PaleoBase: Macrofossils Part 2.0. Molluscs

Reviewed by Mark Webster

by Norman MacLeod, Ed.
Blackwell Science (Oxford) and the Natural History Museum (London).
CD-ROM (Macintosh or PC). $55.

There is no substitute for hands-on, specimen-based work when it comes to paleontological education. At all levels, whether teaching a basic "waltz through the phyla" course to undergraduates or finding yourself at the foot of a steep learning curve in the early stages of systematic research, training in systematics benefits from having specimens strewn out on the desk in front of you. Playing with fossils can render bearable even an onerous task such as familiarizing oneself with technical anatomical jargon. However, few institutions have the finances, history, or storage space to house collections of sufficient quality, phylogenetic breadth, and stratigraphic depth to cover all the bases when it comes to highlighting organismal diversity and disparity through time. Thankfully for those of us with patchy teaching collections of variable preservational glory, the Natural History Museum (London), in collaboration with Blackwell Publishing, continues to make its wonderful collections accessible through the *PaleoBase* CD-ROM series.

The PaleoBase Macrofossils Database System brings superb-quality digital images of commonly encountered macrofossil genera direct to your desktop. Part 1.0 was released in 2002 and covered trilobites and other arthropods, brachiopods, bryozoans, graptolites, and trace fossils. Part 2.0, the subject of the present review, covers the Mollusca (cephalopods, gastropods, bivalves, scaphopods, monoplacophorans, bellerophonts, hyoliths, polyplacophorans, and rostroconchs; although the opening screen of the program inexplicably says "Molluscs and Early Metazoa"). Part 3.0 (sponges, cnidarians, and echinoderms) is due

for release later this year. *PaleoBase* claims to be an "authoritative reference for common and stratigraphically important macrofossil genera" and "what most systematists believe will be the future of systematics in general, and paleontological systematics in particular". Having seen the software in operation, I believe both those claims to be well substantiated. (Although I feel obliged here to voice my opinion that it will be a sad day if and when systematics in general and paleontological systematics in particular goes entirely electronic.)

Like the first volume, *PaleoBase* 2.0 was ably managed by Norman MacLeod (general editor) and Paul Taylor and Dave Lewis (taxon description coordinators). Imaging was done by Andrew Henderson, Colin Donne, and Dave Lewis, and systematic expertise was provided by Jon Todd, Paul Jeffrey, Steve Baker, and John Cooper, with contributions by Michael Howarth, Neale Monks, Hugh Owen, Steve Tracey, Malcolm Symonds, Liz Harper, and Noel Morris. Given this cast it is perhaps not surprising that the end product is (and probably will be for quite some time) the best one-stop place to shop for molluscan systematics information. The program is closely tied to Euan Clarkson's (1998) excellent and widely-used *Invertebrate Palaeontology and Evolution* textbook (also published by Blackwell Science), sharing
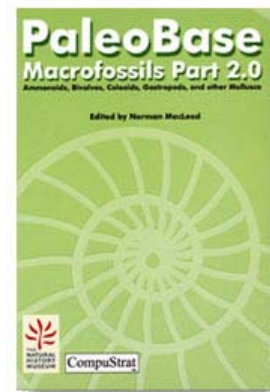
illustrations and (thankfully) terminology, and so can be incorporated into an undergraduate course with relative ease (see below).

There are three main components to the *PaleoBase* database: the Groups, the Bibliography, and the Time Scale sections. All are intimately cross-linked, but each can be searched independently if desired. For systematics education, the Groups section will be the most widely used component of the software. Upon entering the Groups section the user is presented with a list of all 307 genera in the database. Each genus name in the list is, by default, followed by the major group of mollusks to which it belongs. However, the list can also show geographic ranges or thumbnail images of the taxa if desired. The full list genera can be selectively culled by using any of the powerful search options (discussed below).

Each genus has its own record page, which can be accessed by clicking on the name in the group list. Each record page includes thumbnail images (from one to eight per genus), plus the stratigraphic range and hierarchical classification of the taxon. A text box contains useful tidbits of information pertaining to the morphology and paleobiology of the genus, plus some relevant literature citations. Clicking on a thumbnail image brings up the true image of the specimen, which can be enlarged or reduced in size using a zoom scale. The specimens and their digital imaging are truly spectacular, and alone provide reason enough to purchase this software. As pointed out in the User's Guide, magnification of the images is not achieved by simply increasing the size of pixels, but rather by progressively adding more information. At maximal magnification the images are beautifully sharp. The specimens are shown in full color which make the images aesthetically appealing, although one wonders if even more anatomical detail would be visible had some been whitened. Scale bars on both x- and y-axes allow recognition of pixelation-related image distortion, although I never noticed this to be a problem.

Of course there has to be a limit on the comprehensiveness of taxonomic coverage in a database such as this. As mentioned above, *PaleoBase* is designed to be a reference source for common and stratigraphically important macrofossil genera, and certainly all the usual suspects are included. Indeed, the only notable absences that this trilobite worker could discern were *Pojetaia and Fordilla:* a little frustrating given the likelihood of these phylogenetically significant genera being mentioned in a paleontology course (they are mentioned but not figured in the Clarkson textbook). However, this minor grumble brings up an impor-

tant benefit of the electronic database format: supplements and revisions can (and presumably will) be available for downloading, potentially rendering this reference source permanently up to date and ever increasing in coverage.

Eleven more records in the Group list link to labeled figures (one per major group) taken from Clarkson's (1998) textbook, providing basic but useful diagrammatic summaries of morphology.

Aside from the staggering images, another incentive to purchase *PaleoBase* comes in its very powerful search capabilities. The Group list can be selectively culled using just about any criterion, from geographic or temporal occurrences, to specific anatomical details. (The program includes a near-vital glossary list, accessible through the "floating palette" window, containing group-specific dictionaries of pertinent morphological terms.) Taxa can also be manually selected from the Group list. Taxon sublists can be saved for later use. The biggest disappointment here (indeed, perhaps the biggest disappointment of the whole database) was the inability to search taxon records by paleobiological information such as mode of life. Among the search criteria, the "Ecology" categories allow extraction of taxa which inhabited marine, brackish, freshwater, or terrestrial environments (exclusively or in combination), but a "mode of life" category would have been a tremendous addition for teaching purposes: how lamentable that one cannot easily extract information pertaining to (for example) the temporal distribution of predatory habits in gastropods, or the diversity of life attitudes of Mesozoic bivalves. Such paleobiological information is sometimes given in the text of the individual taxon pages, but does not form an option in the otherwise great searches.

A serious hiccup in the program is evident when culling the generic list by specifying that a taxon must occur in a particular stratigraphic interval. Using the "Search By Range" option, the user can specify the lower and upper stratigraphic bounds (entering the stage or sub-stage names) of an interval of time, and the program extracts all genera that occur within or are restricted to (user's choice) that interval. However, I found that taxa which made their last occurrence in the interval preceding the specified lower interval limit, or which made their first appearance in the interval following the specified upper interval limit, were also extracted. For example, when trying to extract from the 307 records all ammonoids which occur in the Tournaisian, the 15 resulting hits included only 3 which actually occur in that interval: 10 of the 15 extracted taxa ranged only up to the preceding Fammenian, and 2 of the 15 extracted taxa made

their first appearance in the following Viséan. This frustrating fact presumably relates to taxa occurring in a stage being treated as spanning the entire duration of the stage, and the common boundary between successive stages unfortunately being computationally treated as a co-occurrence of taxa of both stages.

In addition to the Groups section, the user can directly access the Time Scale or Bibliography sections of the database. The Time Scale section contains a tabulated breakdown of the Phanerozoic into its component periods, sub-periods, epochs, stages, and sub-stages, plus the absolute dates for the beginning and end of each (based on Gradstein and Ogg, 1996). This provides a convenient reference guide when conducting searches of the Group list, or when comparing the ranges of several taxa. The only annoyance I found here was the misspelling of Tournaisian ("Tournasian"), which means that the user has to similarly misspell the word when conducting stratigraphic searches. The Bibliography section contains a list of some 484 references (linked to the Group and Time Scale sections), and again with very powerful search options and the useful ability to export extractions to other programs.

The software designers really seem to have thought of everything. Using either the "floating palette" window and/or push-button options in the main window, multiple windows can be opened simultaneously. Thus two or more taxon images can be compared side-by-side, or the glossary or timescale lists can be opened alongside a search window to aid in the specification of search options. The pull-down menus and push-button options are very user-friendly and largely self-explanatory, although pop-up help balloons can be used to reveal the identity of more cryptic buttons. The CD-ROM also includes a "Goodies" folder containing images of "mystery specimens" which can be identified using the software: a great idea for entertaining (and sneakily educating) students. The program runs speedily and smoothly from the hard drive.

The accompanying 65-page User's Guide was extremely useful. All aspects of the program were very well explained, with useful step-by-step instructions and worked examples. It could per-

haps have done with another proof read given the number of misprints (including one on the front cover!) and inconsistent British-American spellings, but that is trivial. The shorter 19-page quick-start guide, designed I suppose for those who are chomping at the bit to get into the program and are less interested in the intricacies of the search options, adequately serves its purpose.

To test the utility of the program as an identification and educational tool, I incorporated use of the software into the mollusk lab as part of my new upper division paleontology course this quarter. The 73 students (most lacking any paleontology background) were required to use the program to identify several mystery specimens from the department teaching collections. (I opted against just using the supplied images in the Goodies folder: a nice specimen in the hand is worth two on the screen.) All fared well, and the feedback was very positive. The students found the program easy to use and soon mastered even the advanced searches involving morphological search criteria (with the valuable aid of the glossary window and Clarkson's textbook at their side), even without the User's Guide. The exercise will remain incorporated into the lab in future years.

In summary, *PaleoBase* 2.0 forms a truly wonderful tool for teaching and provides a great resource for those seeking to identify fossils (at least those genera most likely to encountered). For undergraduate paleontology courses *PaleoBase* offers a convenient source of information pertaining to the morphology, systematics, and paleobiology of the Mollusca, and could be used to supplement and fill gaps in teaching collections. Through its search capabilities, embedded paleobiologic information, and links to the literature, it will provide a very useful starting point for those conducting serious systematic studies of particular clades or assemblages. And finally, at only $55.00, this software is an absolute bargain. I await with eager anticipation the release of the third volume.

REFERENCES

Clarkson, E. N. K. 1998. *Invertebrate Palaeontology and Evolution. Fourth Edition.* Blackwell Science. 452 pp.

Gradstein, F. M., and J. Ogg. 1996. A Phanerozoic time scale. *Episodes* 19: 3-5.