

# An online bibliography of bioerosion references

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**Abstract.** A bibliography of bioerosion-related books and papers has been available on the Internet for several years. The list now includes almost 2200 references. This bibliography is freely available to the public and frequently edited, so it grows in size, coverage, and accuracy. The bibliography shows the diversity of interests in the bioerosion community. References range from the mostly geological to the botanical; from articles concerned with macrobioerosion by bivalves, worms, sponges, and barnacles to numerous papers on microbioerosion by bacteria and fungi. The online nature of this resource means it will grow with the needs of the bioerosion research community.

**Keywords.** Bioerosion, bibliography, online, microbioerosion, macrobioerosion

## Introduction

Since 1990 I have maintained a bibliography of references related to bioerosion. It began as a list of articles which included carbonate hardgrounds and their faunas, both encrusting and boring, which was later published in Wilson and Palmer (1992). It was annually updated and circulated within the small community of hardground researchers as an unpublished booklet. In 2000, Paul Taylor and I began work on a review of all marine hard substrate communities, both ancient and modern. Together we accumulated hundreds of references which covered sclerobionts (organisms which live on hard substrates). Upon the publication of this paper (Taylor and Wilson 2003), I separated the bioerosion-related articles from the hardground papers and placed both lists on the Internet at this website:

<http://www.wooster.edu/geology/bioerosion/bioerosion.html>

The bioerosion bibliography is online as a pdf:

<http://www.wooster.edu/geology/bioerosion/bioerosionbiblio.pdf>

It is also online as a Microsoft Word file:

<http://www.wooster.edu/geology/bioerosion/bioerosionbiblio.doc>

As of the time of this writing, the bibliography has 2198 references, and it has been growing by about a dozen new papers a month. This bibliography has been downloaded an average of 130 times each month over the past three years. I also send free copies of the bibliography on a compact disk to all who request it.

## **Construction of the bioerosion bibliography**

This bibliography is a product of the growing community of paleontologists and biologists interested in bioerosion. Since it is an online resource which is frequently updated, anyone can send the compiler additions and corrections to the reference list. Dozens of people have done so, with the most prominent contributors listed in the acknowledgments for the bibliography and in this paper. In a sense, then, this bibliography is like a 'Wikipedia' for bioerosion specialists where all participants can see the full information resource and help develop its content.

The bibliography is updated about once a month, with the date of the newest version always posted in the header. New articles are added from Internet searches, professional databases (GeoRef and Biological Abstracts especially), and contributions from users. To be included they must make a significant contribution to our knowledge of marine bioerosion processes, the distribution in space and time of bioerosion, or the systematics of bioeroding organisms. Often one or more of the above topics will be the primary purpose of the paper, but commonly the bioerosion portion of the article will be relatively small yet important to bioerosion experts. The selected articles also must be accessible to the community. Unpublished manuscripts and dissertations are not included, nor are abstracts or sections in locally-produced guidebooks. Exceptions are made, though, if there are no other sources covering the particular topic.

Accuracy of the citations is a concern. I have seen my own mistakes in the reference list passed into published articles. These errors are usually small but are surprisingly common. With the increasing speed and efficiency of Internet searches, we can quickly compile a list of how a reference has been cited in dozens of different sources. When we do this we often see an accumulation of scribal errors, some of which make the original reference impossible to find. I work on reducing errors in this bibliography by collecting actual paper reprints when I can, checking questionable citations with the original authors where possible, and continually asking bioerosion experts for corrections. The most common error I have observed among bioerosion citations is a misspelling of the journal's title, especially if it is not in English and has been listed with more than one abbreviation. If I could I would require all journals to list the references in their articles by the full name of the journal. This would greatly limit this pervasive bibliographic error. I have reproduced the full journal titles in the bibliography and encourage future contributors to do the same.

I have attempted to make this bibliography 'comprehensive', but of course it can never be. Every topic covered by these articles can be probed in more detail, revealing additional secondary and tertiary references. This is especially true with the biological articles. I have endeavored to include the most important modern

bioerosion references; each one, though, opens doors into further exploration of systematics, evolution and biochemistry of the bioeroders. A bibliography of ten thousand or more references would be so large as to be unwieldy, and so there is a limit to how many literary rabbit holes we can safely go down.

## **Review of other bioerosion-related bibliographies**

The most comprehensive bibliography of an important aspect of bioerosion is that by Clapp and Kenk (1963) on marine borers. It is over 1100 pages long and thoroughly annotated. It was produced for the United States Navy and as such is directed toward practical concerns such as the maintenance of wooden wharf pilings, limestone coastal defenses, and the hulls of wooden boats. There is considerable overlap with the online bioerosion bibliography, but many of the papers in Clapp and Kenk (1963) are not included because they are engineering reports on the stability of the substrates rather than the process of boring itself. Radtke et al. (1997) produced an extensive bibliography of bioerosion, integrating macrobioerosion and microbioerosion. This is still a valuable bibliography, but its contents are now almost entirely subsumed in this online version. The best general trace fossil bibliography is the references cited list in Bromley (1996). While this book contains many citations of papers on borings as trace fossils (all of which are in this online bibliography), it was not intended to include a thorough examination of bioerosion. The most recent extensive bioerosion-related bibliographies are the long references cited sections in Taylor and Wilson (2003) and Bromley (2004). Almost all of these references are now in the online bioerosion bibliography.

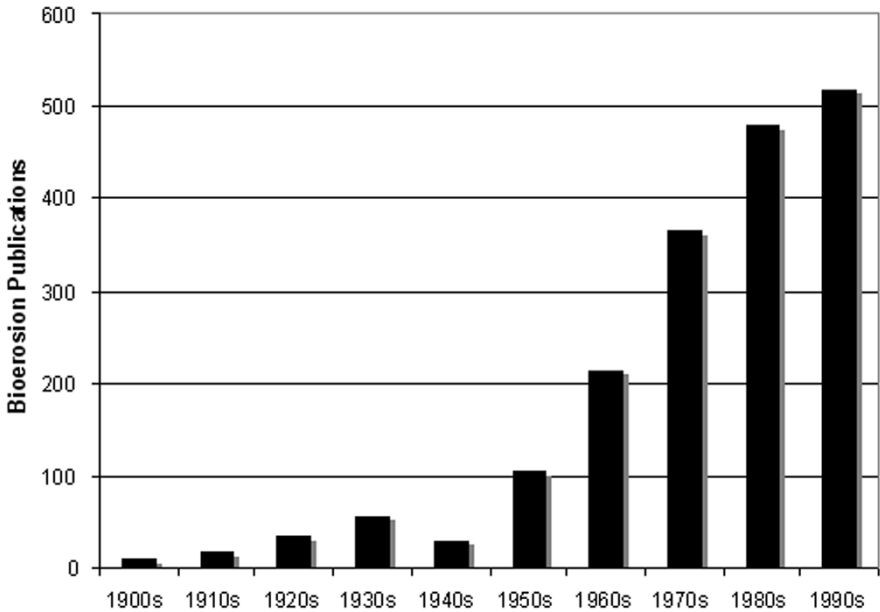
## **The bibliography as a reflection of the bioerosion community**

I began this bibliography as part of my own research program in bioerosion and other aspects of sclerobiology. It was thus centered on macroborings and the fossil record. I relied upon the geological literature for most of the references. Later my colleagues impressed upon me both the importance of modern bioerosion and the growing number of papers covering microborings. With the help of several German bioerosion experts, I have added hundreds of articles on microbioerosion to the list. They are now more than one-third of the bioerosion references. The result is an unusual mix of journal types in the list from the strictly geological (such as, well, *Geology*) to the botanical (*The Canadian Journal of Botany* is an example) and zoological (*Zoologica Scripta* comes to mind). This shows that the study of bioerosion in its entirety is highly interdisciplinary, more so than would be expected from an apparently narrow focus on a biological process.

## **Statistics gathered from the bioerosion bibliography**

As of May 2007 there are 2198 references in the bibliography. The earliest is a 1733 book by Gottfried Sellius who showed the molluscan affinities of the ‘shipworm’

*Teredo*, which at the time was devastating the wooden dikes holding back the sea in Holland. The distribution of citations through time is predictable. There are four references from the 18<sup>th</sup> century, 55 from the 19<sup>th</sup>, 1827 from the 20<sup>th</sup>, and thus far 302 from the 21<sup>st</sup> century. The number of references through the 20<sup>th</sup> century by decades is shown in Figure 1. Except for a dip in the war years of the 1940s, there has been a steadily increasing number of references through the century. About half of all the bioerosion papers in the bibliography come from the 1980s and 1990s.



**Fig. 1** Bioerosion-related papers and books published during each decade of the 20th century

The most prolific author on the list is Stjepko (Steve) Golubic of Boston University. He has 81 articles in the bibliography, most of them on microbioerosion. The second most common author in the bibliography is Richard Bromley of the University of Copenhagen who has 58 articles here primarily covering macrobioerosion. The most appropriately named author must be J.E. Barnacle of Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO)!

Dozens of journals host these bioerosion papers. The most common journals in the bibliography are the *Journal of Paleontology* (67 articles), *Palaios* (60), *Lethaia* (53), *Palaeogeography Palaeoclimatology Palaeoecology* (52), *Ichnos* (39), and *Palaeontology* (38). These journals are all from the geological community. This appears to show that the geologists in our community tend to publish in relatively few journals and the biologists in many more.

## **The advantages of an online bibliography**

The primary reason an online bibliography is valuable is that it can be continually corrected and updated. The bioerosion bibliography is prominent on the web within our discipline – type ‘bioerosion’ into the Google or Yahoo search engines and it is the second link to appear, preceded only by the Wikipedia page on bioerosion (which has a link to the bibliography). Authors are not shy about telling me when I have made an error with one of their citations, and some students have taken it as a challenge to find bioerosion references elsewhere which are not on the list. The Microsoft Word document version of the bibliography can be quickly downloaded and the references can be electronically searched for words in the article titles, the journals, or the dates. These references can then be cut out and pasted into other documents.

## **The disadvantages of an online bibliography**

The Internet does not yet have the permanence, or at least the illusion of permanence, we have with books and journals. The words placed on paper will be outdated soon, and they cannot be easily corrected, but at least history shows they have a chance of surviving indefinitely. A power failure at The College of Wooster will shut down the server, making the bibliography temporarily inaccessible. A cyber-attack on our server could erase the bibliography from its memory. I keep numerous back-up copies on other computers and on compact disks for these eventualities, but I may not be around to reload the bibliography. Right now I would have to count on a colleague uploading a copy of the documents on another server if I could not.

## **The future of the online bioerosion bibliography**

To increase the longevity of the online bioerosion bibliography, we will soon have at least one mirror website to serve as a real-time back-up. To increase the usefulness of the bibliography as a database of bioerosion research, I hope to soon convert the text into data fields for a bibliographic program such as EndNote. I also hope to add keywords to the references so that we can search on text-strings not necessarily in the article titles. With the continual editing and help of my colleagues, the bioerosion bibliography will also become more accurate and comprehensive with time.

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