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Book review

Microfossils (2nd Edition)
H.A. Armstrong & M.D. Brasier (2004)

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Overview

The first book on micropalaeontology I bought, as an undergraduate, was the original, green-covered, 1980 edition of *Microfossils* by Martin Brasier. Since there was almost no micropalaeontology in the degree course I did, it must have been partly responsible for my getting into the subject. The strength of the book was that it gave concise introductions to the palaeobiology of all the different microfossil groups and so an intriguing introduction to microfossil diversity. The weaknesses were the less than authoritative text and the indifferent illustrations - line-drawings only. But it was the only reasonably priced, English language introduction to the subject, so it definitely filled a niche. Given this, it sold well and it is not surprising that Blackwell's recently decided to commission a second edition. Howard Armstrong, of Durham University, has handled the revision. This revision has been extensive, the new book is 50% longer, the chapters have been rearranged and the original short introductory chapter has been replaced by longer sections on *Applied Micropalaeontology* and *The rise of the biosphere*, and a new chapter on scolecodonts has been added. It is not, however, a new book; for most of the groups covered, the bulk of the original text and figures have been retained with only light editing and addition of limited amounts of new material. The new material includes a few micrographs and, for most groups, a more detailed review of taxonomy, typically at family level. The main exception is the conodont chapter, reflecting the fact that Armstrong is a conodont specialist. This chapter has been totally rewritten and reillustrated and is a good modern review of the group. Unfortunately, given that the original text was over 20 years old, and all the groups covered have been intensively researched over this time period, the limited revision for the other groups is not really acceptable. By comparison, Elsevier recently considered revising the substantially better (although much more expensive) Haq & Boersma (1978) *Introduction to Marine Micropaleontology*. This project foundered when the revising authors (including Katharina von Salis) realised that a total rewrite would be necessary. Whether Elsevier were justified in then reissuing the original text as a 'second edition', when all they had done was add a stratigraphic column, is debatable; but they did state on the cover that it was essentially a reprint. The new edition of *Microfossils* falls awkwardly and unsatisfactorily between the alternatives of a comprehensive modern revision and a simple reprint. To illustrate this, I will discuss the calcareous nannoplankton chapter in some depth.

Calcareous nannoplankton

The chapter on coccolithophores, or to give it its full title '*Calcareous nannoplankton: coccolithophores and discoasters*' is 12 pages long and organised into sections on: The living coccolithophore; Coccoliths; Ecology of coccolithophores; Coccoliths and sedimentology; Classification; General history of coccolithophores; Applications of coccoliths; Further reading; and Hints for collection and study. This is a sensible organisation and a reasonable length to give a useful introduction to the group. Unfortunately though, the coverage is outdated, inaccurate and incomplete. As mentioned above, a comparison of the two editions shows that the text in the new edition is a mix of very lightly edited original content from the 1980 version and some new content. The old text is so outdated that it does not deserve to be reprinted, whilst the new text is poorly informed and based on a very limited review of modern literature, the main source being Winter & Siesser (1994). The old and new are also poorly integrated, so that there are repetitions of some concepts and inconsistencies in statements on them. A few quotes will serve to give a general idea.

"Coccolithophores are unicellular planktonic protozoa with chrysophyte-like pigments but differ from most other Chrysophyta in having two flagella of equal length and a third whip-like organ called a haptonema" p.129, text recycled from 1980 edition.

Coccolithophores are unicellular algae, not protozoa. They are not included in the Chrysophyta in any modern classifications. Mentioning the haptonema is of little value if there is no explanation of how it differs from a flagellum. The most important difference between haptophyte and chrysophyte flagella is the absence of retronemes (hairs) on haptophyte flagella, which is not even mentioned.

"The stellate calcareous nannofossils, the discoasters, are an extinct group that are exceedingly useful in the biostratigraphy of the Tertiary. Their taxonomy is based

on the number of rays and ornamentation in plan view" p.129, new text.

Well, that is more-or-less right, but unfortunately this pair of sentences is about all there is on discoasters and, in particular, there is nothing discussing the relationship of nannoliths, such as discoasters, to coccoliths, even though at least two texts in which this topic is discussed are cited: Perch-Nielsen (1985) and Bown (1998).

"In some living genera there is also an alternation between a motile and a non-motile planktonic or benthic stage. The motile stage has a flexible skeleton with coccoliths embedded in a pliable cell membrane, but in the non-motile cysts, calcification of the membrane can take place, thereby forming a coccosphere (Fig. 14.1)" p.129, text recycled from 1980 edition.

In some holococcolith-bearing phases, an outer membrane (or 'skin') occurs beyond the coccosphere, but coccoliths are never 'embedded' in a membrane. Calcification of membranes never occurs. Cyst formation has only been documented in *Ochrosphaera* and coccospheres are not cysts. Fig.14.1 illustrates a non-calcifying haptophyte, without a coccosphere.

"Little is known about the mechanism of formation of coccoliths (for a review see Piennar [*sic*, the correct spelling is Pienaar], *in Winter & Siesser 1994)"* p.131, new text.

I suppose that sentence was bound to irritate me since I have published several papers on the subject. However, even in 1994 the statement was contentious at best and nowadays it is simply incorrect.

"In Coccolithus pelagicus *scales are first produced in the Golgi body, are extruded and then form the nucleation sites for later development of the coccolith between the cell membrane and an organic pedicle that develops around the cell"* p.131, new text.

This is reasonably accurate, but omits the vital information that this is a description of *holococcolith* biomineralisation.

"Some species of coccolithophores are known to be dimorphic, for example Scyphosphaera apsteinii *(Fig. 14.3d) and* Pontosphaera japonica *are known to occur on the same coccosphere as do* Helicosphaera carteri *and* H. wallichii*"* p.131, new text.

S. apsteinii and *P. japonica* are separate species and, whilst the body coccoliths of *S. apsteinii* resemble those of *P. japonica,* they are significantly different. Coccospheres of *H. carteri*, including *H. wallichii*-like coccoliths, have been illustrated (see Geisen *et al.*, 2004 for a recent clarification of this), but this is not an example of dimorphism.

*"Some living coccolithophores (*e.g. Scyphosphaera, *Fig. 14.3d) produce two layers of morphologically distinct coccoliths (dithecatism)"* p.131, new text.

Scyphosphaera shows dimorphism but not dithecatism. Presumably the author has confused *Syracosphaera* and *Scyphosphaera* here, but the illustration (Fig. 14.3d) is a perfectly good SEM of *Scyphosphaera apsteinii,* clearly showing no trace of dithecatism, so there is no excuse for this.

"Neither botanists nor palaeontologists have agreed on how to classify coccolithophores and their relatives" p.136, text recycled from 1980 edition.

I am not quite sure what this sentence is meant to mean. With the input of new data from, for example, biomineralisation and molecular genetics, our understanding of coccolithophore classification is certainly evolving but since the classification of Jordan & Kleijne (1994), there has been no significant difference between botanical and palaeontological taxonomy.

"To extract them for study is relatively simple. Pulverize about 5-50g of fresh sample..."

It is quite amusing to think of anyone trying to make a smear-slide from 50g of sediment, but I suppose this may have been a typo for milligrams. The sentence comes straight from the Brasier (1980) text and shows the danger of reprinting outdated text without informed review.

I could continue and give numerous further examples of seriously misleading sentences but these will suffice to give a general impression of the level of scholarship. Some sections are reasonable, but overall the text contains too many errors to be recommended to any potential readership.

Unfortunately, the illustrations are no better than the text. There are not many of them, so I will briefly describe them all.

Fig. 14.1 is a very schematic line-drawing of a non-calcifying haptophyte redrawn from Siesser (1993) and miscaptioned as a coccolithophore.

Fig. 14.2 is an array of sketchy line-drawings of coccoliths labelled with idiosyncratic terminology and some badly outdated generic identifications (*e.g. Helicopontosphaera* and *Cyclococcolithina*). This is another example of content from the Brasier (1980) version being recycled without revision, and is particularly misleading since the modern generic name *Helicosphaera* is used elsewhere in the chapter.

Fig. 14.3 is a row of four SEMs of modern coccolithophores reprinted from Winter & Siesser (1994). It is always nice to see images of coccolithophores, but these are reproduced poorly and are too small. It also seems strange to reproduce old images when much better SEMs of modern coccolithophores are readily available. Finally, the images are cited as being reproduced with permission from Winter & Siesser (1994) but they were all originally

published in other journals, hence neither the editors nor the publishers of Winter & Siesser (1994) would have the right to grant copyright use of these images.

Fig. 14.4 is a plot of water-column distribution of intact coccoliths, broken coccoliths and 'coccolith flour'. It is recycled from the Brasier (1980) edition and ultimately from Listisyn *in* Funnell & Riedel (1971) and bears little relation to the results of sediment-trap studies carried out over the last couple of decades. It was an interesting study 34 years ago but has no place in a modern textbook.

Fig. 14.5 is supposed to be a map of coccolith concentration in surface sediments from McIntyre & McIntyre *in* Funnell & Riedel (1971). However, whilst there are black dots indicating sample localities, the data on coccolith concentration is omitted. Again this diagram has been recycled from the Brasier (1980) edition, but evidently someone decided to clean up the diagram, by removing the data.

Fig. 14.6 is a plot of coccolith species diversity through time, based on Tappan & Loeblich (1973). This is an obsolete, crude, poor-quality dataset, recycled from Brasier (1980), and was the best available compilation in 1980. However, the only possible explanation for using it in preference to the much more reliable and detailed curve of Bown and co-workers, versions of which have been included in numerous publications, is complete ignorance of the literature on nannofossils.

Figs 14.7 and 14.8 are redrawn diagrams of Pleistocene coccolith assemblage migrations from McIntyre *et al.* (1972) and of stable isotope data from Steinmetz & Anderson (1984), these are old but still good.

There is one piece of substantial new content in the chapter, *Box 14.1*, a three-page family-level taxonomic overview of the coccolithophores. This comprises brief summaries of 35 families, accompanied by thumbnail sketches of coccoliths of representative genera. Thirty-five families is too many to attempt to summarise in this way, especially as they are simply listed in alphabetical order, and the descriptions are too short to explain the basis of coccolith classification, for example, *"Rhabdosphaeraceae (Lemmermann 1980) Nannofossil with a base consisting of a varying number of cycles of elements. A central process rises from the base."* This description could apply to numerous coccoliths not included in Rhabdosphaeraceae and completely fails to explain the unique aspects of coccoliths of the Rhabdosphaeraceae. Moreover, the taxonomy used is rather archaic, there are numerous spelling mistakes in this section and the quoted ranges for several of the families are wrong - *e.g.* Crepidolithaceae is quoted as Palaeogene-Neogene (should be Jurassic), Eiffellithaceae as Early Jurassic (should be Early to Late Cretaceous), Heliolithaceae as Palaeogene to Recent (should be Palaeogene). Finally the diagrams are awful. They are ugly, rapidly-drawn sketches which show no understanding of coccolith morphology, fail to highlight the characteristic features of the families and, in some cases, are simply unrecognisable (the drawing of *Prediscosphaera* is particularly special, resembling an ice cream cone with chocolate sprinkles).

Other chapters

As mentioned above, the conodont chapter has been totally rewritten and the scolecodont chapter is new, these are both probably reliable. The other chapters on microfossil groups, however, appear to be, like the coccolithophore chapter, unreliable mixtures of recycled old content and poorly-informed new text. I will not attempt to review them in detail here, but I have been reliably informed that the chapters on foraminifera, ostracods and dinoflagellates are all dire. The introductory sections on *Applied micropalaeontology* and *The rise of the biosphere* might be expected to be rather better, but I was not impressed. For example, in the *Applied micropalaeontology* section there is a moderately detailed discussion of graphical correlation, but no mention of age-depth plots, which are far more widely used. There is also reasonable discussion of sequence stratigraphy, but almost nothing on cyclostratigraphy. The section on *The rise of the biosphere* is equally unbalanced, with decent coverage of astrobiology and the Cambrian explosion, but seriously inadequate discussions of eukaryogenesis and endosymbiosis. Overall, I found these sections seriously inadequate and substantially inferior to many treatments of these topics readily available in other texts or on the WWW.

The book concludes with an appendix on *Extraction methods*. This is essentially reprinted from the Brasier (1980) version, which was a decent summary of microfossil preparation methods, if far from authoritative. There is, however, one extraordinary change. In Brasier (1980), suitable care was taken to explain that some extraction methods had significant health and safety risks. Over the past two decades, this has become far more of an issue and one would expect that the cautions would be made much more strongly. However, the reverse is the case; the warnings have been diluted. Most notably, Brasier (1980) took care to explain, in the spores and pollen chapter, that whilst professional palynology laboratories routinely used HF extraction, this should not be carried out without proper facilities. By contrast, in the new edition this explanation has been omitted and a basic protocol for extraction of organic microfossils has been added without any specific warning of the extreme hazards involved in the use of hydrofluoric acid.

Conclusion

There is a clear need for a low-cost modern textbook on micropalaeontology. This book aims to meet this need and is superficially attractive - indeed according to the back-

cover it is "*the definitive guide to all the major microfossil groups*" and "*a complete guide to taxonomy, phylogeny, ecology and palaeoecology of microfossils and their applications*". It is nothing of the sort, but rather a student-level introduction, which is flawed by slip-shod editing, outdated content, and poor illustration. It does no credit to the authors, publishers, or our science.

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