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REGINE JAHN &amp; WOLF-HENNING KUSBER

## Algae of the Ehrenberg collection – 3. Typification of seven diatom taxa described by C. G. Ehrenberg predominantly from Greece

### Abstract

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Lectotypes are selected and illustrated for seven names of diatom species described by Ehrenberg in 1840 from Greece: *Amphitetras antediluviana*, *Epithemia hellenica* (*Eunotia hellenica*), *Lyrella praetexta* (*Navicula praetexta*), *Rhopalodia graeca* (*Cocconema graecum*), *Stictodiscus parallelus* (*Amphitetras? parallela*), *Triceratium favus* and *T. pileus*. This includes the type of the genera *Amphitetras* and *Triceratium*. New combinations are validated for *Epithemia hellenica* and *Rhopalodia graeca*.

Key words: *Amphitetras*, *Triceratium*, marine micro-algae, subfossil *Bacillariophyta*, lectotypes.

### Introduction

This is the third of a series of papers typifying names of algae taxa, which were described by Ehrenberg as new, and illustrating their type specimens. Whereas the first (Jahn & Kusber 2004) focused on Ehrenberg's early diatom taxa from live material and the second on some of his non-diatom taxa (Kusber & al. 2005), the present paper focuses on diatom taxa mainly described from subfossil Greek material.

While Ehrenberg's folio book "Infusionsthierchen" (Ehrenberg 1838a) was being published, which was based on living organisms, he began to collect data for his "Mikrogeologie" (to be published in 1854), focusing on soils and fossil deposits. Ehrenberg, also called the founder of micropaleontology, was one of the first scientists to recognize the organismal derivation of these deposits (Ehrenberg 1838b, 1840b). He even recognized the same species in fossil and living material and called this "the microscopical but strong linkage between the organismal life of different ages of the earth" ["So giebt es also ... ein wenn auch mikroskopisches doch starkes Band, welches das organische Leben entfernter Erdalter verbindet ..."] (Ehrenberg 1839: 156) and continued to describe them from all over the world for the next 30 years (Ehrenberg 1870).

Ehrenberg was very interested not only in the distribution of microscopical life through the geological ages but also in their biogeographical distribution patterns. Early in his scientific career he joined big expeditions, e.g., to Arabia, between 1820 and 1825, and to Russia and Siberia, 1829, where he took many samples. Later, because of his fame, Ehrenberg received material from all over the world, e.g., from the Americas by Bailey and others (Ehrenberg 1843), and he asked fellow scientists going on expeditions to collect for him. He even searched for soil on roots of plants on herbarium sheets if they came from an interesting location (e.g., Cayenne, French Guiana, see Ehrenberg 1843) or collections of geological deposits (e.g., Klaproth Collection, see Crawford & al. 2003). From Greece he got three samples by his German colleague Dr K. G. Fiedler, who collected from diatomite deposits in Aegina (Ehrenberg 1838b, 1842).

Ehrenberg published his new names from Greek material quickly (1840a-b) but the publication of the drawings did not take place until his second large folio book “Mikrogeologie” (Ehrenberg 1854) appeared. Since most of his publications in the monthly and annual reports to the Royal Prussian Academy of Science are not well known, his Mikrogeologie is often considered to be authoritative for Ehrenberg’s taxonomic concepts of earlier published names. In the present paper lectotypes for seven species are selected among his original samples and microscopic preparations. Two recombinations are validated.

This paper is dedicated to Professor Dr Werner Greuter who inspired both authors to delve into algae nomenclature. The first author is grateful to Prof. Greuter for encouraging her to cooperate closely with the Institut für Paläontologie, Museum für Naturkunde, Humboldt Universität zu Berlin, where the Ehrenberg Collection is housed, to help activate its accessibility for international research. The diatoms of this paper were chosen because of their relation with Greece, which has been one of the favourite regions of research of Prof. Greuter.

## Material and methods

The following material of the Ehrenberg collection (BHUPM) was studied: unmounted material sample No. 2157 “Aegina”; geographical preparations 310912-e, 310914-c, 310916-a, -c “Aegina”; 311002-e “Santorin”; 311101-a “Griechenland 2.1.”; 360806-b “Cuxhaven 6”; and taxonomic preparations under the name “*Amphitetras antediluviana*”: 540014-1, 540014-5, 540014-6 “lebend v. balthischen Meer” [Isle Tjörn], 540014-2 “im dunkelblauen Ring Actinocycl. ...” [probably same locality as 540014-1], 540014-4 “von Oran”, and under the name “*Triceratium favus*, Cuxhaven”: 540193-1, -2, -5, -6. Also Ehrenberg’s drawing sheets No. 100, 101, 104, 988, 1236, 2131, 2271, 2272, 2326, 2329 were consulted.

For better protection, Ehrenberg coated most of his geographical preparations with Canada balsam which in some cases results in a low visibility of fine structures especially where the balm is broken or became opaque (for further details see Jahn & Kusber 2004).

Original material in BHUPM was photographed with an Olympus DP 50 digital camera and a BX 51 microscope, objectives: Olympus 80x: IC 80/0.75, 40x UPlan Fl 40/0.75, and 20x: UPlan Fl 20/0.50.

Copies of the cited original drawings of the Ehrenberg Collection (which is original material in the sense of the International Code of Botanical Nomenclature, see Greuter & al. 2000), will be published in the AlgaTerra Information System (Jahn & Kusber 2006).

## List of taxa

*Amphitetras* Ehrenb. in Abh. Königl. Akad. Wiss. Berlin 1839: 122. 1840.

Type: *Amphitetras antediluviana* Ehrenb. in Abh. Königl. Akad. Wiss. Berlin 1839: 142. 1840.

*Amphitetras antediluviana* Ehrenb. in Abh. Königl. Akad. Wiss. Berlin 1839: 142. 1840

≡ *Biddulphia antediluvianum* (Ehrenb.) Van Heurck, Syn. diatom. Belgique: 207. 1885 ≡ *Triceratium antediluvianum* (Ehrenb.) Grunow in Fenzl, Reise Novara 1, 1: 24. 1868. – Lectotype

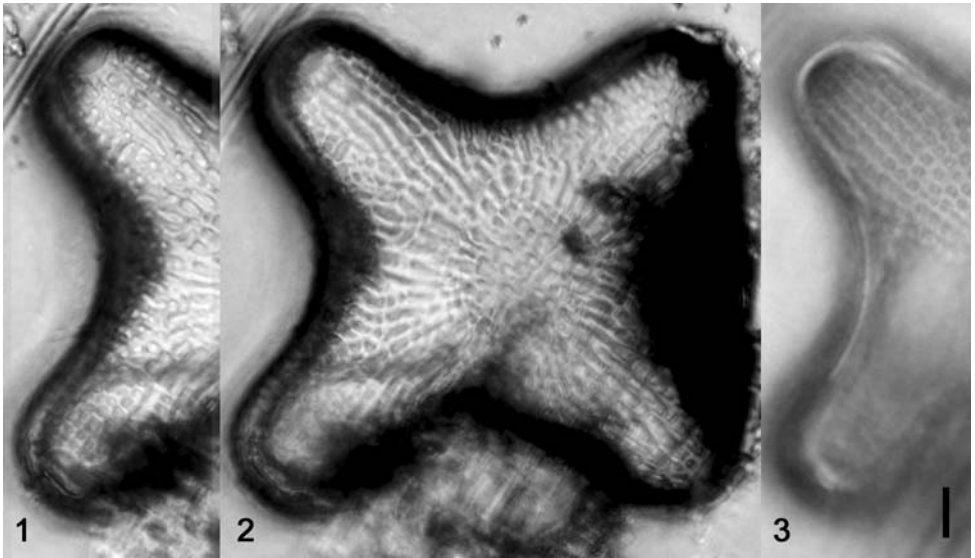


Fig. 1-3. *Amphitetras antediluviana*, Isle Tjörn, Sweden – 1, 2: cell on preparation No. 540014-5 in BHUPM, lectotype (ocelli in the focus on Fig. 1); 3: second valve of the same cell with regular ornamentation. – Scale bar = 10  $\mu$ m.

(designated here): preparation No. 540014-5 in BHUPM (Fig. 1-3); lectotype locality: “lebend bei der Insel Tjörn am Cattegat” [alive, marine coastal locality at the Isle Tjörn, SW Sweden].

*Further original material.* – Preparations No. 540014-1, 540014-2 (Fig. 4), 540014-6 and drawing sheets 100 (left hand side) and 101 from Tjörn in BHUPM.

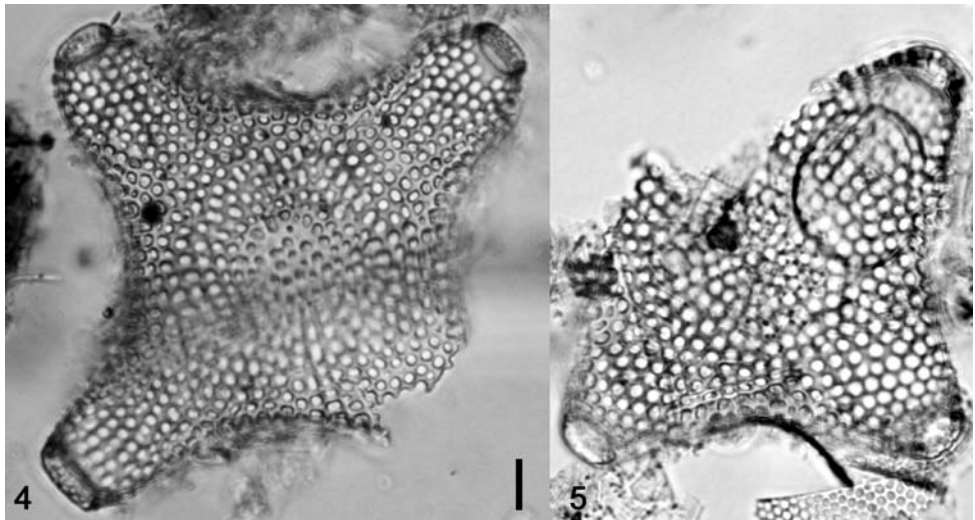


Fig. 4-5. *Amphitetras antediluviana* – 4: valve fragment from recent material on preparation No. 540014-2 in BHUPM, probably from Isle Tjörn, Sweden; 5: valve fragment from subfossil material from Greece on preparation No. 310916-a in BHUPM. – Scale bar = 10  $\mu$ m.

*Description (Ehrenberg 1840a).* – “A. testula singula cubica ubique cellulosa, cellulis in faciebus lateralibus radiatis, angulis varie productis.”

*Comments.* – (1) Ehrenberg gave three localities: “Fossil in den Kreidemergeln von Oran und Griechenland, lebend bei der Insel Tjörn am Cattegat”. From the undated Oran deposits Ehrenberg depicted only a few valves, mostly broken (drawing sheets No. 100 “a”, valve in the center; No. 2271, No. 2272) which were published in Ehrenberg (1854: t. 21, fig. 25a, b). From the undated Greek deposits Ehrenberg depicted two valves: the valve on drawing sheet No. 2329 was published as t. 19, fig. 19 in Ehrenberg (1854) and differs from the valve depicted on drawing sheet No. 100 “b” (on the right hand side) by its slightly concave sides. The valve on Geographical Preparation No. 310916-a blue in BHUPM (Fig. 5) is in between the published and the unpublished Ehrenberg drawing in respect to the valvar outline, the latter having more pronounced and tapering angles. Ehrenberg later described (1840b) another *Amphitetras* taxon from this Greek material (see *Stictodiscus parallelus*).

(2) Ehrenberg (1840a) gives for recent and subfossil valves  $1/72-1/36'' = 31.3-62.7 \mu\text{m}$ . The valve on the (recent) lectotype preparation is  $94.8 \times 90 \mu\text{m}$ . The valves from the subfossil Greek material vary in their dimensions between  $46.8$  and  $81.6 \mu\text{m}$  and may be heterogeneous.

(3) Because of the mentioned imponderabilities of the subfossil material from Oran and Greece (see Comment 1 and 2) we selected a specimen from the defined marine locality, in West Sweden at the juncture of Kattegat and Skagerrak.

(4) Even though Round & al. (1990) stated that further taxonomic studies are needed in addition to Liebisch (1928), they accepted *Amphitetras* in their work on current diatom genera.

(5) Grunow’s (1868) combination was based on published drawings of Kützing (1844), who did not consult Ehrenberg’s original material and depicted a valvar view without ocelli and a girdle view which differs from cells in Ehrenberg’s specimens (see Jahn & Kusber 2006).

*Epithemia* Kütz., Kieselschal. Bacill.: 33. 1844.

Lectotype (designated by Boyer 1928: 488): *Epithemia turgida* (Ehrenb.) Kütz. (*Eunotia turgida* Ehrenb.).

*Epithemia hellenica* (Ehrenb.) R. Jahn & Kusber, **comb. nov.**

≡ *Eunotia hellenica* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1840: 210. 1840. – Lectotype (designated here): preparation No. 311101-a “Griechenland 2.1.” in BHUPM (Fig. 6); lectotype locality: “E Graeciae marga” [subfossil limnic sediments, Greece].

? = *Epithemia adnata* (Kütz.) Bréb., Consid. Diat.: 16. 1838.

*Further original material.* – Part of drawing sheet No. 2326, depicted as t. 6 (part 2) fig. 17a, b in Ehrenberg (1854).

*Description (Ehrenberg 1840b).* – “E. striata, testula elongata leviter curva, apicibus rotundis dorso aequaliter convexo, striis tenuissimis inter costas internas validas pauciores. Centesima lineae pars 4 costas offert.” The dimension given is up to  $1/40''$  ( $56.4 \mu\text{m}$ ).

*Comments.* – (1) The outline of the valve almost corresponds to Ehrenberg’s drawing, but is smaller,  $36.6 \times 8.4 \mu\text{m}$ , with 2-3 costae and 9-11 striae in  $10 \mu\text{m}$ , 3-5 striae between two costae.

(2) The depicted lectotype is similar to the modern concept of *Epithemia adnata* (Kütz.) Bréb., based on *Frustulia adnata* Kütz. (e.g. Krammer & Lange-Bertalot 1997). Since Kützing’s original material has not been studied and Kützing (1844) synonymized his *F. adnata* with *Epithemia zebra* (Ehrenb.) Kütz., the conspecificity of these taxa could not be proven.

*Lyrella* Karaeva in Bot. Žurn. (Moscow & Leningrad) 63: 1595. 1978.

Type: *Lyrella lyra* (Ehrenb.) Karaeva (*Navicula lyra* Ehrenb.); see Jahn & al. (2004).

*Lyrella praetexta* (Ehrenb.) D. G. Mann in Round & al., Diatoms: 673. 1990.

≡ *Navicula praetexta* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1840: 214. 1840 ≡ *Pinnularia praetexta* (Ehrenb.) Ehrenb., Mikrogeologie, Atlas: 18. 1854. – Lecto-

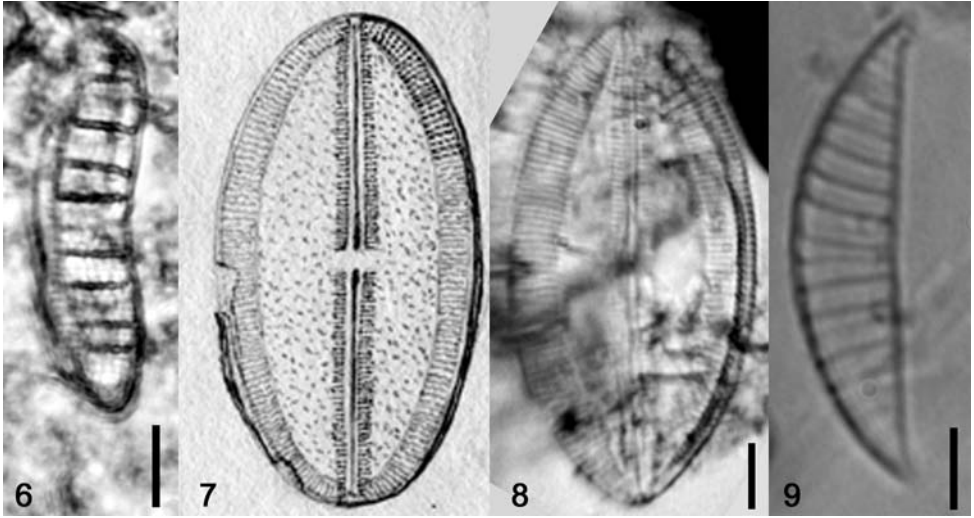


Fig. 6-9: 6: *Epithemia hellenica* (as *Eunotia hellenica*), valve on preparation No. 311101-a in BHUPM, lectotype; 7: *Lyrella praetexta* (as *Navicula praetexta*), drawing on sheet No. 988 in BHUPM, lectotype; 8: *Lyrella* sp., valve on preparation No. 310912-e “Aegina 4” in BHUPM; 9: *Rhopalodia graeca* (as *Cocconema graecum*), valve on preparation No. 311002-e in BHUPM, lectotype. – Scale bars = 10  $\mu$ m.

type (designated here): [icon] part of drawing sheet No. 988 (Fig. 7), published as t. 19, fig. 28 in Ehrenberg (1854); lectotype locality: “E marga Graeciae” [subfossil marine material collected in Greece].

*Description* (Ehrenberg 1840b). – “*N. testula elliptica magna, margine lateris dorsualis latissimi pinnulis late praetexto, area media ampla granulosa. Long. 1/24”*, 1/100” 17 strias offert.” The measurements, in Paris lines, correspond to 94.0  $\mu$ m length and 7.5 striae in 10  $\mu$ m.

*Comments*. – (1) Although we found a few *Lyrella*-like valves in the mica of Aegina (e.g. preparation No. 310916-c, marked with a blue ring “Aegina 8” and No. 310912-e “Aegina 4”), none matched Ehrenberg’s drawing exactly. Either the outline was different and the dispersed punctae were missing (see Fig. 8) or the outline fits but the striae were missing or invisible (no picture was possible because of bad quality of this mica preparation). We could not find the one valve with its broken edges drawn by Ehrenberg, as we did for *Lyrella lyra* (Ehrenberg) Karaeva (Jahn & al. 2004). Also a search in the unmounted material No. 2157 from Aegina (BHUPM) was in vain.

(2) The drawing of Ehrenberg as well as his published figure (Ehrenberg 1854: t. 19, fig. 28) can be considered as not being in conflict with the historic and current concept of the species by Schmidt (1874: t. 3, fig. 30-34), Hustedt (1964, t. 1488, fig. a-g), Hendey (1964, t. 33, fig. 1), and Witkowski & al. 2000: t. 97, fig 5).

*Rhopalodia* O. Müll. in Bot. Jahrb. Syst. 22: 57. 1895, nom. cons.

Lectotype (designated by Boyer 1928: 491): *Rhopalodia gibba* (Ehrenb.) O. Müll. in Bot. Jahrb. Syst. 22: 65. 1895 (*Navicula gibba* Ehrenb.; see Jahn & Kusber 2004: 586).

*Rhopalodia graeca* (Ehrenb.) Kusber & R. Jahn, **comb. nov.**

$\equiv$  *Cocconema graecum* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1840: 206. 1840  $\equiv$  *Eunotia graeca* (Ehrenb.) Ehrenb. in Abh. Königl. Akad. Wiss. Berlin 1870: 54. 1870. – Lectotype (designated here): preparation No. 311002-e “Santorin”, marked with a white ring, in BHUPM (Fig. 9); lectotype locality: “Ex Insula Santorin dicta, illic vivam”, Carolus Ritter attulit [Thera Island (Thíra), Greece].

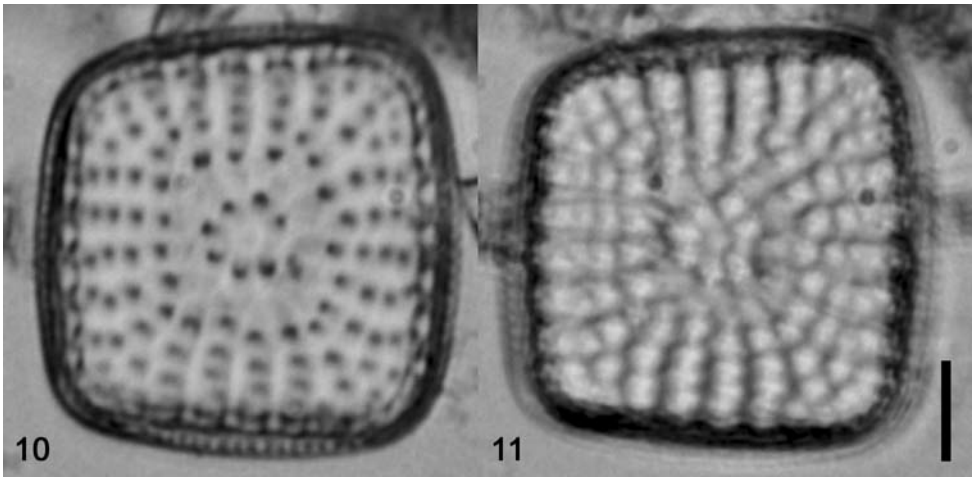


Fig. 10-11. *Stictodiscus parallelus* (as *Amphitetras? parallela*), valve on preparation No. 310916-a in BHUPM, lectotype, subfossil marine material from Greece; 10: exterior; 11: same valve, interior. – Scale bar = 10  $\mu$ m.

*Further original material.* – Part of drawing sheet No. 2131 in BHUPM, published as t. 3, fig. 11-14 in Ehrenberg (1870).

*Description (Ehrenberg 1840b).* – “C. habitu *C. cistulae*, striis validioribus paucioribus, in 48vae lineae parte 12-13. Long. 1/48”.” The length, in Paris lines, corresponds to 47.0  $\mu$ m.

*Comments.* – (1) The measured valves are 56.4-57.6  $\mu$ m long, one valve is 13.2  $\mu$ m wide, 2-3 transapical costae are in 10  $\mu$ m.

(2) The outline of this taxon is somewhat similar to the marine *Rhopalodia acuminata* Krammer, but differs by its rather straight instead of slightly concave ventral margin (see Krammer & Lange-Bertalot 1997: 162, t. 112, fig. 7-10).

*Stictodiscus* Grev. in Trans. Roy. Microscop. Soc. London, ser. 2, 9: 39. 1861.

Lectotype (designated by Boyer 1927: 69): *Stictodiscus rota* (Kütz.) Grev. (*Cyclotella rota* Kütz.).

*Stictodiscus parallelus* (Ehrenb.) Pantocsek, Beitr. Kenntn. Foss. Bacill. Ungarns 1: 68. 1886.  $\equiv$  *Amphitetras? parallela* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1840: 205. 1840  $\equiv$  *Triceratium parallelum* (Ehrenb.) Grev. in Trans. Roy. Microscop. Soc. London, ser. 2, 13: 104. 1865  $\equiv$  *Trigonium parallelum* (Ehrenb.) A. Mann in Contr. U. S. Nat. Herb. 10/5: 293. 1907. – Lectotype (designated here): preparation No. 310916-a, marked with a blue ring, in BHUPM (Fig. 10-11); lectotype locality: “E marga Graeciae” [subfossil marine material collected in Greece].

*Further original material.* – Part of drawing sheet No. 104, depicted as t. 19, fig. 20a in Ehrenberg (1854).

*Description (Ehrenberg 1840b).* – “A. testulae quadratae lateribus rectis, angulis obtusis, laterum punctis in lineas rectas parallelas dispositis, aperturis angulorum obscuris. Diam. 1/12”.”

*Comment.* – The diameter given by Ehrenberg (1840b), 1/12” corresponds to 188  $\mu$ m; this must be a misprint (instead of 1/72”?) since the measured valve on the lectotype preparation (Fig. 10-11) fits the drawing of Ehrenberg, but is only 40.8  $\times$  40.2  $\mu$ m.

*Triceratium* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1839: 156. 1839. Lectotype (designated by A. Mann 1907: 295): *Triceratium favus* Ehrenb.

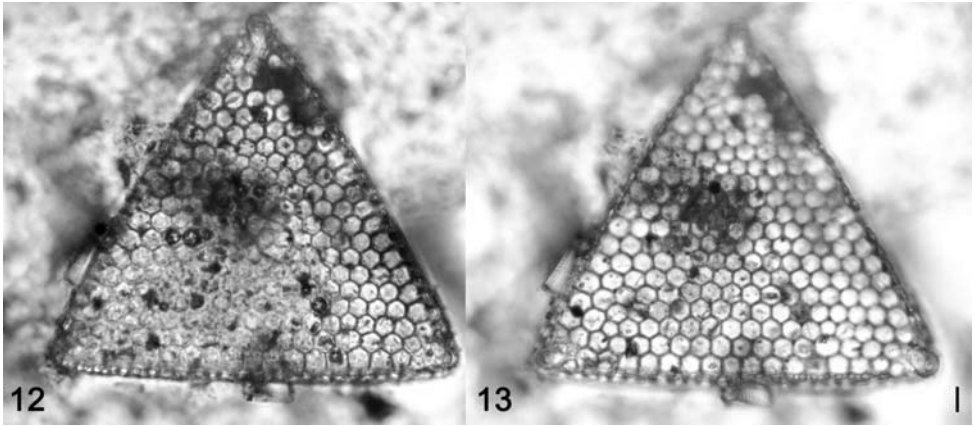


Fig. 12-13: *Triceratium favus*, valve on preparation No. 360806-b in BHUPM, lectotype, same valve in two different focuses; marine material from Cuxhaven. – Scale bar = 10  $\mu$ m

*Triceratium favus* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1839: 156. 1839.

Lectotype (designated here): preparation No. 360806-b “Cuxhaven 6”, marked with a red ring, in BHUPM (Fig. 12-13); lectotype locality: “Lebend in der Nordsee bei Cuxhaven” according to Ehrenberg (1840a: 159), Sample of 22 Sept. 1839 according to drawing No. 1236 in BHUPM [alive, marine coastal locality at Cuxhaven, North Sea, Germany].

*Further original material.* – Part of drawing sheet No. 1236 published as t. 4, fig. 10 in Ehrenberg (1840a).

*Description (Ehrenberg 1839: 156).* – “lorica cellulis sexangulis magnis favosa”. This brief description was emended by Ehrenberg (1840a: 159): “*T. testulae lateribus triquetris planis aut leviter convexis, angulis obtusioribus superficie cellulis sexangulis magnis favosa, dorsi cingulo medio laevi*”.

*Comments.* – (1) The cell depicted on Ehrenberg’s drawing No. 1236 was sampled in Cuxhaven on 22 September 1839, observed by Ehrenberg in Berlin on 12 and 14 October 1839, and presented at the Royal Prussian Academy of Science on 17 October 1839 (see Ehrenberg 1839).

(2) Ehrenberg (1840a) gave a second locality “fossil in dem Kreidemergel Griechenlands” and stated “Merkwürdig genug war ihr Wiederfinden im Kreidemergel, wo sie, meist als Fragmente, auch zahlreich vorkommen”. One of these fragments from Greek subfossil material was depicted on drawing sheet No. 2329 published as t. 19, fig. 17 in Ehrenberg (1854). Because Ehrenberg’s description refers mainly to living material from the North Sea and because no complete valves were found in the Greek material, we selected the specimen from the Cuxhaven preparations.

(3) The preparations 540193-1, -2, -5, and -6 in BHUPM, indexed as “*Triceratium favus*, Cuxhaven” were no longer available for typification because they were found to be destroyed.

*Triceratium pileus* Ehrenb. in Ber. Bekanntm. Verh. Königl. Preuss. Akad. Wiss. Berlin 1840: 217. 1840.

Lectotype (designated here): preparation No. 310914-c “Aegina 11 ii”, marked with a red ring, in BHUPM (Fig. 14-15); lectotype locality: “Fossilis in marga Graeciae” [subfossil marine material collected in Greece].

*Further original material.* – Part of drawing sheet No. 2329 published as t. 19, fig. 18 in Ehrenberg (1854).



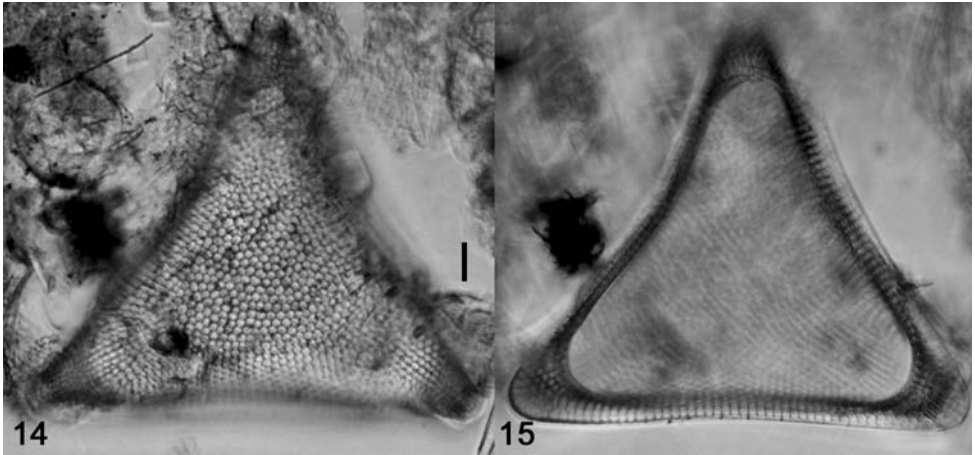


Fig. 14-15: *Triceratium pileus*, valve on preparation No. 310914-c in BHUPM, lectotype, subfossil marine material from Greece. – 14: exterior; 15: same valve, focus near the girdle. – Scale bar = 10  $\mu\text{m}$ .

*Description* (Ehrenberg 1840b). – “*T. testulae triquetrae lateribus concavis, angulis acutioribus, cellularum minorum seriebus radiatis.*” The size given is 1/24" (94.0  $\mu\text{m}$ ). The valve on the lectotype preparation has a length from pole to pole of 117.6  $\mu\text{m}$ .

*Comment.* – This taxon does not seem to fit into the genus *Triceratium* as typified with *T. favus* and depicted above. No current combination is available (Silva 1997-, VanLandingham 1978) and further studies are needed (Round & al. 1990).

### Acknowledgements

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