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# First record of the ammonite genus *Graefenbergites* (Perisphinctoidea: Passendorferiinae) from the late Oxfordian of the Swabian Alb (SW Germany)

MICHAEL W. MAISCH & ANDREAS T. MATZKE

## Abstract

The passendorferiine perisphinctid ammonite genus *Graefenbergites* SCHAIRER & SCHLAMPP, 2003 is recorded for the first time from the Upper Jurassic of Baden-Württemberg. It is represented by a well-preserved phragmocone of a macroconch from the *semimammatum* Horizon (Hypselum Zone) of the Plettenberg quarry near Balingen. The specimen cannot be accurately referred to one of the two nominal species. Since it shares more characters with *G. arancensis* (MELÉNDEZ, 1989) than with *G. idoceroides* (DORN, 1930), it is tentatively assigned to *G. cf. arancensis* (MELÉNDEZ, 1989). The new record closes a biogeographic gap, since the genus *Graefenbergites*, which is typical of the Submediterranean upper Oxfordian (Grossouvrei to Semimammatum subzones), was hitherto only recorded from the Jurassic of Franconia, Spain, France, and Poland. Its palaeogeographic distribution and biochronological significance are briefly discussed.

**Key words:** Jurassic, Oxfordian, *semimammatum* Horizon, Impressamergel Formation, taxonomy, palaeobiogeography, biochronology.

## 1. Introduction

The ammonite fauna of the Impressamergel Formation of the Swabian Alb is high-diverse, but has not been comprehensively reviewed in modern literature. According to the latest data, the Impressamergel Formation comprises most of the Oxfordian (the lower Oxfordian being represented by the Glaukonitsandmergel Member of the Ornatenton Formation) as well as the lowermost Kimmeridgian (WIERZBOWSKI et al. 2016). Ammonites from the Bimammatum Zone, comprising the Bimammatum and Hauffianum subzones (sensu WIERZBOWSKI et al. 2016) have been studied in detail by SCHWEIGERT & CALLOMON (1997), who focussed on the ammonite fauna of the *bauhini* Horizon, the topmost biohorizon of the Bimammatum Zone in south-western Germany, and by JANTSCHKE (2014), who described the ammonite fauna of the *bimammatum* Horizon.

The Oxfordian part of the Impressamergel Formation, which comprises the Plicatilis to Hypselum zones, have not received much attention due to the insufficient preservation of ammonites (fragmentary or strongly compressed specimens, small pyritized steinkerns, “dwarf” faunulae in the biohermal facies).

The purpose of this paper is to describe a well-preserved specimen of the passendorferiine perisphinctid *Graefenbergites* from the *semimammatum* Horizon (lower Hypselum Zone) of the Plettenberg quarry, Baden Württemberg. Although only its phragmocone is preserved the specimen is diagnostic. It represents the first record

of this genus from the Upper Jurassic of Baden-Württemberg and allows chronological comparisons with other areas in Europe (Franconia, Spain, France, Poland), where *Graefenbergites* has been recorded previously.

**Institutional abbreviation:** SMNS – Staatliches Museum für Naturkunde, Stuttgart.

## 2. Geological and stratigraphic setting

The specimen described herein comes from the limestone quarry of the Lafarge Holcim Süd AG on top of the Plettenberg hill near Dotternhausen (Landkreis Balingen, Baden-Württemberg). The Plettenberg section has been partially described by SCHWEIGERT & CALLOMON (1997), JANTSCHKE (2014) and SCHWEIGERT & KAPITZKE (2018). A full description is not provided here, as this would interfere with ongoing projects of other researchers, particularly H. JANTSCHKE.

In the Plettenberg quarry the exposed Oxfordian–Kimmeridgian succession expands from the higher Bifurcatus Zone up to the Planula Zone. Much of the succession is developed in biohermal lithology, making it one of the most fossiliferous sections in this stratigraphic interval in the Jurassic of Swabia. The *semimammatum* Horizon, from which the specimen described herein was collected, is developed as a succession of several meters of grey to greyish-green marls with some intercalating marly limestone layers. The thickness varies greatly depending on the lithology. Sometimes it is developed in sponge micro-

bial facies and represented by somewhat brighter, more calcareous and less well-bedded marls to limestones. The present specimen comes from one of these small bioherms.

The *semimammatum* Horizon contains a rich ammonite fauna; much of it was described in the 19<sup>th</sup> century (particularly by OPPEL 1862–1863 and QUENSTEDT 1887–1888), but, as mentioned by JANTSCHKE (2014), this fauna has not been revised ever since. JANTSCHKE (2014) provided a faunal list. Particularly characteristic taxa, which were also recorded by us along the *Graefenbergites* specimen described below include *Amoeboceras alternans* (v. BUCH), *Microbiplices microbiplex* (QUENSTEDT), *Clambites hypselum* (OPPEL) and *Taramelliceras pichleri* (OPPEL). The index *Epipeltoceras semimammatum* itself is rare in the Plettenberg quarry and could not be recovered, but from the remaining taxa there is no doubt about the stratigraphic placement of the *Graefenbergites* specimen. The specimen was picked up from scree at the base of a small slope, which exclusively contained sediments of the *semimammatum* Horizon and where exclusively ammonites indicative of that horizon were found. This slope, well-known among local amateur collectors for its particularly rich fauna of the *semimammatum* Horizon, was destroyed by ongoing quarry activities shortly after the discovery of the specimen.

### 3. Systematic palaeontology

Order Ammonitina HYATT, 1889

Superfamily Perisphinctoidea STEINMANN, 1890

Family Perisphinctidae STEINMANN, 1890

Subfamily Passendorferiinae MELÉNDEZ, 1989

Genus *Graefenbergites* SCHAIRER & SCHLAMPP, 2003

*Graefenbergites* cf. *arancensis* (MELÉNDEZ, 1989)

Fig. 1

Type species: *Perisphinctes idoceroides* DORN, 1930

Diagnosis of genus (emended from SCHAIRER & SCHLAMPP 2003): Evolute micro- and macroconchs with *Subnebrodites*-like ribbing style. Ribs radial to prorsiradiate, biplicate, triplicate to polygyrate, with tendency to become blunt in the adult stage. Number of umbilical ribs increases during ontogeny in the inner whorls, decreasing again in later ontogeny; ribbing less rigid than in *Passendorferia* and *Enayites*; conch less evolute than in *Geyssantia*.

Material: SMNS 70443, probably a complete or nearly complete phragmocone, three-dimensionally preserved steinkern (Fig. 1A–C), found and mechanically prepared by the authors.



**Fig. 1.** *Graefenbergites* cf. *arancensis* (MELÉNDEZ, 1989), SMNS 70443. *Semimammatum* Horizon, *Semimammatum* Subzone, *Hypselum* Zone (Upper Oxfordian), Plettenberg Quarry near Balingen, Baden-Württemberg. A: ventral view, B: lateral view, C: ventral view opposite to A. Scale bar = 20 mm.

#### 4. Description

The specimen is a serpenticone phragmocone lacking its body chamber. Its diameter of 108.25 mm suggests that it is a macroconch (compare SCHAIRER & SCHLAMPP 2003). Assuming that the body chamber occupied ca.  $\frac{3}{4}$  of the penultimate whorl, as in more complete specimens of the genus, the original diameter of this specimen must have exceeded 130 mm. Only one flank and the venter of the specimen have been extracted from the hard limestone matrix. It shows all diagnostic characters of the genus *Graefenbergites*.

The venter and whorl section are rounded. Along its midline, it shows a smooth band about  $\frac{1}{4}$  the width of the venter, where the secondary ribs fade out. The flanks are almost flat and parallel to each other so that the whorl section becomes somewhat rectangular. The umbilical wall is low and steep. Most primary ribs are slightly prorsiradial, a few on the outermost preserved whorl are radial. The primary ribs of the inner whorls are sharp and well defined; the intercostal spaces are wider than the ribs themselves. On the outermost preserved whorl, the ribs tend to get less well defined and blunter; the widths of the ribs and the intercostal spaces are similar. Bifurcation points of the ribs are not visible on the inner whorls. On the outer whorl, most ribs bifurcate at about 0.7 of whorl height. Trifurcation is also observed, particularly in the most aperturally situated ribs, which are almost exclusively trifurcate. Intercalatories are absent. On the outermost preserved whorl, parabolic nodes occur on several ribs, but their detailed structure remains obscure due to corrosion of the surface. Constrictions have formed during the entire observable ontogeny, but they are rare, only 1–2 per whorl are present.

**Measurements** [in mm]: Diameter (D) 108.25; whorl height (WH) 26.5; whorl breadth (WB) 24.5; umbilical width (UW) 60.5, at  $180^\circ$  WH 21.5

**Number of primary ribs (N)**: 43; 2<sup>nd</sup> whorl: 53; 3<sup>rd</sup> whorl: 51; 4<sup>th</sup> whorl: 39; 5<sup>th</sup> whorl: 32; 6<sup>th</sup> whorl: 31.

**Ratios**: At diameter 108.25: U (UW/D) 0.556; H (WH/D) 0.244; W (WB/D) 0.226; Q (WH/WB) 1.08. Whorl expansion rate (as defined by KLUG et al. 2015) is 2.37.

#### 5. Comparisons

As noted above, significant ratios of measurements in the Plettenberg specimen are as follows: U 0.56 H 0.24 W 0.22.

In *G. idoceroides* (M) they are (SCHAIRER & SCHLAMPP 2003, N (number of specimens) = 7, diameters ranging from 60–150 mm): U 0.47–0.52; H 0.28–0.32; W 0.19–0.24.

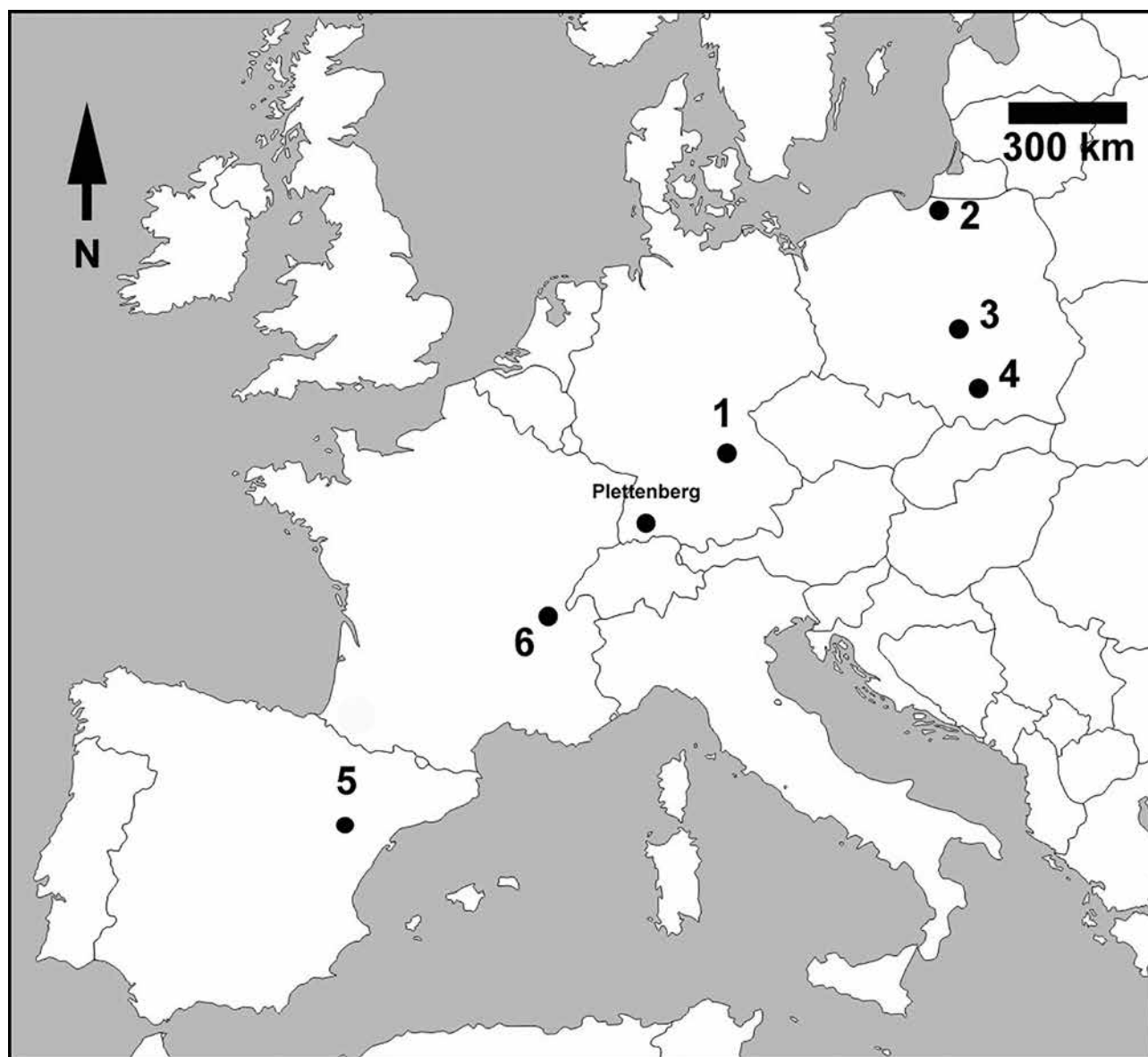
In *G. arancensis* (M) they are (SCHAIRER & SCHLAMPP 2003, N = 7, diameters ranging from 75 to 148 mm): U 0.47–0.54; H 0.27–0.32; W 0.21–0.27.

This means that the Plettenberg specimen lies within the range of *G. idoceroides* regarding the ratio W (WH/D), but its umbilical width (U) is somewhat larger and its relative whorl height (H) distinctly lower than in representative specimens of that species. Compared to specimens from Poland attributed to *G. idoceroides* by WIERZBOWSKI & MATYJA (2014) the differences are even more significant. They noted a U of 0.39–0.48 and an H of 0.29–0.35 in their material. These specimens are therefore much more involute and have significantly higher whorls than the studied specimen from the Plettenberg quarry. The Plettenberg specimen lies within the variability of *G. arancensis* considering W, and it is very close in U, but it has a significantly lower H.

The number of ribs in macroconchiate *G. idoceroides* range between 43 and 52 at comparable diameters (SCHAIRER & SCHLAMPP 2003). The specimen from the Plettenberg quarry lies within the range of macroconchiate *G. idoceroides*. The increase in the number of ribs in the inner whorls is also very similar. The Plettenberg specimen, however, differs considerably in the distinct decrease of the number of ribs on the outermost preserved whorl of the phragmocone. There, the number of primary ribs is only 43, whereas it is 53 on the penultimate whorl (at D = 88.5). Although there is a slight decrease in the number of primary ribs (2–3 ribs) on the outermost whorls of some of the specimens of SCHAIRER & SCHLAMPP (2003), such a significant difference is never present. In macroconchiate *G. arancensis*, the ribs also increase in density throughout ontogeny and there is only a very slight decrease in the number of ribs on the outermost whorl (2–3 ribs at maximum). Therefore, the studied specimen differs from other *Graefenbergites* in two significant features: a lower whorl height and a marked decrease in the ribbing density of the late ontogenetic phragmocone. Despite these differences we do not erect a new species due to the lack of additional specimens and the fact that the sole specimen does not preserve its body chamber. Since the specimen is closer to *G. arancensis* in its umbilical width than to *G. idoceroides* and exhibits parabolic nodes on the outermost preserved whorl of the phragmocone, which are present in *G. arancensis*, but not typical of *G. idoceroides* (SCHAIRER & SCHLAMPP 2003), we assign it to *Graefenbergites* cf. *arancensis*.

#### 6. Discussion

The passendorferiine genus *Graefenbergites* is a rare but widespread component of late Oxfordian Sub-mediterranean ammonite faunas (MELÉNDEZ et al. 2009; WIERZBOWSKI et al. 2016). It is hitherto only known from a few localities in France (ÉNAY 1966; MELÉNDEZ 1989) Spain (MELÉNDEZ 1989, MELÉNDEZ et al. 2009), the Franconian Alb



**Fig. 2.** Generalised map of Europe showing the occurrences of *Graefenbergites* including the new one from Baden-Württemberg (data compiled from MELÉNDEZ 1989, SCHAIRER & SCHLAMPP 2003 and WIERZBOWSKI et al. 2013). 1: Gräfenberg, Franconia, Germany 2: Biskupice section near Olsztyn, Poland, 3: Biala Dolna section, Poland (other localities close by, see WIERZBOWSKI et al. 2014) 4: Syborowa Hill section near Olkusz, Poland, 5: Ariño, Teruel, Spain, 6: Aranc, Dept. Ain, France.

(SCHAIRER & SCHLAMPP 2003), and Poland (WIERZBOWSKI & MATYJA 2014; WIERZBOWSKI et al. 2015, 2016; see Fig. 2). Considering this palaeogeographic distribution, its occurrence in the Jurassic of Swabia was expectable. It has probably escaped notice so far, because larger perisphinctid specimens are very rare in the *semimammatum* Horizon. The classical “Lochenfauna” of this horizon is famous for its richness in small to diminutive fossils, including most ammonites. Perisphinctids also tend to be small there. In a collection of more than 3000 ammonite specimens from

this horizon in the Plettenberg quarry sampled by the first author, there are less than one dozen perisphinctids reaching a diameter significantly larger than 50 mm. Small perisphinctid specimens, which are often lacking parts or most of the body chamber as well as the aperture, are difficult to determine. From our own field observations it is clear that *Graefenbergites*-like forms are not common in this horizon of the Plettenberg quarry, but they turn up occasionally. Usually they are not determinable due to their small size or poor preservation state.

The genus *Graefenbergites* was introduced by SCHAIRER & SCHLAMPP (2003) based on material from the *semimammatum* Horizon of the Deuerlein quarry near Gräfenberg in Franconia. They recognized both microconchiate and macroconchiate specimens of *G. idoceroides* and *G. arancensis*, and described them in detail. Their material came from two limestone beds, thus indicating that the two species are coeval in Franconia.

*G. arancensis* was originally described by MELÉNDEZ (1989) as *Passendorferia* (*Enayites*) *arancensis*. This species occurs in France (Aranç, Dépt. Ain), from where it was originally figured by ÉNAY (1966) and in Spain (Ariño, Teruel; MELÉNDEZ 1989). The French material is from the Calcaires lités, which represent the Hypselum Zone. MELÉNDEZ (1989) noted that these limestones may partly belong to the upper Bifurcatus Zone, Grossouvrei Subzone. The Spanish material was assigned to the Grossouvrei Subzone (MELÉNDEZ 1989: 49). In a later paper (MELÉNDEZ 2009), however, the material was said to come from the Hypselum Zone.

The Polish specimens, described in detail by WIERZBOWSKI & MATYJA (2014), are referred to beds of the Grossouvrei Subzone in the case of *G. arancensis*, and to the Semimammatum Subzone of the Hypselum Zone in the case of *G. idoceroides* (see also WIERZBOWSKI et al. 2016). The placement of the specimens of *G. arancensis* indicates that the original stratigraphic attribution of the French and Spanish material by MELÉNDEZ (1989) was correct.

In the Deuerlein quarry of Gräfenberg, the two species are coeval, as pointed out above. The occurrence of a specimen assignable to *G. cf. arancensis* in the *semimammatum* Horizon of the Plettenberg section underlines the probably somewhat later occurrence of *G. arancensis*-like forms in southern Germany, at least as compared with the Polish sections. As pointed out above, it is well conceivable that the Plettenberg specimen represents a distinct taxon morphologically close to but not identical with *G. arancensis*. Whether this may also be the case for the Gräfenberg material described by SCHAIRER & SCHLAMPP (2003) cannot be decided here, as this would need a revision of the genus *Graefenbergites*, taking into account all known material, which is beyond the scope of this paper.

For the time being it must be considered that the genus *Graefenbergites* occurs in the Grossouvrei to Semimammatum subzones of the higher Oxfordian of the Submediterranean Faunal Province (MELÉNDEZ et al. 2009; WIERZBOWSKI et al. 2016). Its occurrence in the Swabian Jurassic closes a biogeographic gap. The stratigraphic position of the specimen described above corresponds perfectly to material known from Franconia (*semimammatum* Horizon, Semimammatum Subzone, Hypselum Zone, Upper Oxfordian), but slight morphological discrepancies do not allow a definite specific identification.

The origin of the genus *Graefenbergites* is probably in the Mediterranean Province, and it is significant as a form close to the transition between the passendorferiine and ataxioceratine perisphinctids, as suggested by MELÉNDEZ et al. (2009). Any new occurrences of this rare ammonite genus are therefore of significant palaeobiogeographical and phylogenetic interest.

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