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A survey of the *Graphis** species from the West Indies and Bermuda, with the description of two new species

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*: "Our dainty Ariel has long served many masters, and perhaps it is time that he should have his liberty...*Graphis* might be a suitable name." JEFFREYS, 1867

Key words: GASTROPODA, HETEROSTROPHA, CIMIDAE, *Graphis*, West Indies, Bermuda, taxonomy.

Abstract: *Graphis eikenboomi* sp. nov. from the Caribbean and *Graphis lightbourni* sp. nov. from Bermuda are described. From the other *Graphis* species from the West Indies: *G. underwoodae* Bartsch, 1947, *G. rotundata* Usticke, 1969 (probably a junior synonym of the former species) and *G. menkhorsti* De Jong & Coomans, 1988, the original descriptions are given, together with some additional data.

Introduction: Usually the find of a new species is unexpected. In this case we have already known for years that the "paratype" of *Graphis menkhorsti* is not conspecific with the holotype of *G. menkhorsti* De Jong & Coomans, 1988. However, a critical analysis of the two specimens is complicated due to the bad condition of that "paratype". Recently we could study additional material, which enabled us to solve this problem and as a result of this to describe *G.eikenboomi* sp.nov.

Working on our manuscript, the ZMA received a large amount of marine microshells, collected around Bermuda by the late Arthur Guest from Mr. J. R. H. Lightbourn (Bermuda). Sorting these shells we again stumbled upon an unexpected, unknown *Graphis* species, which we will describe in this paper as *Graphis lightbourni* sp. nov.

Besides *"Graphis" ambigua* (Weisbord, 1962), a species with probably a deviating generic taxon (compare Redfern, 2001: 79-80), there are up to now three *Graphis* taxa described from the West Indian faunal province, being *G. underwoodae* Bartsch, 1947, *G. rotundata* Usticke, 1969, and *G. menkhorsti* De Jong & Coomans, 1988. All are different from both *G. eikenboomi* sp. nov. and *G. lightbourni* sp. nov. in shape, sculpture and protoconch.

Abbreviations:
AMNH = American Museum of Natural History, New York, USA.
USNM =United States National Museum Washington, D. C., USA.
ZMA = Zoölogisch Museum Amsterdam, The Netherlands.
LH = collection J. van der Linden, The Hague, The Netherlands.

Systematics:

Family CIMIDAE Warén, 1993
Genus *Graphis* Jeffreys, 1867.
Type species: *Turbo unicus* Montagu, 1803 (= *Turbo albidus* Kanmacher, 1798). Recent, northeastern Atlantic.

Graphis underwoodae Bartsch, 1947
(figs. 1-6)

Type material: Holotype, USNM 573623. Height 2.9 mm, width 0.8 mm [not studied].

Type locality: "Tampa Bay, St. Petersburg, Fla.", USA.

Original diagnosis: "Shell small, elongate-turreted, yellowish white. The nucleus consists of a little more than a single well-rounded smooth turn which forms a blunt apex. The postnuclear whorls are rather high between summit and suture and are strongly rounded. They are marked by strong, sinuous, almost vertical axial ribs which extend prominently from summit to the suture. Of these ribs 30 are present on the last

turn. These ribs are about as wide as the spaces that separate them. The spiral sculpture consists of 9 slender threads of about half the thickness of the axial ribs, which are rather uniform in size and fairly regular in spacing and confined to the anterior two-thirds of the turns. The combination of the axial and spiral sculpture produces a reticulated pattern. Suture very strongly constricted. Periphery well rounded. Base inflated, strongly rounded, not umbilicated, marked by a feeble continuation of the axial ribs and spiral cords weaker than those on the spire. Aperture oval; outer lip thin; the inner lip concave and slightly reflected."

Discussion: Contrary to the other *Graphis* species with a very depressed first half whorl of the protoconch, this part is more swollen and tilted, obliquely over the subsequent whorl, sometimes even "*Pyramidella*-like" in *G. underwoodae*. Though somewhat variable, this is the most striking feature of this species. The more variable is the spiral sculpture: only the lower two-thirds of the whorls are covered with spiral cords,(fig.3) or just the subsutural shoulder is free from spirals, or the whorls are entirely covered with spiral sculpture (fig.6). Sometimes there is also a shallow umbilical chink (not mentioned in the original description), occasionally partly covered by a reflected inner lip. All these characteristics do occur without any mutual connection, so there are no specific series of features that can be determined within the investigated material. Due to this variability, we consider all these specimens conspecific with *G. underwoodae*.

Material studied: Netherlands Antilles, Aruba: 10 shells ZMA; Oranjestad from sandsupplies: 1 shell ZMA; Malmok, Boca Catalina: 4 shells ZMA; Bahamas, Abaco Island, Guana Cay: 1 shell ZMA; Bermuda, Gibbons Bay: 6 shells ZMA, 3 shells LH; South of Castle Roads: 4 ZMA.

Graphis rotundata Usticke, 1969
(figs. 7-8)

Type material: Holotype, AMHN 195421. Height [protoconch missing] 2.4 mm, width 0.7 mm.

Type locality: "Barbuda (Palm beach)."

Original diagnosis: "A minute semitranslucent delicate white shell, with 8 tapering strongly rounded whorls, plus 1 1/2 small smooth nuclear whorls having fine, slightly curved ribs and delicate radials. Very rare."

Second diagnosis (1971): "A very minute, narrow, elongate, transparent white shell, with 1 1/2 smooth nuclear whorls, followed by 8 tapering, rounded whorls having very noticeably curved ribs, with very weak spirals on the lower two-third of the whorl. Suture strong. Very rare. Close to *underwoodae* Bartsch, 1947; differs in the ribs, which are evenly curved, much finer and more delicate, also the base has an umbilical chink."

Discussion: Although the original description is very superficial and appropriate to nearly all the *Graphis* species, it is valid according to the rules of the ICZN. Moreover, the photograph is also poor giving only some information about the outline of the shell. No differential diagnosis nor a holotype has been established. Due to all these omissions Usticke (1971) gave additional details.

The specimen we have studied is, according to the investigation of Boyko & Cordeiro (2001), the holotype of *Graphis rotundata* and the only specimen of this species known to us. We have made SEM photographs of this shell, of course without cleaning or coating it. Because of this very insufficient reference material we are unable to ascertain whether *G. rotundata* is a valid species or just a junior synonym of *G. underwoodae*. In spite of the relatively few axial ribs (which are somewhat more flexuous as usual),we tentatively regard this species a junior synonym of *G. underwoodae*, due to the very characteristic spiral-free zone on the upper part of the whorls. More material is necessary for a final conclusion.

Graphis menkhorsti De Jong & Coomans, 1988
(figs. 9-11)

Type material: Holotype, ZMA Moll. 387076. Height 1.7 mm, width 0.45 mm. Paratype, ZMA Moll. 387077 [=*G. eikenboomi* sp. nov.].

Type locality: "Curaçao, Slangenbaai ", Netherlands Antilles.

Original diagnosis: "Shell very small, with 2 1/2 nuclear and 6 postnuclear whorls.

The whorls are strongly rounded, about 22 ribs on the penultimate whorl, many fine spirals in between. The species shows a great variety in the ratio length/width [sic]. *G. menkhorsti* is distinct from *G. underwoodae*, the latter is larger (3 mm), has more whorls (10), with more ribs (30) on the body whorl."

Discussion: As already mentioned in the introduction, we disagree with the original identification of the paratype of *G. menkhorsti.* Moreover, the original authors already noticed the "great variety in the ratio length/width" which they based on only the holo- and paratype. Now that we have found identical specimens from different localities we are in a position to describe it as a new species.

Graphis eikenboomi sp. nov.
(figs. 12-14)

Type material: Holotype, ZMA Moll. 403024. Height 1.9 mm, width 0.7 mm.

Type locality: Pt. Guignard, Dominica, West Indies (March 1987, leg. R.G. Moolenbeek).

Other material examined: Netherlands Antilles, Curaçao, Slangenbaai: 1 shell [paratype of *Graphis menkhorsti* , ZMA Moll. 387077]; Aruba, Mangel Halto, depth 27 m: 1 shell ZMA, 1 shell LH;Aruba, Malmok: 1 shell ZMA

Diagnosis: The shell is minute, elongated and conical. With a height of 1.9 mm there are -including the protoconch- seven to eight whorls. Protoconch smooth, transparent and glassy, 1.5 whorls. The first half whorl depressed and flat, the next complete whorl convex. The teleoconch whorls are strongly rounded, their diameter rapidly increasing, the first one 0.2 mm, the ultimate one 0.7 mm. For that reason the last whorl looks robust; with a height of 0.9 mm, almost 50% of the total height. Sculpture of many axial ribs, in between less conspicuous spiral threads. On the first three whorls the axial ribs are more or less straight and orthocline, on the subsequent whorls somewhat sinuous and clearly opisthocline; circa 22 on the penultimate whorl. The interspaces, about twice as large as the axial ribs, are sculptured with equally spaced and narrow spiral ribs (nine on the penultimate whorl), spread all over the whorls including the

basis of the shell, where they are more crowded. Aperture ovate, outer lip not thickened, in side-view flexuous; columella almost straight and vertical, slightly reflected over a narrow umbilical chink. Colour semitransparent (due to the "lively" sculpture) colourless.

Discussion: There are two more *Graphis* species known from the West Indies: *G. menkhorsti* and *G. underwoodae*.

The first species differs from *G. eikenboomi* sp. nov. by its protoconch of 2.5 whorls (versus 1.5). Also the shape is different: very slender, almost cylindrical, on *G. menkhorsti*, distinctly conical on *G. eikenboomi* sp. nov. The "paratype" of *G. menkhorsti* differs from its holotype by its conical shape -though not so heavily built like the figured *G. eikenboomi*- and having only 1.5 protoconch whorls.

Although *G. underwoodae* is somewhat coarser and slightly more conical than *G. menkhorsti*, *G. eikenboomi* sp. nov. is decidedly more conical and sturdy than the two other species. Moreover, *G. underwoodae* has a different protoconch, the first half whorl more swollen and tilted, making an angle of 135° with the shell axis. On *G. eikenboomi* sp. nov.(and on *G. menkhorsti*) the first half whorl of the protoconch is depressed. Furthermore, *G. underwoodae* has a deviating sculpture: though its whorls are much smaller, there are more axial ribs than on *G. eikenboomi* sp. nov. and on the first species there is generally a rather large subsutural zone free from spiral threads (the same concerns *G. rotundata*, provisionally a junior synonym), whereas they are equally spread over the whorls on *G. eikenboomi* sp. nov. (and *G. menkhorsti*).

The differences with *G. lightbourni* sp. nov. from Bermuda are mentioned below.

Distribution: West Indies.

Derivatio nominis: Dedicated to Mr. J. C. A. Eikenboom, a concentious and modest malacologist; together with Mr. H. P. M. G. Menkhorst and the first author during twenty years member of a fellowship for malacological study.

Graphis lightbourni sp. nov.
(figs. 15-17)

Type material: Holotype, ZMA Moll. 403025. Height 1.6 mm, width 0.6 mm. One paratype (ZMA Moll. 403026) from the type locality.

Type locality: 1.25 miles S of Castle Roads, Bermuda (April 1985, leg. A. Guest, don. J.R.H. Lightbourn, 2003).

Diagnosis: The shell is minute (height 1.6 - 1.8 mm), though not fragile, rather elongate, more cylindrical than conical. With a height of 1.7 mm, there are -including the protoconch- about 5.5 whorls. Initial part of the protoconch smooth, gradually fine granules develop which are more or less arranged in spirals towards the rim; semitransparent, circa 1.3 whorls. The first half whorl of the protoconch depressed and flat, the next one convex. The teleoconch whorls strongly rounded, their diameter just gradually increasing, the first one 0.35 mm, the ultimate one 0.70 mm. Last whorl 50% of the total height. Sculpture of many axial ribs, in between numerous microscopical spiral threads. On the first whorl the axial ribs are straight and orthocline, on the subsequent whorls somewhat prosocline and inverted C-shaped, circa 20 on the penultimate whorl; on the last whorl fading near the basis of the shell. Interspaces twice to three times larger than the axial ribs, sculptured with numerous extremely fine and crowded spiral threads, which consist of very fine granules spread all over the whorls, the bases of the shell included. Aperture somewhat ovate, more pointed apically; outer lip not thickened, columella straight, not reflected. No umbilical chink. Colour semitransparent white.

Discussion: Contrary to the other *Graphis* species described in this paper, *G. lightbourni* sp. nov. is, in view of its minute size, relatively broad, not only the last whorl like on *G. eikenboomi* sp. nov., but over its total height. A second deviating characteristic of *G. lightbourni* sp. nov. concerns its extremely fine spiral sculpture.

The new species somewhat resembles a *Cima*-species (*C. cylindrica* Jeffreys, 1856), but these shells have at most a very obscure sculpture, while the axial sculpture is evident and very "*Graphis*-like" on *G. lightbourni* sp. nov.

Murchisonella spectrum Mörch, 1875 [=*Bermudaclis bermudensis* (Dall & Bartsch, 1911)] is very different due to its more and shouldered whorls, its tilted protoconch

and its completely different sculpture: spiral threads only below the shoulders and no axial ribs.

Kejdonia cachiai (Mifsud, 1998) -probably a junior synonym of *Kejdonia galatensis* (Oberling, 1970)- from the Mediterranean Sea, is very similar in shape, dimensions and sculpture (compare figs in Buzzurro et al., 2001), but the axial ribs are slightly flexuous and not inverted C-shaped like on *G. lightbourni* sp. nov. The main difference concerns the protoconch, which is heterostrophic and intorted in *Kejdonia cachiai*, the upperside of the visible part of the protoconch with a rather conspicuous keel. Other differences on the teleoconch are less striking.

Distribution: Bermuda.

Derivatio nominis: Dedicated to Mr. J. R. H. Lightbourn, who kindly donated the unidentified micro-shell collection of his friend Arthur Guest to the Zoölogisch Museum Amsterdam in 2003.

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Summarizing translation into Dutch/ Samenvattende Nederlandse vertaling

Naast *Graphis eikenboomi* sp. nov. uit West Indië en *Graphis lightbourni* sp. nov. van Bermuda, worden in het bovenstaande artikel ook de andere thans bekende *Graphis*-soorten uit deze gebieden besproken.

Graphis underwoodae Bartsch, 1947 is langgerekt, licht conisch met bolle windingen. Protoconch 1.5 windingen; eerste halve winding min of meer los liggend* als een lus t.o.v. de rest van de protoconch. Talrijke, dicht opeenstaande axiale ribben; op het onderste 2/3 deel van de windingen gekruist door vele, wat minder geprononceerde, spiralen.
*N.B.: Bij de overige, hieronderstaande soorten is de eerste halve winding plat op de volgende winding gelegen.

Graphis rotundata Usticke, 1969. Een wat twijfelachtige soort, voorlopig beschouwd als een junior synoniem van de vorige soort. Slechts het holotype (zonder protoconch) is bekend. Dit exemplaar verschilt van *G. underwoodae* door minder en wat meer gebogen axiale ribben.

Graphis menkhorsti De Jong & Coomans, 1988. Zeer slank, cylindrisch. Protoconch 2.5 windingen. Talrijke dicht opeenstaande axiale ribben; spiralen over het gehele oppervlak van alle windingen.

Graphis eikenboomi sp. nov. heeft dezelfde sculptuur als de vorige soort, maar verschilt daarvan door de zwaardere, veel conischer bouw en door de protoconch van slechts 1.5 windingen.

Graphis lightbourni sp. nov.. Hoewel de kleinste van al deze soorten, toch vrij stevig. Slechts weinig conisch. In tegenstelling tot de overige soorten, zeer vele, dicht opeenstaande, microscopische spiralen. Protoconch 1.3 windingen. Waarschijnlijk endemisch in Bermuda.

Plate 1

1-6: ***Graphis underwoodae*** Bartsch, 1947

1-3. Aruba

1: ventral view, length 2.1 mm.

2: protoconch

3: sculpture

4-6. Bermuda

4: ventral view, length 1.9 mm

5: protoconch

6: sculpture teleoconch

7-8: ***Graphis rotundata*** Usticke, 1969. Holotype (AMHN 195421), Barbuda.

7: ventral view, length 2.4 mm[not coated]

8: sculpture teleoconch

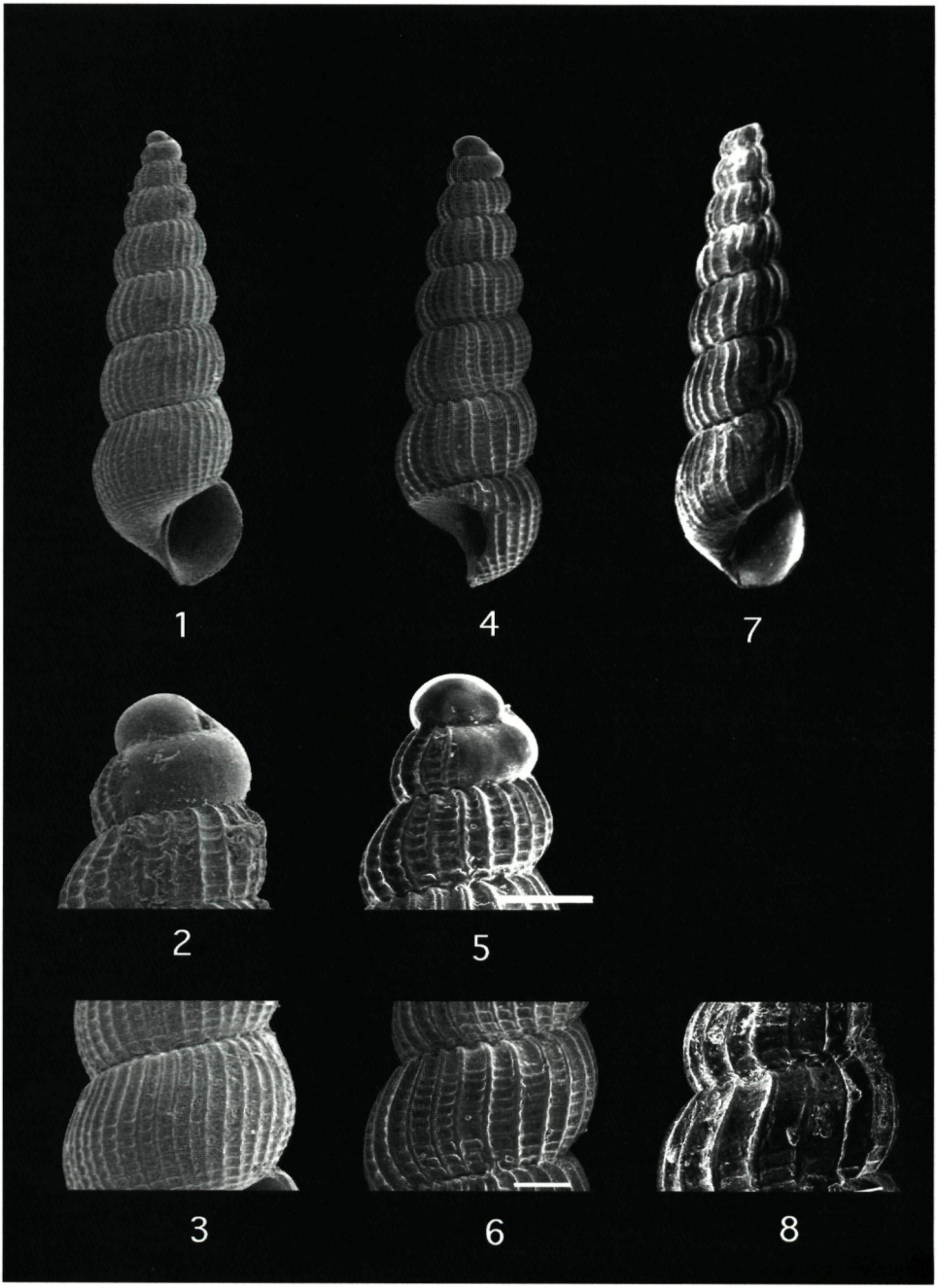
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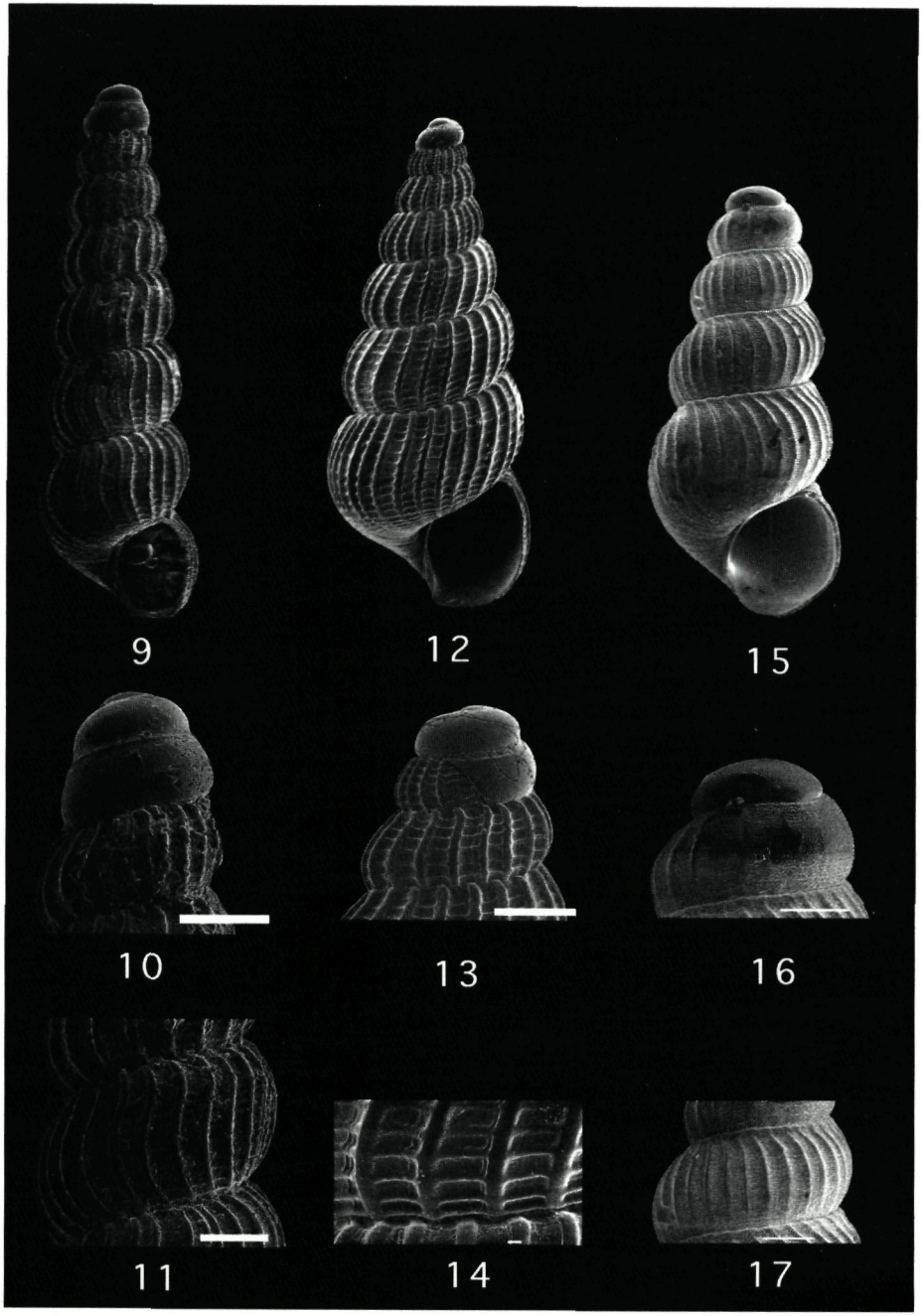
Plate 2

9-11: ***Graphis menkhorsti*** De Jong & Coomans, 1988. Holotype (ZMA Moll. 387076), Curaçao.
9: ventral view, length 1.7 mm.
10: protoconch
11: sculpture teleoconch

12-14: ***Graphis eikenboomi*** sp. nov. Holotype (ZMA Moll. 403024), Dominica.
12: ventral view, length 1.9 mm.
13: protoconch
14: sculpture teleoconch

15-17: ***Graphis lightbourni*** sp. nov. Holotype (ZMA Moll. 403025), Bermuda
15: ventral view, length 1.6 mm.
16: protoconch
17: sculpture teleoconch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