. 14: 7-9. pl. 15:1
v 1985 *Sonninia mesacantha* (Waagen 1867) – Schlegelmilch: 60: pl. 16: 3 [refiguration of the ST figured by Waagen]
1985 *Papilliceras mesacanthum* (Waagen) 1867 – Fernández-López: 42, text-figs. 3G, 3H, pl. 4: 4-5

Material (in SNSB): Syntype-1 (SNSB-BSPG AS XXII39).

Measurements. Syntype-1: *D* = 152 mm, *H* = 69 mm, *W* = 38 mm, *U* = 44 mm, *H/D*(%) = 45, *W/D*(%) = 25, *U/D*(%) = 29.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone
Type Horizon: most probably *polyschides* horizon (Dietze et al. in press)
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII39

Description. Discoidal shell, large in size and moderately evolute. The inner whorls are depressed and subcircular. The outer whorls are compressed, with slightly convex flanks, external border tectiform with a narrow and high keel. The umbilical wall is sloping, with rounded umbilical edge. The ornamentation in the inner whorls consists of broad blunt ribs and prominent mid-lateral tubercles from which emerge weak secondary ribs curving forward. In the middle of the whorls the tubercules disappear, and only weak ribs remain.

Remarks. *P. mesacanthum* is the "spinose" and *P. arenatum* (Quenstedt) the smooth variant of the genus.

Remarks on the Type Horizon. *Papilliceras mesacanthum* occurs at its type locality in the Lower Bajocian Laeviuscula Zone. *Papilliceras* spp., *Emileia polyschides,* and *Otoites pauper* are typical ammonites in the Blaukalk of the area Eningen unter Achalm - Neuffen (Middle Swabian Alb), which

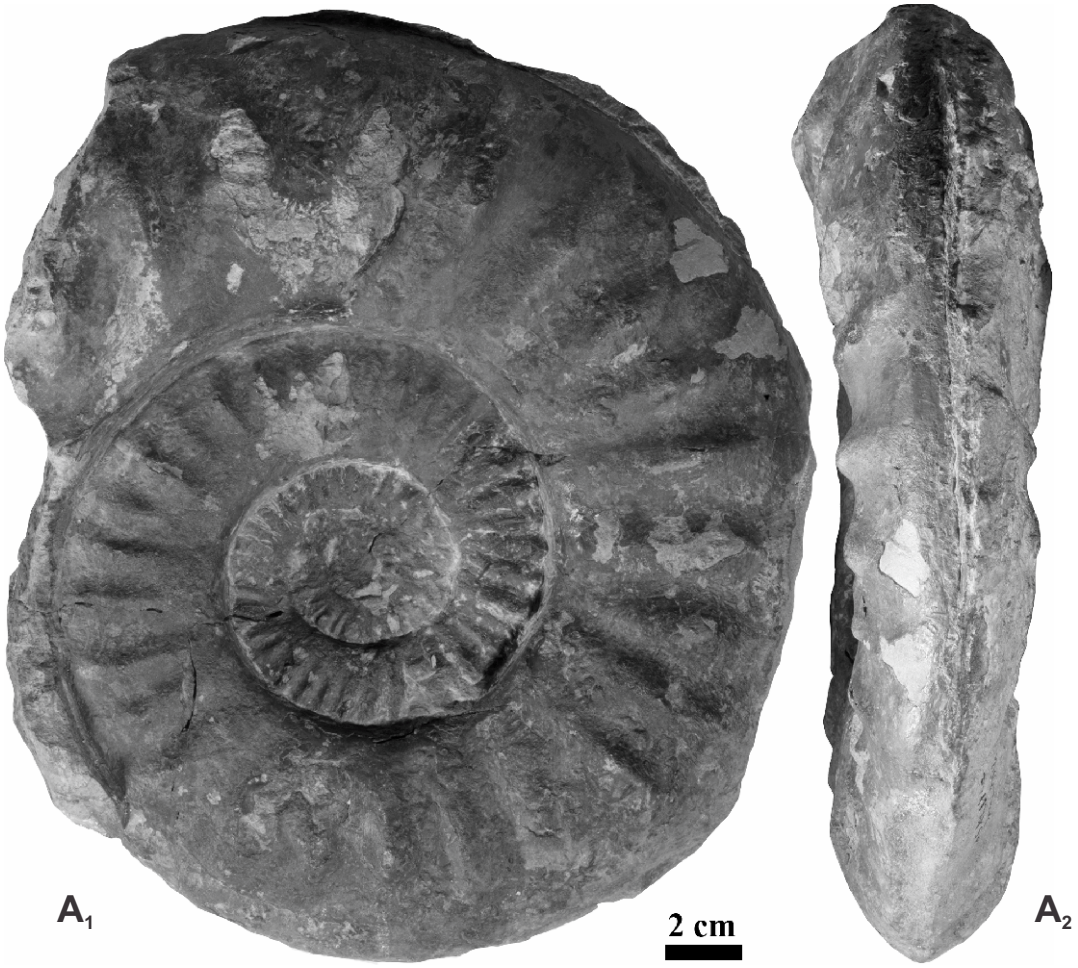

Figure 7. *Euhoploceras polyacanthum* (Waagen, 1867) [M], holotype (SNSB-BSPG n° AS XXII40), lateral and ventral views. Gingen/Fils. Laeviuscula Zone, Trigonalis Subzone, *adicra* α/β horizons. - Reduced to half-size (x0.5).

belongs to the *polyschides* horizon (Dietze et al. in press).

Records. S Germany, S England, Scotland, Cordillera Ibérica.

Genus *Sonninia* Bayle in Douvillé, 1879

Type species. *Waagenia propinquans* Bayle, 1878

Remarks. *Sonninia* occurs first in the Laeviuscula Zone, but is especially abundant in the Sauzei (Propinquans) Zone. The genus includes moderately evolute forms with compressed whorls and a narrow high keel. The inner whorls carry more or less developed tubercles sometimes replaced, in the middle whorls, by bulges. The ribs, present at all the stages, are strongly irregular, flexuous, and may be divided into two or more secondaries. The suture line is more or less complex.

In the material of Waagen there is one species: *Sonninia patella.*

***Sonninia patella* (Waagen, 1867) [M]**
Fig. 10

Synonymy

v 1867 *Ammonites patella* Waagen n. sp. – Waagen: 597, pl. 25: 2 [LT], 3
v 1935 *Sonninia patella* Waagen – Dorn: 51, pl. 14: 6 [re-figuration of the LT]
v 1985 *Sonninia patella* (Waagen 1867) – Schlegelmilch: 61, pl. 18: 2 [re-figuration of the LT]
1988 *Sonninia patella* (Waagen) – Branger: pl. 1: 1, text-fig. 97.7
1997 *Sonninia patella* (Waagen) – Rioult et al.: 48, pl. 14: 3a-b
2008 *Sonninia patella* (Waagen 1867) – de Baets et al.: 572, fig. 6b

Material (in SNSB**):** Lectotype (SNSB-BSPG AS XXII34).

Measurements. Lectotype: *D* = 128 mm, *H* = 56 mm, *W* = 28 mm, *U* = 32 mm, *H/D*(%) = 44, *W/D*(%) = 22, *U/D*(%) = 25.

Stage: Middle Jurassic, Bajocian
Type horizon: probably from the *adicra* α/β horizons
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII34

Description. The species is characterised by a compressed section. The inner whorls are ornamented with irregular, often bundled, radial sigmoidal ribs that disappear gradually on the external whorls.

Figure 8. *Shirbuirnia gingensis* (Waagen, 1867) [M], lectotype (SNSB-BSPG n° AS XXII503), lateral and ventral views. Gingen/Fils, Württemberg. Laeviuscula Zone, Trigonalis Subzone, probably from the *adicra* α/β horizons. - Natural size (x1).

Stratigraphic range. According to Dietze et al. (2005), *Sonninia patella* occurs in the Lower Bajocian with a probable type horizon in the Sauzei Zone (Propinquans Zone). Recently found chorotypes (coll. W. Dangelmaier) and a further investigation of the LT, however, show that it comes from the Sowerbyioolith Member and so from the *adicra* α/β horizons.

Records. S Germany, France, S England.

Subfamily Witchelliinae Callomon & Chandler, 2006

Genus *Witchellia* Buckman, 1889

Type species. *Ammonites laeviusculus* Sowerby, 1824

Remarks. The genus *Witchellia* first appeared in the Ovale Zone and reached its acme in the Laeviuscula Zone. It includes sonniniids that Buckman had designated under various generic names (*Anolokoleites*, *Dundryites*, *Gelasinites*, *Rubrileites*, *Stiphromorphites*, *Zugella*, and *Zugophorites*). The species of the genus *Witchellia* show involute to moderately evolute conchs, with a narrow external border carrying a keel bordered by two grooves; ribs are fairly low to relatively strong, flexuous, simple or grouped in pairs from the umbilical edge.

In the material of Waagen we have one species: *Witchellia jugifera.*

***Witchellia jugifera* (Waagen, 1867) [M]**
Fig. 11

Synonymy

v 1867 *Ammonites jugifer* Waagen n. sp. – Waagen: 596, pl. 26: 1 [LT]
v 1935 *Sonninia jugifera* Waagen – Dorn: 46, pl. 7: 5 [re-figuration of the LT]
v 1985 *Sonninia jugifera* (Waagen 1867) – Schlegelmilch: 60, pl. 16: 2 [re-figuration of the LT]
1985 *Sonninia jugifera* (Waagen) 1867 – Fernández-López: 51, fig. 4B, pl. 8: 9
non 1988 *Sonninia jugifera* (Waagen) – Branger: pl. 2: 5, text-fig. 96.4
v 2005 *Witchellia jugifera* (Waagen, 1867) [M] – Dietze et al.: 59, fig. 34a
v 2007 *Witchellia jugifera* (Waagen) [M] – Dietze et al.: pl. 5: 3 [re-figuration of a cast of the LT]
v 2009 *Witchellia jugifera* (Waagen) [M] – Dietze et al.: 21, text-fig. 3a-b
v 2010 *Witchellia jugifera* (Waagen) [M] – Dietze et al.: 25, pl. 2: f-h
2014 *Witchellia jugifera* (Waagen, 1867) – Metodiev & Tsvetkova: 32, figs. 3.6-7
2015 *Witchellia jugifera* (Waagen, 1867) – Galácz et al.: 10, pl. 3: 1-2
2019 *Witchellia jugifera* (Waagen, 1867) – Dietze et al.: 58, figs. 4.5, 5.6a-b, 6.3a, b, 7.1a-7.2, 7.5a, b, pl. 3: 3a-8b, pl. 4: 1a-10b

Material (in SNSB): Lectotype (SNSB-BSPG AS XXII36).

Measurements. Lectotype: *D* = 107 mm, *H* = 45 mm, *W* = 26 mm, *U* = 35 mm, *H/D*(%) = 42, *W/D*(%) = 24, *U/D*(%) = 33.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone

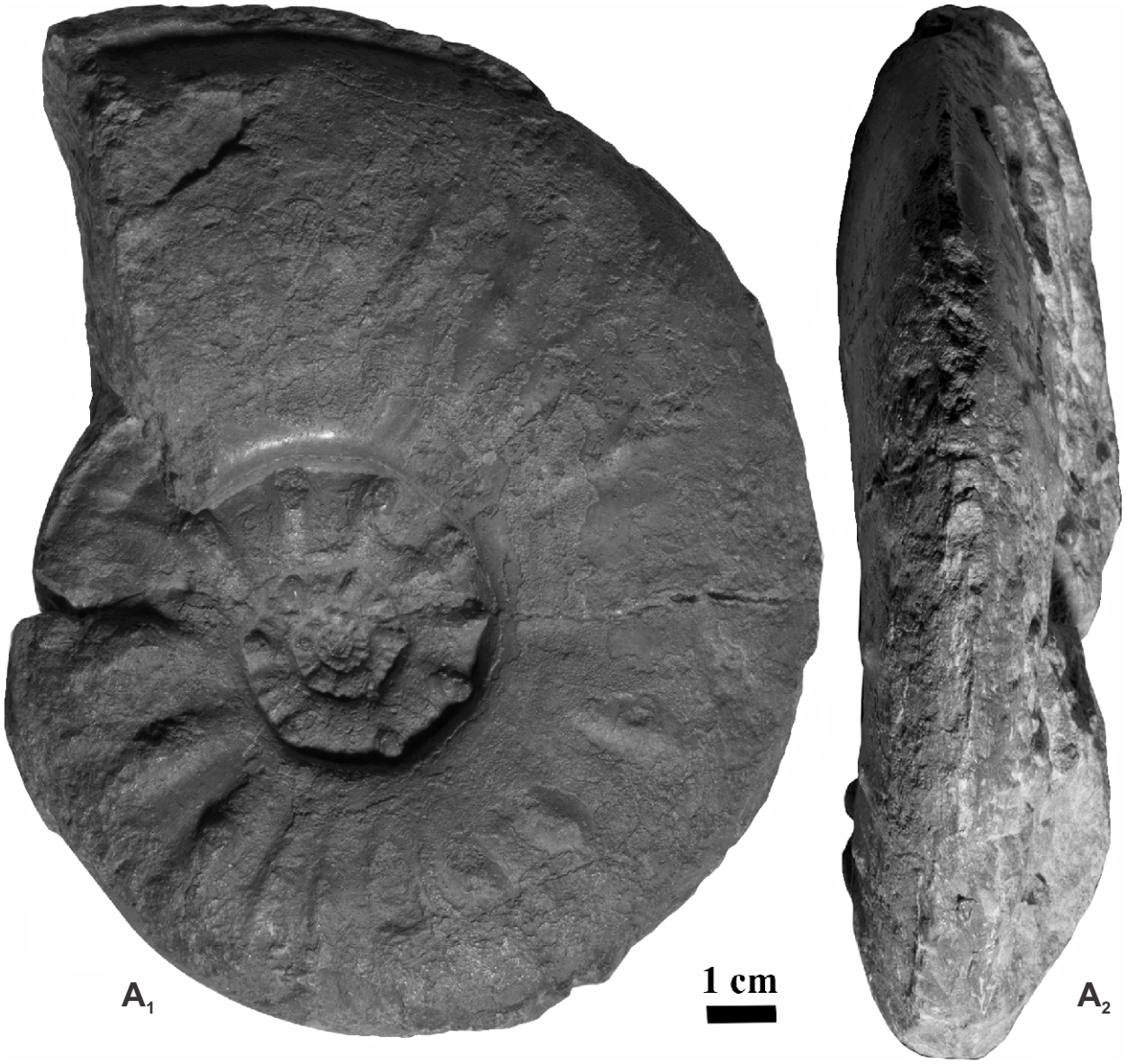

Figure 9. *Papilliceras mesacanthum* (Waagen, 1867) [M], syntype-1 (SNSB-BSPG n° AS XXII39), lateral and ventral views. Gingen/Fils. Laeviuscula Zone, most probably *polyschides* horizon. - Natural size (x1).

Subzone: Ovale Subzone
Type Horizon: ?*oechslei* Horizon
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII36

Description. The species is moderately evolute, with narrow external border showing a keel bordered by two grooves. The umbilical edge is sharp and acute, delimiting a sheer umbilical wall. The ribs are relatively strong, flexuous, grouped in pairs from the umbilical edge.

Records. S Germany, Spain (Cordillera Ibérica), France, Hungary, Bulgaria.

Family Hammatoceratidae Buckman, 1887
Subfamily Hammatoceratinae Buckman, 1887

Genus *Fissilobiceras* Buckman, 1919

Type species. *Ammonites fissilobatus* Waagen, 1867

Remarks. *Fissilobiceras* includes forms with compressed subovate whorl section, an external border rounded, not very distinctive ventro-lateral edges, more or less narrow umbilicus, and a highly incised suture line. *Fissilobiceras* occurs from the Ovale to the Trigonalis Subzone. The taxonomy of *Fissilobiceras* was reinterpreted by Dietze et al. (2005) and Chandler et al. (2006). The genus was excluded from the Sonniniidae and transferred to the Hammatoceratidae, with a possible derivation from the late Aalenian *Parammatoceras obtectum* Buckman or the early Bajocian *Euaptetoceras* (Dietze et al. 2005). This reclassification was accepted by other authors (de Baets et al. 2008, Dietze et al. 2012, Howarth 2013, Galácz et al. 2015, Sandoval 2019).

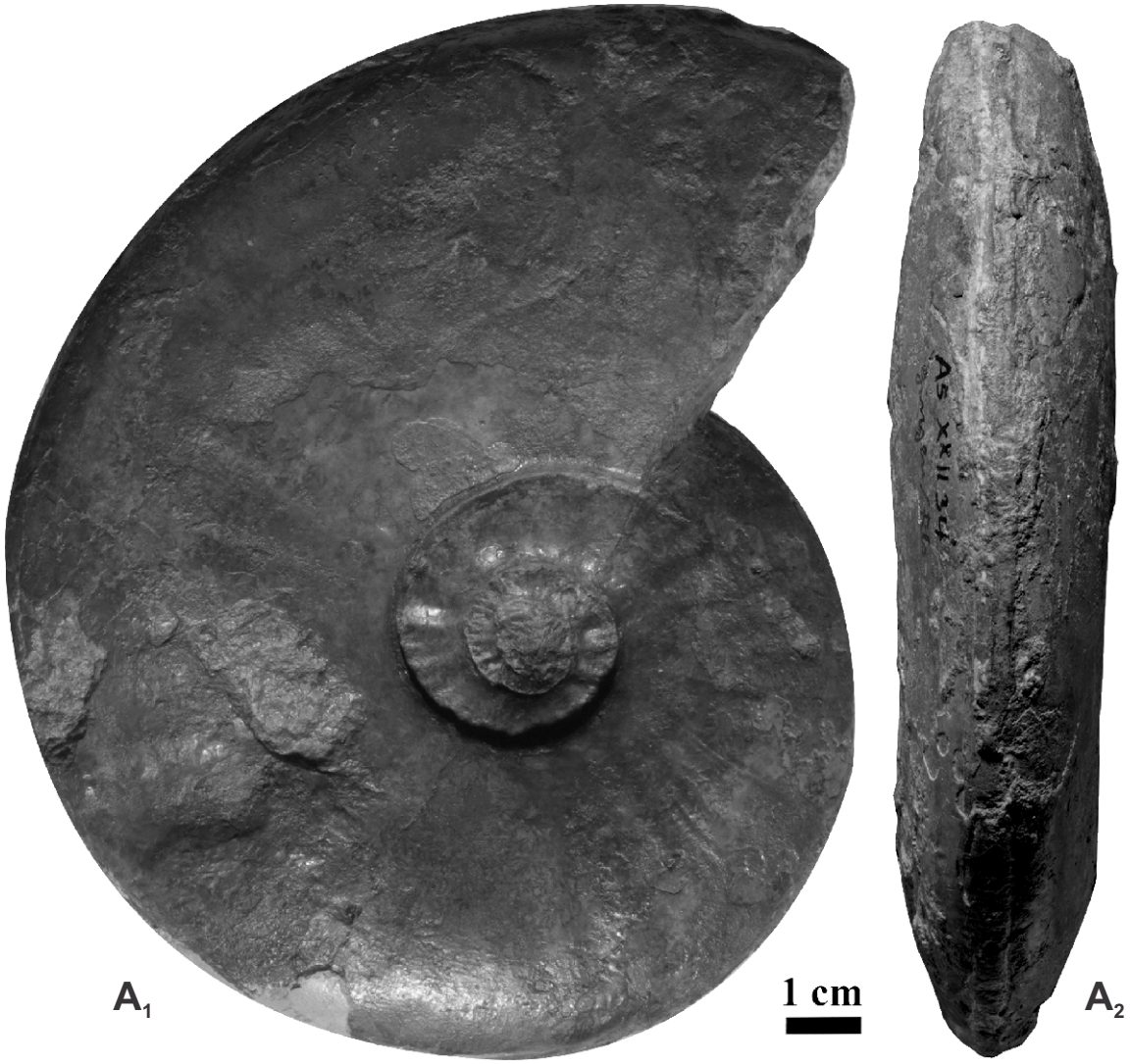

Figure 10. *Sonninia patella* (Waagen, 1867) [M], lectotype (SNSB-BSPG n° AS XXII34), lateral and ventral views. Gingen/Fils. Laeviuscula Zone, Trigonalis Subzone, probably from the *adicra* α/β horizons. - Natural size (x1).

In the material of Waagen, we have only one species: *Fissilobiceras fissilobatum.*

***Fissilobiceras fissilobatum* (Waagen, 1867) [M]**
Figs. 12-13

Synonymy

v 1867 *Ammonites fissilobatus* n. sp. – Waagen: 599, pl. 27: 1 [LT]
v 1935 *Sonninia fissilobata* Waagen – Dorn: 56, pl. 13: 1 [re-figuration of the LT], pl. 15: 4, text-figs. 8-9
v 1985 *Sonninia fissilobata* (Waagen 1867) – Schlegelmilch: 61, pl. 17: 4 [re-figuration of the LT]
1985 *Fissilobiceras fissilobatum* (Waagen) 1867 – Fernández-López: 28, pl. 3: 5
1988 *Sonninia fissilobata* (Waagen) – Branger: pl. 2: 1, text-fig. 96.5
v 2005 *Fissilobiceras fissilobatum* (Waagen) [M] – Dietze et al.: 65, figs. 36-37 [with synonymy]

Material (in SNSB): Lectotype (SNSB-BSPG AS XXII38).

Measurements (mm). Lectotype: *D* = 220 mm, *H* = 113 mm, *W* = 53 mm, *U* = 38 mm, *H/D*(%) = 51, *W/D*(%) = 24, *U/D*(%) = 17, *N/2* c. 10.

Stage: Middle Jurassic, Bajocian
Zone: Laeviuscula Zone
Subzone: Trigonalis Subzone
Type-Horizon: ?*adicra* α/β horizons
Type locality: Gingen/Fils
Collection number SNSB: SNSB-BSPG AS XXII38

Description. Specimen more or less involute, with a compressed, high subovate whorl section. The flanks are curved, with a very depressed bend near the slightly narrow umbilicus. The external border is rounded and the ventro-lateral edges are moderately pronounced. The ventral margin is rounded carrying a blunt keel. The flanks are slightly arched, covered with rare, barely visible radial folds. The suture line is very complex.

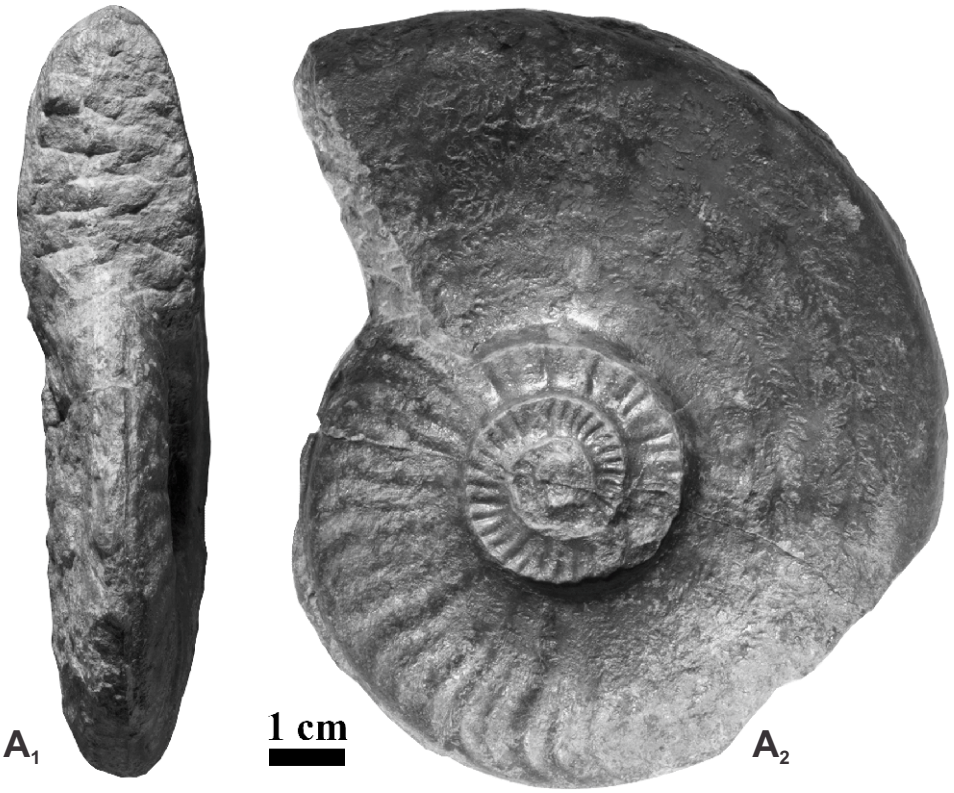

Figure 11. *Witchellia jugifera* (Waagen, 1867) [M], lectotype (SNSB-BSPG n° AS XXII36), apertural and lateral views. Gingen/Fils. Laeviuscula Zone, Ovale Subzone, *oechslei* horizon. - Natural size (x1).

Remarks on the Type Horizon. *F. fissilobatum* occurs in the Lower Bajocian, Laeviuscula Zone, Trigonalis Subzone. The type-horizon of the LT is probably either the *adicra* α or the *adicra* β horizon. The *stephani* horizon is obviously missing in the Sowerbyioolith Member of Gingen an der Fils, so that it is unlikely that the LT comes from that horizon as supposed by Dietze et al. (2005).

Records. S Germany, S England, Scotland, France, Spain (Cordillera Ibérica). *F. fissilobatum* is common in the Laeviuscula Zone of many central and west European localities.

ADDITIONAL COMMENTS ON SONNINIIDS FROM GINGEN AN DER FILS

Ammonites from Gingen/Fils in the Waagen collection of the Geoscience Museum of the University of Göttingen

Most of the ammonites of the Waagen collection from Gingen/Fils in the Geoscience Museum of the University of Göttingen belong to *Shirbuirnia gingensis* and *Euhoploceras* spp., both from the Sowerbyioolith Member. There are also some microconchiate sonniniids from the Sowerbyioolith Member, which we refer to the genus *Pelekodites*. A specific determination is not possible. There are some *Witchellia* [M & m] in the same limonitic preservation as the ammonites figured by Dietze et al. (2005: fig. 14e-f) as *W. spinifera*. These ammonites come obviously from the "γ-Tone" and hence biostratigraphically from the *spinifera* horizon of the Laeviuscula Subzone. Interestingly these ammonites are labelled (?by Waagen) as "*Ammonites* conf. *Gingensis* juv. Waagen". One ammonite, unfortunately without a readable label, belongs to *Pseudoshirbuirnia oechslei*. According to its preservation it is likely to come from the Sowerbyioolith Member of Gingen an der Fils. This would be, beneath *Witchellia jugifera,* evidence of the *oechslei* horizon (Ovale Zone) at Gingen/Fils.

Other sonniniid species described by Waagen (1867) and Dorn (1935) from Gingen an der Fils

***Euhoploceras berckhemeri* (Dorn, 1935) [**HT by monotypy: Dorn (1935: 31, pl. 21: 1, textfig. pl. 2: 1-2]. The type horizon of *E. berckhemeri* is either the *adicra* α or the *adicra* β horizon (Dietze et al. 2005).

***Euhoploceras mayeri* (Waagen, 1867)** [4 syntypes from Gingen an der Fils, an unknown number of syntypes from Betzenau (Switzerland) and Yeovil (S England)]. One syntype from Gingen an der Fils was figured by Dorn (1935: pl. 6: 4). Waagen (1867: 593) gave no figure of this species. The syntype figured by Dorn –which is said to be "Waagen's original" from the Munich collection– shows a densely, somewhat irregularly ribbed, evolute *Euhoploceras* with no spines or nodules. It comes from the Sowerbyioolith member. We designate the specimen figured by Dorn (1935: pl. 6: 4) from the syntype series of Waagen as lectotype of the species. The ammonite figured by Dorn is now lost.

Waagen (1867) additionally mentioned the sonniniid taxa *Ammonites sowerbyi* Miller and *Ammonites furticarinatus*

Figure 12. *Fissilobiceras fissilobatum* (Waagen, 1867) [M], lectotype (SNSB-BSPG n° AS XXII38), lateral view. Gingen/Fils. Laeviuscula Zone, Trigonalis Subzone, ?*adicra* α/β horizons. - Natural size (x1).

Figure 13. *Fissilobiceras fissilobatum* (Waagen, 1867) [M], lectotype (SNSB-BSPG n° AS XXII38), ventral view [lateral view in Figure 12]. Gingen/Fils. Laeviuscula Zone, Trigonalis Subzone, ?*adicra* α/β horizons. - Natural size (x1).

Quenstedt from Gingen/Fils, without figuring any of these species.

***Pseudoshirbuirnia stephani* (Buckman, 1883)**

Neither among the ammonite taxa erected by Waagen in 1867 nor in the collections of Munich, Göttingen, Tübingen or Stuttgart are there any ammonite of the species *P. stephani* from Gingen/Fils. This observation is noteworthy because *P. stephani* is very common in the « Sandmergel » [= upper part of the Sowerbyioolith Member], *stephani* horizon, in the sites of the nearby Lauter valley (Weißenstein-Nenningen, Donzdorf-Grünbach, Donzdorf-Winzingen; see Oechsle 1958, Dietze et al. 2005). Obviously the *stephani* horizon is missing in Gingen/Fils.

BIOSTRATIGRAPHY OF THE TYPE-SPECIMENS OF WAAGEN (1867)

The chronostratigraphy and faunal horizons used here for the Lower Bajocian of Southern Germany (Fig. 14) are those proposed by Dietze et al. (2005, 2009, 2017, in press).

CONCLUSION

This work focuses on the systematics and taxonomic revision of the Lower Bajocian type-specimens of the Sonniniidae and Hammatoceratidae described by W. Waagen in 1867. The ammonites come from two different lithostratigraphical units (Sowerbyioolith Member and Blaukalk Member) in the Wedelsandstein Formation. These levels lie, in Gingen/Fils, in the Laeviuscula Zone (Trigonalis Subzone and Laeviuscula Subzone, see Fig. 15). The Blaukalk Member of Gingen an der Fils and the type horizon of the ammonites from there lie in the uppermost Laeviuscula Zone and not in the Sauzei Zone as thought before (Dietze et al. in press).

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NW Europe and Mediterranean (Rioult et al. 1997)			SW Germany (Dietze et al. 2017, in press)			S England (Chandler 2019)		
Zone	Subzone	Horizon	Zone	Subzone	Faunal horizon	Zone	Subzone	Faunal horizon
Laeviuscula	Laeviuscula	*laeviuscula* *jugifera*	Laeviuscula	Laeviuscula	*polyschides* *glauca* *spinifera*	Laeviuscula	Laeviuscula	*polyschides* *micracanthica* *spinifera* *rubra*
	Trigonalis	*trigonalis* *connata*		Trigonalis	*stephani* *adicra α* *adicra ß* *macer* *gingensis*		Trigonalis	*trigonalis* *nodatipinguis* *pseudoromanoides*
							Sayni	*gelasina*
Ovalis		*fissilobatum* *ovale*	Ovale		*oechslei* *ovale*	Ovale		*pseudoromani* *gingense* *zugophorum* *romanoides* *inclusa* *higginsi*
Discites	Subsectum	*subsectum* *rudidiscites*	Discites		yet to be worked out	Discites		*subsectum* *rudidiscites*
	Walkeri	*walkeri-contorta* *mundum-aspera* *incisum-rotabilis*						*walkeri* *politum*

Figure 14. Standard chronostratigraphy and faunal horizons of the Lower Bajocian (pars) of Southern Germany (Dietze et al. 2005, 2009, 2017, in press), and correlation with Southern England (Chandler 2019) and with the North-West European and Mediterranean provinces (Rioult et al. 1997). The type-horizons of the sonniniids and hammatoceratids described by Waagen (1867) from Gingen/Fils are highlighted in dark grey. Ammonites from the *spinifera* horizon (highlighted in light grey) from Gingen/Fils were figured by Dietze et al. (2005).

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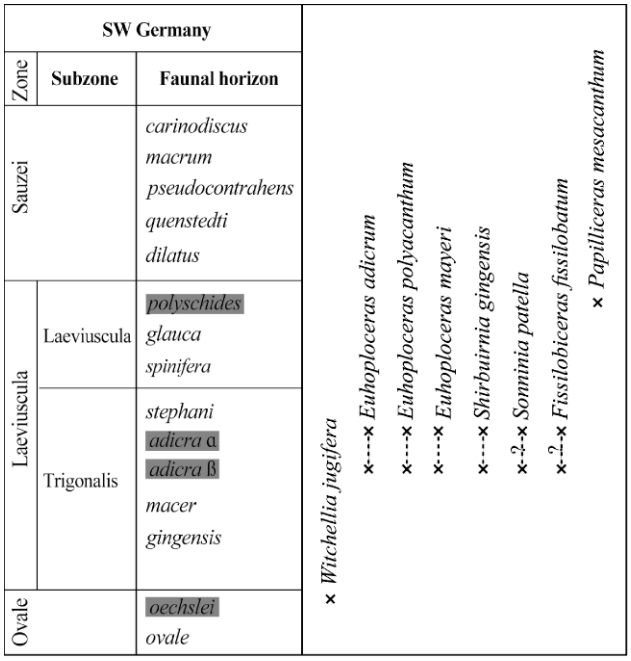

Figure 15. Type-horizons of the Lower Bajocian species of sonniniids and hammatoceratids described by Waagen (1867).

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