New hyostragulids, Tabulata *incertae sedis* from the Wiltz-beds, Upper Emsian of Western Eifel (Germany)

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Schlüsselwörter: *Marekostragulum*, *Parostragulum*, Cnidaria, Tabulata, Wiltz-Schichten, Unter Devon, West-Eifel.

Zusammenfassung

Aus den Wiltz-Schichten des Ober-Emsium der Eifel werden erstmals sehr seltene Hyostraguliden beschreiben und zwei neue Taxa aufgestellt, *Marekostragulum grafi* n. sp. und *Parostragulum problematicum* n. gen. n. sp. Bei dem letzen Taxon ist das Vorhandensein von Kavitäten in Form dreieckig-schuhförmiger Vertiefungen zwischen der Basal-Platte der inkrustierenden Koralle und dem Substrat, auf dem sie aufgewachsen ist eine Besonderheit. Dieses wird herangezogen um die ungewohnte Morphologie der Proximal-Seite zu erklären. Die Hypothese stützt sich auf dem studium von Fossilisations-Modalitäten verschiedener Hyostraguliden aus dem Armorikanischen Massif und Böhmen. Aus Sicht der palaeogeographischen Verbreitung der Hyostraguliden in Süd-Laurussia läβt sich ihr Vorkommen diversifizieren, wobei dieses wahrscheinlich einen endemischen Charackter aufweist.

Key words: *Marekostragulum*, *Parostragulum*, Cnidaria, Tabulata, Wiltz-beds, Lower Devonian, Western Eifel.

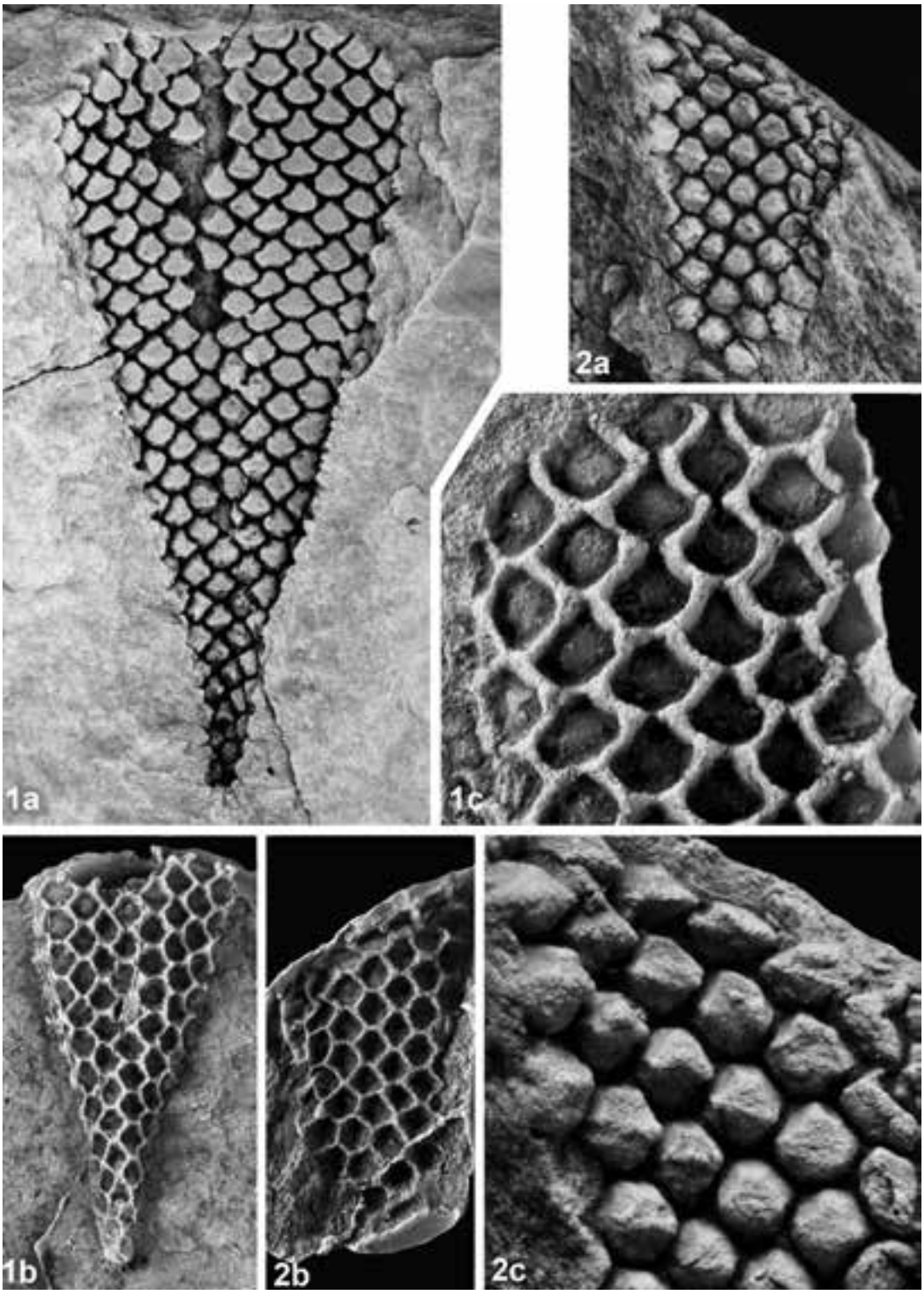
Abstract

The very rare hyostragulids from the Upper Emsian of the Eifel (Wiltz-beds) are described for the first time and two new taxa are erected, *Marekostragulum grafi* n. sp. and *Parostragulum problematicum* n. gen. n. sp. In the latter taxon, the development of wedge-like cavities between the basal plate of the encrusting coral and the substrate to which it was attached is suspected to explain the peculiar morphology of the proximal side. This hypothesis is supported by the study of the modalities of fossilization of some hyostragulids from the Massif Armoricain and Bohemia. The paleogeographic distribution of the hyostragulids in South Laurussia is somewhat expanded by the new occurrences but they appear more diversified and show a certain endemic character.

Mots clés: *Marekostragulum*, *Parostragulum*, Cnidaria, Tabulata, Schistes de Wiltz, Dévonien inférieur, Eifel occidental.

Résumé

Les très rares hyostragulids de l'Emsien supérieur de l'Eifel (Schistes de Wiltz) sont décrits pour la première fois et deux nouvelles formes sont proposées, *Marekostragulum grafi* n. sp. et *Parostragulum problematicum* n. gen. n. sp. Chez ce dernier taxon, la présence de cavités en forme de coin entre la lame basale du tabulé encroutant et le support est proposée pour expliquer la morphologie inhabituelle de la face proximale. Cette hypothèse est basée sur l'étude des modalités de fossilisation de quelques hyostragulides du Massif Armoricain et de Bohème. Du point de vue paléogéographique la répartition des hyostragulides n'est que peu modifiée par les nouvelles découvertes mais ils apparaissent plus diversifiés et marqués d'un endémisme certain.


1a
2a
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Introduction

The sediments of the Wiltz beds are well exhibited in the area of today´s Grand Duchy of Luxembourg and in the West of Germany. The beds known as Wiltz slate (Wiltzer Schiefer) have been deposited in the Wiltz basin, the Daleiden synclinal group and the Prüm basin (see Franke 2010:6-13). The Erpeldange quarry near Wiltz (Luxembourg) and the Daleiden slate pit (Daleider Schiefergrube, Germany) have gone down in the geological history as classical localities.

The Berlé quartzite, beginning with the Upper Emsian, signalize a level of reworking of the deltaic sediments of the lower Emsian Klerf beds in the synclinorium Neufchateau-Eifel and in their continuation of the Eifel north-south zone. After the reworking was concluded, probably due to a further subsidence of the synclinorium, there was a prolonged deposition phase of fine-grained, mainly dark sediments. The Wiltz beds, having been deposited over a period of about three million years (see Requadt 1998:24), and reaching a thickness of up to 140m, are extremely difficult to be subclassified finely stratigraphically due to their special folding.

The discovery by one of us (Y. P.) of a specimen of *Nowakia* e.g. *elegans* (H. Lardeux provisional assignation and Lardeux *et al.* work in progress) on the slab Kr 101.59, locality Krautscheid (see chapter *Parostragulum*), provides interesting new data. According to Lardeux (personal communication) the index nowakiids, *N. elegans* (late Zlichovian) and *N. cancellata* (Early Dalejian) occur together in some localities, and moreover transitional forms between *elegans* and *cancellata* are known. On the other hand, the boundary between Lower and Upper Emsian approximatively coincides with the Zlichovian/ Dalejian boundary. Thus, the occurrence of *N.* e.g. *elegans* is not inconsistent with the usual assignment of the Wiltz-beds to the Upper Emsian, but indicates that, at least the level outcropping in the locality Krautscheid, belongs to the lower part of the Upper Emsian.

The evaluation of the abundant macrofossils reveals a high biodiversity, which shows that faunal assemblages in biotopes have existed close to the coastal region up to far from the coastal shallow sea above the storm-wave base. During the whole period normal open maritime conditions prevailed.

The very rare Hyostragulids, which are found there, are described here for the first time. The genus *Parostragulum* n. gen. with its type species *Parostragulum problematicum* n. sp. and the species *Marekostragulum grafi* n. sp. are new.

The material described in this paper is catalogued and housed in the collections of the Musée national d'histoire naturelle Luxemburg (prefix MnhnL). Some specimens of *hyostragulids* from the Massif Armoricain and Bohemia, used for the study of fossilization, are registered at the Université de Bretagne Occidentale, Brest (France), Laboratoire de Paléontologie, catalog number LPB 15 440 – 15 446.

Systematic paleontology

Subclass TABULATA Milne Edwards & Haime, 1850

Order INCERTAE SEDIS

Family HYOSTRAGULIDAE Galle & Plusquellec, 2002

Genus *Marekostragulum* Galle & Plusquellec, 2002

Type species : *Marekostragulum adami* Galle & Plusquellec, 2002

Diagnosis : see Galle & Plusquellec, 2002

Repartition : Moravia (Czech Republic), Upper Pragian or Lower Emsian

Marekostragulum grafi n. sp.
Figs 1-4, Pl. 1

Holotypus: specimen MnhnL Kr 132.32

Plate 1

1. *Marekostragulum grafi* n. sp., Krautscheid, Western Eifel, Germany, Wiltz-beds, Upper Emsian. Specimen MnhnL Kr 132.32. **1a.** Distal side, natural cast; x4, **1b.** Distal side, apical area, latex replica; x4, **1c.** Distal side, distal area, latex replica showing the morphology of the corallites and especially the missing adapical wall; x10.

2. *Marekostragulum grafi* n. sp., Krautscheid, Western Eifel, Germany, Wiltz-beds, Upper Emsian. Specimen MnhnL KRA 1-500, **2a-2b.** Distal side, apical area, respectively natural cast and latex replica; x4, **2c.** Distal side, apical area, corallites showing the aspect of the transverse furrow in natural cast; x10.

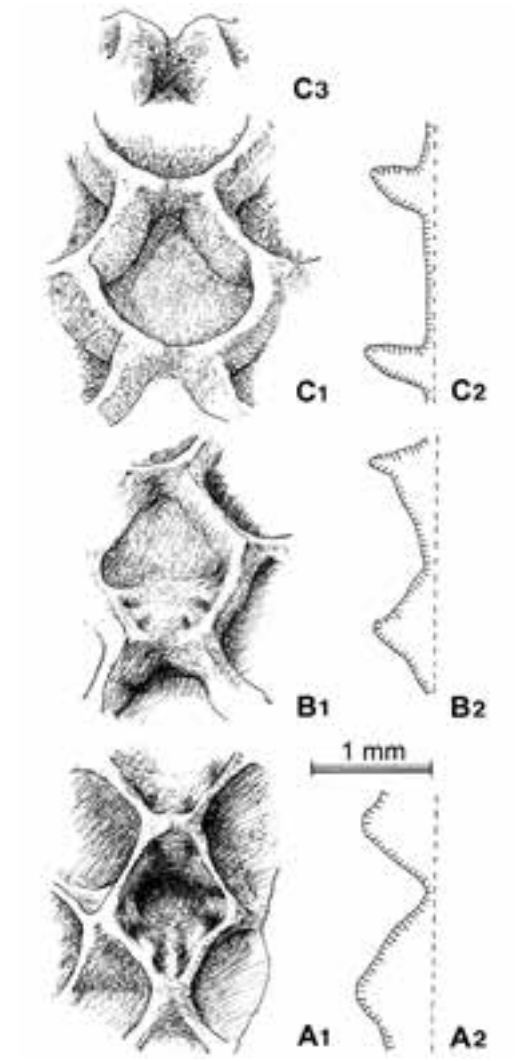


Fig. 1: *Marekostragulum grafi* n. sp. Evolution of the structural features of the corallites from apex to adapical area; camera lucida drawings of latex replica. Close-ups of apical views of calices (A1-C1), "optical" sections along the plane of bilateral symmetry (A2-C2), oblique view of the adapical wall (C3). A: proximal part of the apical area of the corallum, B: distal part of the apical area, C: adapical area. Note the sub-rhombic (A) hexagonal (B) squamose (C) outlines of the corallites, and the well-marked interseptal depressions (A1-B1), the transverse furrow (A1A2-B1B2) and the flat calicinal base (C). Specimen MnhnL Kr 132.32.

Derivatio nominis: the species is named after Walter Graf who found the holotype.

Locus typicus: Krautscheid, TK 5903 Neuerburg, Western Eifel, Germany.

Stratum typicum: Wiltz-beds, Upper Emsian.

Diagnosis: species of *Marekostragulum* with corallites hexagonal to squamose, calicinal bases of the proximal area of the corallum showing a well-marked transverse furrow; presence of septal ridges in the proximal sector of the calices. Calicinal bases of the distal area flat. Mural pores lacking. Corallites length usually between 1.20 and 1.40 mm, width between 1.30 and 1.55 mm.

Material: two specimens, MnhnL Kr 132.32 (coll. W. Graf) and MnhnL KRA 1-500 (coll.Ch. Franke)

Description

The specimens are preserved as natural casts. Some incomplete latex casts have been made and the material will be described from this angle.

Proximal side (lower surface)

This side has not been collected, but it can be inferred from the conoid shape of the distal side (Fig. 3) that the hyostragulid lived on the dorsal side of an hyolitid conch. The hyolitid "shows" an apical angle of approx. 30° and was probably subtrigonal in cross section.

Distal side (upper surface)

As shown by the very well preserved specimen Kr 132.32 three areas can be distinguished from apex to aperture of the hyolitid (see Fig. 3).

Proximal or apical area. The corallites are rhombic to roughly hexagonal, the calicinal bases are not flat and display a transverse furrow. At its extremities, this furrow is slightly deeper and broader. In some places, the furrow is gently curved, its concavity generally facing the apex of the corallum. Owing to the presence of the transverse furrow, the distinction between the calicinal base and the wall is not very easy (Fig. 1A-B). Moreover, on their half proximal sector, some calices show poorly prominent septal ridges mainly emphasized by generally four well-marked pyriform depressions (= interseptal furrows) (Fig. $1A_1$-B_1); on the opposite sector the depressions, if present, are much shallower (Fig. $1A_1$). These features lead to an obvious bilateral symmetry.

Distal or adapical area. The corallites are squamose, and this is particularly obvious at the calicinal base level (Fig.1C, Pl. 1, fig.1a, 1c). The calicinal base is flat and devoid of any structures such as ridges, furrows or spines. The walls are rather thin and the virtual axis of the corallites slightly dipping/

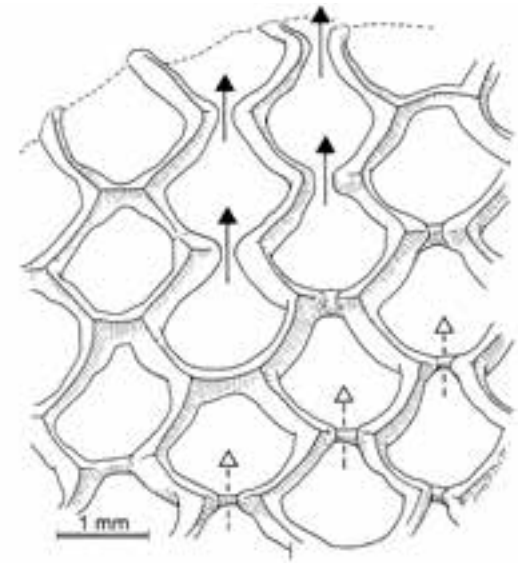


Fig. 2: *Marekostragulum grafi* n. sp. Distal area of the corallum (latex of the natural cast) showing the adapical wall not developed (black arrow) or as a low and narrow step (open arrow). Specimen MnhnL Kr 132.32.

inclined toward the apex of the hyolitid. Between some corallites (never more than three) the rounded adapical wall (in the sense of the hyolitid shell) is missing or appears in the form of a low and narrow step. These features correspond to two stages of growth of the wall (Fig. 2).

Intermediate area. The corallites show transitional morphology between hexagonal and squamose and the lack of transverse furrow as well as that of the missing adapical wall.
Mural pores are not recorded in any area.

Increase

The corallites are arranged in parallel rows along the axis of the hyolitid conch and during the increase the new rows are added on the external side of the previous ones. Nevertheless, it will be noticed that in the left side on the distal area of the corallum of specimen Kr 132.32, a new row of corallites comes in between the others (Fig. 3) and that the oldest corallite of this row (restored) was probably smaller and less squamose.
According to Galle & Plusquellec (2002, p.55 and fig.1), in the species of *Hyostragulum* and *Marekostragulum*, previously described, the rounded proximal part of the wall is built prior to the closing of its adapertural part. In *M. grafi* the squamose corallites exhibit a different and to date undescribed feature: the adapical wall is built very late during the increase (Fig.2). In our present opinion, the missing wall does not correspond to the true basal pore (= basal mural pore *sensu* Swann 1947, pore basal alias P_0 *sensu* Plusquellec 2007), first, because this part of the skeleton do not remains open as usual in tabulate corals (see Swann 1947, pl. III, fig. 4; Fernández-Martínez *et al.* 2002, fig. 5) and second, following our diagrammatic figure (Galle & Plusquellec 2002, fig. 1 and its more complete version – this paper, Fig. 4A) two parent-corallites would share the same offset !

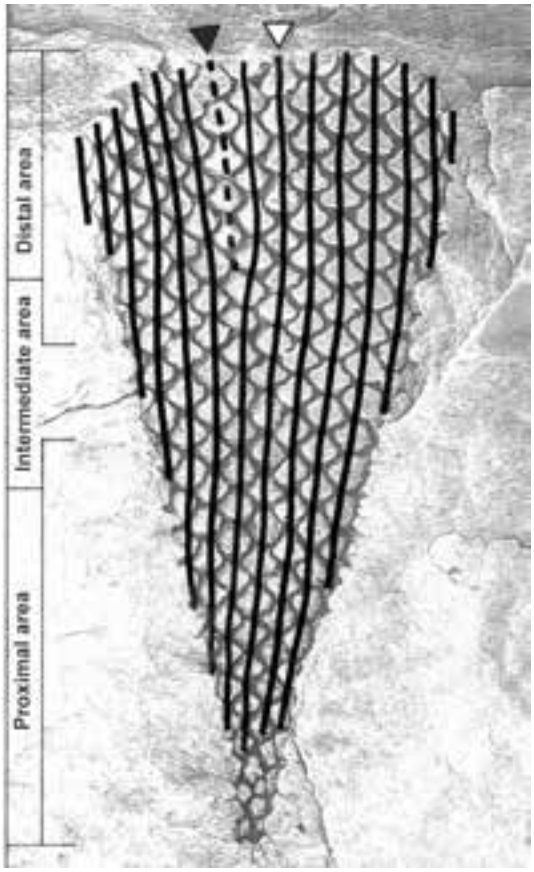


Fig. 3: *Marekostragulum grafi* n. sp. Retouched photograph showing the rows of corallites and the areas defined on the basis of calicinal morphology (explanations in text). Black arrow as new row of corallites developing in between the others, open arrow as alleged median row. Note that in the very proximal area the rows are not clearly visible. Specimen MnhnL Kr 132.32.

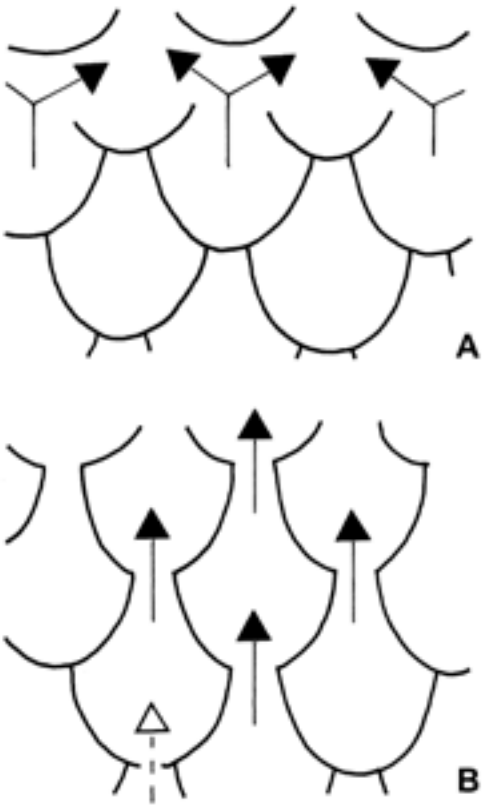


Fig. 4: Increase in hyostragulids with squamose corallites.
A: *Hyostragulum* sp. Diagrammatic drawing (modified from Galle and Plusquellec, 2002, fig. 1) showing that the sectors of the wall not yet developed cannot be equivalent of the basal pore because here two parent corallites would share the same offset.
B: *Marekostragulum grafi* n. sp. Corallites with adapical wall not developed in early stage of growth; open arrow indicates a development of the adapical wall.

Biometric data

Over all dimensions of *M. grafi* are listed in Table 1 except the size of the corallum; MnhnL Kr 132.32 (complete specimen) 29x13 mm and MnhnL KRA 1-500 width at the proximal/intermediate boundary area approx. 8mm.

Discussion

Our material has been assigned to the genus *Marekostragulum* Galle & Plusquellec, 2002 mainly on the basis of the lack of the median septum and despite the peculiar mode of increase which systematic value at the generic level remains unknown. The transverse furrow developed on the calicinal base in the proximal area of the corallum has never been recorded in the known species of *Marekostagulum* (nor in *Hyostragulum*) as well as the peculiar setting of the septal ridges and, in our opinion, these features are enough to establish a new species. In cases where the proximal area would be not preserved, the characteristics of the increase (distal area) should make it possible to identify the species.

Genus ***Parostragulum*** n. gen.

Type species: *Parostragulum problematicum* n. sp.

Derivatio nominis: combination of the modified prefix *para* and the genus-group name *Hyostragulum*.

Diagnosis: Tabulate coral known as epizoan; corallum cerioid, encrusting. Corallites short, hexagonal to subrhombic. Calicinal bases generally bearing up to five parallel ridges oriented along the long axis of the corallite and/or few spines usually arranged in row along the ridges or scattered. Mural pores not recorded.
Additional characteristic but probably not diagnostic feature: enigmatic wedge-like cavity developed between the hyostragulid and the incrusted shell, and located below the junction of the walls of adjacent corallites or in their apical corner.

Discussion: the new genus differs from *Hyostragulum* Marek & Galle, 1975, due to the lack of a median septum and from *Marekostragulum* Galle & Plusquellec, 2002, due to the development of a set of parallel ridges, spiny ridges or scattered spines on the calicinal bases. The systematic value of the wedge-like cavity remains questionable and needs further investigations.

Parostragulum problematicum n. sp.
Figs 5, 7; Pl. 2

Holotypus: specimen MnhnL Kr 101. 59

Derivatio nominis: from the Latin *problematicus* to emphasize the presence of a strange structure on the proximal side of the corallum.

Locus typicus: Krautscheid, Western Eifel, Germany.

Stratum typicum: Wiltz-beds, Upper Emsian.

Diagnosis: species of *Parostragulum* with corallites polygonal to subrhombic, calicinal base with no more than five, more or less spinose, ridges. Corallite length at calicinal aperture level mainly between 1.60 and 1.80 mm, width approx. 1.50 mm.

Material: only one well preserved specimen is available (MnhnL Kr 101. 59, col. W. Graf). Another one from Daleiden, same level, is badly preserved and not well exposed, so its assignation remains doubtful (MnhnL DAL 1-300, coll. Ch. Franke, 1980).

Description of the holotype

The specimen, slightly deformed as shown by the oval shape of a crinoid ossicle, is preserved as natural casts (part and counterpart) in brown silty shales. Latex casts of both sides have been made and the material will be described as such.

Proximal side (lower surface)

The hyostragulid is fixed by its base to a foreign body which seems to be a fragment of an unidentified "shell", both slightly concave and convex (such a morphology could correspond to a cyrtoconic nautiloid); its size is approx. 23 x 16 mm. In its lower left, lower right and upper right margins, the foreign body appears smooth (Fig. 5A).

The main part of the proximal side shows two kinds of structures:

1 - More or less hexagonal to rhombic rather flat areas generally showing up to five parallel narrow furrows; some of them show few small rounded pits, especially on the right side of the specimen. The polygonal areas are lined by a narrow smooth "frame" appearing as a more or less continuous network. The "frame" of each polygonal unit is slightly depressed with regard to this latter structure.

2 – Between the polygonal areas, the proximal side exhibits a set of asymmetrical cavities, with a sub triangular to arched outline, here called "wedge-like cavities"; all these structures show the same orientation and dipping. It will be noticed that the direction of the axis of the wedge-like cavities forms an angle to 45° with that of the furrows.

The proximal side displays some coiled tubes of *Spirorbis* sp. These epibionts, scattered on the surface were probably attached after the death of the hyostragulid. Remark: in the lower right corner, the free part of the foreign body shows, on its distal side, a lacuna directly above the *Spirorbis* (Fig. 5B and **7**A); this is very unusual …

Although less well preserved than the *Spirorbis* sp. figured by Franke (2010, pl. 11, fig. 1-3), our material probably belongs to the same species. In addition, it can be noted that they come from the Wiltz-beds and that they are attached to the nautiloid whose ornamentation does not show any structures resembling neither from near nor from far the wedge-like cavities, only in the format –as usual – weak ribs or growth lines.

Distal side (upper surface)

The polygonal short corallites show cerioid patterns and occupy the main part of the foreign body which locally appears free on its margin. The corallites are slightly inclined. In other species and particularly in *M. grafi*, it seems that the corallites are tilted toward the adapical (or distal) part of the colony; this datum is here tentatively used for the orientation of the corallum (see Fig. 5B, top of fig. as adapical part).

At the calicinal aperture level the corallites are mainly hexagonal, but very often one or two sections of wall are very short (Pl. 2, fig. 5); moreover they all exhibit the same asymmetrical pattern showing that the material is probably deformed.

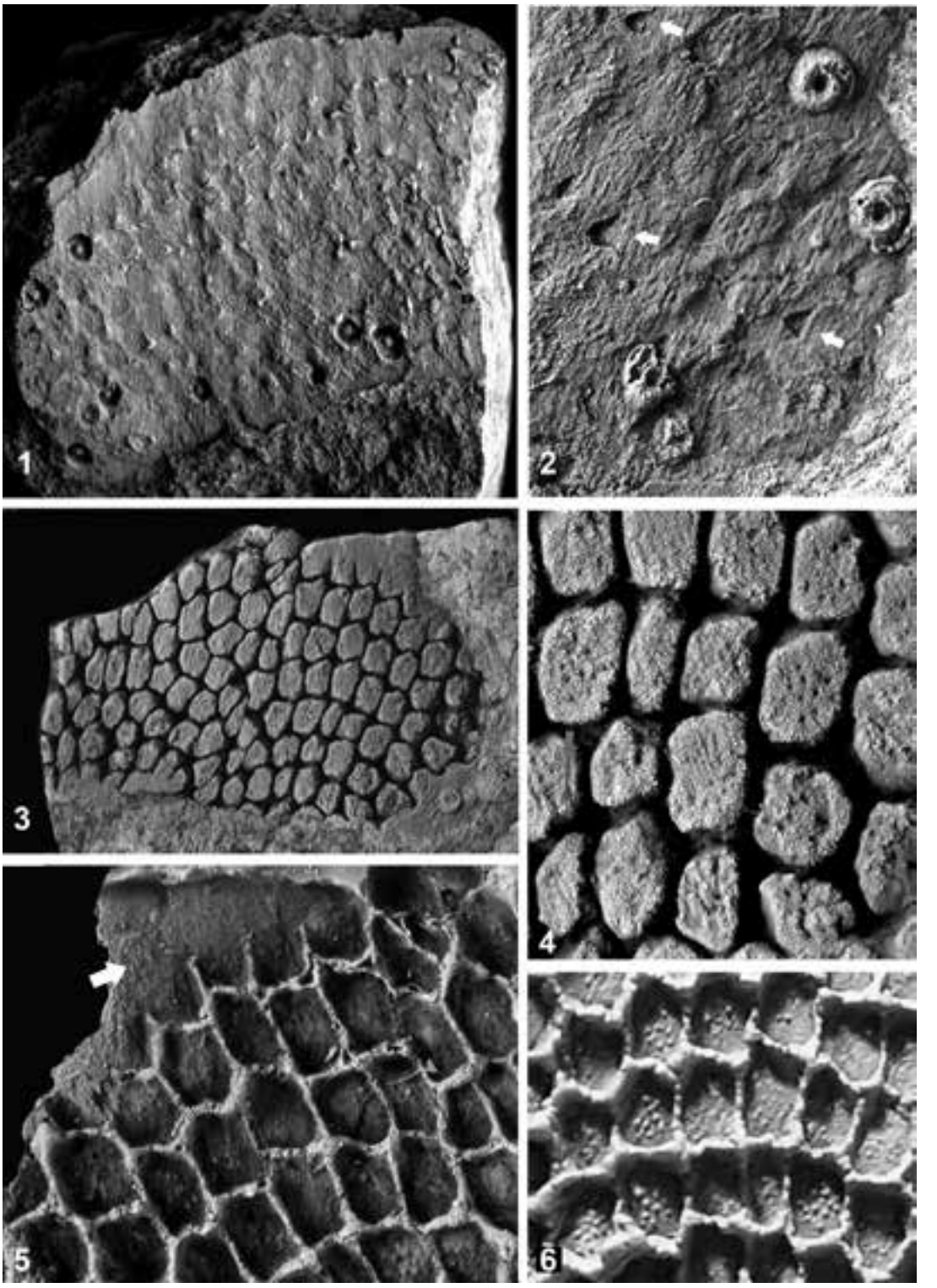
At the calicinal base level, the walls are rather thick especially in the corners of the corallites and the outline of the calicinal base is somewhat irregular (Fig. 5B, drawing of the natural cast and Pl. 2, fig. 4).

The calicinal base exhibit up to five parallel ridges, in some cases they bear a single row of spines. However, some corallites are devoid of spines or ridges, and occasionally the spines display a scattered pattern, or only one or two of them are present. With regards to the median septum known in the genus *Hyostragulum*, we suppose that the ridges are parallel to the median plane of the corallites.

The walls seem to be smooth and devoid of mural pores.

Biometric data

It will be noticed that the material is slightly deformed, so the biometric data are an indication. The sizes of the calices, at the calicinal base level, are measured on the natural casts. The calice length, along the "median" ridge, ranges between 1.10 and 1.90 mm,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50% of the measurements are between 1.40 and 1.55 mm (mean 1.49 mm, mode 1.50 mm). Because of their asymmetrical and/or irregular shape, the width of the calices is difficult to define, and therefore it is roughly estimated at approx. 1.20 mm.

The corallite length (including the thickness of the wall) at the calicinal aperture level, measured on latex replica of the natural cast, ranges between 1.35 and 2.00 mm, 50% of the measurements lie between 1.60 and 1.80 mm (mean 1.71 mm); width approx. 1.50 mm.

Discussion/Proximal and distal sides superimposed

Camera lucida drawing of the latex taken from the natural cast of the proximal side, on the one hand, and the drawing of the natural cast of the distal side on a tracing paper, on the other hand, allow to superimpose the structures displayed on the two sides of the specimen; some small adjustments are necessary because the surfaces are not flat (Fig.5).

Therefore, it clearly appears that:

1 - The polygonal/rhombic structures exposed on the proximal side correspond to the calicinal bases, the furrows to the calicinal ridges and the small pits to the spines. In some cases, the spines, obvious on the calicinal bases, do not show the corresponding pits.

2 - The "frames" of the polygonal/rhombic structures correspond to the path of the corallite walls.

3 - The wedge-like cavities are clearly linked to the meeting point of three corallites walls, not along the "median" calicinal ridge, but generally on the left side of the corallite. The wedge-like cavities cannot be identified on the distal side of the hyostragulid; they are completely hidden by the corallite walls.

4 - On the proximal side, the area (middle left in Fig. 5A) where these structures (1-3) are less obvious fits with the calicinal bases devoid of ridges and spines.

5 - The wedge-like cavities, as well as the furrows and pits, are missing below the area not occupied by the hyostragulid

6 - The *Spirorbis* are undetectable on the distal side (except in its lower right corner, see above).

What about the wedge-like cavities?

1 - If these cavities belong to the hyostragulid, they are very strange and have never been recorded in other tabulate corals even in forms such as *Granulidictyum* which has a skeleton fully covered with living tissue.

2 - If the wedge-like cavities belong to the foreign body, it is difficult to understand why their distribution seems to correspond to that of the corallites. Could this be a chance? Can one imagine the coral adapts the size of its corallites to substrate irregularities? Why they are missing in some particular areas (cf. point 5 above)? Moreover, the known ornamentations and/or structures shown by the external side of the hyolitids, nautiloids or other marine organisms do not correspond to those exposed by the calicinal bases of specimen Kr 101.59.

On the other hand, it seems unlikely that the hyostragulid secondarily was removed from the foreign body by splitting at the boundary between the two organisms, and before the development

Plate 2

Parostragulum problematicum n. sp. Krautscheid, Western Eifel, Germany, Wiltz-beds, Upper Emsian. Specimen MnhnL Kr 101.59.

1. Proximal side, natural cast; x3.5.

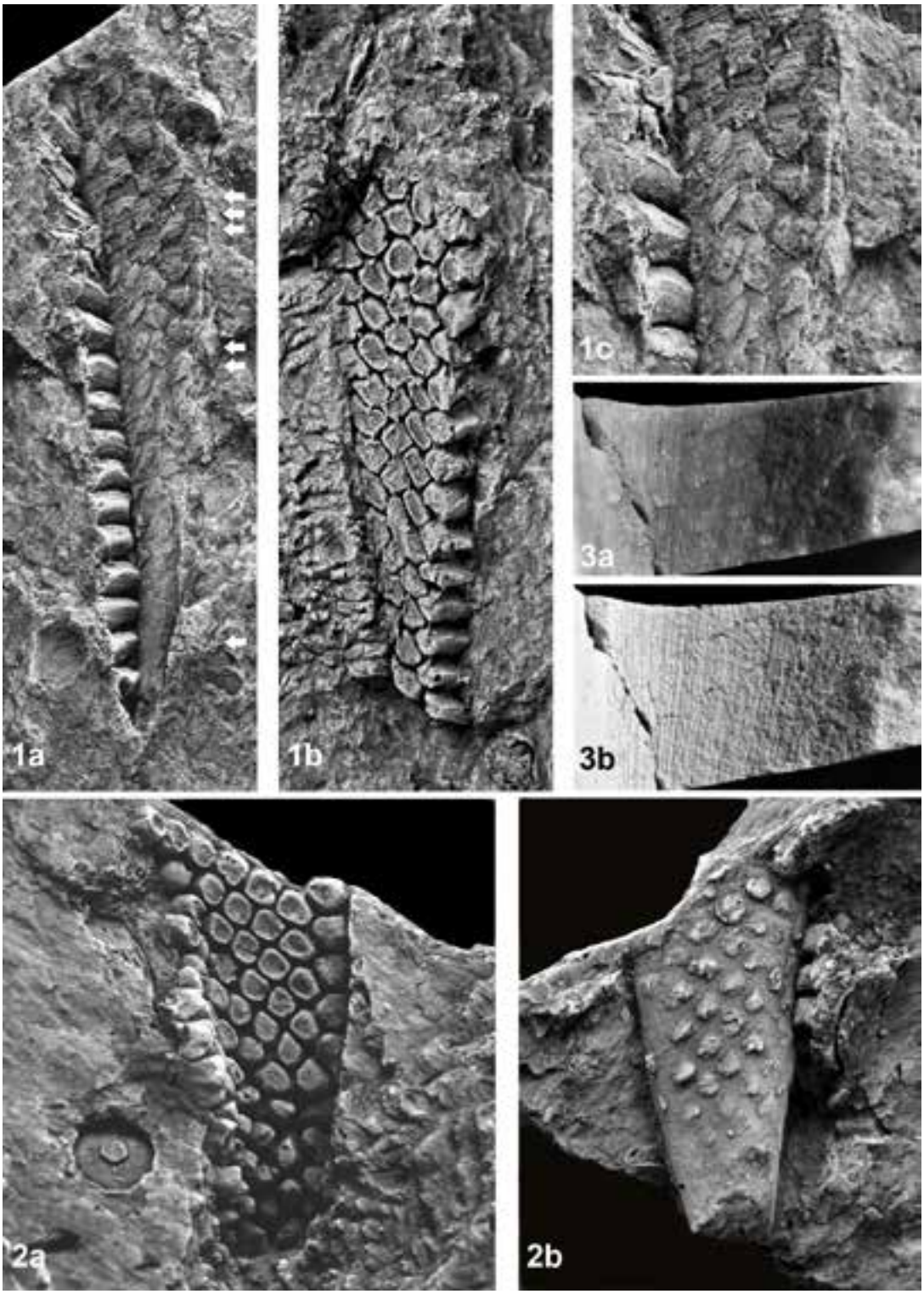
2. Proximal side, latex replica showing its detailed morphology, note the wedge-like structures (arrows) and the *Spirorbis*; x8.

3. Distal side, natural cast; x3.5.

4. Distal side, natural cast showing the morphology of the calicinal bases, note particularly the moulds of the spines; x10.

5. Distal side, latex replica showing the boundary between peripheral incompletely walled corallites and the smooth surface of the foreign body (arrow); x8.

6. Distal side, latex replica showing the spines emphasized by coating; x8.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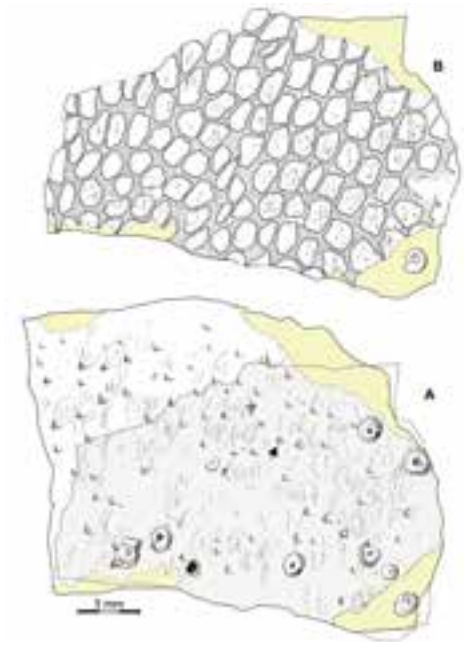

Fig. 5: *Parostragulum problematicum* n. gen., n. sp. Morphology of the two sides of specimen MnhnL Kr 101.59.
A: Proximal side, latex of the natural cast (= restored skeleton) showing numerous wedge-like cavities (black arrow), polygonal to rhombic areas (striped arrow) lined by a more or less obvious "frame" (open arrow), and some *Spirorbis*; marginal smooth area in pale yellow. The dotted line corresponds to the outline of the preserved distal part.
B: Distal side, natural cast, showing the calicinal bases and the network of the walls at the calicinal base level (dotted). The location of the main features of the proximal side (wedge-like cavities and *Spirorbis*) is shown as if they were seen by transparency; the free part of the foreign body in pale yellow.

of the *Spirorbis*, mainly because this foreign body remains on the margin of the corallum in the area not incrusted by the hyostragulid.
It is difficult to choose between the two hypotheses, but it appears that the wedge-like cavities, are more likely related to the hyostragulid rather than to the encrusted body.
In order to try to understand more about the strange wedge-like cavities of our specimen we have first studied the morphology of some *Marekostragulum* from the Upper Emsian of the Massif Armoricain, growing on dorsal side of hyolitid conchs, and preserved as natural casts in shales (Pl. 3, fig. 1-2). Secondly, we have complemented our observations by the study of a specimen from Bohemia showing another kind of preservation.

Specimens from the Massif Armoricain. Very often, the structure of the hyostragulid appears on the inner side of the hyolitid and the following features are described based on the restored calcitic skeleton. In the median to distal part of the hyostragulid/hyolitid system the skeleton becomes increasingly thin**,** and directly below each calicinal base, the inner surface of the hyolitid exhibits a more or less concave area (convex in natural cast, see Pl. 3, fig. 1a, 1c, 2b).Thus, the path of the hyostragulid walls appears in the form of a positive network (see section in Fig. $6B_2$). Moreover, the ornamentation and/or the transverse growth lines developed on the external side of the hyolitid (but hidden by the hyostragulid) are often obvious on its inner side (Pl. 3, fig. 1a, 1c).

Thus, in shaly facies, the thin conch of the hyolitid appears deformed by a kind of stamping and its

Plate 3

1-2. *Marekostragulum* e.g. *simplex* (Morzadec & Plusquellec, 1977) preserved as natural casts in shales, western part of the Massif Armoricain.

1. Prioldy section, Rosnoën district (Finistère), Prioldy Formation, Upper Emsium (*laticostatus*/*serrotinus* Zone). LPB 14 440. **1a.** Proximal side/inner side of the encrusted hyolitid showing, from apex to aperture of the hyolitid, a rather smooth surface (1), the rhombic print of the calicinal bases (2), and - in addition to these structures - the transverse growth lines of the exterior surface of the hyolitid (3). Note on the left a row of corallites belonging to the distal side; x 4, **1b.** Distal side showing the calicinal bases evolving from rather flat near the apex to slightly concave (convex in restored skeleton) in the distal part; x4, **1c.** Close up of the proximal side, boundary between area (2) and (3); x6.

2. Reun ar C'hrank section, Lanvéoc district (Finistère), Le Fret Formation, Upper Emsian (*serrotinus* Zone); see text and Fig. 6. LPB 14 441; x5, **2a.** Distal side showing the more or less rhombic calicinal bases, their concavity (convex in restored skeleton) are probably due to stamping; x5, **2b.** Inner side of the encrusted hyolitid showing in its distal part the calicinal bases prints.

3. *Hyostragulum*? sp. Koněprusy, Císařský quarry, Bohemia, Suchomasty Lst., Zlichovian-Dalejian. Proximal side of the basal plate before (3a) and after coating (3b); see text. LPB 15 446; x5.

inner side reflects both the external morphology of the hyolitid and that of the hyostragulid. On the other hand, the so called phenomena of stamping have not been recorded in limestones.

In addition, we have to keep in mind that in *Hyostragulum mobile* Marek & Galle (1976, fig. 7F) and *Marekostragulum simplex* Morzadec & Plusquellec (1977, fig. 1D) that the basal plate of the corallum is missing in the distal area of the colony and therefore, the external side of the nautiloid or of the hyolitid forms the calicinal base of the hyostragulid. However, this peculiar feature – probably rather common – is out of the question for the specimen from Krautscheid, mainly because the free part of the foreign body to which the coral is attached is smooth on both sides.

Thus, gathering from the data provided by the study of the relationships between the two sides of the specimen, our knowledge of the hyostragulid/hyolitid system (Marek & Galle 1976, Galle *et al*. 1994, Galle & Plusquellec 2002) and the study of unpublished material from the Massif Armoricain, it seems that, the structures of the distal side were stamped as negative on the proximal one, throughout the support body; this latter being very thin and probably not very tough, even somewhat supple (mainly horny material ?).
On the basis of these previous data, prior to burying in the sediment and diagenesis, our hypothesis is that the wedge-like cavity was probably an empty space between the foreign body and the skeleton of the hyostragulid (Fig. 7B) and that this structure "belongs" to the coral. Afterwards, the structure imprinted itself on the inner side of the foreign body (Fig.7C).

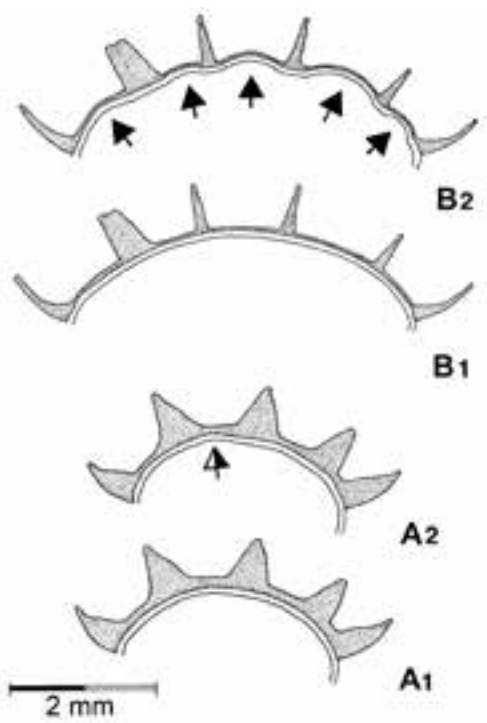

Fig. 6: *Marekostragulum* sp. Reun ar C'hrank section, Lanvéoc district, western Massif Armoricain, Le Fret Formation, Upper Emsian (*serrotinus* Zone). Restored transverse section of the hyostragulid (dotted)/hyolitid (open) system made from natural casts of a specimen preserved in shales; A: proximal part, B: distal part (Specimen LPB 14 441, see also Plate 3, fig. 2).
Following the hypothesis of "stamping", the sections show the calicinal base morphology before (A_1, B_1) and after (A_2, B_2) diagenesis. In the proximal part of the system the skeleton of the hyostragulid is rather thick and the deformation does not occurs or is very weak (half black arrow), while in its distal part, where the basal plate is very thin or even missing, the calicinal bases become strongly convex as well as the corresponding areas of the hyolitid.

Specimen from Bohemia. Some interesting data that partly confirm our hypothesis are supplied by a specimen of *Hyostragulum* ? sp. from the Suchomasty Limestone in Bohemia (LPB 15 446). As usual in this formation, the calcitic skeleton of the hyostragulid and that of the hyolitid (*Ottomarites discors*) are preserved.

The specimen is broken at the boundary between the external surface of the *Ottomarites* and the proximal side of the skeleton of the *Hyostragulum* ?. Thus we have two pieces: - pcs 1, a convex one showing the dorsal side of the conch of *Ottomarites* bearing longitudinal ribs (Fig. 8C) - pcs 2, a concave one showing the proximal side of the basal plate of the hyostragulid and the negatives of the ribs. (Fig. 8A-B and Pl. 3, fig. 3a-b).

On the surface of piece 2, a set of light, yellowish, arched to tongue-shaped patches, that differ from the rest of the surface only by their color (they do not show any relief), is rather conspicuous. All the patches show the same orientation and their tips are facing the apex of the hyolitid. When the specimen is coated with ammonium chlorid, the patches disappear while the moulds of the ribs as well as a very discontinuous net of slightly depressed structures are emphasized.

A drawing of the specimen before and after coating shows the relationships between the two structures (Fig. 8A) and allow the followings remarks.
- the tongue-shaped patches are clearly similar to the wedge-like cavities in shape and size, but here they seem to be filled with yellowish calcite.
- the net of depressed structures corresponds to the path of the corallite walls (in fact, in some places the very proximal part of the wall remains on pcs 1, therefore the wall appears carved on pcs 2)
- the tongue-shaped patches are not located at the meeting point of three corallite walls (as in *Parostragulum*) but in the apical corner of the calicinal base.

The transverse section in the *Ottomarites* conch (pcs 1, polished section and acetate peel) shows the ribs on its external side and a smooth outline on its internal side. It will be noticed that this latter surface is absolutely devoid of structures related to the patches.

The data provided by the bohemian specimen indicate: 1) that - as inferred from the morphological study of *Parostragulum* - the wedge-like cavities belong to the hyostragulid, not to the substrate, 2) that these structures are probably not relevant for the diagnosis of the genus *Parostragulum*, 3) that the global orientation assigned to our specimen of *Parostragulum* (see on Fig. 5 the wedge-like cavities) is consistent with that of the Bohemian *Hyostragulum* ?, and 4) that, although showing numerous similarities, the concave surface of pcs 2 and the proximal side of *P. problematicum* **are not identically**; we have shown that the proximal side cannot be obtained by the splitting of the specimen between the substrate and the incrusting organism but, indisputably, is the (natural mould of the) proximal or inner side of the substrate. In fact, the two surfaces are separated by a layer of calcite whose thickness corresponds to the skeleton of the substrate. Thus, a modification of the morphology of the substrate (stamping?) remains necessary to explain the characteristics of the specimen of *Parostragulum problematicum*

The morphology (probably developed by stamping) recorded in the two studied hyostragulid/foreign body system - from Eifel

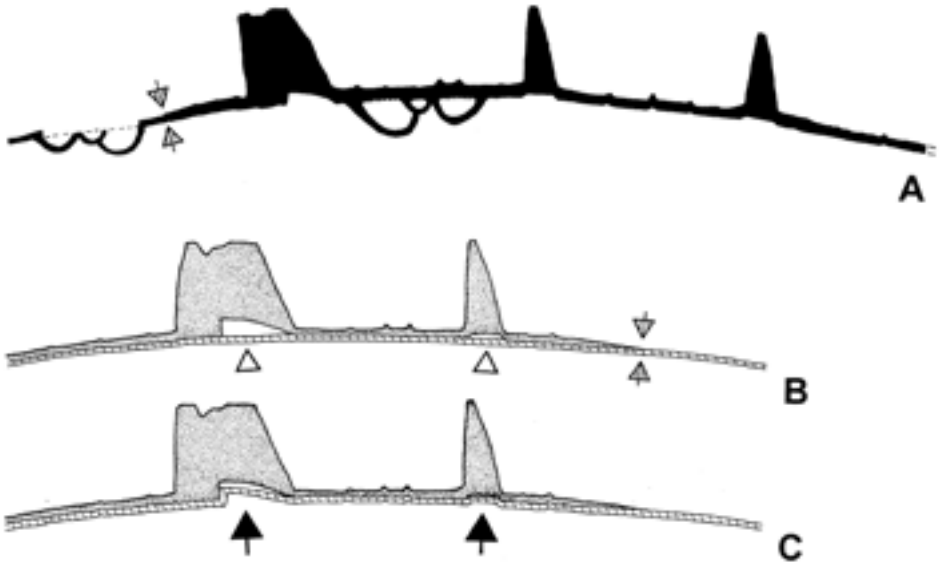

Fig. 7: *Parostragulum problematicum* n. gen., n. sp.
A: Idealized vertical section in the *Hyostragulum*/foreign body system (with *Spirobis*) made from natural casts in the lower right area of specimen MnhnL Kr 101.59 (see Fig. 5); striped arrows as the boundary between the free foreign body on the left and the encrusted part on the right.
B-C : Same sections depending as how the morphology is interpreted, before (B) and after (C) the deformation; dotted area to show the skeleton of the hyostragulid, left open triangle to show wedge-like cavity, right one to show empty space below and along the wall, hatched area as foreign body.

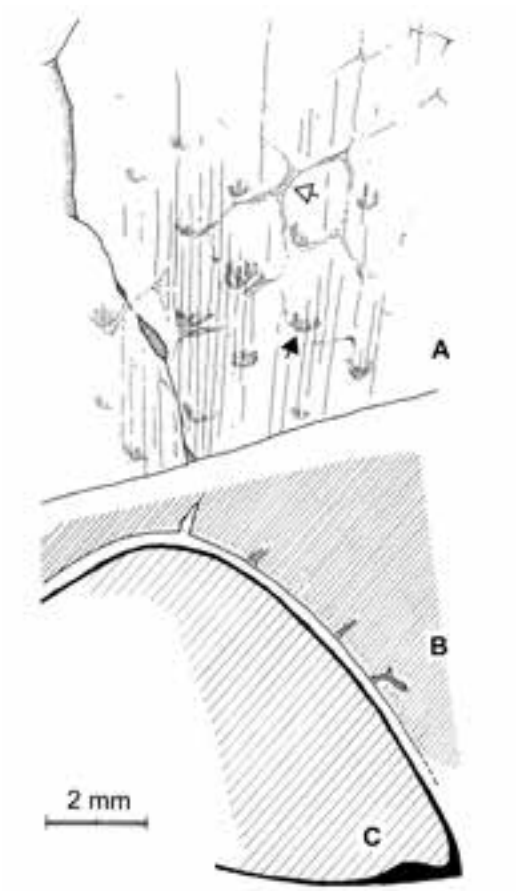

Fig. 8: *Hyostragulum*? sp. Koněprusy, Císařský quarry, Bohemia, Suchomasty Lst., Zlichovian-Dalejian. Detailed explanations in text.
A: Proximal side of the basal plate of the hyostragulid showing the tongue-shaped patches (black arrow), the path of the corallite walls (open arrow) and the casts of the ribs of *Ottomarites* (parallel lines).
B-C: transverse section in the hyostragulid/hyolitid system broken at the boundary between the external surface of the *Ottomarites* conch (C) and the *Hyostragulum*? (B) of which only the corallite walls (in vertical section) are visible. The gap between the drawings A and B has been added by us. Specimen LPB 15 446.

and Massif Armoricain - shows some similar features. Nevertheless, in the specimen from the Eifel, the path of the hyostragulid walls appears as a negative network on the proximal side of the system (see Fig. $6B_2$ versus Fig. 7A and Pl. 2, fig. 2). Why? Is there below each side of the wall a more or less continuous narrow and low empty space similar to the wedge-like cavity? We can agree with this idea (Fig.7B-C), but other questions arise.

Why are the *Spirobis* not stamped in the distal side of the corallum if our hypothesis iscorrect? Does this data indicate that the deformation occurs very early, i.e. before the development of the *Spirorbis* and consequently before the diagenesis? Through which phenomena? Could constraints related to differences in composition of the skeleton generate deformations of the hyostragulid/foreign body system after its death? If true, why does this phenomena seem not to be recorded in the limestones?

Indeed this specimen is very strange and partly remains misunderstood; further material will be required to furnish additional information and to determine if certain characters such as the wedge-like cavities are consistently maintained.

Comparison

As far as we know, the specimen Kr 101.59 differs from all known species and thus, a new one is erected herein.

Conclusion

The study of the marine fauna of the Wiltz-beds from Luxembourg and Germany has already led to previous publications by one of us (Franke 2010 and 2012) and the following can be pointed out concerning the hyostragulids.

Two new species and one new genus are described. It would certainly be better if there were more specimens but their characteristics are so much different from known hyostragulids that establishing the new taxa is, in our opinion, completely justifiable.

For reasons of compairs, the description of the new material has led us to focus on to the peculiar modalities of preservation or deformation of the hyostragulid/hyolitid system in rocks like shale and silty shale, provided by some specimens from the Massif Armoricain. It is probably the first time that a paper points out such unusual feature where the incrusting organism seems to be printed in the substrate to which it is attached.

The wedge-like cavities (herein reported for the first time) and the yellowish tongue-shaped patches of the Bohemian hyostragulid, probably belong to the same structure.

Table 1: *Marekostragulum grafi* n. sp. Biometric data.

Specimen	Corallum area		Corallite length	Corallite width	Calicinal base length	Calicinal base width
Kr 132.32	Proximal area	Range	1.15 - 1.45	0.90 - 1.50	0.80 - 1.20	1.05 - 1.50
		N	33	28	24	28
		X	1.28	1.28	1.02	1.21
		Mode	1.35	1.30	1.05	1.10
	Inter-mediate area	Range	1.15 - 1.25	1.45 - 1.70	1.05 - 1.20	1.20 - 1.50
		N	6	5	7	7
		X	1.21	1.55	1.11	1.38
		Mode	1.20	1.45	1.05 -1.15	1.45
	Distal area	Range	1.10 -1.45	1.35 - 1.70	1.00 - 1.25	1.15 - 1.50
		N	31	26	28	27
		X	1.31	1.55	1.12	1.33
		Mode	1.35	1.55	1.10	1.35
KRA 1-500	Proximal area	Range	1.20 - 1.65	1.30 - 1.65	1.00 - 1.30	1.10 - 1.30
		N	17	17	12	12
		X	1.43	1.48	1.15	1.16
		Mode	1.45	1.50	1.15	1.10

The genus *Marekostragulum* is well known to appear in the northern margin of Gondwana during Upper Emsian (Galle & Plusquellec 2002) but this genus has for the first time been reported from the Devonian of south Laurussia (Eifel). Nevertheless, this occurrence does not extend the known stratigraphic distribution of the genus. In addition it will be noticed that 1) the others representatives of hyostragulids in south Laurussia during upper Emsian (new genus A Galle & Plusquellec, 2002 and *Parostragulum* n. gen.) are, as far as we know, endemic, and 2) that the complete record of hyostragulids in south Laurussia are restricted to a relatively small region represented by the autochtonous Rhenish Massif.

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