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Cribratina hoeverensis Steffahn & Helm sp. nov.: a new 'larger' agglutinated foraminiferal species from the Upper Cretaceous (Lower Campanian) of Hannover, NW Germany

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ABSTRACT – A new species, *Cribratina hoeverensis* sp. nov., is erected to accommodate the youngest known species of the larger agglutinated foraminiferal genus *Cribratina* Sample, 1932, recovered from Upper Cretaceous beds (Lower Campanian, *lingua/quadrata* Zone and lowermost *pilula* Zone) east of Hannover, NW Germany. *J. Micropalaeontol.* **21**(1): 17–22, May 2002.

INTRODUCTION

Several species of free larger agglutinated foraminifera have been found in Upper Cretaceous beds of north-western Germany in the last few years (e.g. Rodriguez, 1987; König, 1994; Riegraf, 1995a, b, 1998). Showing remarkable sizes up to 1 cm, these foraminifera can be easily recognized even in the field. Field work at a well-known locality near Hannover has revealed a previously unknown species of such foraminifera.

For decades extensive quarrying of Upper Cretaceous marl to limestone deposits has been carried out for the cement industry at a number of localities east of Hannover, NW Germany. Hitherto, these outcropping beds have been the subject of numerous sedimentological and palaeontological studies (Abu-Maaruf, 1975; Koch, 1975; Niebuhr, 1995, 1999; Niebuhr *et al.*, 1997; Ernst *et al.*, 1997; Rehfeld *et al.*, 1998; Volkmann, 1998; Helm & Richter, 1999; Helm *et al.*, 1999).

In the Höver quarry 'Alemannia' (Fig. 1) these quarrying operations have revealed a substantial exposure of an undisturbed stratigraphic succession from the lowest Lower Campanian (*lingua/quadrata* Zone) to the lowest Upper Campanian (*gracilis/mucronata* Zone). The beds have a general dip of 10° towards ENE.

Recent findings originating from the *lingua/quadrata* Zone and lowermost *pilula* Zone, which crop out extensively on gently inclined slopes in the southwestern part of the quarry 'Alemannia' (Fig. 1), have revealed several free 'larger' calcareous and agglutinated foraminifera (Helm & Steffahn, 1999). The foraminiferal assemblage yields species of *Neoflabellina* (most abundant *N. elliptica*), *Nodosaria* (e.g. *N. vertebralis* gr.) and different agglutinated species of the well known genus *Lituola*; these are not further considered in this paper.

Conspicuous is the presence of numerous uniserial, agglutinated specimens which are thought to belong to *Cribratina* Sample, 1932 a genus previously not known from the Upper Cretaceous of NW Germany. These specimens are here proposed to represent a new species.

MATERIAL AND METHODS

The specimens were obtained by simply collecting them individually from the surface of slightly weathered marl beds and the erosional slopes of the Lower Campanian *lingua/quadrata* Zone and lowermost *pilula* Zone (Fig. 2). The bulk of the material was collected between 1995 and 1999.

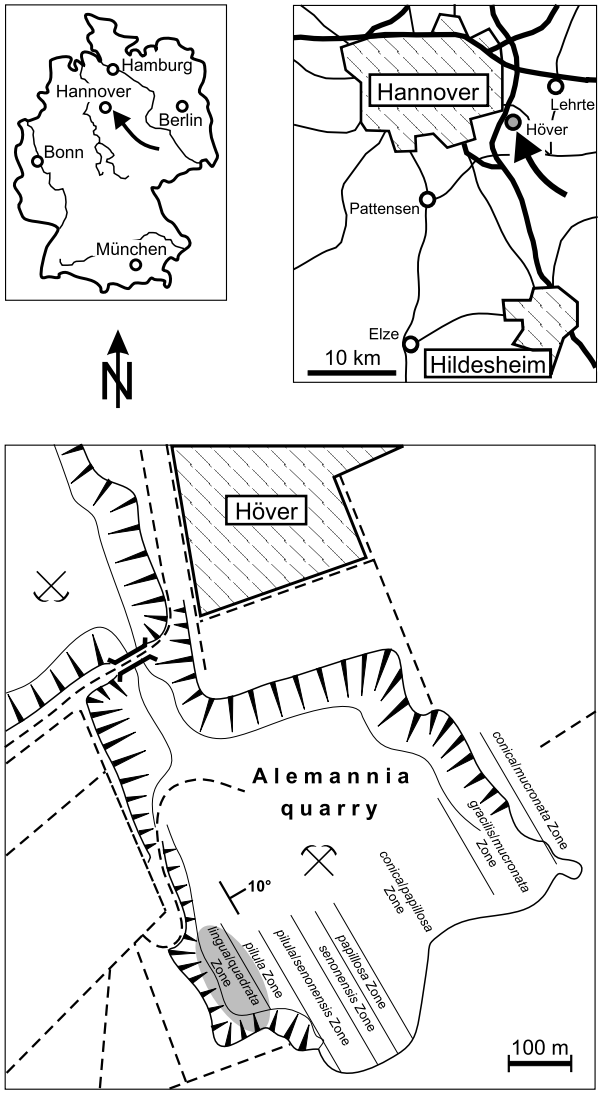


Fig. 1. Sketch map of Germany, showing the location of the city of Hannover and the 'Alemannia' quarry south of Höver. The area in which specimens of *Cribratina hoeverensis* sp. nov. were found is shaded.

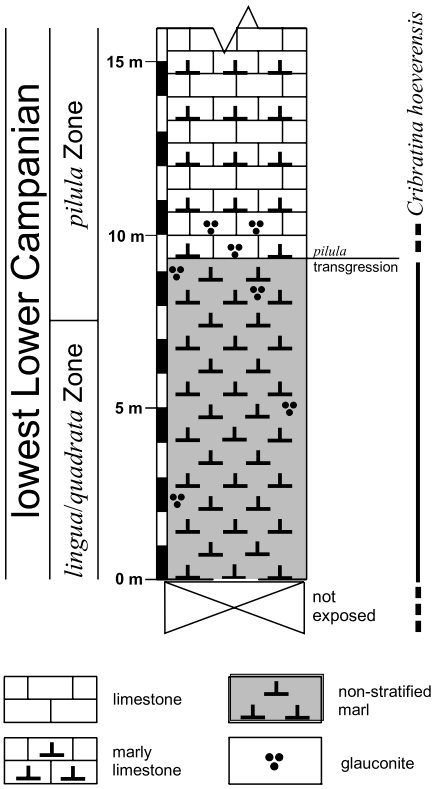


Fig. 2. Generalized lithological sequence of the Lower Campanian succession exposed in the SW of the 'Alemannia' quarry and stratigraphic range from which *Cribratina hoeverensis* sp. nov. was collected.

The overall preservation of the *Cribratina* specimens is good even though the proloculus is broken in most of the tests. The tests were cleansed by ultrasonic treatment and examined with a binocular microscope; ten well preserved specimens were prepared as thin sections (longitudinal and cross-sections); four tests were analysed by SEM.

The specimens are stored in the collection of the 'Niedersächsisches Landesmuseum' (NLM), 'Abteilung Naturkunde', Hannover, Germany (catalogue numbers: Holotype NLM 102.392; Paratypes NLM 102.393 to NLM 102.397).

GENERIC DETERMINATION

Cribratina Sample, 1932 would be the most suitable genus to describe the species under discussion because of its prominent cribrate aperture and true twofold alveolar wall structure.

Referring to Arnaud-Vanneau & Prestat (1984), Loeblich & Tappan (1988) and Hart (1995) the assignment of the species to other external similar appearing genera within the Textulariina (the characteristics of these genera are listed in Table 1) can be excluded.

- *Atactolituola* Loeblich & Tappan, 1984 is about the right size but can be excluded because its wall is always of simple (pseudolabyrinthic) structure and it possesses an initial coil.
- *Coscinophragma* Thalmann, 1951 is a very large genus with a cribrate aperture but is generally branching and possesses a canaliculate wall structure.
- *Labyrinthidoma* Adams, Knight & Hodgkinson, 1973 is also a very large genus and can be excluded because of its initial trocho- or streptospiral coil.
- *Polychasmina* Loeblich & Tappan, 1946 is very similar in size but its aperture possesses just a single row of slits.
- *Thomasinella* Schlumberger in Peron, 1893 can be excluded because of the simple nature of its aperture and arborescent growth form.

The species under discussion belongs almost unquestionably to *Cribratina* because it best fits the initial description of the genus from Sample (1932) which is as follows:

Test free, nodosarian in shape; chambers numerous, overlapping; apertural chamber larger and better rounded in microspheric than in megaspheric form; proloculum small in microspheric form, large in megaspheric form; sutures depressed; wall medium to finely arenaceous, cement calcareous or ferruginous; aperture terminal, cribrate, composed of numerous subangular openings within an oval area, better developed in microspheric form; size, up to 10 mm.

A more recent diagnosis of the genus from Loeblich & Tappan (1987) is:

Test free, large, up to 10 mm in length, elongate, uniserial and rectilinear, chambers closely appressed, sutures straight, horizontal and constricted; wall thick, agglutinated, of medium- to coarse-grained quartz and other mineral particles, with subepidermal alveolar layer; aperture terminal, cribrate, with many irregular and subangular openings on a produced area of the final chamber face.

However, the specimens do not fit entirely the description of the known species of this genus (there is only one recorded species – *Cribratina texana*) and therefore a new species is proposed here:

SPECIFIC DETERMINATION

Order **Foraminiferida** Eichwald, 1830
Suborder **Textulariina** Delage & Hérouard, 1896
Superfamily **Hormosinacea** Haeckel, 1894
Family **Cribratinidae** Loeblich & Tappan, 1964
Subfamily **Cribratininae** Loeblich & Tappan, 1964
Genus *Cribratina* Sample, 1932

Cribratina hoeverensis sp. nov.
(Pl. 1, figs 1–7; Pl. 2, figs 1– 7)

1999 *Cribratina* sp., Helm & Steffahn: 170, fig. 1; 171, pl. 1, figs 6 and 7.

Type species. *Nodosaria texana* Conrad in Emory, 1857.

Derivation of name. With reference to the region of origin: sampling locality Höver, NW Germany.

Diagnosis. A species of *Cribratina* with several, scarcely overlapping, sturdy chambers – very gradually increasing in breadth and height – bordered by straight occasionally slight oblique sutures giving the chambers a strongly flattened respectively a shallow wedge-like shape. Final chamber is also sturdy, but presents a slightly vaulted apertural face with a terminal, multiple aperture comprising numerous rimmed openings.

Holotype. NLM 102.392 (Pl. 1, figs 1 and 2).

Genera	*Cribratina* Sample, 1932	*Atactolituola* Loeblich & Tappan, 1984	*Coscinophragma* Thalmann, 1951	*Labrynthidoma* Adams, Knight & Hodgkinson, 1973	*Polychasmina* Loeblich & Tappan, 1946	*Thomasinella* Schlumberger, in Peron, 1893
Features						
Size	'large'	'large'	'large'	'large'	'large'	'large'
(max. size in mm)	10	8	34	50		7
Attached or free	free	free	free	free	free	?
Branching growth form	no	no	yes	(very) rare	rare (bifurcate)	yes (arborescent)
Early growth stage of the microspheric form	no coil, totally uniserial	?	trochospiral coil	High trochospiral coil	?	?
Early growth stage of the megalospheric form	no coil, totally uniserial	semicoiled planispiral	no coil, totally uniseriali	involute streptospiral coil	no coil, totally uniserial	'globular'
Aperture in the uniserial growth stage	cribrate (numerous)	cribrate	cribrate (numerous)	cribrate (numerous)	single row of slits	simple, round or ovoid
Cement in the outer wall	yes: carbonate	yes: some carbonate	yes: acid resistant	yes: some carbonate	yes: acid resistant	?
Internal structures	alveolar structure	simple wall structure	median layer possesses canaliculi	labyrinthic interior	simple wall structure	wall canaliculate
Nature of the inner wall	chamber cavity smooth	?	chamber cavity smooth	chamber cavity smooth	?	?
Currently known range	Upper Aptian to Cenomanian	Albian	Middle Albian to Lower Turonian	Turonian to Santonian	Upper Albian	Cenomanian
Geographical distribution	N. America, N. Africa	N. America	Central Europe	SE England	N. America	N. Africa, India

Partly based on a modified table from Hart (1995).

Table 1. Generic characteristics of some larger Textulariids.

Paratype. NLM 102.393 (Pl. 1, figs 5 and 6).

Material. 26 specimens.

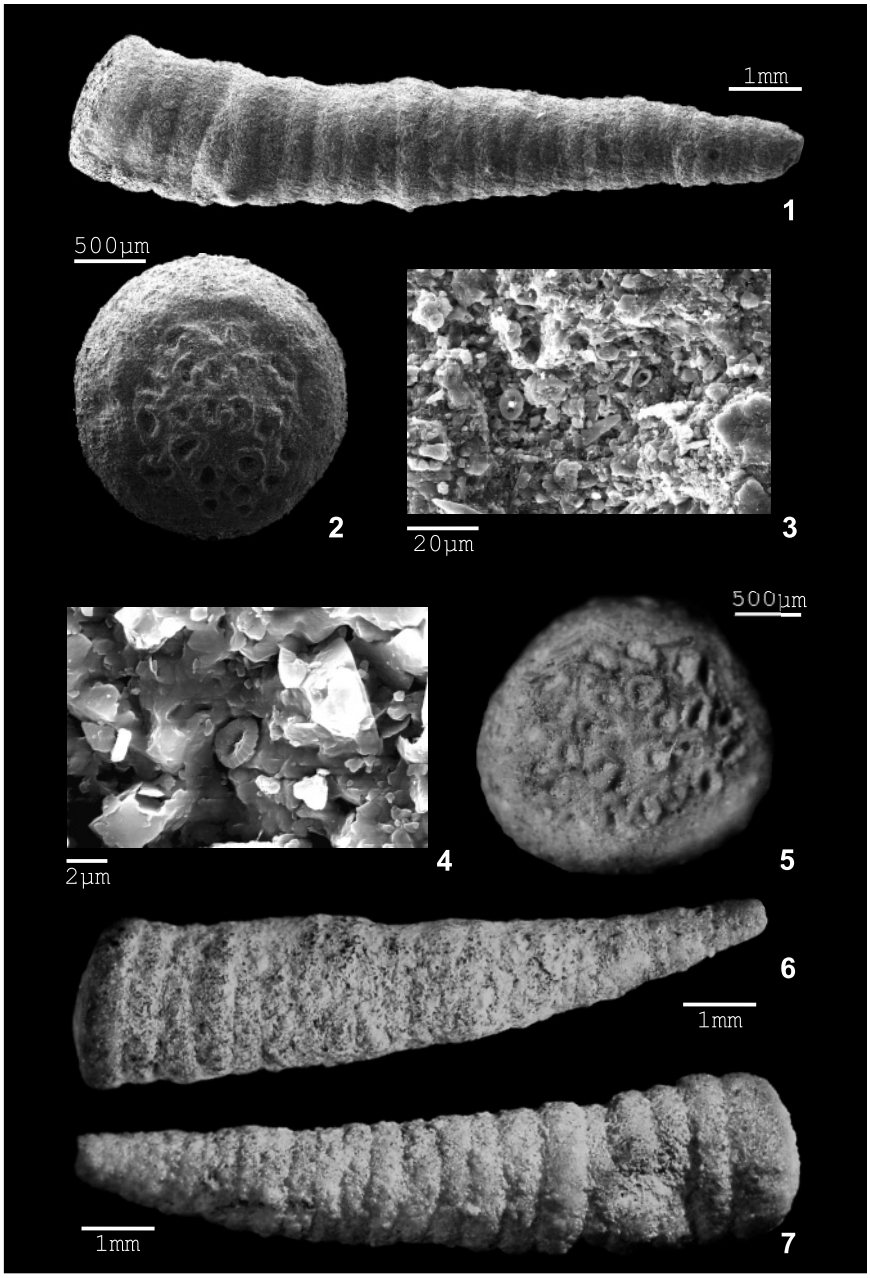
Locality and horizon. Quarry 'Alemannia' at Höver, a village *c*. 5 km east of the city of Hannover, NW Germany. Uppermost 5 m of the *lingua/quadrata* Zone to lowermost 2 m of the *pilula* Zone (non-stratified marl facies below the '*pilula* transgression', see also Fig. 2), Lower Campanian/Upper Cretaceous.

Description. Test free, uniserial, rectilinear, sub-cylindrical. Neither coiled or biserial stages nor branching have been observed. Proloculus globular to bulbous. Chambers numerous (23 to 31), distinctly sturdy to closely appressed; all chambers wider than high, very gradually but slightly increasing in size, giving the test a slender conical appearance; intercameral septa are predominantly planar especially in the first two thirds of the test; chambers just scarcely overlapping (Pl. 2, figs 1, 5); the well defined sutures are mostly straight; occasionally oblique sutures giving a wedge-like shape to some chambers; in extreme cases these chambers pinch out, i.e. grow progressively thinner on one side up to total disappearance; last chamber sturdy, having a slightly vaulted apertural face and possessing a multiple 'cribrate' aperture with 21 to 27 rounded to subangular rimmed openings randomly arranged within a round to oval area; the exoskeleton is build up of true alveolar layers which display no polygonal subepidermal network and endoskeletal differentiation like beams and rafters; wall is twofold:

(1) an outer thin epidermal layer of agglutinated medium to fine-grained diverse calcareous particles, e.g. bioclastic debris and coccoliths (Pl. 1, figs 3 and 4) and subordinate quartz;
(2) an inner thick alveolar subepidermal layer of calcitic-cemented fine-grained detritus. The alveoli are developed as more or less regular multiple branching blind ending cavities (Pl. 2, figs 1 to 7).

Dimensions. Holotype (with proloculus): length of test 10.4 mm, breadth of test 2.2 mm; range (25 specimens, proloculus broken among most of the tests): length of test 8.2–10.8 mm, breadth of test 1.3–2.4 mm.

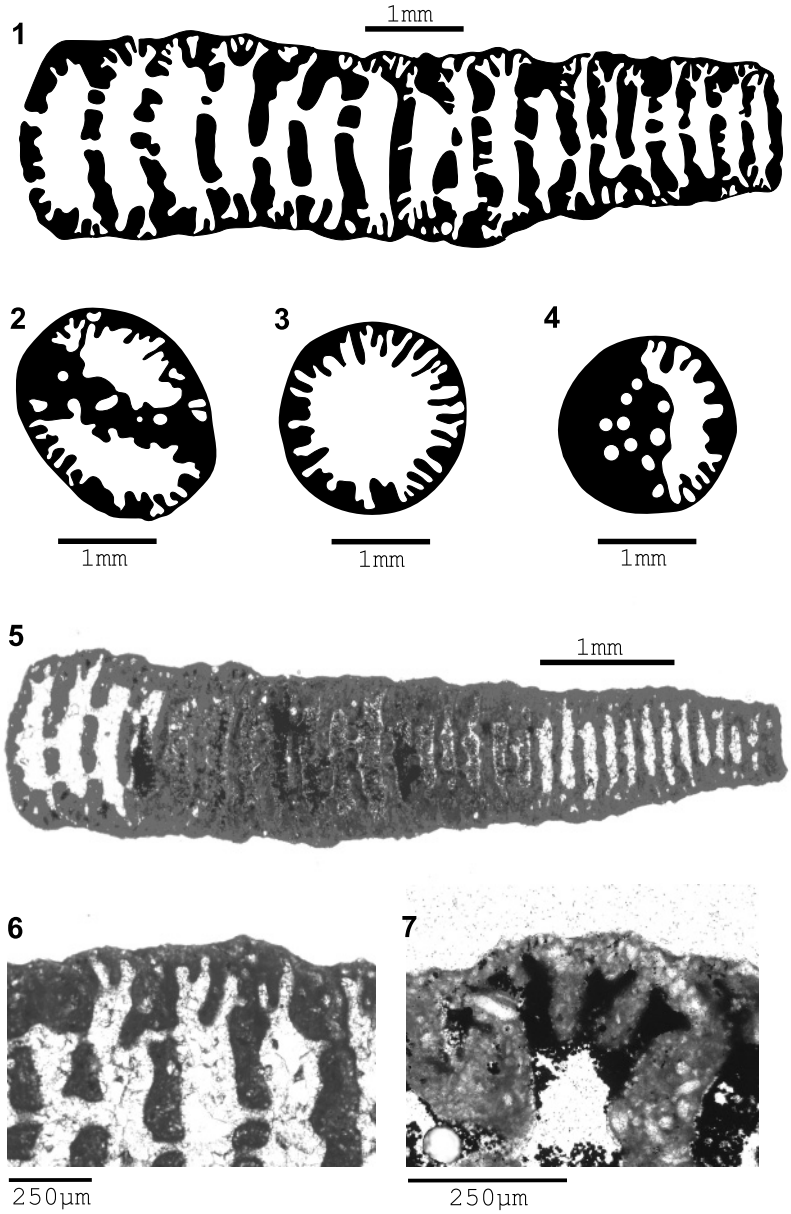
Variations. The tests may be rectilinear, slightly curved, or sigmoidally bent. The diametrical outline of the test may be strictly circular or slightly elliptical. Other variations are observed concerning the shape (round or subangular) and number of openings belonging to the multiple aperture. Variations are also noted in the size of the agglutinated material. Tests may be comprised of exclusively fine- or medium-grained particles, or a mixture of both.



Explanation of Plate 1

Figs 1–4. SEM images of the holotype of *Cribratina hoeverensis* sp. nov.: **1**, illustration of the holotype (NLM 102.392); **2**, view of the multiple aperture showing numerous round to subangular rimmed openings (NLM 102.392); **3**, enlargement of the wall of the holotype (NLM 102.392) – this shows agglutinated mainly carbonate particles; **4**, enlargement of the wall of the holotype (NLM 102.392) showing some carbonate particles and a well preserved coccolith with an imbricated cycle. **Figs 5–7**. Binocular digital images of *Cribratina hoeverensis* sp. nov.: **5**, apertural view of paratype (NLM 102.393a); **6**, illustration of paratype showing the bulbous proloculus (NLM 102.393a); **7**, illustration of an incomplete specimen of *Cribratina hoeverensis* sp. nov. (NLM 102.393b).

Remarks. *Cribratina hoeverensis* sp. nov. can clearly be distinguished from the genotype species *Cribratina texana* Conrad in Emory, 1857 as it presents plane septa in contrast to vaulted intercameral septa especially in the initial and early advanced stage. Therefore, the chambers do not overlap as much as in *Cribratina texana*. Furthermore, the chambers of *Cribratina hoeverensis* sp. nov. are more numerous and more compressed. The final chamber is not as rounded as in *Cribratina texana* but always comprises a vaulted apertural face with 21 to 27 rimmed openings. This is much more than in *Cribratina texana*, which is not known for possessing much more than 10 less prominent rimmed openings in multiple aperture (*fide* [partly illustrations by] Sample, 1932; Arnaud-Vanneau & Prestat, 1984; Loeblich & Tappan, 1988). *Cribratina hoeverensis* sp. nov. shows agglutination of fine- to medium-grained diverse material whereas the wall of *Cribratina texana* is



Explanation of Plate 2

Figs 1–4. Silhouette sketches of thin sections of *Cribratina hoeverensis* sp. nov. showing the multiple dichotomously branching cavities of the alveolar layer: **1**, longitudinal section (NLM 102.394a); **2**, cross-sections with tangential cut of cribrate aperture (NLM 102.394b); **3**, cross-sections (NLM 102.394c); **4**, cross-sections with tangential cut of cribrate aperture (NLM 102.394d). **Figs 5–7**. Thin sections of *Cribratina hoeverensis* sp. nov.: **5**, longitudinal thin section showing the plane intercameral septa in initial and early advanced stage (NLM 102.395); **6**, enlargement of the alveolar wall structure (NLM 102.395); **7**, enlargement of an initial triple branching and second dichotomously branching of an alveolar cavity (NLM 102.395).

described as being agglutinated of medium- to coarse-grained commonly quartz particles. Nevertheless, it must be admitted that the size and nature of the agglutinated grains alone are not an adequate specific differentiator, as this can reflect environmental conditions rather than specific preferences (see also variations).

CONCLUSIONS

Cribratina hoeverensis sp. nov. possesses – within the characteristics of *Cribratina* Sample, 1932 – some powerful distinctive morphological traits that distinguish it as a new species.

It remains unclear if *Cribratina texana* is directly ancestral to *Cribratina hoeverensis* sp. nov. because neither transitional forms have been observed nor is a fossil record of the genus known from the Turonian to Santonian.

The specimens of *Cribratina hoeverensis* sp. nov. originate from Lower Campanian beds of the *lingua/quadrata* Zone and lowermost *pilula* Zone. It is therefore the youngest known species of the genus *Cribratina*, as other findings of *Cribratina*

are known only from the Comanchean (Upper Aptian to Lower Cenomanian) of Texas and Oklahoma (e.g. Conrad in Emory, 1857:*Cribratina texana*); the Cenomanian of Tunisia (Arnaud-Vanneau & Prestat, 1984: *Cribratina* sp.); and Morocco (Butt, 1982: *Cribratina texana*). Our discovery of *Cribratina* near Hannover extends the stratigraphical occurrence of the genus up to the late Upper Cretaceous and its geographical distribution into the Boreal Realm of central Europe.

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