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Paleobiogeography

Examples from the Sponge Bioherms and Bedded Limestones in the Lower Malm of South Germany

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In the deposits of the epicontinental sea at the border of Oxfordian Tethys only two facies are to be found: bedded cryptocrystalline limestones and marls and bioherms of sponges. This uniformity provides an ideal chance to study the relationship between microfauna and facies.

Of 132 species of Foraminifera only 86 are frequent. Thirty-one of these prefer the bedded facies, 14 the sponge environment. Moreover, the carbonate content has an influence on the microfauna: 12 species are restricted to layered deposits poor in carbonates. Four are the reverse. Twenty-eight species are indifferent both to facies and carbonate content. Only these are of some stratigraphic value.

Near the sponge bioherms or in the sponges smaller and cone-shaped species are frequent. The species preferring sponge facies are restricted to the immediate neighborhood of the bioherms.

This fact and the specific relationship between Foraminifera and carbonate content are of general interest. In this particular case, the microfauna proves the scarcity of bottom currents.

Foraminiferen und Fazies. Beispiele aus dem Malm Sueddeutschlands

EUGEN und ILSE SEIBOLD

Während des Oxford wurden im Schelfmeer am Nordrand der Tethys fast nur gebankte, mikrokristalline Kalke und Mergel, sowie Schwammriffe abgelagert. Diese Einheitlichkeit der Sedimente erlaubt es in idealer Weise, die Abhängigkeit der Foraminiferenfauna von diesen beiden Faziestypen zu studieren.

Von den 132 gefundenen Arten kommen 86 etwas häufiger vor. 31 davon bevorzugen die Bankfazies, 14 die Schwammfazies. Ausserdem ist der Kalkgehalt der Bankproben von Einfluss: 12 Arten sind auf kalkarme, 4 auf kalkreiche Schichten beschränkt. 28 Arten zeigen keinen Zusammenhang mit der Fazies oder dem Kalkgehalt. Nur diese können stratigraphische Hinweise liefern.

Die statistische Auswertung dieser Faunen zeigt, dass nach mehreren Diagrammen in Schwammnähe oder in den Schwämmen selbst, kleinere und häufig auch kegelförmige Arten stärker beteiligt und dass die schwammliebenden Foraminiferen eng an diese Gebiete gebunden sind.

Dies und die engen Beziehungen einiger Foraminiferen zu dem Kalkgehalt des Sediments lässt den Beweis zu, dass in diesem Meeresbereich keine nennenswerten Bodenströmungen aufgetreten sind.

Evaluation of Bathymetric Evidence Furnished by Marine Fossils

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The published record contains many references to bathymetric conditions under which fossil species are believed to have existed. However, such conclusions are often not based on intrinsic evidence, derived from study of the species or community itself, but rather on lithologic evidence, stratigraphic and paleogeographic conditions, or on evidence presented by associated faunas.

Such indirect evidence may be all that is available; for example, in the case of extinct groups without close living relatives: fusulines, tabulate corals, receptaculitids, trilobites, crystoids, blastoids, and others. If sufficiently many paleontologic and stratigraphic observations link such groups to designated bathymetric ranges, these can serve as bathymetric indicators, where other indications are absent, as possibly the fusulines.

In fossil groups having living relatives bathymetric range may be similar to that of the living forms. This conclusion will increase in validity as the present is approached. Conversely, caution is required with increasing geologic age. Because living Monoplacophora and stalked crinoids are found only in the deep sea, it does not follow that their Paleozoic ancestors were bathyal. On the contrary, such a conclusion would be demonstrably incorrect.

The bathymetric distribution of marine plants depends on light penetration. Thus, the geologically important calcareous algae have depth limits (Cloud, 1952, Teichert, 1958). On the other hand, for invertebrates (the commonest fossils in marine rocks) light is less important among the factors governing depth distribution than temperature, salinity, pressure, availability of nutrients, and bottom conditions.

Bathymetric conditions in ancient seas may be estimated from fossils by three different approaches, here arranged in order of decreasing reliability:

1. Analysis of faunas comprising species identical with, or closely related to living species of known bathymetric range.

2. Study of adaptational structures in fossils that suggest analogies with features in living forms of known bathymetric range.

3. Inductive reasoning based on observation of fossils in their stratigraphic relationships.