

PRAE-JURASSIC AND JURASSIC CALCAREOUS NANNOFOSSIL BIBLIOGRAPHY: AN UPDATE.

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A compilation of the literature regarding prae-Jurassic and Jurassic calcareous nannofossils was performed. Purposes of this work are:

- 1) to compile an up-to-date report of the available literature
- 2) to summarize the "state of the art" of our knowledge (taxonomy, biostratigraphy, evolution, paleoecology) on the prae-Jurassic and Jurassic nannofossils
- 3) to provide a framework for future research.

119 papers were considered. They deal with various localities from all over the world and are focused on various time intervals. Most of the papers deal with European localities. Particularly sections from France, Germany, and England have been extensively studied so far. In general, the most studied localities are medium to high latitude sites from the northern hemisphere and few papers deal with low latitude sections. Finally only two papers regard high latitude sites from the southern hemisphere (Falkland Plateau).

For what the age of the sediments is concerned, the Late Jurassic was the most studied interval. Several papers deal with the Early Jurassic; the Middle Jurassic was overlooked mainly because good Middle Jurassic sections are very rare.

Most nannofossil workers focused their studies on taxonomy and biostratigraphy. Very little attention was paid to the evolution and paleoecology of Jurassic nannofossils. Despite the large number of taxonomic papers, the Jurassic nannofossil taxonomy is still poorly established. Little agreement exists about the classification at ranks higher than the specific level. The proliferation of species is often an artifact due to different investigation techniques, to the preservation, and to a very restrictive taxonomic concept which overlooked the intraspecific variability.

The unclear taxonomy is also reflected in the Jurassic biostratigraphy. Twelve biozonations were proposed but none of them has been generally accepted. The nannobiostratigraphy was calibrated usually to the ammonite biostratigraphy and more rarely to the calpionellid zonation and/or the magnetostratigraphy.

Stratigraphic ranges of only few taxa were established but further investigations are required in order to determine the stratigraphical range of numerous species including several "markers". Recent works on the evolution of the oldest nannofossils seem to be promising for future improvement on biostratigraphy.

Moreover it must be noticed that a correlation between the boreal and the tethyan realms has never been attempted.

Illustrations of the papers generally comprise SEM and/or LM photographs. However, no papers report both SEM and LM photographs of the same specimens. Only few papers are illustrated with drawings or with TEM photographs.

All the informations are summarized in a scheme as follows: 1) author; 2) stratigraphic interval according to legend: "X" indicates that the entire interval is considered, "O" that the interval is partially studied; 3) area; 4) topics: "T" indicates that the paper includes taxonomic notes, "R" indicates that stratigraphic ranges are reported, and "B" indicates the presence of a biostratigraphic scheme as biozones and/or biohorizons; 5) the type of correlation used: "A" indicates that the ammonite biostratigraphy is considered, "P" indicates that the nannofossil data are calibrated to the paleomagnetic stratigraphy, and "C" indicates that the nannobiostratigraphy is integrated with the calpionellid zonation; 6) some general remarks; and finally 7) the type of illustrations (=ILL): "SEM" indicates that scanning electron microscope photographs are reported, "TEM" indicates the presence of transmission electron microscope pictures, "LM" indicates that light polarizing microscope photographs are shown, "DR" indicates that the illustrations consist of drawings, and "-" indicates that no illustrations are reported.

LEGEND

AGE: X = TOTAL O = PARTIAL

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|-----------|---------------|-----------|--------------|
| RHAETIAN | TOARCIAN | CALLOVIAN | BERRIASIAN |
| CARNIAN | PLIENSBACHIAN | BATHONIAN | TITHONIAN |
| NORIAN | SINEMURIAN | BAJOCIAN | KIMMERIDGIAN |
| PALEOZOIC | HETTANGIAN | AALENIAN | OXFORDIAN |

| AUTHOR | AGE | AREA | T | R | B | CORR A/P/C | REMARKS | ILL |
|-------------------------|-----------------------|-----------------------|---|---|---|---------------|-------------------------|-----------|
| ALLEMANN et al. 1975 | X O | SE Spain | X | X | X | X | | |
| AMEZIEUX 1972 | X X X X X | France | X | X | X | | | SEM LM |
| AUBRY & DEPECHE 1974 | X O | France | X | | | | <i>Schizosphaerella</i> | SEM LM |
| BALDI-BEKE 1965 | X O | Hungary | X | X | X | | | LM |
| BARNARD & HAY 1974 | X X X X X | S England N France | X | X | X | | | SEM |
| BOWN 1987 a | X X X X | Austria England | X | | | | evolution | |
| BOWN 1987 b | X X | | | | | | abstract | |

| AUTHOR | AGE | AREA | T | R | B | CORR A/P/C | REMARKS | ILL | AUTHOR | AGE | AREA | T | R | B | CORR A/P/C | REMARKS | ILL |
|---------------------------|-------------|--|---|---|---|---------------|--------------------------|-----------|---------------------------------|-----------------------|--------------------------------|---|---|---|---------------|--|-----------|
| BOWN 1987 c | X X X | Europe N Africa C Atlantic Ocean | X | X | X | X | evolution | SEM LM | COOPER & SHAFER 1976 | X O | Louisiana | X | X | | | | SEM |
| BOWN & COOPER 1987 | X X | | | | | | abstract | | CRUX 1984 | X X X O | SW Germany | X | X | X | X | | LM |
| BRONNIMANN 1955 | X O | Cuba | X | X | X | | | DR LM | CRUX 1987 a | X X O O | | X | | | | dimorphism evolution | SEM LM |
| BUKRY 1974 | X X O | E Indian Ocean DSDP LEG 27 | | | | | | | CRUX 1987 b | X X X | SW England | X | X | X | X | | LM |
| BUKRY 1975 | X X O | NW Pacific Ocean DSDP LEG 32 | X | | | | | LM | DEFLANDRE 1939 | X X X | France | X | | X | | <i>Stephanolithon</i> | DR |
| BUKRY & BRAMLETTE 1969 | X O | C Atlantic Ocean DSDP LEG 1 | X | | | | | TEM | DEFLANDRE 1970 | X X | N Africa | X | | | | | LM |
| CANUTI & MARCUCCI 1969 | X X | C Italy | X | | | | nannofacies | TEM | DEFLANDRE & DANGEARC 1938 | X X X | France | X | | | | <i>Schizosphaerella</i> <i>Stephanolithon</i> | DR |
| CEPEK 1978 | X O | C N Atlantic Ocean DSDP LEG 41 | X | | | | | SEM | DERES & ACHERITEGUY 1980 | X O | world-wide | X | X | X | | | LM |
| CEPEK et al. 1980 | X O | C Atlantic Ocean DSDP LEG 50 | X | | | | | | DI NOCERA 1971 | X X | S Italy | X | | | | | SEM |
| CHANNELL et al. 1987 | X X X | N Italy | X | X | X | X | | | DI NOCERA 1973 | X X X | C Italy | X | | | | | SEM |
| CITA & PASQUARE 1959 | X O | N Italy | X | | | | | DR | DI NOCERA & SCANDONE 1977 | X X X | Tethys | X | | | | | SEM |
| COOPER 1984 | X X | Tethys | X | X | X | X | quantitative analyses | | DOCKERILL 1987 | X X X X | England N France Germany | X | | | | | SEM LM |
| COOPER 1987 a | X X | | | | | | abstract | | DOCKERILL & DOCKERILL 1987 a | X X X X X | | | | | | abstract evolution | |
| COOPER 1987 b | X X | Russia | X | | | | | SEM LM | DOCKERILL & DOCKERILL 1987 b | X X X X X | | | | | | abstract systematic | |

| AUTHOR | AGE | AREA | T | R | B | CORR A P C | REMARKS | ILL | AUTHOR | AGE | AREA | T | R | B | CORR A P C | REMARKS | ILL | AUTHOR | AGE | AREA | T | R | B | CORR A P C | REMARKS | ILL | |
|--------------------------------|-----|-------------------|---|---|---|---------------|------------------|-----------|---------------------------|-----|---------------------------------|---|---|---|---------------|----------------------------|-----------|--------------------------------|-----|-------------------|---|---|---|---------------|--|--------------|-----------|
| ERBA & QUADRIO 1987 | | N Italy | X | X | | X | | SEM LM | GRUN & ALLEMANN 1975 | | Spain | | X | X | X | | | LEZAUD 1967 | | France | X | X | X | | | DR | |
| FANTINI SESTINI et al. 1981 | | N Italy | | | X | | nannofacies | SEM | GRUN & ZWEILI 1980 | | Switzerland | X | X | | | | SEM DR | LORD et al. 1987 | | Russia | X | | | | correlation with S England | SEM | |
| FLUGEL & FRANZ 1967 a | | Switzerland | | | | | nannofacies | TEM | GRUN et al. 1974 | | S Germany | X | | | | | SEM DR | MEDD 1971 | | England France | X | X | X | | | TEM SEM | |
| FLUGEL & FRANZ 1967 b | | Germany France | | | | | nannofacies | TEM | HAMILTON 1977 | | Portugal | X | X | X | X | | SEM LM | MEDD 1979 | | SE England | X | X | X | | | SEM LM | |
| FLUGEL & KEUPP 1979 | | S Germany | | | | | diagenesis | SEM | HAMILTON 1978 | | Scotland | X | | X | | | SEM | MEDD 1982 | | England | X | X | X | | overview | | |
| GAETANI & POLIANI 1978 | | N Italy | | | | X | | SEM | HAMILTON 1979 | | Portugal | X | X | X | X | | SEM | MONECHI & VIVIANA 1987 | | C Italy | | | | | abstract biostratigraphy | | |
| GALLOIS 1976 | | S England | | | X | | coccolith blooms | | HAMILTON 1982 | | S England | X | X | | | overview | SEM LM | MOSHKOVITZ 1972 | | Israel | X | X | X | | | biometry | LM DR |
| GALLOIS & MEDD 1979 | | S England | X | | X | | coccolith blooms | SEM | HAO 1983 | | world-wide | | | X | X | overview | | MOSHKOVITZ 1979 | | England | X | X | X | | <i>Schizosphaerella</i> | SEM LM | |
| GARTNER & GENTILE 1972 | | Missouri | X | | | | | TEM | KALIN 1980 | | Italy | | | | | <i>Schizosphaerella</i> | SEM | MOSHKOVITZ 1982 | | Austria | X | | | | <i>C. ziambachensis</i> | SEM LM | |
| GASPARKOVA 1982 | | W Carpathian | X | X | | | | SEM | KALIN & BERNOULLI 1984 | | C Atlantic Ocean DSDP LEG 79 | | | | | <i>Schizosphaerella</i> | SEM LM | MOSHKOVITZ & EHRLICH 1976 a | | Israel N Sinai | X | X | X | X | | paleoecology | SEM LM |
| GEEL 1966 | | SE Spain | X | | | X | | LM | KEUPP 1976 | | S Germany | X | | | | +Pithonella | SEM | MOSHKOVITZ & EHRLICH 1976 b | | Israel N Sinai | X | | X | | <i>Schizosphaerella</i> <i>C. crassus</i> | SEM LM | |
| GOY 1981 | | France | X | | X | | | SEM | KEUPP 1977 | | S Germany | X | | | | diagenesis + Pithonella | SEM | MOSHKOVITZ & EHRLICH 1981 | | Israel | X | X | | | | SEM LM | |
| GOY et al. 1978 | | France | | | | | abstract | | KEUPP 1978 | | S Germany | X | | | | morphometry | SEM | MOSHKOVITZ & EHRLICH 1987 | | world-wide | X | X | | | <i>W. manvatae</i> | SEM LM | |
| GOY et al. 1979 | | France | X | | | | nannofacies | SEM | JAFAR 1983 | | Austria S Germany | X | X | X | | overview | SEM LM | NICOSIA & PALLINI 1977 | | Italy | | | X | | | TEM | |

| AUTHOR | AGE | AREA | T | R | B | CORR | A | P | C | REMARKS | ILL | AUTHOR | AGE | AREA | T | R | B | CORR | A | P | C | REMARKS | ILL | AUTHOR | AGE | AREA | T | R | B | CORR | A | P | C | REMARKS | ILL |
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| NOEL 1957 | X X X X | Algeria | X | X | X | | | | | | DR | ROOD et al. 1971 | X X X | England | X | | X | | | | | | SEM | THIERSTEIN 1973 | X X X | Tethys | X | X | X | X | | | | | SEM LM |
| NOEL 1958 | X X X | Algeria | X | | X | | | | | | DR | ROOD et al. 1973 | X X X | England N France | X | | X | | | | | | SEM | THIERSTEIN 1975 | X X X | SE France N Atlantic Ocean W Pacific Ocean | X | X | X | X | | | | | |
| NOEL 1961 | X X X | Morocco Tunisia Algeria Oklahoma | X | | | | | | | | DR | ROTH 1973 | X X X | C Pacific Ocean DSDP LEG 17 | X | X | | | | | | | LM | THIERSTEIN 1976 | X X X X | world-wide | X | X | X | X | X | | | | LM |
| NOEL 1965 | X X X | Europe Algeria | X | | | | | | | | TEM | ROTH 1978 | X X X | N Atlantic Ocean DSDP LEG 44 | | | X | | | | | | SEM LM | TREJO 1960 | X X | America | X | X | | | X | | | LM | |
| NOEL 1972 | X X X | France England | X | | | | | | | nannofacies | SEM | ROTH 1983 | X X X | C Atlantic Ocean DSDP LEG 76 | X | X | X | X | | | | | LM | TREJO 1969 | X X | Mexico | X | | | | | | | <i>C.mexicana</i> | LM |
| NOEL 1978 | X X X | France | | | | | | | | nannofacies | SEM | ROTH 1986 | X X X X X | world-wide | | | | | | | | evolution paleoceanography | - | WIEGAND 1984 a | X X X | NW Africa | X | | | | | | | | SEM LM |
| PERCH-NIELSEN 1985 | X X X X | world-wide | X | X | X | | | | | overview | SEM LM | ROTH in press | X X X X | world-wide | | | | | | | | evolution | - | WIEGAND 1984 b | X X X X | C Atlantic Ocean DSDP LEG 79 | X | X | | | | | | | SEM LM |
| PIRINI 1971 | X X X | Turkey | X | | | | | | | | TEM | ROTH et al. 1983 | X X X | C Atlantic Ocean DSDP LEG 76 | X | X | X | X | | | | | - | WILCOXON 1972 a | X X X | N Atlantic Ocean DSDP LEG 11 | X | X | | | | | | TEM | |
| POSCH & STRADNER 1987 | X X X | Austria | X | X | | | | | | | LM | SCHMIDT 1978 | X X | N Atlantic Ocean DSDP LEG 44 | X | X | | | | | | | SEM | WILCOXON 1972 b | X X | N Atlantic Ocean DSDP LEG 11 | X | | | | | | | | |
| PRINS 1969 | X X X | England France W Germany | X | X | X | X | | | | | DR | SINGH 1975 | X X | India | X | | | | | | | | LM | WIND 1978 | X X | NW Atlantic Ocean DSDP LEG 44 | X | X | X | | | | | | LM |
| PRINS & DRIEL 1987 | X X X | England France Germany | | | | | | | | abstract evolution paleoceanography | - | SISSINGH 1977 | X X X | world-wide | | | X | | | | | | DR | WIND & WISE 1976 | X X | Falkland Plateau | | | O | | | | | SEM | |
| PROTO DECIMA 1974 | X X X | E Indian Ocean DSDP LEG 27 | | | X | | | | | | LM | SISSINGH 1978 | X X | stratotypes | | | X | | | | | | - | WISE & WIND 1976 | X X | Falkland Plateau DSDP LEG 36 | X | X | | | | | | | SEM LM |
| REINHARDT 1966 | X X X | Central Europe | X | | | | | | | | TEM LM | STRADNER 1963 | X X X X | world-wide | X | X | | | | | | | DR | WORSLEY 1971 | X X | W Atlantic Ocean | X | X | | | | | | | LM |
| ROOD & BARNARD 1972 | X X X | England N France | X | X | X | | | | | evolution of <i>Stephanolithon</i> | TEM LM | THIERSTEIN 1971 | X X | SE France W Atlantic Ocean | X | X | X | X | | | | | SEM LM | YOUNG et al. 1986 | X X X | S Italy | X | X | X | | | | | | SEM LM |

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