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# An online micropaleontology database: Radiolaria.org

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*Key words:* Online databases, paleoinformatics, www.radiolaria.org

## ABSTRACT

Growing amounts of available radiolarian data require better information-management systems. Managing, preserving and exchanging information can be done by using online databases with a web interface. Radiolaria.org (www.radiolaria.org), an example of such a web-database, contains species information and other resources, and has been designed by and for the radiolarian community. In Radiolaria.org researchers can contribute with information and this body of data is then made freely available. All submitted information

is reviewed by appointed web-editors to ensure quality and correctness. Species names, descriptions, synonyms and references are based on published material, and this is linked to a picture-archive showing representatives of the species from different geographical areas and/or periods. In addition, Radiolaria.org also serves as a communal website with e.g. news, events and discussion forums.

## 1. Introduction

Paleoinformatics, the area of paleontology concerned with management of information, including preservation of systematic information and expertise, was first introduced in the paleontological literature by MacLeod & Guralnick (2000) and MacLeod et al. (2000). These authors pointed out that, due to the increasing pace of micropaleontological data gathering, there is a need for more efficient ways of storing, accessing, exchanging, analyzing and presenting data. These demands are met by the adoption of more sophisticated information-management technology, paired with training in the development and use of such technologies. There is also a need to coordinate initiatives in these areas to ensure maximum benefits for the research community as a whole.

Online databases (defined herein as databases with a web interface) are one effective way of managing micropaleontological data. The information is entered or accessed easily, at any time, from anywhere with the use of a web browser. These web-databases enable easy searching and comparison of data, and make it easier to extract needed data in a suitable format, which is important for data exchange.

Building online databases requires large amounts of time and work: 1) to develop a robust and user-friendly paleoinformatic system; 2) to gather and ensure that any data added into

the system is of a high quality; 3) to transform the data into a suitable format for storage; 4) to enter the data into the system; and 5) to have the data quality controlled (by web-editors). However, once such a system is operational, it has the potential to make micropaleontological work more efficient by making better use of the information and resources that already exist. Eventually, similar initiatives may be interconnected creating networks of knowledge bases.

In the following sections, we will present the website Radiolaria.org (www.radiolaria.org). The idea of making Radiolaria.org came up during late spring 2000, due to our need of having a database with information (images, descriptions, references, synonyms, geographic and stratigraphic distribution etc.) about radiolarian species. Previously we had used books, reprints, library-copies, and various computer documents to keep information at hand, but a database would make the information more easily available. Instead of making a local system, we decided to put the database online so other radiolarian researchers also could access and add data. The first version of Radiolaria.org was presented at the Interrad-meeting in 2000 in California, where it received positive feedback from fellow researchers. Since then, there has been both functionality and content added to the system. Radiolaria.org is now an established source for radiolarian information online, with several thousand requests every week from all over the world.

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## 2. Radiolaria.org

Radiolaria.org includes general pages explaining what radiolarians are, as well as more detailed pages with taxonomic data on different species. It can be accessed free of charge, through a standard web browser, and uses hot-links for navigation. Most of the information is contained in a relational database, and the webpages are generated from this content.

The most important feature of Radiolaria.org is probably the "species information", and the link between what researchers name different radiolarians (or used to name them, i.e. synonyms) and pictures of how the species look like in different areas/periods. Having this information online, where researchers can contribute and discuss species concepts, may be one step in the right direction in the process of bringing taxonomy into conformity, which is very important for both local and regional biostratigraphic and paleoclimatic work.

### 2.1. Home page

The web-interface of Radiolaria.org consists of several sections that divide content and functionality into more manageable reports and tools. On the home page (Fig. 1) you will find links to most pages and sections included in the site. A detailed description and screenshot of every page is beyond the scope of this paper, we will here rather give an overview and some examples of the database features and functionality.

Under "About radiolaria.org" you will find general information about the website, the idea behind it, how the system works, and a user manual (.pdf) on how to contribute information to the system. "Species list" contains names (listed alphabetically), pictures, and links to all radiolarian species in the database. The "Archive" section includes (scanned) plates and captions of important taxonomic publications, which we have got the necessary permissions to reproduce. As many books and journals with original plates and species descriptions are getting old, out of print, or somehow unavailable, it is of great importance to digitize and make these publications available online. "Web links" contains links to other online radiolarian resources available on the Internet. "InterRad" informs about the International Association of Radiolarian Paleontologist (InterRad) meetings, membership, key people and the "Rad-folks" mailing list. The official "Newsletter" can be downloaded from a password protected page. "News" keeps researchers updated on what is happening within the website and the radiolarian community in general. Under "Mystery Rad" it is possible to post a picture and information about an unknown species and let the community share their opinions and suggestions as to which species it may be. "Radiolarian art" is a page that links science and art. At present (October 2005) it contains pictures of eleven radiolarian models made in white clay by the Swedish artist Eva Bjerke, several pictures of a large quilt made by the Canadian artist Barbara J. West, and pictures of three plexiglass models of living radiolarians made by the German artist Dagmar Borgwart. "Contributors" lists

the people that are (or have been) contributing to Radiolaria.org. It also gives the names and contact information for the web-editors responsible for the different geographical areas/time periods. "Radpeople" is a username- and password-protected section providing addresses and e-mails of radiolarian researchers. (If interested, contact the webmaster on Radiolaria.org). To locate specific information it is possible to type in one or more words on the "Search"-page. The user selects whether it is a search on species, synonym, reference, description or archive. The result is displayed with hot-links to the relevant pages. Introduction pages like "What are Radiolarians", "Quaternary and Tertiary radiolarians" written by various authors, contain general information about radiolarians for non/novice researchers.

### 2.2. Species information

Information about a radiolarian species can be found in several ways:

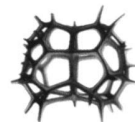
- 1) By scrolling the species list and looking for names (listed alphabetically) or pictures;
- 2) By navigating via the stratigraphic time scale (adopted from the International Commission on Stratigraphy) and geographic links listed on the right-hand side of the home page (e.g. by clicking on "Holocene (Recent)" and selecting "Nordic Seas"). When selecting the area of interest, the different species are listed under either Nassellaria, Spumellaria, or Phaeodaria. The number of species found in each category is also indicated;
- 3) By using the search-engine.

Under each species it is possible to find the original and/or other descriptions, images, synonyms, references and web links (if any) to other resources on the internet. There is also a discussion forum where radiolarian researchers can exchange ideas and opinions, add comments and suggestions, and post related non-published material. Each species is linked to a geographic/stratigraphic distribution. The user can navigate between different pages by clicking on the links in the submenu:

The "Images"-link displays a list of photographs for the selected species. Information about location, sample, latitude, longitude and photographer is shown next to each picture. Availability of various specimen pictures from different oceanic regions and time intervals may help point out regional/stratigraphic variations within the species. This is of importance, e.g. in comparative morphological analysis.

The "Synonyms" displays a list of registered synonyms for the species, sorted in ascending chronological order. The full reference to each synonym is found when selecting "References". This online facility may give the user a more updated and complete overview of available information relating to a species compared to the consultation of single publications.

All areas/periods where the species has been registered are found under "Distribution". (As this is work in progress, not



[About radiolaria.org](#)

[Species list](#)

[Archive](#)

[Web links](#)

[InterRad](#)

[News](#)

[Mystery rad](#)

[Radiolarian art](#)

[Contributors](#)

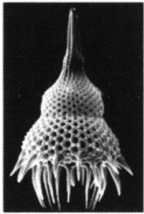
[Radpeople](#)

[Search](#)

[Radiolaria.org](#)

Radiolaria.org is an online database containing information about radiolarians - fossil and recent, with images, descriptions, references, synonyms and links to other online resources. [more...](#)

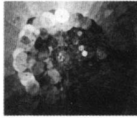
[What are Radiolarians](#)




Radiolaria are holoplanktonic protozoa widely distributed in the oceans. They occur throughout the water column from near surface to hundreds of meters depth. As with many planktonic organisms, their abundance in a geographical region is related to quality of the water mass, including such variables as temperature, salinity, productivity, and available nutrients. [more...](#)

[Radiolarian Art](#)

Radiolarians have been an inspiration for many artists. These pages show examples of their works. [more...](#)



**Artist:**  
Barbara West  
(Canada)



**Artist:**  
Eva Bjerke  
(Sweden)

[What are radiolarians](#)


[Quaternary radiolarians](#)

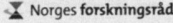
[Tertiary radiolarians](#)

Radiolarian species info:

[I.C.S. Time Scale](#)

[International Code on Zoological Nomenclature](#)



 Norges forskningsråd

Webmasters: Jane K. Dolven - jane@radiolaria.org | Hans Skjerpén - hans@one.no (2000-2005)

Fig. 1. The home page of Radiolaria.org (October 2005).

all areas/periods may have yet been included.) The presence of a species should be documented by a picture and preferably a reference to a book or paper. The name of the person who contributed the information is indicated in parenthesis.

The display of species names, descriptions, synonyms and pictures together has proven very important in making the species concept more homogenous between users, as scientists use different taxonomies and will therefore give different names to the same specimen. Unfortunately, Radiolaria.org does not prevent the possibility of the same species being registered under two different names in two geographical areas/periods.

### 2.3. Contributing information

One important aspect of Radiolaria.org is that any radiolarian researcher can add information (provided it meets certain criteria, see section 2.4.) into the database. This can be done in several ways:

- 1) A contributor can add a species by selecting the stratigraphic/geographic location where the species is known to be present and click on the "Add species" link on top of

the page. This will take the contributor through several steps (pages), where different forms are filled out. In form one (Species and original description) and two (Other description), the genus and species name along with at least one description (including author and year) is entered. Synonym(s) and Reference(s) are inserted in form three, and Image(s) with related information is added in form four. All fields marked with an asterisk (\*) are required fields that need to be filled in order to submit the data into the system. Once the data entry is completed, the user can preview the contributed information. After approval, the data is submitted along with the contributor's name and e-mail address. The contributor is also suggested to notify the web-editors by e-mail about the new additions.

- 2) A user may also add single pieces of information to a species that is already registered in the system. This is done by selecting the species of interest, locating the "Add"-link on top of each page in the submenu (e.g. Add description, Add image, Add synonym/reference), filling out form(s), and submitting the information.

When data are submitted into the system (either way described above), it is not instantly made visible on the site, but

placed in an administration area and flagged for review. The review process is described in more detail under the following section.

#### 2.4. Administration and Quality control

The goal of the Radiolaria.org-project is to gather high-quality information about radiolarians from all time periods and make this available online. One way to acquire data of good quality is to use information published mainly in peer-reviewed books, journals and electronic publications. In Radiolaria.org, the content of species names, descriptions, synonyms and references is based solely on published data.

Copyright laws affects online information, as this is a form of publishing. Ownership and different use-rights for data can be a source of conflicts, especially regarding already published material. We are aware of copyright issues and are working on solving them.

To further ensure the quality of the submitted data, web-editors are allowed to log on to the system and check submitted material flagged for review. A web-editor is assigned a certain geographic or stratigraphic area, according to his/her expertise, and reviews all information related to this area. The web-editors ensure that: 1) the information submitted is (with regards to species descriptions, synonyms and references) based on published material with correct citations; and 2) the images, distribution and web-links are correctly assigned. If a web-editor finds errors, judges the data entry to be insufficient or wrong, or needs to contact and discuss with the contributor, he/she can use the name and email that was submitted with the content. The review process (checking of submitted material before it is made available online on the website) also prevents intentional sabotage by online pranksters.

### 3. Future and goals

A complete online catalogue with high quality information requires different people with different expertise to donate many hours of work. While some work in Radiolaria.org is sponsored by grants, most is based on voluntary work without monetary compensation. An important part of reaching the goals of Radiolaria.org is to recruit area/period-experts willing to contribute with their time and expertise. Although most radiolarian researcher already have a fully booked schedule, we hope that many will see the importance of this project and will be able to provide help to build up the database in the future.

Information systems evolve over time, with new functionality ever adapting to new users and needs. What new features will be requested by the radiolarian community is hard to predict, but some of the currently planned features for Radiolaria.org include:

- Support for a wider variety of data, particularly quantitative radiolarian data (including sample information like location, geographic coordinates, age etc.). This data could then be used further, e.g. in a Geographical Information System, to plot species distribution maps.
- A Software Archive with links to useful applications for radiolarian researchers (e.g. data analysis packages including common statistical, plotting and modeling functions).
- A Taxonomic Identification Tool that displays species according to selected characteristics (e.g. number of spheres/segments, number of spines, pore size/shape). Each species is registered with a certain number of characteristics, allowing searches and drill-downs on taxonomic keys.

Radiolaria.org belongs to the radiolarian community and the people that have invested their time and expertise building it. While the system is currently hosted on a private server, it will be transferred to a research institution (doing radiolarian research) for further development and hosting – preferably long term. This transfer will take place after Radiolaria.org has reached a defined goal of content (e.g. when the Recent radiolarians catalogue is completed). The new hosting research institution must be committed to run Radiolaria.org on the following conditions:

- Keep Radiolaria.org freely accessible for all.
- Maintain the system, and preferably develop it further.
- Agree to hand the system over to a new institution, should the institution not be able to comply with the above conditions.

Radiolaria.org was built for the radiolarian community, and will exist as long as this community shares the work and the benefits in our quest for better science.

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