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Neue Moglichkeiten erdgeschichtlicher Forschung mit Hilfe des Paiaogeruches

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complex, with the exception of the reefs. The fact that most studies were completed some eight years before publication is glaringly obvious both from the text and the references quoted, few of which are later than 1967.

Eight years ago this would have been a major publication in the field of carbonate sedimentology, today it is a solid addition to the literature; for the serious worker on carbonate sedimentology and paleoecology this book should be handy as a reference; for the worker on carbonate diagenesis it can easily be reached in the nearby library.

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Neue Möglichkeiten erdgeschichtlicher Forschung mit Hilfe des Paläogeruches

By W. A. Schnitzer and R. G. Schwab
Erlanger Geol. Abh., Helf 101, 20 Seiten, 1975.
DM 8.00 (approx. $3.25).

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New Possibilities in Stratigraphic Research with the help of Paleosmell

Paleosmell is the term used by Schnitzer and Schwab in their publication. Considered is the sensorial perception of smell from clays and its usefulness and importance in stratigraphic geology.

It is known that burnt clay is able to adsorb odorous substances from the atmosphere. During fieldwork in India, Schnitzer came in contact with the manufacturer of an "earth parfum" "Matti-ka-attar" and he could follow the process of retrieving that odorous substance from its source. The substance is produced in the clay burnt by the sun in the hot summer months from April to June.

I. J. Bear and R. G. Thomas, Melbourne, Australia have made detailed studies of the complex composition of that "Matti-ka-attar". They introduced the term "petrichor" to describe the smell of clay and also the smell displayed by outcropping rocks on earth.

Schnitzer and Schwab speculated that shale and even other rocks from the past must have had the same ability to adsorb odorous substances. Hence, the goal was to make use of this assumption and to find methods to identify these odorous substances, which are of great variety and discernible in moistened shales and marls.

The two researchers established a joint program, in which Schnitzer used thin-layer chromatography to graphically explain paleosmell. He gives a detailed description of the procedures in his method as well as illustrations of the chromatograms received from the shales used in the experiments. He found that shales of different age and facies could be distinguished because of remarkable differences in smell ranging from musty to earthy and aromatic to burnt. This thin-layer chromatographic method has been successfully applied to the Upper Triassic shales of southern Germany. From vertical sections without noticeable changes in facies, there is evidence that isochronous strata are identical, whereas heterochronous sediments differ as far as their paleosmell is concerned. Over a studied area with a distance of approximately 50 km, these observations proved to be correct. Many other shale samples have been investigated, such as Precambrian shales from India, Devonian ones from Spain and Plio/Pleistocene shales from western Germany.

Chromatograms in this project are not interpreted in terms of the nature of the easily volatilized organic compounds, but are made for visual comparison only, to record which chromatograms are identical and which have a different configuration.

A series of chromatographic identity cards have been compiled for the Upper Triassic stratigraphic units, representing 200 collected samples. Hopefully, these cards will serve as a comparative standard in the future.

Information regarding the nature of those organic compounds, which are volatile in water vapour and are the essence of paleosmell, is given by Schwab in part II of the reviewed publication. He uses pulse-polarography to investigate various clay-stones and gives a description of his method. Most of the samples investigated contained polarographically active compounds giving characteristic polarograms. These compounds being the source of the paleosmell apparently are aldehyds, ketones, terpene-aldehyds and terpen-ketones, possibly also aromates and heterocyclic compounds.

The polarograms received proved to be identical within the same stratum. A valuable point is that Precambrian samples, as expected, do give characteristic polarograms, which are quite different from the Mesozoic ones. This may reveal what type of compounds existed in the Precambrian biology and in the primeval atmosphere. It may bring out such important information as when and where the first animals appeared and started to compete with the all dominating algae.

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.

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Fossil and Living Dinoflagellates

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

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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, expecially 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 *archeopyle*, 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