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Editorial

Pioneers of Plankton Research: Priscilla Susan Bury (1799-1872)

In 1862, Priscilla Susan Bury authored a small but significant book with a rather long title: "*Figures of Remarkable Forms of Polycystins, or allied Organisms, in the Barbados Chalk Deposit, (Chiefly from that Collected by Dr. Davy, and which He had Noticed in a Lecture Delivered to the Agricultural Society of Barbados, in July 1846) Drawn by Mrs. Bury, as Seen in Her Microscope, on Slides Prepared by Chr. Johnson, Esq., of Lancaster, 1860 and 1861*" (Bury 1862). It is today quite obscure, and held in only a few libraries. Recall that it was not until 1887 that the term "plankton" was coined by Victor Hensen (Hensen 1887), and thus one might question if the author of an 1862 work can be considered a pioneer of plankton research. The position taken here is that Bury was indeed a pioneer as her work appears to be the first pictorial work dedicated to the beauty of planktonic organisms, specifically, ones which came to be known as the radiolarians of the marine plankton.

Bury was one of the female amateur microscopists of the Victorian era in the United Kingdom, such as Mary Ward in 1857 and Agnes Catlow in 1851, who authored popular books featuring microscopic life (see Dolan 2019). Like Ward and Catlow, Bury was an amateur naturalist. However, she was known in her time as a very talented illustrator of botanical works, and would later be featured in Blunt's classic history of botanical illustration (Blunt 1950). Bury's work on the group of microscopic marine organisms now known as radiolarians was exceptional in several aspects. It was a pictorial publication focused on one group of microorganisms. Bury's identifications of the organisms she depicted included very specific references to academic publications. To identify the organisms she drew, Bury sought the advice and help of several renowned naturalists of her time. The production was also quite unusual. Bury created a series of plates, many containing illustrations of organisms from different samples. Thus, each plate was an artistic assemblage (e.g. Fig. 1). Bury's plates were photographed, rather than reproduced by an engraver, or a lithographer. The plates in the book were photographs, the work of experts of their time, Enrico Negretti and Joseph Zambra (Hannavy 2013). Lastly, the publication history of Bury's work was odd. It was first self-published, through subscription, and exists in at least two different 'first editions', with and without an extensive "Addenda". A second edition, edited by the well known naturalist Mordecai C. Cooke, was later published by a commercial firm with additional illustrations in 1869 (Bury 1869), just a few years before her death.

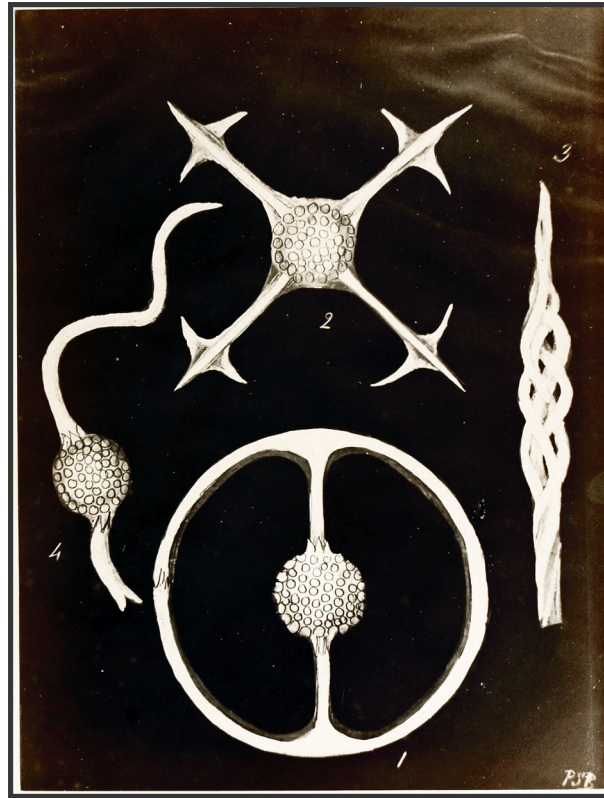


Figure 1. Plate 3 from Bury's 1862 self-published monograph on radiolaria, entitled "*Figures of Remarkable Forms of Polycystins, or Allied Organisms, in the Barbados Chalk Deposit...*".. While the monograph is largely an artistic work, from the legends, it is apparent that Bury was quite conversant with the works of Ehrenberg on fossil radiolarians (e.g. Ehrenberg 1882-1856) and Müller on living forms (e.g. Müller 1858). The plate legend reads: **1.** A Polycystinous nucleus, with one spine running through it, and attached at each end to a plain circle of Silex (In slide B. VI. Cambridge, Barbados) Lithocircus, Mesocena (?) **2.** A similar nucleus with four Acanthometrum shaped spines (see Müller's *Mittelmeeres*, &c., Pl. X.) attached to it, the hooks of which describe part of a circle. Actiniscus (?) in slide T. Cambridge, Barbados. **3.** A Hyaline wand, spirally twisted. **4.** Rhabdolithes Pipa. var. Ehrenberg.

Here, first a brief account of the 'discoveries' of the 'new' microscopic forms in the chalk deposits of Barbados will be given, followed by a summary of Bury's life and work previous to her "*Figures of Remarkable Forms...*". It will become apparent that exactly how and why Bury worked on the microscopic organisms now known as radiolaria in samples from Barbados is a complete mystery. Several examples of her remarkable illustrations will be shown, and the complicated publication history of the work will be reviewed. Bury's efforts to promote the study of radiolaria through an article in the popular scientific press and an exhibition for a microscopical society are also documented.

To begin it is useful to review the discovery of the forms drawn by Bury as it reveals how samples were widely exchanged among early microscopists, and also exactly how very new and little-known radiolaria were when Bury published her book. In 1839 and 1840, a few forms, now known as radiolarians (e.g. *Cornutella* and *Haliomma*) were described, but not illustrated, by the microscopist Christian G. Ehrenberg, from samples

of chalk deposits (Ehrenberg 1839, 1840). A few years later, Ehrenberg received some samples of the "earth" of Barbados from Jacob Bailey an early American microscopist (see Dolan 2022) who had been given them by a Mr. Toumey. From the sample Ehrenberg described a few more species, again without any illustrations, and without designating them as a separate group of microorganisms within his heterogeneous group 'Polygastrica' (Ehrenberg 1844). It was not until 1846 that Ehrenberg erected a new group 'Polycystina' for the organisms now known as radiolarians because he received rocks from Bermuda containing an astounding diversity of forms.

Robert Schomburgk, an explorer and travel writer who was traveling in Bermuda, sent Ehrenberg some rocks from Bermuda. Ehrenberg discovered and described the remains of a multitude of microorganisms and named them Polycystins (Ehrenberg 1846, 1847). The peculiar character of the Bermuda chalk deposits was first discovered by John Davy. He was a chemist who was serving as Inspector General of Army Hospitals in Bermuda. Davy gave a lecture in July of 1846 (mentioned in the title of Bury's book) describing the microscopic characteristics of the chalk deposits. Clearly, Schomburgk's samples traveled quickly from Bermuda to Berlin as Ehrenberg's preliminary report appeared in December of 1846.

The first publication in English on Polycystins, and with illustrations, appeared in late 1847 by Schomburgk (Schomburgk 1847). It was a translation of Ehrenberg's 1847 publication in German with four of Ehrenberg's 12 figures. A much more complete analysis of the Bermuda samples, with many figures, appeared in Ehrenberg's landmark monograph "*Mikrogeologie*" on microfossils (Ehrenberg 1854-1856) and one of the 39 plates was largely dedicated to the 'Polycystins' of Bermuda, plate 36, all from the material that Schomburgk had sent Ehrenberg from Barbados. It was about this time, that Johannes Müller published the first observations of living forms, without illustrations, from his work in Messina, Italy (Müller 1855). Shortly afterwards, a substantial article, with several plates, summarizing observations of many living forms he collected from several Mediterranean sites, was published posthumously (Müller 1858). However, Müller's findings appeared only in a German language academic journal; and unlike Ehrenberg's articles, His work was not translated and re-published in an English language journal.

In the 1850's, Polycystins began to appear in popular books on microscopy (Carpenter 1856) and in textbooks (e.g. Carpenter 1859; Greene 1859) but the illustrations were only those from Schomburgk's translation of Ehrenberg's 1847 article. Thus, in 1860, when Priscilla Susan Bury first began examining prepared slides made of Davy's Bermuda material, few people, outside of academics familiar with Ehrenberg's '*Mikrogeologie*', knew of the beauty and diversity of radiolarians.

Unfortunately, it is a complete mystery as to how and why Priscilla Susan Bury came to examine slides of radiolarians remains from Bermuda chalk deposits. From the very little known of her life, there are no hints of any interest in microscopic organisms. The following brief account is based on an article entitled "Mrs Edward Bury (née Priscilla Susan Falkner), Botanical Artist" (McMillan 1968), giving the most complete information available. Priscilla Susan Falkner was born January 12th 1799 into a wealthy family who had a greenhouse. Early on she was engaged in painting water colors of Lilies, creating what she called 'portraits'. In 1830 she married Edward Bury, a very successful engineer

in Liverpool, whose company made locomotives. As Mrs. Bury, she published her first work, a book of her 'portraits' entitled "*A Selection of Hexandrian Plants belonging to the Natural Orders Amaryllidaceae and Liliaceae*" (Bury, 1831-1834). Later in the 1830's, she contributed botanical illustrations to the publications of the botanist Benjamin Maund. She was then likely familiar with, and known to, the botanists of the time. Of her personal life we know she had a son, Edward James Bury, only because he donated a copy of the Polycystine book to the Liverpool Library. Bury's husband retired in 1846 and the couple moved from Liverpool to Windermere in the Lake District. Her husband died in 1858.

So, we do not know when Bury began using a microscope, nor how and why she obtained prepared slides, or, for that matter, how or when she in came into contact with the several naturalists of renown mentioned in the legends of her book. However, from the legend of her Plate 7, by 1860, she was examining slides and was in contact with naturalists of her time. The legend for figs. 1 and 2 of Plate 7 states that the figures of the diatom *Surirella* were drawn from a slide she showed in October of 1860 to the botanist William Crawford Williamson. The slide she showed Williamson had been loaned to her by Mr. Johnson (the preparer of the Davy material slides), and Johnson later sent the same slide to John Ralfs, an expert on diatoms and desmids.

Bury drew most of her illustrations from slides of Barbados material supplied by John Davy, and the slides were prepared by Charles Johnson, as mentioned in the long title of Bury's book. Johnson was an unusual character. He practiced medicine in Lankaster, about 40 km from Windemere. As part of his medical duties, he performed public dissections of hanged murders deemed especially evil, as mandated by law at the time (Hurren 2016). He was a member of the Microscopical Society of London that later became the Royal Microscopical Society of today. Johnson was described in an obituary notice as "...one of those quiet workers with the microscope who did much for diffusing a taste for the investigation of minute organisms by his continuous work at the forms of *Diatomacae*" (Anon. 1867). No information is available as to how and why Johnson received material from Davy. However, Johnson likely was interested the possibility of finding new diatoms. He went to some trouble to process the chalk material as the treatment of it was not a trivial procedure. As detailed in an article by Thomas Furlong, dissolving the calcareous material to obtain clean specimens of siliceous material (e.g., diatom frustules and radiolarian skeletons) involved breaking the rock into small pieces, repeated boiling in 'washing soda', repeated dilution and sedimentation steps, and soaking in a solution of sulfuric acid, etc., to obtain a solution containing 'clean transparent polycystins' ready to be mounted in permanent slide preparations (Furlong 1861).

The 'first version' of the first edition, published in 1862, had 12 "photographed quarto plates" plates totaling 72 figures. According to the figure legends, all of the figures were drawn from the slides Johnson made from the Barbados sample of John Davy. The cover of the 'first version' and 3 of the plates are shown in Fig. 2. In the inner cover, a list of 12 subscribers (including 3 women identified as 'Miss') was given along with the price of "1 Guinea", in today's currency about 130 Euros. Thus the audience for Bury's book was the relatively wealthy classes.

Bury promoted her 'polycystins' work with at least one showing. In October of 1862 she displayed photographs of 12 plates as well 17 slides of "Barbados earth" to the Literary and Philosophical Society of Manchester (Anon. 1864). Thus, we know that she had at least 17 slides of Barbados material in 1862.

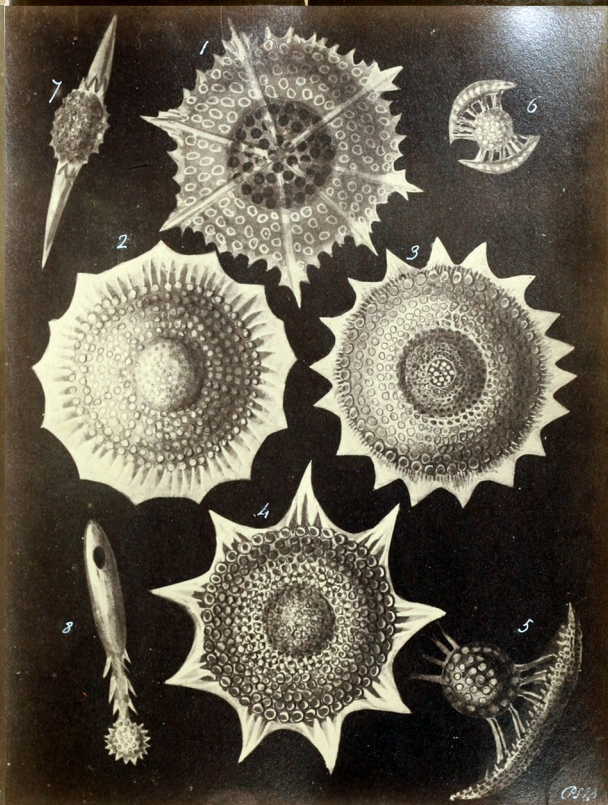
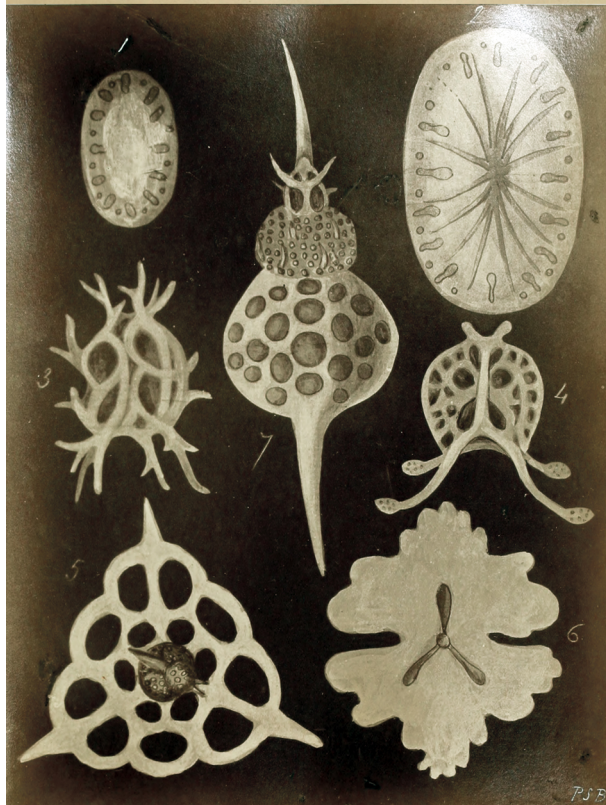
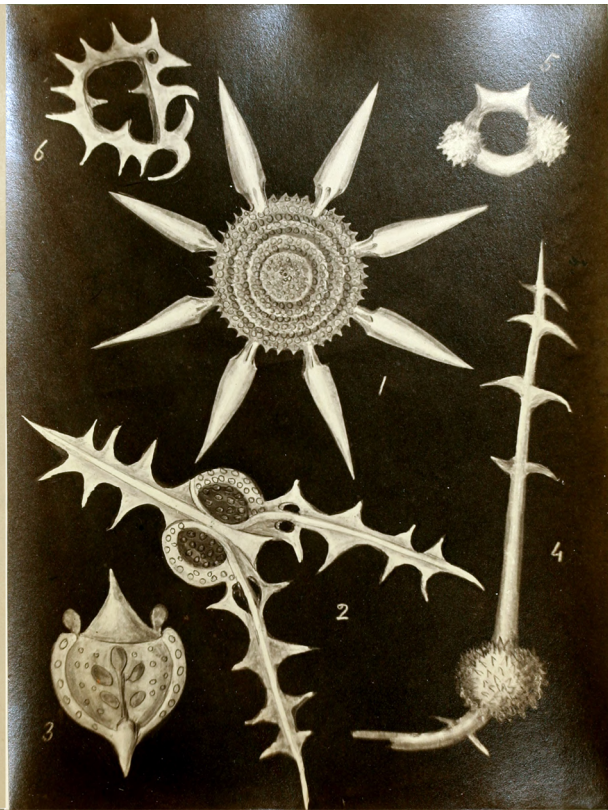
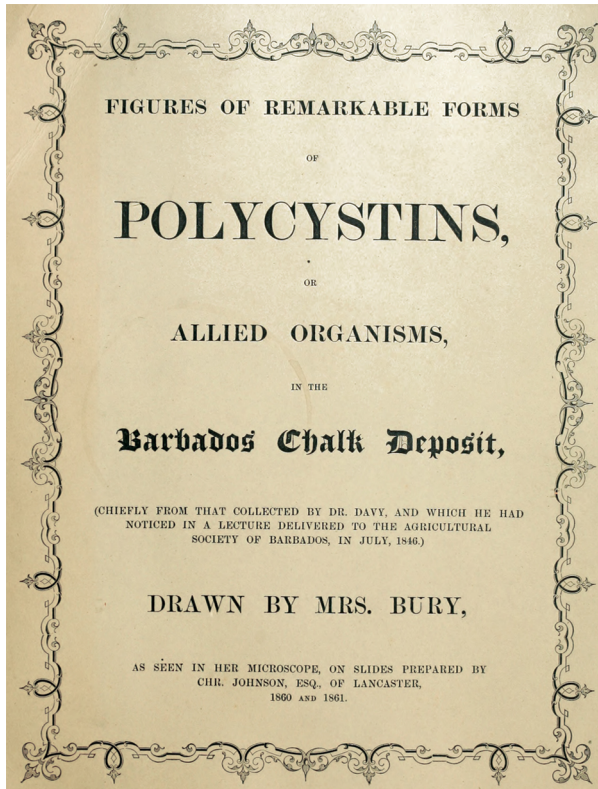


Fig. 2. The cover of the first version of Bury's work published in 1862 and examples of the 12 plates it contained: top right - plate 2, bottom left - plate 7, bottom right - plate 8.

At some point, a 'second first edition' was published with the same cover and preface but with greatly enlarged contents. It included 14 more plates, most with detailed legends, described as 'Addenda'. Thus the 'Addenda edition' had 26 plates. We do not if it might have sold for a higher price than the previous version with 12 plates. The list of subscribers of the edition with the Addenda gave 47 names, including 16 women identified as 'Miss, Mrs. or Lady'. An advertisement (presumably placed by Bury) announced the availability of the last set of plates in the *Annals and Magazine of Natural History* in March 1864 (Fig. 3). At least one copy includes a plate with the signature of Bury, dated 1865, the copy given to the Liverpool Library by her son (McMillian 1968).

**FIGURES OF REMARKABLE FORMS OF POLYCYSTINS,
AND THEIR ALLIES.**

(Chiefly from the BARBADOS DEPOSITS,) brought over by Dr. DAVY.
Prepared for the Microscope by CHR. JOHNSON, Esq.; drawn by Mrs. BURY;
Photographed from the Original Drawings by NEGRETTI & ZAMBRA.
Part IV., and last, containing Plates 18 to 24 (about 50 figures), price 10s. 6d.
A few Sets of the former Parts can still be had by application to Mrs. BURY,
Fairfield, Thornton Heath, Surrey.

Fig. 3. The advertisement for the last installment of Bury's Figures of Remarkable Forms of Polycystins appeared on the inside cover of the March 1864 issue of the *Annals and Magazine of Natural History*. Note that the price for the seven plates was ten Shillings, in today's currency about 60 Euros.

The "Addenda" plates showed specimens from slides prepared by Johnson from Barbados material and also some slides he made using material from another location in the Caribbean, "South Naparima, Trinidad". The slides of Trinidad material were not only the sources of some of Bury's illustrations but were also used to describe new species of diatoms by Robert Kay Greville. He described a new species of diatom for Bury (*Stictodiscus Buryanus*) and one for Johnson (*Stictodiscus Johnsonianus*) with both descriptions acknowledging "the kindness of Mrs. Bury" (Greville 1861), presumably for giving Greville slides(s). Greville was a very accomplished botanist and scientific illustrator (Balfour 1866). He published extensively on diatoms in his later years, contributing, for example 20 papers on 'New Diatoms...' in the *Quarterly Journal of Microscopical Science* from 1861 (Greville 1861) to 1866 (Greville 1866). Bury's illustrations in the additional plates were not all from slides prepared by Johnson. She also drew specimens from a slide of Greville's containing material from deep water soundings in the North Atlantic, and used slides from George Mansfield Browne containing material from Barbados. There are diatom slides from both Browne and Greville in the collection of the Natural History Museum in London including one of Bury's slides, containing specimens of *Stictodiscus Buryanus* (Fig. 4).



Fig. 4. One of Bury's slides of Trinidad material containing specimens of the diatom named for her by Greville, *Sticodiscus Buryanus* (Greville 1861). As the slide is in the Greville Collection of diatom slides in the Natural History Museum in London, it is presumably one of the slides Bury gave to Greville. The label in the image of the slide was rotated to ease interpretation. It reads: "36/20, *Sticodiscus Buryanus* Grev, Trinidad deposit, Mrs. Bury". Image courtesy of the Natural History Museum.

The Addenda plate legends also indicated that Bury sought the advice of George Wallich in identifying some of the specimens she drew. From the remarks in the legends is not clear if Wallich's saw the slides or based his opinions only on Bury's drawings. Wallich differed from the other naturalists who offered advice and aid to Bury as he was somewhat of an authority on radiolaria (or polycystins) at the time. In 1865 he published 'the structure and affinities of the Polycystina' (Wallich 1865) and would later publish 'On the Radiolaria as an order of Protozoa' (Wallich 1878). He was also a colorful character who carried on disputes with major scientific personalities (see Rice et al. 1976).

Given its price, Bury's book likely did not reach a large audience. However, her later action of 'promoting' polycystins through an article in a popular science periodical likely did reach a large audience. In 1865 Bury's illustrated article (Fig. 5) "A Popular Description of Polycystins" appeared in the May issue of the new monthly periodical "*Hardwicke's Science-Gossip: an Illustrated Medium of Interchange and Gossip for Students and Lovers of Nature*" (Bury 1865). Her article charmingly described the wonder of radiolarian skeletons:

"Now, the Polycystins are lumps of sarcode; and it is precisely this power of constructing shelly coverings which attracts our notice to them. They actually do spin or weave for themselves coverings resembling the most delicate and costly silver filagree-work, rivalling in pattern the choicest productions of the ancient Peruvians or modern Easterns. Yet, our little Polycystin artificers choose afar more beautiful material than silver, being a shining transparent preparation of silex, which these little lumps of apparently inert jelly possess, - a cunning laboratory capable of extracting the silex from the sea-water and fitting it for use. But it is not only outer-corselets that they construct, there are also solid internal pillars and rafters to support and strengthen the fabric, in the exterior walls of which suitable and convenient open spaces are carefully left for the extrusion of the pseudopodia, which we may suppose are sent out in all directions to collect and bring home whatever is needful, either for nourishment or for continuing their work."

A POPULAR DESCRIPTION OF
POLYCYSTINS.

BY MRS. P. S. BURY.

WHILST engaged in 1861 and 1862 in delineating the microscopic forms in some of the Barbadoes earths brought to England by Dr. Davy, and beautifully prepared for the microscope by Mr. Johnson, of Lancaster, the progress of my interesting occupation being partially watched by the late

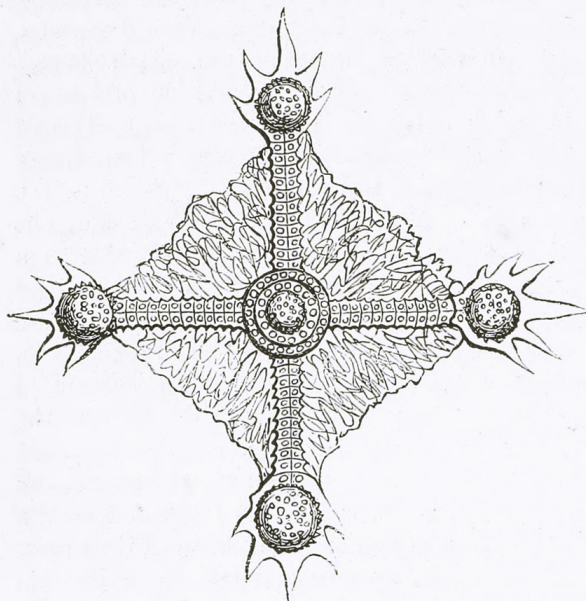


Fig. 64.—STEPHANASTRUM, Ehr.

accomplished Dr. Boott, he exclaimed, "You surely have found the excavated toilette-service of Titania, with all her essence-bottles and trinkets." Yes, in that dirty-looking, chalky earth are indeed found exquisitely jewelled vases, and diamond crosses and stars, to represent in fairy miniature the badges of every order of knighthood. But what, then, are these Polycystins? They are a family of the *Rhizopods*;

Fig. 5. From the first page of Bury's article in the popular press on polycystins (Bury 1865). The illustration is from plate 4 of her Polycystins book.

Bury's article mentioned, at some length, the pioneering work of both Ehrenberg and Müller, but pointedly maintained that the credit for the first discovery of the richness of the Barbados deposits rests with John Davy (who never published a report) rather than Schomburgk. Apparently then Schomburgk (recall he sent Barbados samples to Erhenberg, and published translations of Ehrenberg's early articles), was credited by some with the discovery of the diversity found in the Barbados deposits.

The periodical *Science Gossip* was edited by Mordecai Cubitt Cooke, the author of many popular books on a variety of topics such as mushrooms (Cooke 1862) and microscopy (Cooke 1869). Among the many unknowns with regard to Bury's polycystins book is how she came into contact with Cooke. He not only published her first and only known article but somehow Cooke was entrusted with the text, negatives of the plate photographs of the Bury's book and he decided to re-publish the work with the following notice following the title page:

"NOTICE TO SECOND EDITION.

The 'negatives' of this work and all interest and copyright having passed into my hands, I have, in consequence of numerous demands for copies resolved upon the reissue of the entire work, as originally published - so that all references and quotations heretofore made to plates, figures, or descriptions will equally apply to the present, which I trust will be found in no way inferior to the first edition.

M. C. C."

The official second edition was published in 1869 (Bury 1869). At the time Bury was living in Croyden, near London, and Cooke was living in London (English 1987). It would not be unreasonable to suppose that Bury herself, then aged 70 entrusted the text and negatives of the plates to Cooke who at the time was editor not only of *Science Gossip* but also the *Journal of the Quekett Microscopical Club* (English 1987). The cover of the second edition, and 3 of the plates (that were not in the first 12 plate version), are shown in Fig. 6. Only a few years after the publication of the official second edition edited by Cooke, Bury would pass away. Priscilla Susan Bury died in early 1872 in Croyden "of bronchitis and cerebral congestion" (Mabberley 2010).

POLYCYSTINS,
 FIGURES OF REMARKABLE FORMS &c.,
 IN THE
BARBADOS CHALK DEPOSIT,
 (Chiefly collected by DR. DAVY, and noticed in a Lecture delivered to the Agricultural Society of Barbados, in July, 1846.)
DRAWN BY MRS. BURY,
 As seen in her Microscope, on Slides prepared by CHR. JOHNSON, Esq., of LANCASTER, 1860 and 1861.
 SECOND EDITION,
 EDITED BY M. C. COOKE.
 PUBLISHED BY W. WHELDON, 58, GREAT QUEEN STREET, LONDON. W.C.

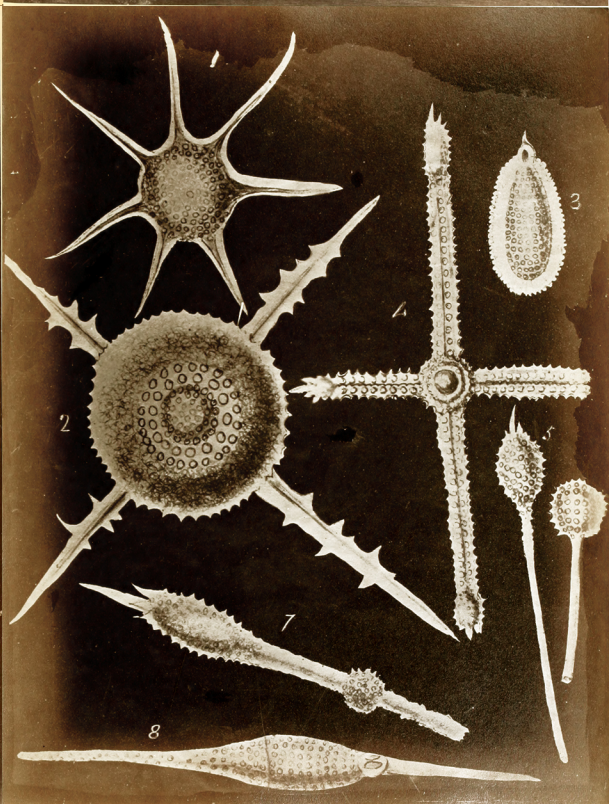
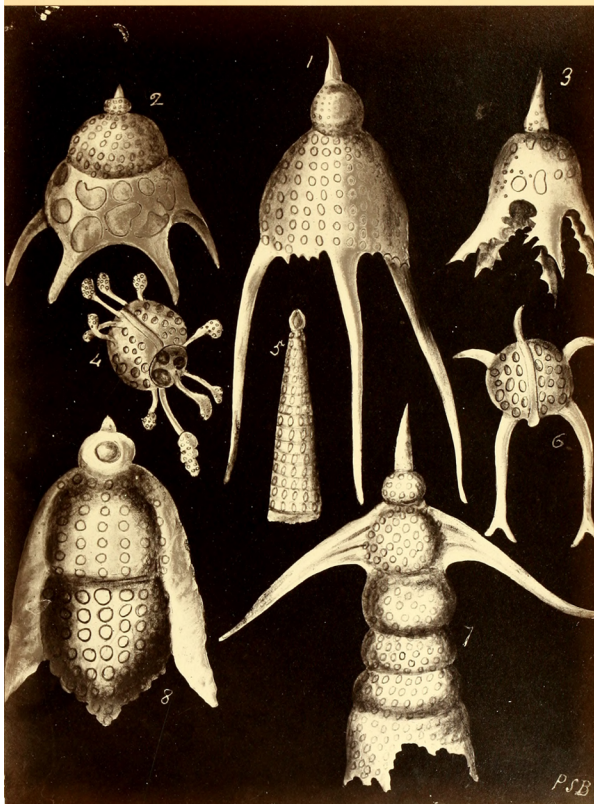
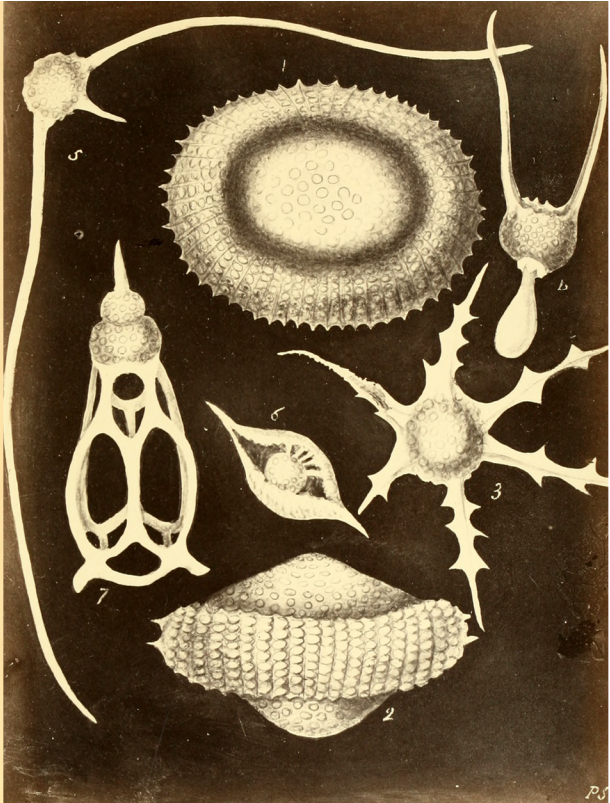


Fig. 6. The cover of the 'official second edition' of Bury's work published in 1869 and examples of the 26 plates it contained: top right - plate 13, bottom left - plate 17, bottom right - plate 22.

Hopefully, with this essay, Bury's striking plankton artwork will reach the modern community of plankton researchers. It should be noted that Bury's "*Figures of Remarkable Forms of Polycystins...*" has not been ignored by those who work on radiolarians. It was discussed by Haeckel in his classic monographs on the radiolarians of the Challenger Expedition in which he remarked that Ehrenberg oddly ignored Bury's work (Haeckel 1887). Haeckel himself used Bury's work to describe new species (Ogane et al. 2009). Bury was most recently cited in 2023 (Meunier and Danelian 2023). Not surprisingly perhaps, most citations to her work refer to the second edition edited by Cooke, the version most commonly held in libraries. Still, today, if one wishes to have a look at a copy of Bury's work, travel would likely be required as Bury's books are actually held in only a few libraries. Most libraries hold only one of the 3 versions, none holds all three. Luckily, electronic versions of all three editions, i.e., both of the two first editions (with and without the Addenda), and the Cooke edited second edition are available online through the Biodiversity Heritage Library and Google Books.

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David J. S. Montagnes very kindly personally examined the copy of Bury's Polycystins in the National Library of Scotland to verify that the plates were actually prints on very thin photographic paper.

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