

The methods described and tried in this publication, might give impulses to other approaches and a wider interest in this field of geochemical research and may bring out information not earlier encountered. The publication is in German, but has a good English summary and many references.

MS received February 2, 1976.

---

## Fossil and Living Dinoflagellates

---

By William A. S. Sarjeant  
*Academic Press, 182 p., 1974.*  
\$13.00

Reviewed by Graham L. Williams  
*Atlantic Geoscience Centre  
Bedford Institute of Oceanography  
Dartmouth, Nova Scotia B2Y 4A2*

Dinoflagellates constitute one of the major components of modern plankton, and also commonly occur in marine sediments of Mesozoic or Cenozoic age. Their abundance and relatively small size (rarely do they exceed 200 microns) make fossil dinoflagellates ideal for biostratigraphical and paleoecological studies of samples from wells. They are becoming increasingly important in petroleum exploration, especially since they are concentrated by the same techniques as used for spores and pollen. A palynologist is able to study dinoflagellates, spores and pollen at the same time, and hence correlate from marine to nonmarine sediments. Modern dinoflagellates are equally important, the majority being an essential component of the aquatic food cycle and of immediate concern to those responsible for replenishing the earth's dwindling food supply.

It is a pleasure, therefore, to see the publication of a book which, for the first time, deals with both fossil and living dinoflagellates. Prior to Professor Sarjeant's monograph there had been a tendency for the neontologist and palynologist to pursue their separate interests in the study of these organisms. Further polarisation of the two fields had resulted from the fact that only the encystment stage of dinoflagellates, the resting cyst, is fossilised. When ready to become active once more, the protoplasm of a living cyst escapes through the *archoepyle*, the excystment aperture. The resting cyst is imperfectly understood in living dinoflagellates, many of which do not appear to form one. Dr. Sarjeant has performed an invaluable service by clearly and logically explaining the different stages in the life cycle of a living dinoflagellate and the relationship between living and fossil forms.

One hopes that this book, the pioneer in its field and as such highly commendable, will be the precursor of other detailed studies. Although the individual chapters are well written in a conversational style, there is some imbalance in coverage. The treatment of the morphology of living dinoflagellates is very technical with possibly too few figures. This may merely reflect my personal interests. The understanding of the morphology of both living thecate and fossil dinoflagellates would have been greatly simplified by reference to some text-figures in which the discrete morphological features, such as the individual plate series, were clearly labelled. I feel that the differentiation of the thecae of the three dominant living genera *Peridinium*, *Gonyaulax* and *Ceratium*, should have been discussed in some detail. The majority of fossil dinoflagellates show affinity to either *Peridinium* or *Gonyaulax*, so that an understanding of the morphology of these two genera is of considerable help to the palynologist. A chapter on cyst morphology is incomplete without illustrations showing the several archeopyle types, since this feature is often the only indication in a fossil of its dinoflagellate relationships.

The chapters describing the reproduction and encystment of living dinoflagellates are excellent, particularly the former which includes all the pertinent literature. The ecology however is inadequately treated, with no data on their geographic distribution. This has become a very important field of study, as provincialism is being increasingly recognized in fossil assemblages, although the relationship to the distribution patterns of modern forms is highly conjectural.

The history of the study of fossil dinoflagellates is a very readable, thoroughly enjoyable synthesis which yet manages to be informative. It also provides an excellent summation of the most important biostratigraphic publications to appear since 1961. The significant increase in the biostratigraphic usefulness of dinoflagellates over the last decade is shown by Professor Sarjeant's statement that in the *Upper Jurassic*, the precision attainable is quite comparable to that achieved by use of ammonites. The stratigraphic treatment, written in general terms, is easily understandable

to the non-specialist and is marred only by the omission of a range chart.

I was sorry to see no discussion of fossil dinoflagellate lineages, one of the major breakthroughs of the past decade. Such studies are ultimately providing more biostratigraphic control.

Paleoecological studies have also shown the importance of the peridiniacean-gonyaulacacean ratio, which is often a useful guide to water depths and/or proximity to shore.

Any publication reflects the inherent interests of its author. Obviously, Dr. Sarjeant's forte lies in the suprageneric classification of fossil dinoflagellates which is given eight pages in the Appendix. It should be borne in mind however, that the familial classification is somewhat speculative and not universally accepted.

The book is written throughout in a lucid, entertaining style. The illustrations are adequate although the absence of the magnification factor in the text-figures is disconcerting. One is left with the impression of a professional product well worth the purchase price, unless you are fortunate enough to receive a complimentary copy for review.

MS received February 17, 1976.

---

## Geological Survey of Canada Report of Activities, Part C

---

Officers of the Geological Survey  
of Canada

*Geol. Survey Can. Paper 75-1 C,*  
371 p., soft cover, 1975.

\$5.00 (\$6.00 outside Canada)

Reviewed by E. A. Christiansen  
*Geology Division*  
*Saskatchewan Research Council*  
30 Campus Drive  
Saskatoon, Sask. S7N 0X1

The *Report of Activities, Part C* which is 371 pages in length, has a convenient 8½ x 11 inch format with a two-column layout giving the authors a choice of one- or two-column widths for figures.

The text is easy to read, well written, and well edited. The cover is attractive, and the book is well bound. Except for a few map- and photo-reductions, the figures are well drawn and easily read.

Considering the short production period for this report, it is an impressive volume and all who contributed to it are to be congratulated.

The text includes six papers on geochemistry, 13 on geophysics, four on marine geoscience, 11 on mineral deposits, two on Precambrian geology and petrology, 10 on Quaternary geology, and 14 on stratigraphy.

*Geochemistry.* Lake water samples from Baffin Island, British Columbia, Canadian Shield, and Ontario, and groundwater samples from 2000 wells in the Maritimes were collected for uranium analysis and, in some cases, base metal analysis. The results of those analyses conducted in the field are reported, and the new developments in sampling techniques of lake water are given.

*Geophysics.* Information on impulse radar, gamma-ray, relative permittivity, and ground magnetic surveys are presented. Part of the studies were done to develop and refine new techniques, and the remainder of the studies were done to apply geophysics to geological investigations such as the bedrock topography of the eastern Niagara Peninsula. For the Cavendish geophysical test range in Ontario, ground magnetic, hammer refraction

seismic, and gravity data are specifically recorded. Developments of the "Impulse radar method" and the "Electrical Polarization mechanism model" along with the determination of soil moisture from permittivity measurements are among the new developments.

*Marine Geoscience.* This subject is dealt with in two papers on foraminifera, one paper on the Meguma Group of sediments, and another on the storage of geological samples:

*Mineral Deposits.* Project Appalachia is the subject of six of the eleven papers, and eight of the eleven papers deal with statistical analysis and organization of mineral deposits data. "Project Appalachia seeks to develop and apply methods of combining information and concepts on regional geology, mineral deposits, and mathematics in computer-aided regional mineral resources appraisal".

*Precambrian Geology.* Two papers deal with this subject: one on petrology and another on aerial geology.

*Quaternary Geology.* Papers are presented on all aspects of Quaternary geology including drilling equipment, mapping and evaluation systems, postglacial sea-level fluctuations, weathering, marine geology, and the Gatineau River.

*Stratigraphy.* Twelve of the fourteen papers on this section are restricted to northern Canada. Eleven are concerned primarily with areal geology and the remaining three papers deal with processes affecting strata including diagenesis and quantification of sulphur-bearing minerals.

Although this Report is an impressive volume, there is some room for improvement. Some reports lack organization and are too long for such a report of activities. It is recommended that the editor restrict each report to two pages which would make it possible for him to have an organized Table of Contents instead of the random one in this report. Furthermore, it is recommended that wherever possible the report be subdivided into: objective, methods, results, and conclusions with a few pertinent references. In my opinion, the paper by Vilks and Rashid and by Veillette and Nixon are excellent examples being two pages long, well illustrated, and clearly displaying their internal organization.