

# Using Mikrotax & Neptune to provide useful access to microfossil occurrence data from scientific drilling

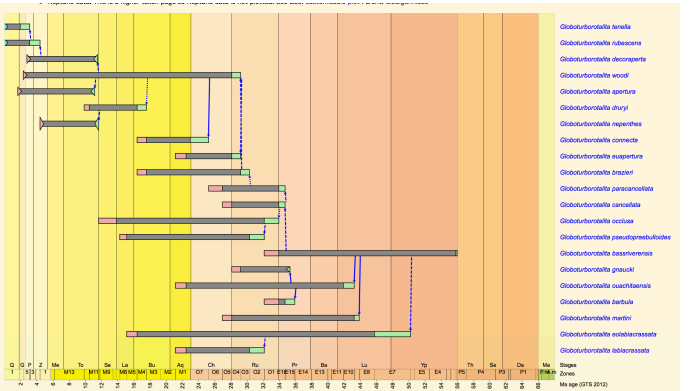
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**Classification:** [Coccolithophores](#) -> [Isochrysidales](#) -> [Noelaerhabdaceae](#) ([edit](#))  
**Sister taxa:** [Noelaerhabdaceae](#), [Prinsiceae](#), [Isochrysidaceae](#),  
**Distinguishing features:** Heterococcoliths with *Reticulofenestra*-type structure, V-units vestigial, R-units forming grill, both shields, and two-layered tube

| Daughter taxa: (blue => in age window 0-300Ma) |  |  |  | Granddaughter taxa                                                             |                                                                                                                                                                                                          |
|------------------------------------------------|--|--|--|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                |  |  |  | <i>Emiliana</i><br>No bridge, slits between distal shield elements             | <i>E. huxleyi</i><br><i>E. sp.</i>                                                                                                                                                                       |
|                                                |  |  |  | <i>Gephyrocapsa</i><br>Bridge across the central area                          | <i>G. oceanica</i><br><i>G. muelleri</i><br><i>G. ornata</i><br><i>G. ericsonii</i><br><i>G. caribbeana</i><br><i>G. omega</i><br><i>G. tunina</i><br><i>G. small</i>                                    |
|                                                |  |  |  | <i>Pseudoemiliana</i><br>With slits between some of the distal shield elements | <i>P. lacunosa</i><br><i>P. ovata</i><br><i>P. sp.</i>                                                                                                                                                   |
|                                                |  |  |  | <i>Reticulofenestra</i><br>No bridge, no slits                                 | <i>C. floridanus</i> group<br><i>R. bisecta</i> group<br><i>R. lockeri</i> group<br><i>R. parvula</i> group<br><i>R. pseudumbilicus</i> group<br><i>R. reticulata</i> group<br><i>R. umbilicus</i> group |

Above – taxon-table from a Nannotax page, showing the layout used to give rapid overview of sub-taxa  
Below – evolutionary tree representation of ranges of sub-taxa on page from pforams@mikrotax



**MIKROTAX- web taxonomy system**  
Mikrotax is a content-management system we have developed, with NERC Knowledge Exchange funding, for curating and displaying palaeontological data. It currently drives two main websites – Nannotax for calcareous nannofossils and pforams@mikrotax for planktonic foraminifera. In each case the sites are nearly comprehensive, they integrate data from several pre-existing monographs, catalogs and papers and are continuously updated. The Nannotax site is now well-established as an essential tool for anyone working with nannofossils, whilst pforams@mikrotax is rapidly gaining similar status. Additional sites covering radiolarians and acritarchs are under development.

- Some features of the mikrotax system**
- Image-based interface based on taxon tables which efficiently summarise the sub-taxa of each higher taxon, and allow browsing/unstructured exploration of the database.
  - Authoritative summaries of the stratigraphic range of each taxon and plotting of these as range charts, or for planktonic forams, as evolutionary trees.
  - Separate databases giving original descriptions of all described taxa and detailed data on accepted taxa.
  - Both rapid search on names, and advanced search using morphological characters &/or geological age.
  - Commenting on all pages to allow user input.
  - Full documentation of sources and referencing on all pages, and extensive metadata for images.
  - Re-imaging of type specimens and links to catalog data on type specimens in museum collections.
  - Inclusion of occurrence data from the Neptune database.

**NEPTUNE – occurrence database**  
The Neptune database has been developed since the 1990s by David Lazarus and co-workers. It contains ca 850,000 occurrence records of planktonic microfossils from deep sea drilling (DSDP, ODP and IODP) with additional tables providing metadata such as age models, palaeolatitudes and palaeolongitudes. This is a probably the best species-level palaeontological database available for any group of fossils and it has been widely used in palaeobiodiversity studies. It has not, however, been readily accessible to end-users and has barely been used to investigate species occurrence patterns.

- Displaying Neptune data on mikrotax**  
Neptune data is now used on mikrotax to provide plots of occurrence frequency through time at the base of species pages and this is directly compared to the ranges based on expert opinion. They provide objective data on the consistency of occurrence of the taxon and variation in its abundance through time. The data can also be viewed as:
- Range charts comparing multiple species – e.g. all species of one genus.
  - Space-time plots of occurrence frequency against age and palaeolatitude.
  - Maps of occurrence records for selected time intervals.

**Occurrence frequency**  
Plots of raw data from Neptune are of limited value since the number of samples per time bin is highly variable. To overcome this we plot occurrence frequency – i.e. the proportion of samples within a time bin in which the taxon occurs – e.g. there are 266 nannofossil samples in Neptune in the time bin 10-11Ma and *Gaillardella coarctata* occurs in 86 of them, so its occurrence frequency is 32%. This is a straightforward statistic and provides a rather good proxy for relative abundance, but compiling it from the raw data requires a rather complex query and so has not been accessible to casual users of the Neptune database. By producing plots of occurrence frequency in mikrotax the Neptune database becomes accessible and useful to end users, such as research students and industrial biostratigraphers.

**Improving the Neptune database**  
Plotting occurrence frequency has also enabled us to spot data anomalies and these have been reduced by: (1) revisiting suspect age models and improving them – in particular the age models for all sites with significant numbers of Mesozoic occurrence records have been revised. (2) Filtering out samples with high proportions of out of place taxa, or with very few taxa. (3) Checking and improving synonym mapping.

**Nannotax**

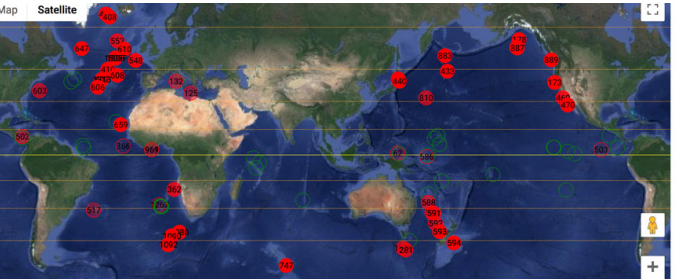
- 3,000 taxa in main database
- 4,500 taxa in catalog
- 25,000 images
- 14,000 users in the last 12 months (average 4.6 sessions of 13.2 minutes per user)

[www.mikrotax.org/nannotax3](http://www.mikrotax.org/nannotax3)

**pforams@mikrotax**

- 1,200 taxa in main database
- 2,500 taxa in catalog
- 8,000 images (most with 3 sub-images)
- 8,000 users in the last 12 months (average 4.0 sessions of 7.9 minutes per user)

[www.mikrotax.org/pforams](http://www.mikrotax.org/pforams)



Displaying Neptune data – various plots of data on the planktonic foraminifera *Neoglobobulimina pachyderma*.

- Left plot on species page, histogram shows Neptune data, coloured bar the total range according to literature sources (in this case Chassign & Pearson 1997).
- Above plot of distribution in 2-4 Ma time-interval, symbols show deep sea drilling sites with samples in the time-interval, colour indicates the occurrence frequency of *N. pachyderma*.
- Below space-time plot of *N. pachyderma*, bins are 2Ma x 15° latitude. Table – sample data for indicated bin. Size of symbol indicates number of samples, colour occurrence frequency.

