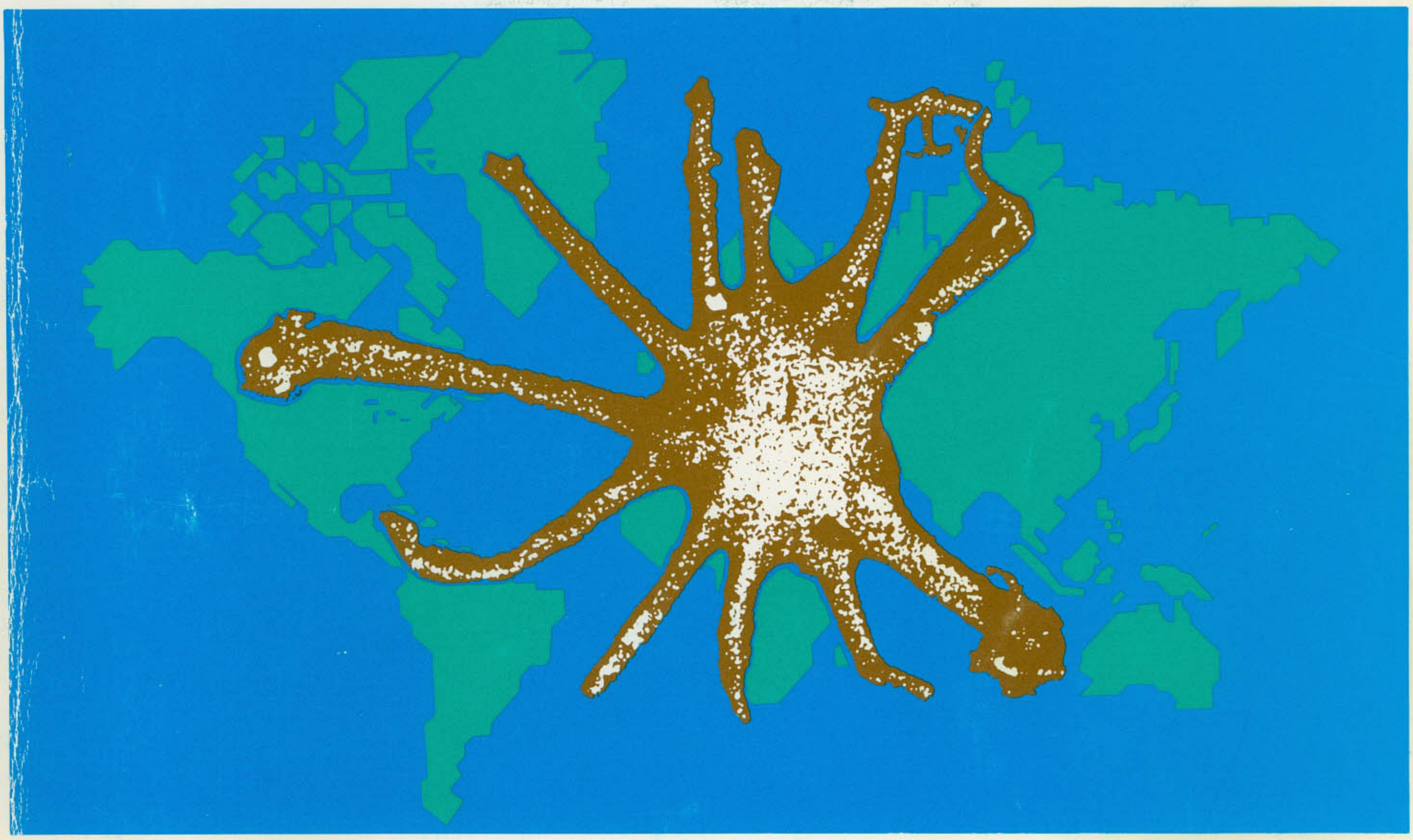
NATO Advanced Study
Institutes Programme

International Workshop on
Agglutinated Foraminifera
(IWAF III)

International Advanced Course on:

Paleoecology, Biostratigraphy, Paleoceanography, and Taxonomy of Agglutinated Foraminifera

Tübingen, West Germany,
17-28 September, 1989



Programme, Abstracts, and List of Participants

Programme

The time schedule may change according to the participation of some speakers.

M O N D A Y 18 September

9:00
Introduction: Ch. Hemleben, D. Scott and W. Kuhnt

Biology and Ecology of Agglutinated Foraminifers: 9:30-14:40

9:30-10:00
Tendal, O.: Why are Foraminifera Foraminifera? And are all of them that?

10:00-10:20
Hemleben, Ch.: Open questions in agglutinating Foraminifera.

10:20-10:50
Bender, H.: Chamber formation and biomineralization in Textularia candeiana kenyaensis BANNER & PEREIRA.

10:50-11:20: Coffee Break

11:20-11:40
Podobina, V.M.: Wall composition and microstructure of agglutinated Foraminifera.

11:40-12:00
Piller, W.: Agglutinated and microgranular foraminiferal tests - a comparison.

12:00-14:00 Lunch

14:00-14:20
McNeil, D.H. et al.: Colouration and silicification - agglutinated foraminifers as indicators of organic maturity level and burial diagenesis.

14:20-14:40
Zheng, S.: The agglutinated Foraminifera of the South China Sea.

Taxonomy of agglutinated Foraminifera: 14:40-17:10

14:30
~~14:40~~-15:10
Berggren, W.A. and Kaminski, M.A.: AA : BB (Abyssal Agglutinants : Back to Basics).

15:10-15:30
Hohenegger, J.: Problems in higher categorical classification of agglutinating Foraminifera.

15:30-16:00 Coffee Break

16:00-16:30
Brönniman, P and Whittaker, J.E.: A revision of the Trochamminacea and Remaneicacea of the Plymouth District, S.W. England, described by Heron-Allan & Earland (1930).

16:30-16:50
Neagu, Th.: GEROCHAMMINA n.g. and related genera from the Upper Cretaceous flysch benthonic foraminiferal fauna-Eastern Carpathians-Romania.

16:50-17:10
Charnock, M.A. and Jones, R.W.: Taxonomic notes on some agglutinated Foraminifera from the Paleogene of the central North Sea.

TUESDAY 19 September

Shallow water and shelf agglutinated Foraminifera: 8:30-11:40

8:30-9:00
Nagy, J. et al.: Facies controlled distribution of Foraminifera in the Jurassic North Sea Basin.

9:00-9:20
Al-Harithi, T. and Weidich, K.F.: Agglutinated Foraminifera from the Cenomanian rocks of Jordan.

9:20-9:40
Koutsoukos, E.A.M.: Stratigraphy and environmental control on the distribution of agglutinated Foraminiferal paleo-communities in the mid- to late Cretaceous succession of the Sergipe Basin, NE Brazil.

9:40-10:00
Matsushita, S. and Kitazato, H.: Seasonal changes of Trochammina hadai UCHIO at Hamana Lake, Japan.

10:00-10:30 Coffee Break

10:30-10:50
Scott, David, B. et al.: Recent marsh Foraminifera from the east coast of South America: Comparison to the northern Hemisphere.

10:50-11:20
Medioli, F.S. et al.: Cretaceous thecamoebians from Ruby Creek (Alberta), Canada.

11:20-12:00 Discussion on NATO ASI / IWAF III proceedings

12:00-14:00 Lunch

Deep water agglutinated Foraminifera: 14:00-16:20

14:00-14:30
Gooday, A.J.: Deep-sea agglutinated Foraminifera.

14:30-14:50
Thies, A.: On the distribution, ecology and taxonomy of Crithionina FLINT 1899.

14:50-15:20
Rajshekhar, C.: Shallow water arenaceous foraminifera from nodular limestones, Bagh beds, Madhya Pradesh, India.

Tendal, O., xenophyophoride

Gooday, A., Fluf.

15:20-15:50
Malata, E. and Oszczypko, N.: Deep water agglutinated foraminiferal assemblages from the upper Createaceous red shales of the Magura Nappe / Polish Outer Carpathians.

15:50-16:20
Kuhnt, W.: Late Mesozoic deep-water agglutinated Foraminifera from the western Tethys and North Atlantic.

16:20 - 18:00 Microscopic session

18:30 Start from the Institute to celebrate the Conference Dinner at the castle "Hohenentringen"

WEDNESDAY 20 September

High Latitude agglutinated Foraminifera: 8:30- 11:30

8:30-9:00
Schröder-Adams, C.: High-latitude agglutinated Foraminifera: Prydz Bay (Antarctica) vs. Lancaster Sound (Canadian Arctic).

9:00-9:30
Gillmore, G. K.: Tertiary agglutinated Foraminifera from the central and southern North Sea.

9:30-10:00
Henderson, A.: Eocene agglutinated Foraminifera from the BP hole F6-2, Forties Field, North Sea.

10:00-10:30 Coffee Break

10:30-11:00
McNeil, D.H.: Foraminiferal biostratigraphy and seismic sequences - examples form the Tertiary of the Beaufort-Mackenzie Basin, Arctic Canada.

11:00-11:30
Kaminski, M.A.: Deep-Water agglutinated Foraminifera as paleohydgraphic indicators: connections between the North Atlantic and the Norwegian-Greenland Sea.

11:30-12:00 Introduction to the Field Excursion

Group Photo.

12:00-14:00 Lunch

Agglutinated Foraminifera of the Tethyan Realm: 14:00-15:30

14:00-14:30
Coccioni, R. and Bellagamba, M.: Deep-water agglutinated Foraminifera from the Massignano section (Ancona, Italy), a proposed stratotype for the Eocene-Oligocene boundary.

14:30-14:50
Altiner, D.: Berriasian-Hauterivian foraminiferal biostratigraphy in northwestern Anatolia (Turkey).

14:50-15:10
Shahin, A.: Agglutinated benthic Foraminifera from the late Cretaceous to early Tertiary succession of Gebel Ekma, southwestern Sinai, Egypt.

15:10-15:30

Kaminski, M.A. et al.: A true abyssal lower Cretaceous agglutinated foraminiferal assemblage from ODP Site 765 (Argo Abyssal Plain): Implications for Tethyan paleobiogeography.

15:30-16:00 Coffee Break

16:00-18:30 Poster session

Geroch, S. Lower Cretaceous AF from Poland

T H U R S D A Y 21 September

Biostratigraphy: 8:30-11:50

8:30-9:00
Hart, M.B.: Cretaceous agglutinated Foraminifera of the UK; a review.

9:00-9:20
Talwar, A.D.: Upper Albian to lower Cenomanian agglutinating Foraminifera from the Glyndelbourne Borhole, south England.

9:20-9:40
Govindan, A. and Chidambaram, L.: Early Cretaceous agglutinated Foraminifera from Kutch, India and its biostratigraphic significance.

9:40-10:00
Schröder-Adams, C. and McNeil, D.H.: Distribution of Oligocene - Miocene agglutinated foraminifers in deltaic and deep-water facies of the Beaufort - Mackenzie Basin, Arctic Canada: Preliminary results.

10:00-10:20
Luczakowska, E.: The agglutinated Foraminifera in Stratigraphic Sequences of the Miocene in Poland.

10:20-10:50 Coffee Break

10:50-11:20
De Klasz, I. & De Klasz, S.: Deep water (bathyal) agglutinated Foraminifera of Danian age from Bavaria; their comparison with coeval assemblages from Senegal and Trinidad.

11:20-11:50
Medioli, F.S. and Scott, D.B.: Fossil Thecamoebians as biostratigraphic and paleoecological indicators.

11:50-14:00 Lunch

Agglutinated Foraminifera in oxygen-depleted environments: 14:00-15:20

14:00-14:20
Almogi-Labin, et al.: Agglutinated Foraminifera in organic rich carbonates, Upper Cretaceous, Israel.

14:20-14:40
Govindan, A.: Cretaceous anoxic events, sea level changes agglutinated Foraminifera in Cauvery Basin, India.

14:40-15:00
Alve, E.: Agglutinated Foraminifera in the oxygen depleted Drammensfjord, SE Norway.

15:00-open end: microscopic sessions and "ad hoc" working groups

Abstracts

AL-HARITHI, T. & WEIDICH, K.F.
(Natural Resources Authority, Amman, Jordan; Institut für Paläontologie u. hist. Geol. Universität München)

Agglutinated foraminifera from the Albian and Cenomanian of Jordan

A stratigraphic and paleoecologic analysis was made of agglutinated foraminifera, in particular of Pterammina, Thomasinella, Hemicyclammina, Daxia, Nezzazata, Simplorbitolina, Orbitolina (Mesorbitolina) and other genera, in six wells and outcrops of the socalled "Cenomanian" of Jordan.
For the first time a Middle Albian age with Simplorbitolina conula SCHROEDER could be established for part of the Naur Formation, which ought to be of Cenomanian age. The occurrence of complex agglutinated warm and shallow water benthonic foraminifera indicates that sediments were deposited mostly under warm and shallow warine environment on the continental shelf.
Oligospecific foraminiferal faunas mostly consisting of Hemicyclammina and related genera show somewhat restricted environments (at least) for sandy and marly intercalations, e.g. embayments or lagoons.

Canaliculate:
Clavulina
Pseudogaudryina

Non-canaliculate
- less resistant to dissolution.

Altiner

N Turkey was Southern Margin of Europe. S Turkey belongs to Gondwana.

Some Lower Cretaceous larger agglutinates were restricted to the Gondwana Margin.

A major fault zone transverses N. Anatolia. Lower Cr. sediments are limestone

Tithonian - Berriasian: Carbonate platform

Late Valanginian: Subsiding margin, Marley sediments.

Nice photos in this section

ALMOGI-LABIN, A., BEIN, A. and SASS, E., Geological Survey of Israel, 30 Malkhe Yisrael, Jerusalem, 95501, Israel.

AGGLUTINATED FORAMINIFERA IN ORGANIC RICH CARBONATES, UPPER CRETACEOUS, ISRAEL

High productivity levels in tectonically controlled basins in the southeastern Tethys created dysaerobic to anoxic bottom-water conditions reflected by deposition of organic-rich sediments and phosphorites. Benthonic foraminifera in general, and agglutinated ones in particular were found to reflect the local fluctuations in the degree of restriction in bottom water in two basins, one in southeastern and one in western Israel, from the Campanian through the Maastrichtian.

The most restricted bottom-water conditions in the area prevailed during the Late Campanian in the southeastern Zin Valley and is characterized by an extremely low diverse benthonic population completely devoid of agglutinated foraminifera. The agglutinated species *Gaudryina pyramidata* and *Spiroplectammina laevis* were the first to appear in the still nearly anoxic bottom-water conditions in the Early Maastrichtian.

In the western, less restricted basin of the Shefela, the uppermost Campanian sediments reflect a dysaerobic environment, and they contain a more diversified assemblage including the following species: *Gaudryina cretacea*, *G. laevigata*, *G. rugosa*, *Pseudoclavulina clavata*, *Pseudogaudryinella colombiana*, *Siphogaudryina stephensoni* and *Spiroplectammina laevis*. During the Early Maastrichtian, more restricted near-anoxic conditions similar to those in the Zin Valley basin prevailed, and the same agglutinated species occur in very low numbers. An upward increase in agglutinated population was noted during the Middle Maastrichtian. This most diversified assemblage contains also *Arenobulimina*, *Clavulina*, *Dorothia* and *Gaudryina pyramidata*. This peak in abundance and diversity of agglutinated species coincides with the relatively high, diverse populations of other groups in this basin and though still dysaerobic, reflects the most aerated bottom-water conditions of the whole period.

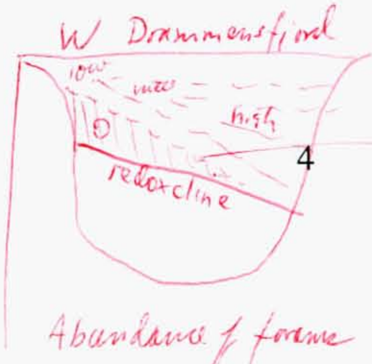
ALVE, E.
Institute of Geology, University of Oslo, Norway

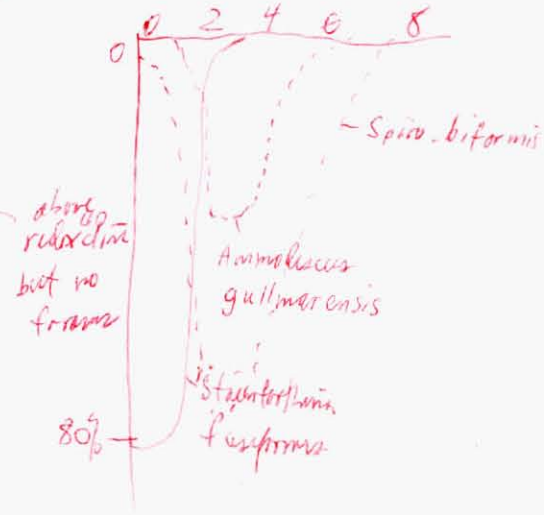
Agglutinated foraminifera in the oxygen depleted Drammensfjord, SE Norway.

The main objectives of the present study are threefold: 1) to increase our knowledge of how benthic foraminifera respond to depleted oxygen conditions, 2) to detect horizontal pollution gradients within the study area, and 3) to make a basis for comparison with assemblages from sediment cores penetrating through polluted sediments in the area.

Drammensfjord is an enclosed estuary, separated from the adjoining Oslo fjord by a sill at 10m water depth. Because of high supply of reactive organic material and infrequent deep water renewal (a pronounced halocline at sill depth), dissolved oxygen is depleted, resulting in anoxic conditions in the deeper parts (from about 40m to 124m water depth). Q-mode factor analysis of samples from six profiles has distinguished six factor units (assemblages). Their distributions are compared to the prevailing hydrographic conditions. The surface sediments from 1-10m water depth contains a low diversity Miliammina fusca assemblage. With increasing water depth, it is succeeded by four different agglutinated assemblages, dominated by Astrammina sphaerica, Eggerelloides scabrus, Spiroplectammina biformis and Ammodiscus gullmarensis respectively. In the middle and southern part of the fjord, the agglutinated components diminish towards the redoxcline, and, when the oxygen concentration falls below 2.0ml/l, the assemblage is totally dominated by the calcareous Stainforthia fusiformis. The distribution of assemblages, total abundance, and diversity-indices suggest that the north-western side of the fjord is more strongly polluted than the south-eastern side.

O_2 content = 0 below 40m, because of strong halocline. Pollution caused permanently anoxic bottom water.





BENDER, H.
Geol.-Pal. Inst. d. Christian-Albrechts-Univ. zu Kiel, Ludwig-Meyn-Str. 12, Kiel, FRG

Chamber Formation and Biomineralization in *Textularia candeiana kenyaensis* BANNER & PEREIRA

A generalized model of chamber formation in calcitic cementing agglutinated foraminifers has been established and will be presented. Chamber morphogenesis was studied in laboratory cultured *Textularia candeiana kenyaensis*, using light, scanning and transmission microscopes.

Test grows for 6 months. Test grows vertically on substrate, with proloculus in the air.

A basic pattern of chamber formation can be subdivided into six stages.

Stage 1: Collection of particles to form a detritic cover. Detritic cover serves as protection, particles are transported in vacuoles.

Stage 2: Development of the chamber lumen and sorting of particles inside the detritic cover.

Stage 3: Selection of particles for the new chamber wall. Arrangement of these particles on the construction front, starting on the second-youngest chamber of the test and continued towards the aperture. Simultaneously, organic enveloping and organic cementation of each particle. All spp show grains that are completely enveloped with organic cement.

Stage 4: Deposition of biomineralized calcite from the distal to the proximal chamber wall. Development of a pore system by oriented deposition of the biomineralizate, forming cylindrical cavities. Interstitial space completely taken up by calcite bundles. Grows from outside → inside. Pores then develop.

Stage 5: Organic lining of these pores.

Stage 6: Forming of a thin organic sheet inside the chamber, after leaving the detritic cover. Development of the multilayered "inner organic lining" during continuous test growth. Pores are then covered by the inner lining. The I.O.L is a thin sheet. It becomes thicker with ontogeny. When a new chamber is added, each previous chamber gets a new organic layer.

The construction process from stage 1 to stage 5 is commonly completed within 24 hours.

These observations are considered to be important for the discussion of taxonomic interrelations and phylogeny.

Pore system may serve as a transport function. Develops during calcification of calcite bundles. Calcite bundles do not dissolve to form pores. Why are pores later blocked by the inner lining

All calcareous-cemented forms observed so far have pores.

BERGGREN, W.A., Woods Hole Oceanographic Inst., Woods Hole, MA and
KAMINSKI, M.A., Dalhousie University, Halifax, Nova Scotia, Canada

AA:BB (Abyssal Agglutinants:Back to Basics)

History has a habit of coming full circle and repeating itself. Early studies nearly a century ago on deep water agglutinated benthic foraminifera were devoted to their utility in biostratigraphic correlation and paleoenvironmental interpretation in hydrocarbon bearing upper Cretaceous and Paleogene flysch basins in the Carpathian Mountains of Poland. Recent studies on the distribution of living deep sea agglutinants coupled with detailed analyses of their stratigraphic distribution in deep sea Mesozoic and Cenozoic sediments and marginal basins, are now rendering this group more useful in hydrocarbon exploration in flysch-type environments. However, interpretative analyses in applied biostratigraphy, paleobathymetry, and paleoecology rely upon a sound taxonomy. This can only be achieved by recognizing the need for comparative examination of museum-based type collections and specimens in order to provide accurate descriptions (including discriminatory features) of taxa and to reduce the list of superfluous synonyms. We shall review problems in the taxonomic history of several representatives of this group by way of illustrating the pressing need for a return "back to basics."

BRÖNNIMANN, P. & WHITTAKER, J.E.

Thonex, Geneva and British Museum (Natural History), London

A revision of the Trochamminacea and Remaneicacea of the Plymouth District, S.W. England, described by Heron-Allen & Earland (1930)

Of the 258 species and varieties of foraminifera recorded by Heron-Allen & Earland nearly sixty years ago form the vicinity of Plymouth, S.W. England, 42 were agglutinating, of which 6 were placed by them in the genus **Trochammina**. The species were **T. squamata** Jones & Parker, **T. rotaliformis** Heron-Allan & Earland (but attributed by them to Wright), **T. ochracea** (Williamoon), **T. plicata** (Terquem), **T. inflata** (Montagu) and **T. inflata** var. **macrescens** Brady. Neither **inflata** nor **macrescens**, said to be represented by single individuals, can be found in their collections and are suspected to be mis-identifications. Of the others, identifications can be confirmed for **rotaliformis**, **ochracea** and **plicata** and these are now placed in the genera **Deuterammina (Deuterammina)**, **Deuterammina (Lepidkodeuterammina)** and **Remaneica**, respectively. The record of **T. squamata**, like many citations of this species at the time and subsequently, is not correct; the specimens identified by Heron-Allen & Earland are now referred to a new species of **Tritaxis**. In addition, a further 13 species of Trochamminacea and Remaneicacea, 6 of them new and 3 left in open slide collection (the so-called "Type-Slide Collection") in the British Museum (Natural History), and are described herein. The aperture of **Remaneica** is shown in detail for the first time and is of the **Deuterammina**-type.

The fauna is one of the most diverse belonging to these groups so far found in the British Isles and has some affinities with more Southern waters.

Textulariina are completely heterogeneous & needs to be split off.

Heron-Allen & Earland collection in revision - Classic Palaeontologists in 19th Cent. Britain had a very wide species concepts. Impossible to use many of the old names because apertural characters are unknown.

Höglund: most spp are lost. Some in Stockholm.

Brönnimann: Wants to split off as a separate high-order group all forms which have an inner, non-canaliculate, ~~non porous~~ imperforate wall bounded by an inner & outer layer.

2 main Families:

Trochamminidae

Adercotrymidae

Subgenera: e.g. Lepidodeuterammina

Environmental as well as morphological significance

Recommendations:

use "Trochammina sensu lato" if you don't see apertures.

CHARNOCK, M.A. & JONES, R.W.

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Taxonomic Notes on Agglutinated Foraminifera from the Paleogene of the Central North Sea

Taxonomic notes are given for all the most common species of agglutinated foraminifera from the Paleogene of the Central Graben and South Viking Graben areas, Central North Sea. The systematics of Gradstein and his co-workers are partly revised and supplemented with additional species. Many of the North Sea species were originally described by Grzybowski from the Polish Carpathians and this paper focuses in part on a comparison of the North Sea and Polish material.

- flysch-type
- calc barren
- Volcaniclastic associations:

Taxonomic Problems with reference to 3 groups:
- Rzehakinidae
- Trochamminidae
- Cyclamminidae

Rzehakinidae:
Spirosigmoilinella sp. 1 problem:
is it an alternate generation of Rzehakina minima.

S. schlumbergeri: LLT put it in the miliolidae. ? Put Sigmoilopsis in the agglutinated group?

Trochammina:
"T. globigeriniformis" put in "Paratrochammina challengeri"
"T. ruthven-murrayi" put in new genus of Seiglie & Baker.
Aperture Trochammina-like. No modern representatives.

Cyclammina:
C. rotundidorsata – Samuel ?? "does not have alveoles"
Puts it in Cyclammina orbicularis.
C. placenta: "No pores"
Areal pores begin in early middle Eocene.
? Can we use it as a character at the genus level
? Development of pores may be ecological response.
? What are apertural characters of placenta in type specimens?

Volcaniclastic Association
Trochamminids
Haplophragmoides
Thurammina
Ammod.-Glomosp.

"Phenacophragma"-like forms described as _ uhligi by Schubert 1901
- Is degree of alveolar structure related to water depth or decreased oxygen levels?
- Do they show width variations with time?

Eocene/Oligocene Stratotype. Multiple Microfossil, Magneto, chemo stratigraphy.

COCCIONI, R. & BELLAGAMBA, M. ICP Proj 174
Istituto di Geologia, Università di Urbino, Italy

Deep-water agglutinated foraminifera from the Massignano section (Ancona, Italy), a proposed Stratotype for the Eocene-Oligocene boundary

As part of a long-term detailed investigation into a better understanding and application of the Cretaceous-Neogene agglutinated foraminifera taxonomy, paleoecology and stratigraphy in the Umbria-Marche basin, we have studied the well preserved deep-water agglutinated foraminifera assemblages from the Late Eocene-Early Oligocene pelagic section at Massignano. The Massignano sequence - the benthic foraminiferal data of which indicate it has been deposited in a lower-middle bathyal zone - is characterized by exceptional stratigraphic, sedimentary petrologic, chemostratigraphic and geochronologic qualities which have recently motivated a proposal that this exposure should be considered as the World Type Section for the Eocene-Oligocene boundary (PREMOLI SILVA, COCCIONI & MONTANARI, 1988).

The species recognized - which belong to the genera Bathysiphon, Rhabdammina, Rhizammina, Pseudothurammina, Ammodiscus, Repmamina, Reophax, Haplophragmoides, Trochamminoides, Recurvoides, Spiroplectammina, Vulvulina, Trochammina, Arenobulimina, Dorothia, Karreriella, Textularia, Clavulina and Sigmoilopsis - are considered in terms of their taxonomy, ecology and biostratigraphic value. Therefore, it has been possible to detect some bioevents and faunal changes and arrive at some paleoenvironmental interpretations.

Close to the Eocene-Oligocene boundary the number of agglutinated foraminifera versus hyaline calcareous benthic forms increases while both benthic foraminiferal species diversity and test-size decrease. Such faunal variations coincide with a marked decrease in the $CaCO_3$ content and may therefore be related to change in productivity and/or to a pulse of terrigenous supply, the latter probably connected with tectonic activity. The events and faunal changes recognized at Massignano are correlated to the biostratigraphy based on calcareous nannofossils and both planktonic and benthic foraminifera, to the magnetostratigraphy and to the chemostratigraphy as well established in the sequence.

References:

PREMOLI SILVA, I., COCCIONI, R. & MONTANARI, A. (1988): The Eocene-Oligocene boundary in the Marche-Umbria basin. Int. Subcomm. Paleog. Strat., Spec. Publ., Tipografia Anniballi Ancona, 268 pp.

Scaglia Cinerea - Contains E0/Olig boundary, terrigenous.
Mid Eocene - some submarine volcanic events.

Biostrat Events

LO N. Truempyi Top zone NP18
Age: 33.7 ± 0.5 Ma with magnetozone 13 R1.
= Top Hantkenina

Fauna:
Recurvoides sp. found only near the E/O boundary.

Above isotope shift.

DE KLASZ, I., & DE KLASZ, S.
Nice, France

Deep water (bathyal) agglutinated Foraminifera of Danian age from Bavaria; their comparison with coeval assemblages from Senegal and Trinidad

Our material has been collected from an outcrop at Grub, near Eisenärzt, Bavaria, in 1952. Recent studies by the authors in the area has shown, that the outcrop, which is the type-locality of the calcareous benthic foraminiferal genus *Quadratobuliminella* de Klasz, 1953 is now overbuilt, and not anymore accessible. As *Quadratobuliminella* is considered by van Morkhoven et al. (1986) as a Cenozoic cosmopolitan deep water genus, this first detailed study of this assemblage is of special interest. Additionally, a considerable part of the assemblage shows strong similarities with the fauna encountered in deposits of nearly the same age from Senegal and also with recently revised Lower Paleocene agglutinated foraminifera of Trinidad (Kaminski et al., 1988).

To make the comparison more precise, we used a rather narrow species concept in our Senegal study and revised in this sense our material from that locality, especially as far as the more primitive arenaceous forms are concerned.

A separate note (in press) on the planktonic foraminifers permitted a more precise dating of our fauna (lower part of Blow's P2, *Morozovella uncinata* zone).

The bathymetric position of both faunas is middle bathyal based on benthic foraminifers and ostracods. In our opinion the bathymetry of the Bavarian material is less deep than the Senegal one. Unfortunately the ostracods in the Bavarian samples are extremely scarce and could not be used for paleoecologic interpretation. Both localities seem to be considerably less deep than the Trinidad *in situ* assemblages studied by Kaminski et al. (1988).

The agglutinated group represents approximately half of the benthic fauna approaching thus the proportion observed in the lower part of the Senegal section, but is lower than in the top level of our Marnes des Madelaines locality of Senegal.

The Bavarian agglutinated fauna shows also a considerable number of common species with that of Trinidad. A quantitative comparison is however not possible because of the difference in the counting method. Whereas in Trinidad only the fraction larger than 212 µm has been used for statistical study, in the Bavarian samples everything above 100 µm has been employed for quantitative purposes and in the Senegal material all the fossils over 125 µm. An experience with the 160 µm fraction has shown very important differences in the counting results.

Buchek Fm. / Buchecker Schichten

Belongs in the Buntmergel Series of the Ultrahelveticum. Majority of AF have fine to coarse-grained tests.

Grub – no S. [illegible], S. [illegible], common S. placenta.
– few calcareous [illegible]

~70–80% planktonics. Contain some trochamminacea (T-[illegible])

De Klasz's paleobathymetry = based on Sliter & Baker, Nyong & Olsson.
= ~1,000 m based on comparisons with Trinidad
= agrees well with Van Morkhoven et al estimate for Quadratobuliminia.

Comparisons with Senegal: has a X diagram comparing Senegal assemblage with Trinidad

Tubular forms are mostly silicified, finely aggl. & flat. more deep-water forms than Bavaria.

Senegal Less deep than Trinidad

Can we get some samples from Madelaine Shale of Senegal?

Gillmore

Outstanding photos of Komokiace. Komoki "Land" with contained bryozoans

GOODAY, A.J.
Institute of Oceanographic Sciences Deacon Laboratory, Wormley, Godalming, Surrey, U.K.

Deep-sea agglutinated Foraminifera

Increasingly, benthic Foraminifera are being recognised as an abundant, sometimes dominant taxon in deep-sea sediment samples. Agglutinated species often predominate, particularly in central oceanic regions below the carbonate compensation depth. In size, they span three orders of magnitude from minute tests ten microns or so across to tubes several centimetres long. Xenophyophores, deep-sea testate protists which in some respects resemble agglutinated foraminifers, may be even larger (>10cm). Recent biological samples, collected using the epibenthic sledge, box-corer and multiple-corer, have yielded diverse and abundant assemblages of fragile, soft, agglutinated species. Those found in the meiofaunal (42-1000μm) and macrofaunal (>1000μm) size ranges include small flask-shaped saccamminids (and allogromiids), forms which are apparently obligate inhabitants of globigerinacean tests, komokiaceans, various delicate, chain-like forms and a variety of "mud balls". Faunas encrusting hard substrates (Mn nodules, erratic stones etc) also consist largely of soft, delicate agglutinated foraminifers, for example, mats and networks of anastomosing tubules. The forms mentioned above include many new species and require urgent taxonomic attention.

Some deep-sea agglutinated foraminifers, for example, komokiaceans (and allogromiids), produce stercomata, intra- or extracellular waste pellets composed mainly of plate-like mineral grains. Taxa containing stercomata are probably deposit-feeders. The erect life-position of genera such as Pelosina (?and Rhabdammina) suggests suspension feeding. Other large species may be carnivorous and some small species probably ingest bacteria. Deep-sea agglutinated Foraminifera may also be either infaunal or epifaunal while attached species sometimes occupy elevated substrates. Their abundance, diversity and ecological versatility suggest that these protists play and extremely important role in deep-sea communities.

Meiofaunal Forams:
One form uses diatom frustules.

forams inhabits a Globigerina shell.

Saccammina w 2 aperture has stercomata

Allogromiid has stercomata

Allogromiid from 4,000 m remained alive for days. Ingested florescent microspheres.

Some DW Allogromids ingest bottom sediments and make lots of pelletised stercomata

Stercomata: made of clay - Waste products of deposit feeders.

Rhizammina algaeformis: decalcified tube shows median strand of protoplasm with stercomata.

Foram Eaters:
- juvenile starfish
- scaphopods.

Encrusting Forams: Glacial dropstones hence by encrusted whole stone covered with anastomosing tubules.

GOVINDAN, A., AND CHIDAMBARAM, L

OIL AND NATURAL GAS COMMISSION, MADRAS, INDIA

EARLY CRETACEOUS AGGLUTINATED FORAMINIFERA FROM KUTCH, INDIA AND ITS BIOSTRATIGRAPHIC SIGNIFICANCE

Kutch mainland in western India is known for its rich megafaunal remains in the exposed Jurassic-Cretaceous sediments. Microfaunal study of the exploratory wells drilled recently in this region resulted in the recognition of stratigraphically significant agglutinated foraminifera besides calcareous forms. In Sanadra well, the upper part of Jhuran Formation (Upper Jurassic-Early Cretaceous) has yielded agglutinated foraminifera such as Ammobaculites cretaceous (Reuss) Arenobulimina Sp.,. Dorothia kummi (Zedler) D.hauteriviana (Moullade) and D.hechti Dieni and Massari besides calcareous form as Lenticulina munsteri Roemer indicating a Hauterivian age (Early Cretaceous) to the section. This assemblage is closely followed downhole by the presence of Epistomina caracolla (Roemer), a diagnostic Early Cretaceous species in this well. These forms have been described and its biostratigraphic significance in the subsurface correlation is discussed.

CONCLUSIONS

1. AF are dominant components
2. Fragile - soft-bodied taxa are in urgent need of taxonomic attention
3. Most are epifaunal
4. Forms with stercomata are deposit feeders

GOVINDAN, A.

OIL AND NATURAL GAS COMMISSION, MADRAS, INDIA

CRETACEOUS ANOXIC EVENTS, SEA LEVEL CHANGES AND AGGLUTINATED FORAMINIFERA IN CAUVERY BASIN, INDIA.

Cauvery Basin located on the east coast of India is actively explored for hydrocarbons due to its thick pile of Cretaceous and Tertiary sediments. Paleobathymetric analyses of Cretaceous section in the wells indicate maximum sea level advances in mid-late Albian, Cenomanian-early Turonian, Santonian - early Campanian and late Campanian-Maestrehtian time. Unusual occurrence of low diversity agglutinated forminifera with rare calcareous forms are found in the sediments at these levels. Dark grey to black shales at these levels show high total organic carbon content values(TOC 2 to 6%) in wells Nannilam-2, Bhuvanagiri-1 and Raghunathapuram-1. These sediments are probably laid in Oxygen depleted water which would have eliminated less tolerant forms and favouring organic material to accumulate in a low energy environment between the submerged basement relief in this basin. Present study brings out that there are distinctly two and possibly three levels in which oxygen depleted anoxic waters transgressed onto the shelf coinciding with global oceanic anoxic events(OAE-1, OAE-2, OAE-3 (?)).

Agglutinated foraminifera found at these levels include representatives of *Glomospira*, *Bathysiphon*, *Haplophrogmoides* , *Ammodiscuss*, *Trochammina*, *Reophax*, *Textularia*, *Dorothia*, *Verneuilinoides*, *Recurvoides*, *Arenobulimina* and these have been reported and discussed.

LCAE: Expansion of O_2 Minimum Zone coincident with Sea-Level Rise

Late Campanian: Appearance of many new taxa. Is it a function of synchronous expansion of O_2 Minimum Zone & Sea-level Rise?

Anoxic Event can be separated into 9 layers. These layers show a stepwise extinction of benthics, planktonics, ostracodes, and lastly nannos.

Marssonellids: change in shape from base to middle part of Anoxic Event

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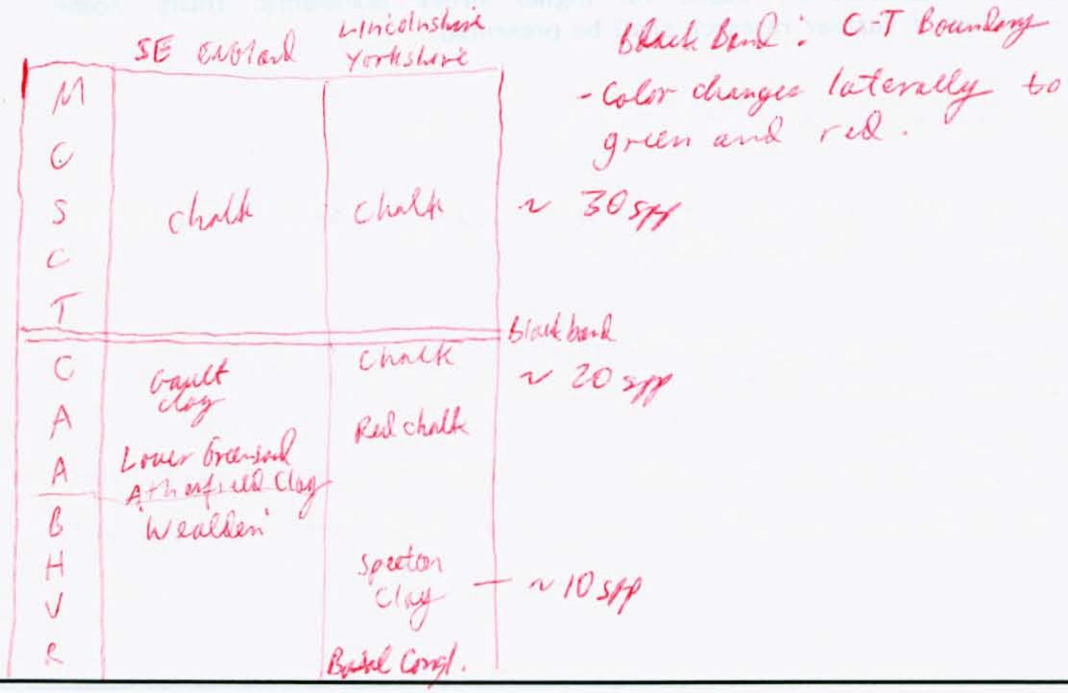
Cretaceous agglutinated Foraminifera of the UK; a review

The Cretaceous (Ryazanian to Maastrichtian) succession of the United Kingdom and adjacent areas of the North West European Continental Shelf provides a near-continuous picture of an evolving, mid-latitude agglutinated foraminiferal population. The taxa discussed belong to a wide spectrum of genera and while many of these are long-ranging, several species have been incorporated into basin-wide zonations. The dramatic change from a clastic-dominated Early Cretaceous succession to the pelagic chalks of the Late Cretaceous is not reflected in the population at the generic level but is marked at the species level. With the decreasing clastic input up the succession there are quite distinctive changes in the material being used by the agglutinated Foraminifera to construct their tests. The effects of changing sea level, anoxic/dysaerobic events and the diminishing grain size of the sediments are all documented, one of the most dramatic changes being that generated by the Late Cenomanian 'anoxic' event.



Diversity of AF increases through time to the Mid-Campanian. (Not related to sea-level). The paleobathymetry was ≈ constant because of large accumulation of chalk.

Arenobulimina: In Santonian there was no clastic sediments. all arenobul. switched to using sponge spicules. In Campanian they switched back to using quartz.

OTHER FORMS:

In Greensand horizon, AF used all the quartz in the sediment. (You can establish a zonation based on coarseness of aggl. alone. Some species agglutinate heavy minerals too.

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Open questions in agglutinating foraminifera

Agglutinated Foraminifera sometimes thought of as "excess baggage" in studies of biostratigraphy and paleoecology. Only recently a deep water biostratigraphy has been developed for sediments deposited below CCD. The ecological significance of agglutinated foraminifera is still mostly neglected as well as their biology.

Reproduction among agglutinated foraminifera has been observed only in very few species; chamber formation has been observed very rarely and not yet published. The ontogeny as well as life span of any species are almost unknown. Grain selection has been treated several times but no more than very few observation have been published. Even the cementation is little known and what has been described did not enter the taxonomic level as well as being treated in respect to evolution. Although some pioneering studies on the wall structure and cementation has been done on selected groups of agglutinated foraminifera much more work needs to be done in order to achieve a natural classification based on higher order taxonomic traits. Some examples of further research shall be presented.

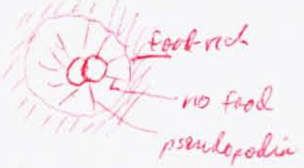
REproduction:
- Observed in Saccammina alba, but not among other spp.

Feeding:
- When Forams Feed, they grow. Food supply is highly seasonal. Spring bloom - much food. Do forams store food?

Grain Selection:
- Fine vs Coarse. What does it depend upon?
- Why do some species select certain size or materials?

Families vs. Cement:
- Still mixed taxonomy. Is calcareous vs organic cement a high-level character?
- C.H. wants to use cement as a high-ranking taxonomic character.

Feeding experiments:



Whittaker:
- splitting based on
Porous vs Non-porous wall.

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Eocene Agglutinating Foraminifera from BP hole FA 6-2, Forties Field, North Sea.

Initial findings from a study of Eocene material (depth 1800 - 2160 m sub-sea) from BP hole FA 6-2, Forties Field, North Sea, show a faunal assemblage comparable with other studies of this age and area.

Although the samples studied were "ditch-cuttings" and prone to caving contamination, it is apparent that the fauna is predominantly agglutinating in nature and bears resemblance to the so-called **Rhabdammina** fauna.

Predominant genera are: **Ammodiscus, Cyclammina, Glomospira, Haplophragmoides, Recurvoides, Rhabdammina, Rzehakina, Saccammina,** and **Spiroplectammina.**

The agglutinated assemblage disappears above 1800 m sub-sea which is comparable with the top of the Eocene (NSB 6), where a calcareous benthonic assemblage takes over.

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Problems of higher categorical classification in agglutinated foraminiferids

Within a general theory of classification the systematic position and categorical ordering of agglutinated foraminiferids will be discussed. So called "natural" classificatory systems are defined as cluster of objects or individuals, showing a homogeneity or cohesion by one or more characters within those clusters (classes), whereas the heterogeneity between the classes must be emphasized. The structures of classificatory systems are determined by the relationships between the objects. While only character states can be used for the determination of relationships. The evolution characterizing a process cannot itself be taken as an attribute for the classification. Thus, there is a "phenetic" system of organism based on the "form" of "appearance" on the one hand, and a "phylogenetic" characterizing the genealogic relationship on the other. Both systems may be regarded as natural, if they accord with the criterion of cohasion. There will therefore be two "natural" systems of agglutinating foraminiferids.

Hitherto most systems of organism have been based on phenetic relationships, but within these systems the problems of character weighting arises. Numerical phenetics prefers equal weighting of the characters, whereas evolutionary phenetics prefers equal weighting of the characters, whereas evolutionary phenetics given different weights to the attributes. The most modern systems of foraminiferids by Loeblich and Tappan 1987 is based on a monothetic classification process, whereby the ultrastructures of the test walls are considered as the most important and directly genetically controlled characters, followed by the number and arrangement of the chambers. This system lacks an objective and testable criterion for the categorical ordering within the classification, which will be shown in the following by different numerical phenetic and phylogenetic (cladistic) methods.

1. Inconsistency in hirarchy of character traits: Calcareous group: wall structure primary trait
AF: " " secondary trait.

Hohenegger's Law: During the development of a classification, the criteria used to separate taxa must not be changed!

eg: Some Allogromiids should be placed in Textulariids
" " split on basis of structure of Gametes! Why not other spores?

Phylogenetic approach not useful if you don't have a fossil record.
∴ Cladistics.
Based on morphology: make dendrogram for Aggl. Genera, to see how they cluster.

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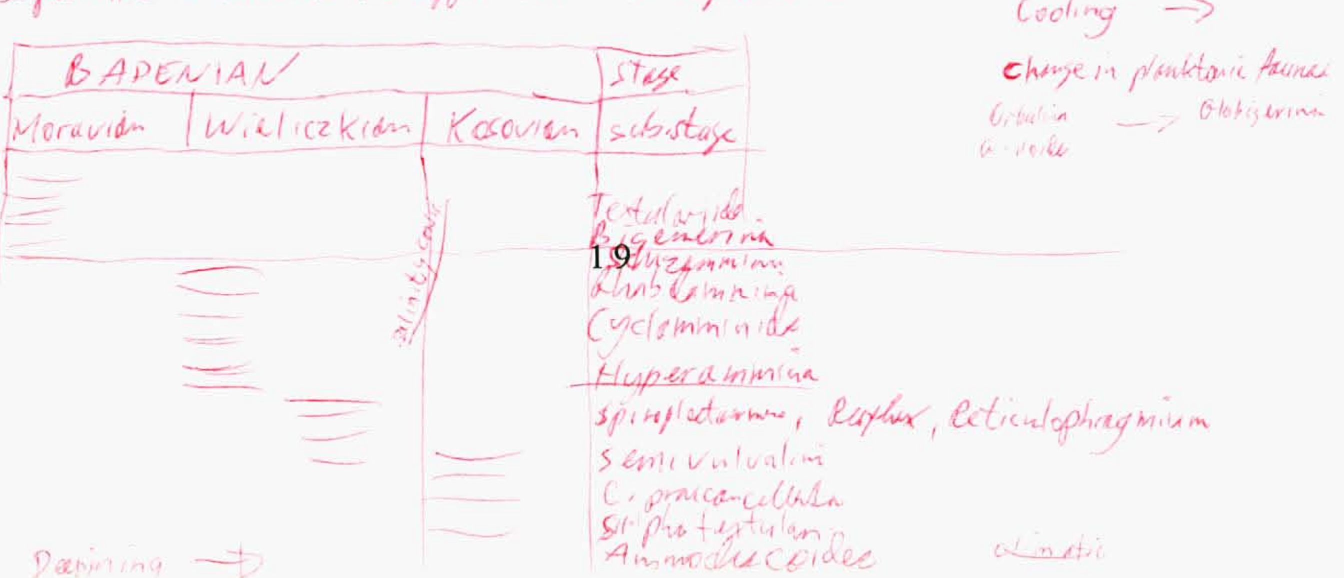
The agglutinated Foraminifera in stratigraphic sequences of the Miocene in Poland

The Miocene deposits of Poland occupy the Carpathian foredeep limited with the Carpathian margin in the South and the Holy Cross Mts and Roztocze Hills in the North. They represent mostly Badenian and Sarmatian Stages. In the central part of the basin rich assemblages of agglutinated Foraminifera occur, varying in stratigraphic sequences of Lower, Middle and Upper Badenian. The Lower Badenian assemblages are composed of the common species Spiroplectammina carinata, Karreriella gaudryinoides, K. bradi, Cylindroclavulina rudis, Bigenerina nodosaria, Martinottiella communis, Vulvulina pennatula, while in the northern margial deposits different species of Textularia and Textulariella are developed. Cylindroclavulina rudis may be regarded as the index species of this period having short stratigraphic range. Towards the end of the Lower Badenian a characteristic microfauna appears, the abundant occurrence of which is for the Middle Badenian typical. These are frequent specimens of Cyclammina pusilla, Haplophragmoides obliquicameratus, Hyperammina granulosa, H. taurinensis, Rhabdammina div. sp.

In the Middle Badenian besides the previously mentioned forms also Cyclammina bradyi, Cyclammina vulchoviensis, Spiroplectammina mariae, Hippocrepinella corrugis, Schizammina sp. occur. In the upper part of the Middle Badenian species typical of this period appear, namely Pseudotriplasia minuta, Reticulophragmium crassum, R. venezuelanum, Textularia serrata, T. pectinata, Reophax brevior. Pseudotriplasia minuta is regarded as the index fossil of the Middle Badenia.

This microfauna disappear at the beginning of the salinity crisis and a great part of the former species do not pass to the Upper Badenian, except Textularia pectinata and Haplophragmoides indentatus. In the Upper Badenian also new species appear, as Haplophragmoides planus, Siphotextularia inopinata, Textularia beregoviensis, Cyclammina praecancellata, Ammodiscoides miocenicus, Pavonitina styriaca, Hyperammina sp. Pavonitina styriaca represents in index fossil of the Upper Badenian.

In the Sarmatian deposits of Poland the agglutinated Foraminifera are not developed.



DEEP-WATER AGGLUTINATED FORAMINIFERA AS PALEOHYDROGRAPHIC INDICATORS: CONNECTIONS BETWEEN THE NORTH ATLANTIC AND NORWEGIAN-GREENLAND SEA.

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With the development of a uniform taxonomic data base and continuing studies of their paleoecology, paleobiogeography and biostratigraphy, Deep-Water Agglutinated Foraminifera (DWAF) are fast becoming important tools for detecting the timing and nature of deep-water paleocirculation changes. DWAF are especially useful in areas where carbonate sediments are underrepre-sented, such as in high-latitude areas of the North Atlantic where much of the deep water in the world ocean is produced. This talk presents new data obtained during ODP Legs 104 and 105 in the Labrador and Norwegian Seas. One of the goals of these legs was to determine the role played by the Greenland-Scotland Ridge as an oceanic gateway between the Atlantic and the Arctic.

ODP Site 646 in the Labrador Sea lies in the present pathway of Denmark Straits Overflow Water (DSOW). Drilling at Site 646 recovered a continuous sedimentary sequence which allows us to reconstruct the history of DSOW at the site over the past 9 m.y. Oxygen isotope evidence and changes in the coiling ratio of *Neogloboquadrina atlantica* point to a cooling of the East Greenland Current at around 8.5 Ma. Prior to ~7.5 Ma, a benthic foraminiferal assemblage with abundant *Nuttallides umbonifera* and smooth agglutinated forms point to a tranquil environment with old deep water. Above the regional seismic reflector R3 (dated at 7.5 Ma) the benthic assemblage is dominated by coarse agglutinated forms and species typical of modern North Atlantic Deep Water. This assemblage displays affinities to assemblages from the Norwegian-Greenland Sea, indicating that northern source deep water was present at Site 646. The faunal data agree with isotopic data at Site 608 which shows an increase in NADW at the time. Maximun overflow of DSOW is postulated to have taken place between 4.5 and 2.5 MA, which corresponds to the age of the sediment drift drilled at Site 646. The onset of drift formation is reflected by another benthic faunal turnover, noted by the loss of primitive agglutinated forms. This turnover suggests increased ventilation of the bottom water at Site 646. Drift formation ceased at 2.5 Ma, reflecting decreased bottom current velocities. The top of the sediment drift coincides with the first ice-rafted sediment.

The faunal turnovers and increased flow of DSOW at 7.5 and 4.5 Ma are probably related to late Miocene and early Pliocene climatic cooling events which increased the volume of deep water produced in the Norwegian-Greenland Sea.

NP 12-13 | Scotian Shelf : Bloom of Organic Microfossils on Scotian Shelf (Frank Ulicny)

A TRUE ABYSSAL LOWER CRETACEOUS AGGLUTINATED FORAMINIFERAL ASSEMBLAGE FROM ODP SITE 765 (ARGO ABYSSAL PLAIN): IMPLICATIONS FOR TETHYAN PALEOBIOGEOGRAPHY

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DAVID W. HAIG, DEPT. OF GEOLOGY,UNIVERSITY OF WESTERN AUSTRALIA, NEDLANDS.
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ODP Site 765 is located at 15°58'S, 117°34'E at a depth of 5,740 m on the Argo Abyssal Plain off NW Australia. A major objective at Site 765 was to study Cretaceous magnetobiostratigraphy, paleoceanography and deep-water paleoecology. Site 765 was drilled on normal oceanic crust which formed during the latest Jurassic, and a complete sequence of Berriasian to Maastrichtian sediments was recovered. The Berriasian to Hauterivian sedimentary units at the base of Hole 765C consist of dark reddish-brown claystones and silty claystones with minor chalk and radiolarites. The claystones contain a diverse assemblage of benthic foraminifera. The age of the unit is well-constrained by palynomorphs, radiolarians and nannofossils. Backtracking calculations indicate that the site underwent normal thermal subsidence and that lower Cretaceous sediments were deposited at an estimated paleodepth of 2700 - 3500 m.

A preliminary study of the lower 120 m of Hole 765C (Lower Cretaceous) indicates that the composition of benthic foraminifera assemblages compare well with those described from the Carpathian flysch basins. The benthic assemblages mainly consist of agglutinated species, with poorly preserved calcareous benthic foraminifera found in only 2.samples. Several species which are biostratigraphic indicators in the Carpathian flysch basins are present at Site 765. These species include *Hippocrepina depressa, Hormosina ovulum, Kalamopsis grzybowskii, Pseudoreophax cisownicensis, Trochammina abrupta, Trochammina quinqueloba*, and *Verneuilinoides neocomiensis*. At Site 765, all of these species were found in the upper Berriasian to Hauterivian sediments directly overlying basement.

A comparison of the biostratigraphic ranges of benthic foraminifera at Site 765 with the Carpathian benthic foraminiferal zonation (Geroch and Nowak, 1984) yields disjunct biostratigraphic ranges for the species *H. ovulum. K. grzybowskii, H. depressa,* and *T. abrupta*. These species were present in the eastern Tethys during the Berriasian to Valanginian, but did not appear in the Carpathian flysch basins until the Hauterivian to Barremian. Since the initiation of rifting and subsidence in both areas was roughly isochronous (latest Jurassic), this observation has important implications for the geologic history of the Carpathian flysch basins.

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Stratigraphy and environmental control on the distribution of agglutinated foraminiferal palaeocommunities in the mid- to late Cretaceous succession of the Sergipe Basin, NE Brazil.

The palaeoecology and biostratigraphy of agglutinated foraminiferal assemblages have been studied through the upper Aptian to Maastrichtian sedimentary succession of the Sergipe Basin, northeastern Brazil. Four agglutinated foraminiferal palaeocommunities can be recognised in the succession: (i) Lituolidae-Haplophragmiidae (upper Aptian to lowermost Albian; paralic -lagoonal- biotopes); (ii) Eggerellidae-Verneuilinidae-Textulariidae (upper Aptian to middle Albian and uppermost Cenomanian; middle shelf to upper slope biotopes); (iii) Haplophragmoididae-Ammosphaeroidinidae (Santonian to Maastrichtian; upper to middle slope biotopes); (iv) Bathysiphonidae-Ammodiscidae (Albian, upper slope biotopes; Santonian to Maastrichtian, middle to lower slope biotopes). The palaeocommunities are characterised by the relative dominance of the major foraminiferal groups and related to variations in trophic structures. The composition and distribution patterns of the agglutinated assemblages (diversity and abundance of morphogroups) are shown to be a direct response to overall palaeoceanographic conditions and to community strategies of exploitation of the trophic resources in the microhabitats. They can, therefore, reflect long-term cumulative changes produced by major cycles in sea-level, rates of nutrient supply, redox conditions and the carbonate equilibrium at sediment/water interface. The taxonomy of the agglutinated microfauna studied is documented and completely revised. A palaeoenvironmental model, mostly derived from micropalaeontological and sedimentological criteria, is proposed for the distribution of the foraminiferal morphogroups.

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Late Cretaceous deep-water agglutinated foraminifers from the North Atlantic and Western Tethys.

Biostratigraphic and paleoenvironmental distribution of Upper Cretaceous abyssal agglutinated benthic foraminiferal assemblages (AAF) from DSDP/ODP sites in the North Atlantic is compared to selected occurrences of deep water agglutinated foraminifers (DWAF) in the Western Mediterranean and in the Alpine/Carpathian foldbelt. Distribution charts of AAF from the North Atlantic Plantagenet Formation (e.g. DSDP/ODP Holes 385, 386, 398D, 543A, 603B, and 641A) are presented. The distribution pattern of taxonomically distinct assemblages and the stratigraphic ranges of individual species are compared to varying sedimentological parameters, such as sedimentation rates and amount of terrigenous detrital input, sediment colour and TOC (total organic carbon) content, amount of calcium carbonate and biosiliceous material.

Low latitude slope faunas, represented on the North African margins and in the Betic Cordillera of Southern Spain contain common calcareous ataxiophragmids. In contrast, **high latitude slope assemblages**, recorded on the Labrador Margin, lack calcareous elements, and are dominated by ammodiscids and lituolids. **Flysch type assemblages** lack calcareous elements. This type includes low diversity assemblages dominated by coarsely agglutinated forms in proximal turbiditic environments and an increase in diversity in distal environments. **Deep-water limestone assemblages** include flysch-type forms, but also some slope-forms and small smooth-walled agglutinates which can be compared to abyssal taxa. **Abyssal assemblages** of the multicolored or red clays in the North Atlantic, Pacific and Indian Ocean consist of thin, smooth-walled varieties and are taxonomically distinct from others. Comparable on-shore assemblages are observed in the multicoloured claystones of the ophiolite-sequences of the Italian Apenninnes and in red claystones of the Romanian Eastern Carpathians.

From the obtained data it can be concluded, that detrital input and substrate disturbance were less important limiting factors for the distribution of Upper Cretaceous AAF in the North Atlantic. The more important discriminating environmental factors were water-mass properties like the oxygenation of bottom waters - changes of which are most probably linked to changes in surface productivity -, and the availability of calcium carbonate, i.e. the relative position of each site to the fluctuating calcium carbonate compensation depth (CCD). Fluctuations in the position of the CCD probably occurred continuosly over a longer period of time, their influence on AAF assemblages in the different sites appears to be heterochronous. Changes in oxygenation and paleoproductivity appear to be short-termed (paleooceanographic events) and can be observed as reliable datum levels for biochronology of DWAF at the Cenomanian-Turonian boundary and in the early Campanian.

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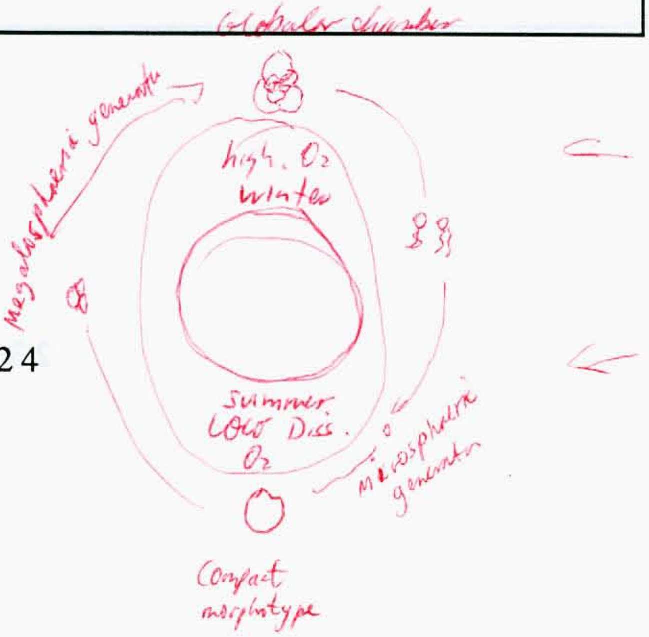
Deep water agglutinated foraminiferal assemblages from Late Cretaceous Red Shales of the Magura Nappe, Polish Outer Carpathians

In the Outer Carpathian basins the sedimentation of black and green radiolarian shales at the Cenomanian/Turonian boundary was replaced by deposition of the pelagic variegated shales, reflecting a distinct change in sedimentary conditions from a more reducing to an oxidizing environment of the Turonian-Lower Senonian variegated shales preceded the uplift of the intrabasins source areas supplying clastic material for the Upper Senonian-Paleocene turbiditic deposits.

In the late Cretaceous the Magura basin was the largest and innermost one being bordered from N and S with zones of sedimentation of variegated marls. In the Magura basin transition from deep-water, pelagic red shales into overlying turbiditic deposits is gradual through the variegated marls and turbiditic limestones.

Foraminiferal assemblages from the Turonian-Lower Senonian red shales of the Magura Nappe were studied. Their specific composition and comparison with coeval assemblages from other units is presented.



Best Paper:

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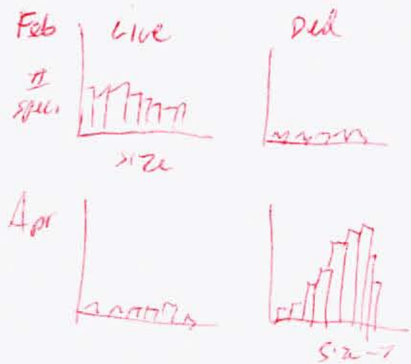
Seasonal changes and life history of *Trochammina hadai* Uchio in the Hamana Lake, Japan.

Trochammina hadai Uchio is an arenaceous foraminifer which is dominant in brakish waters of Japan. In order to investgate the life history of *T. hadai*, we continuously observed this species in the Hamana Lake, central Japan. From 1987 to 1989, we collected sediment samples on a monthly basis at a fixed station by SCUBA diving. On these occasions, we also monitored water temperature, salinity and dissolved oxygen contents.
Trochammina hadai is an epibiont, feeding on algae on the sediment surface. In contrast, *Ammonia beccarii* (Linne) which co-occurrs with *Trochammina*, is living in the sediment between 0 and 10 cm depth. The population density of *T. hadai* drastically changed from nearly 0 indiv./cm^2 during summer time to 100 indiv./cm^2 in winter. These changes are well related to environmental changes of lake water. Lake water has stagnated in summer time, creating a vertical stratification with low oxygen values and high concentrations of H_2S.
The life cycle of *T. hadai* is yearly and biphasic. Microspheric generation mainly occurs in spring and summer. Megalospheric generation occurs in autumn. We also cultured *T. hadai* in the laboratory for measuring growth rates. The growth rate is higher in juvenile (58 μm/month) than in adult specimens (34 μm/month). The growth curve calculated from culture data explains the growth of the *Trochammina* population in situ.
Two different morphotypes are distinguishable in *T. hadai*. One type is relatively high trochospiral, has a lobated periphery and 4-5 chambers in the final whorl. The other is low trochospiral, has a smooth periphery and 5-7 chambers in the final whorl. We conclude that these morphotypes are seasonal variants within the same species.

Summer - Oxygenated sediment layer = 0.5 cm (water stratified)
Winter - " - " - " 5.0 cm (water column mixed)

Peaks in foram abundance: July (small peak)
Dec-Jan (large peak)

Ammonia beccarii - changes its depth habitat during the year.
due to change.
Breeds in April



Cultured Trochammina hadai on carborundum substrate.
Small specimens Added 3 chambers in 1 month.

larger specimens added av. 1.5 chambers in one month.

Asexual reproduction: July (microspheric many specimens)
Asexual reproduction: Nov-Dec. (megalospheric specimens)

CRETACEOUS THECAMOEBIANS FROM RUBY CREEK (ALBERTA), CANADA

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Microscopic organic objects extracted from Cretaceous freshwater deposits at Ruby Creek (Alta.) have been studied. The authors have reached the conclusion that these objects are fossilized thecamoebian tests that they arrange into 9 genera and 12 species all new to Science. The new taxa are described and abundantly illustrated with SEM microphotographs as well as numerous line drawings.

The state of preservation of this material is at times rather poor and requires extensive interpretative reconstruction. The authors, being unable to base their extrapolations on the knowledge of the almost inexistent mesozoic fossil record, had to make detailed comparisons with recent and well known forms that most closely resemble those under study. Although occasionally the similarities are rather strong, in most cases they are not. This seems to suggest that, contrary to common belief, most thecamoebians have evolved during the last 60 my. This in turn points to the fact that probably this group represents an untapped source of biostratigraphic information that deserves substantially more attention than it has received so far.

FOSSIL THECAMOEBIANS AS BIOSTRATIGRAPHIC AND PALEOECOLOGICAL INDICATORS

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The polyphyletic "group" of the "Thecamoebians" is comprised mainly of fresh-water testate rhizopods. These organisms build an extremely acid-resistant test and can encyst and survive, in a dormant state, conditions such as freezing, dessiccation, etc. This enables them to be dispersed by migratory birds or by winds and become the first pioneer forms in all newly-formed moist environments (lakes, bogs, rivers, springs, mosses, sphagnum, wet soils, etc.). Clearly, their potential for fossilization should be very high yet, except for later Quaternary freshwater deposits, the established fossil record consists of only seven serious findings spread over a period of over 300 my.

In this paper, we try to synthetize and update the state of our knowledge of fossil thecamoebians by: 1) trying to explain the undeniable scarcity of the fossil record, 2) discussing critically and evaluating the attendibility of all previous findings and, finally, 3) reviewing what we know about their mode of life, their present distribution and how that compares with what we know from their Holocene fossil record, in an attempt to evaluate their importance as paleoecological indicators.

Dispersion:

Can be transported by wind & birds.

Difflugia

Reviewed reports of fossil occurrences, from Carboniferous.

FAI - Foram Alteration Index | - Compare with following data
SMI - Silica Maturation Index | Vit Refl.; Thermal Alt.; Florescence Index

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COLOURATION AND SILICIFICATION — AGGLUTINATED FORAMINIFERS AS INDICATORS OF ORGANIC MATURITY LEVEL AND BURIAL DIAGENESIS

It is well established that organic matter and mineralogical matter undergo progressive and predictable changes with increasing depths of burial. What is not well established, is that the agglutinated foraminiferal test also undergoes progressive and predictable changes with increasing depths of burial. It is this fact that creates an important, but previously overlooked, potential for agglutinated foraminifers to be used as indicators of organic maturity level in much the same manner as have conodonts and palynomorphs.

Observation of agglutinated tests from the Mesozoic-Cenozoic of the Beaufort-Mackenzie Basin has documented two trends: 1) a progressively darker colouration of the test with increasing depths of burial (white to dark brown) and 2) "silicification" or recrystallization of the test at burial depths in excess of approximately 2800 metres.

Colouration of the test is explained as a maturation of the test's organic cement and lining. The "silicification" of the test is explained as a mobilization of silica along grain boundaries by pressure solution or possibly by the introduction of secondary silica generated from clay mineralogical changes in the surrounding rock matrix. Overall maturation level of the test can be measured by its fluorescent intensity which decreases with increasing maturity levels, similar to algae in sediment and liptinite in coal.

Hypothesis:
- Color change f(thermal maturation)
- Silicification f(silica dehydration of clay matrix)

* Organic cement preserved in fossil material.
Paleogene material shows organic envelope.

- Recent specimens which have been "cooked" turn black.
- Color gets darker down core.
- Fossil specimens have secondary quartz xls in void spaces
- Thermally-controlled clay mineral changes.
smectite → illite + H_2O + SiO_2
- Silicification occurs at Vit. refl. level of 0.5
- Amber-brown color change ≥ Vt Refl 0.7 (middle of oil window)

- Silica stable over a range of temp
- Organic matter sensitive to temp.

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FORAMINIFERAL BIOSTRATIGRAPHY AND SEISMIC SEQUENCES -- EXAMPLES FROM THE TERTIARY OF THE BEAUFORT-MACKENZIE BASIN, ARCTIC CANADA

Cenozoic, terrigenous clastic, continental margin deposits of the Beaufort-Mackenzie Basin provide prolific assemblages of high latitude agglutinated foraminifers. A dual zonation consisting of interval zones and assemblage zones has recently been established for these strata. The interval zonation utilizes the last appearance datums of agglutinated and calcareous benthic foraminifers. The assemblage zonation includes a preliminary analysis of foraminiferal biofacies within the basin.

To resolve the complex deltaic-dominated stratigraphy of this basin, biostratigraphic zonations and seismic data have been integrated. Biostratigraphy and seismic stratigraphy are vastly different disciplines, but their integration produces results that are more informative and reliable than either can produce in isolation. Benthic foraminiferal distributions and seismic profiles from the Beaufort-Mackenzie Basin provide excellent examples of the complementary nature of these two disciplines.

Faunas: 99% Aggl, Mainly Endemic

Oligocene faunas may have migrated into the Arctic = T. alsatica.

Miocene faunas are more agglutinated.

the inner Neritic and Outer Neritic facies biozonations. Some Biozones are diachronous.

Inner shelf

Oligocene Kugmallit: Recurvoides, Labrospira, Turrilina, Reticulophragmium

Normal shelf, Topset Beds

upper Olig - Mio Mackenzie Bay: Asterigerina, Globocassidulina, Ammod. Ammol, Bathys. Cystam. Gravellina, Reticulo.

Cont rise, Basin Plain

Akpak Fm: Ammod. Ammol. bathy. Cyst., Gravellina, Haplo, Adercot. Martinot, Recurv. Reticu. Rhabd, Spirosig, Trod. Thuramminoides, Verm.

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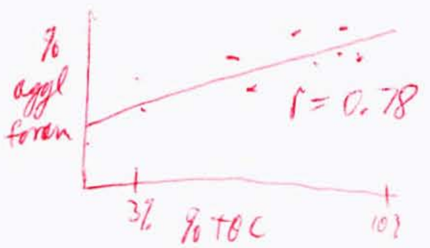
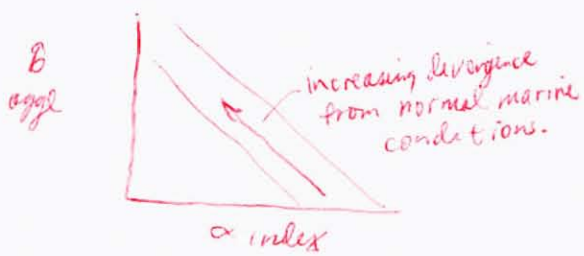
Facies controlled distribution of foraminifera in the Jurassic North Sea Basin.

Foraminiferal faunas have been analysed from three parts of the Jurassic North Sea basin including: the Statfjord area - Pliensbachian to Bajocian; the Yorkshire coast - Bajocian; north Scotland - Sinemurian, Pliensbachian and Callovian. The various assemblages are defined by distribution of suborders, genera, species and diversities. Based on these parameters and sedimentary facies data the assemblages are attributed to marine shelf and deltaic conditions.

Organic-lean shelf deposits contain high diversity assemblages dominated by species of Marginulina, Lenticulina and Dentalina. Locally high frequency of Ammodiscus asper suggests increased terrestrial influence. Organic-rich shelf sediments show strong dominance of suborder Textulariina and high aboundance of Haplophragmoides pygmaeus.

Distal deltaic strata contain almost exclusively Textulariina, forming assemblages of intermediate diversity dominated by species of Trochammina, Verneuilinoides and Reophax. Proximal deltaic assemblages in the Statfjord area consist exclusively of Textulariina, while on the Yorkshire coast they include locally significant amounts of Lagenina and Spirillinina in addition to the agglutinated component. At both places the diversity is extremly low and Ammodiscus yonsnabensis is most common.





NEAGU, Th.
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Gerochammina n.g. and related genera from Upper Cretaceous flysch-type benthic foraminiferal faunas, Eastern Carpathians, Romania

A correlation of Upper Cretaceous sequences in the Romanian eastern Carpathians is presented using the planktonic foraminiferal zonation of ROBASZYNSKI, CARON et al. (1984) and the smaller agglutinated benthic foraminiferal zonation of GEROCH & NOWAK (1984). The ranges of significant agglutinated species are revised i.e. for *Reophax parvulus* HUSS, *Hormosins gigantea* GEROCH, *Recurvoides imperfectus* HANZLIKOVA, *Haplophragmoides gigas minor* NAUSS, *Ammobaculites problematicus* NEAGU, *Uvigerinammina jankoi* MAJZON, *Thalmannammina meandertornata* NEAGU and TOCORJESCU, *Thalmannammina recurvoidiformis* NEAGU and TOCORJESCU, *Goesella rugosa* HUSS, *Rzehakina epigona* (RZEHAK), *Plectorecurvoides alternans* NOTH. Using population studies including internal and external morphological features it was possible to discriminate a new genus ***Gerochammina*** and a new species *Uvigerinammina praejankoi* .
Finally, the most important taxons of these so particular agglutinated foraminiferal assemblages are presented systematically.

Andy Gooday FLUF

~~Piller~~

Calcareous Benthics:
cat algae & cyanobacteria. Vacuole stain & flouresce.

AGOL:

Saccammina } eat small
Trochammina spp. } algae

Conclusions 4,800 m

1. Species respond in an opportunistic way to food resource.

Protoplasm at 4,800 m is green.

PODOBINA, V.M.

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Composition and Microstructure of Agglutinated Foraminifera Wall

The agglutinated foraminifera which prevail in the Late Cretaceous Complexes of Western Siberia were studied in detail on a large factual material. The composition, microstructure of agglutinated wall were examined in detail, close secretion-agglutinated (intermediate) and sectional types of walls are given for comparison.

For classification of primitive Foraminifera, possessing relatively uniform morphological structure, composition and microstructure of wall acquire the first-rate taxonomic significance. For more progressive Ammodiscida, especially Haphlophragmiidea in addition to composition and microstructure of the wall, morphological peculiarities of shells have great significance.

The research under examination and also the analysis of published works gave the possibility to offer classification of microstructure of foraminifera mineral shells.

Geroch & Olszewska

Cieszyn Limestones collected in a quarry in Goleszów ~100 samples Age based on Tintinids. Upper Tithonian to Berriasian.

Found ~14 Genera of DWAF

Pseudoreophax
T. quinqueloba
mainly tubes.

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Shallow water arenaceous foraminifera from Nodular Limestone, Bagh Beds, Madhya Pradesh, India.

The occurrence of arenaceous foraminiferal genera viz. *Ammobaculites*, *Haplophragmoides*, *Lagennammina*, *Spiroplectammina* and *Tritaxia* in the mixed foraminiferal assemblage of Nodular Limestone of Cretaceous rocks of Bagh Beds suggests shallow water origin for the deposition of Nodular Limestone.

RECENT MARSH FORAMINIFERA FROM THE EAST COAST OF SOUTH AMERICA: COMPARISON TO THE NORTHERN HEMISPHERE

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A large body of information exists on marsh foraminifera of North America but up until now few quantitative studies had been done at corresponding latitudes in the southern hemisphere. To remedy this situation, we sampled 8 marshes along the eastern coast of South America from Tierra del Fuego, Argentina (54°S) to Guaratuba, Brazil (25°S). The southernmost area corresponds in latitude to work done in Hudson-James Bay marshes and the South American material is almost identical to Hudson-James Bay with *Polysaccammina ipohalina* and *Trochammina macrescens* dominating. Marshes in between are more similar to the Californian marshes with *Trochammina inflata* dominating high marsh areas. In the Brazilian marsh, which is in the southernmost limit of mangroves, the fauna is similar to that found in the Mississippi Delta marshes, at approximately the same latitude north. Species here include *Haplophragmoides wilberti* and *Arenoparrella mexicana*. This study illustrates that marsh foraminifera do respond to latitudinal gradients in both hemispheres of the Americas.

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High latitude agglutinated foraminifera: Prydz Bay (Antarctica) vs Lancaster Sound (Canadian Arctic)

Surface sediment from 5 holes drilled during Leg 119 of the Ocean Drilling Program in Prydz Bay (Antarctica) yielded an entirely agglutinated foraminiferal assemblage of approximately 45 species. This assemblage is compared qualitatively with the agglutinated component of Lancaster Sound and Admiralty Inlet (Canadian Arctic). Lancaster Sound also has calcareous species. Living specimens were found in both polar regions. The factors controlling each benthic environment are comparable. Seasonal ice cover influences salinity, sediment input and nutrient supply. The dominance of agglutinated species in Prydz Bay may be caused by long periods of sea ice with subsequent low surface productivity leading to undersaturation of calcium carbonate. Prydz Bay and Lancaster Sound have numerous common species as well as taxa unique to each pole. Most mutual species are also represented in deeper water in lower latitudes, suggesting a possible migration of highly adaptable species between the poles. Some species may have originated in place and exhibit morphological resemblance, resulting from adaptation to similar environmental regimes.

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Distribution of Oligocene - Miocene agglutinated foraminifers in deltaic and deep-water facies of the Beaufort - Mackenzie Basin, Arctic Canada: Preliminary results.

Oligocene to Miocene terrigenous sediments of the Beaufort - Mackenzie Basin have yielded approximately 90 species of agglutinated foraminifers from 395 samples from 9 wells (well cuttings). The data comes from a spectrum of facies that range from the inner shelf to the continental rise and include the Oligocene Kugmallit deltaic depocentre. A preliminary perusal of the species distribution indicates that the data is complex and will require analysis by quantitative methods. A striking feature of the distributions is apparent diachroneity of the agglutinated assemblage in relation to regional seismic horizons and to datums established from extinctions of calcareous benthic foraminifers. A few of the agglutinated species appear to be chronostratigraphically useful. Correlation of last appearance datums in shallow water strata is more accurate than in deeper water. The generalized trend is for species to be longer ranging with increasing water depth. In deep water, agglutinated species occur in the Late Miocene, whereas on the shelf Late Miocene faunas are calcareous. Most agglutinated species show large bathymetric ranges. The abundance of a number of species, however, changes with water depth and therefore become characteristic for paleoenvironments. Further work on the quantitative species relationships within the assemblages and on the stratigraphic interpretations of the sampled sections will be necessary to document significant trends.

R. pilulifer = Outer Shelf – upper Rise

rotundidorsata = isobathyal Inner Shelf – lower Rise

Cystammina pauciloculata = isobathyal, max Outer Shelf – upper Rise

P fusca – I. Sh – U. Rise

A. clavata = isobathyal; Max Outer Shelf.

Shelf – Slope facie	Cont. Rise fac	Calcareous – Aggl. transition diachron
Reticulophragmium Haplophragmoides Recurvoides	"R. orbicularis"	(based on seismic evidence, LAD's of Calcareous benthics)

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Agglutinated benthic foraminifera from the late Cretaceous to early Tertiary succession of Gebel Ekma, Southwestern Sinai, Egypt

Gebel Ekma succession, southwestern Sinai is one of the most complete exposed successions in Egypt across the Cretaceous-Tertiary boundary. The studied section representing the Maastrichtian to Early Eocene can be lithostratigraphically subdivided into three formations arranged from top to bottom as follows:

Thebes Fm.: it is composed of sandy limestone at the base followed by intercalations of limestone and chert bands (Early Eocene).

Esna Fm. : It is composed of shale with thin limestone band in the middle (Late Maastrichtian to Early Eocene).

Sudr Fm. : It is made up of chalky limestone (Campanian - Maastrichtian).

Paleontologically, this study deals mainly with the agglutinated benthonic foraminiferal content, their taxonomy and their paleoecology. 26 samples were investigated and have led to the recognition of 60 species belonging to 23 genera, 14 families and 8 superfamilies. The superfamily Verneuilinacea Cushman,1911 seems to be the more abundant and diverse one. However, the Ataxophragmiacea Schwager, 1877 has proved to be diverse but less abundant.

The Planktonic/Benthonic ratio, the Calcareous/Arenaceous ratio and the lithological characters shed some lights on the environments of deposition that are deduced as follows :

The sudr Formation was deposited in bathyal environment.

The Esna Formation was deposited in middle neritic to bathyal environ.

The Thebes Formation was deposited in shallow neritic with direct connection to the open sea.

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Upper Albian to Lower Cenomanian Agglutinated Foraminifera from the Glyndebourne Borehole, South England

Preliminary findings from the uppermost twenty meters of the Glyndebourne Borehole from Sussex in southern England are presented. The Borehole forms part of the initial Channel Tunnel Site Investigation Study.

The section includes the Albian-Cenomanian Transition and is comprised of 18 metres of Gault Clay, overlain by approximately 2 meters of Glauconitic Marl.

A rich and varied fauna of ostracoda and foraminifera was recovered. The benthonic component is dominated by various agglutinated foraminifera, principally arenobuliminids. Their subgeneric associations are outlined for this location.

Tritaxis spp. become numerically important towards the top of the section.

A preliminary biostratigraphic zonation for the section is presented and the arenobuliminids are used to suggest the position of the Albian-Cenomanian Transition.

TENDAL, O.S.

Why are foraminifera foraminifera ? And are all of them that ?

The diagnostic characterization of the foraminifera as a taxonomic unit has varied somewhat during time and also among contemporary authors. It is here discussed from a biological point of view, especially with respect to testate versus naked condition, reticulopodia versus filopodia, and the degree of complexity of the reproductive cycle. Some of the very large extant members of the Astrorhizidae, the Schizamminidae, and the Saccamminidae serve as examples.

The Komokiacea - fragile and easily overlooked, but abundant and diversified members of the deep-sea fauna.

The Komokiacea are agglutinated fragile foraminifera of great diversity. They occur abundantly in oligotrophic abyssal areas, and many of the taxa are cosmopolitan in distribution. A survey is given of the current knowledge about the group, and some main problems are outlined.

2 Main Trends:

1. Diagnoses become longer

3 main Characters:

- Granuloreticulose pseudopodia
- Mono or Poly-chambered Test
- reproduction comprising 2 alternating generations

Granuloreticulose Pseudopodia:

1) Thread-like 2-10 μm Thick,
2) form anastomoses - network around the animal
3) finely granular - mitochondria, dense bodies, phagosomes, coated vesicle
4) Some granules move along - bidirectional flow, saltatory movement 1-6 μm/sec.

Pseudopodia have not been described in the Hormosinidea, Lituolidea, Komokiidae.

Living Foraminifera

	# families	Pseudopodia described in # spp.
Allogrom	3	11
Textular	17	10
Miliolina	3	–

few spp have been investigated for pseudopodia.

Astrorhiza limicola : leaves its test.

? Can all forams do this

? Are there alternating generations with & without tests

Recommendations:

study pseudopodia with a phase-contrast microscope

Biological terms are used inconsistently - Define terms.

THIES , A.

On the Distribution, Ecology and Taxonomy of
Crithionina hispida FLINT 1899

Crithionina hispida was investigated in the East-Greenland Sea and Fram-Strait. This species is one of the most abundant and occures mainly at a depth range between 2000 and 3200 m, associated with *Pyrgo murrhina* , *Cribrostomoides subglobosum* and *Cibicidoides wuellerstorfi* - a deep sea community of low diversity and low standing stock. A second distribution maximum is found between 1400 and 1500 m. In both areas *Crithionina* reaches 12 - 57% of the living foraminiferal assemblage (>250 µm); between 1 and 6 individuals per 10 cm² were counted. It has not been found in the dead assemblage.

Examinations of undisturbed surface samples showed that *Crithionina hispida* must have an infaunal habitat. It was also found alive inside empty tests of large *Hyperammina* -species in samples from the Fram-Strait.

Main ecological factors controlling the distribution of *Crithionina hispida* , and its high abundance at two different depth ranges are discussed. The well preserved material allowed taxonomical investigations of the relation to *Crithionona pisum* GOES 1896, and the reconstruction of the ontogenetic development of the test.

In high Mag, see strands of organic cement.

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The Agglutinated Foraminifera of the Nörthern South China Sea

Faunal analysis of 121 South China Sea surface sediment samples (7-1010m) at long. $108^{\circ}30'$ to $118^{\circ}30'$E distributed in an area north of an oblique line extending from $108^{\circ}30'$ E to lat. $16^{\circ}30'$N, long. $118^{\circ}30'$E yielded some 200 species of agglutinated foraminifera. In general, species number increases with water depth and different species composition characterize different depth zones. Southwest of the Pearl River estuary, stations with water depths > 70 m usually have 20 or more species, in the deepest station of 1010 m, > 40 species. The ten most dominant species in rank order, are Bigenerina nodosaria d'Orbigny, Textularia foliacea Heron-Allen and Earland, T. pseudogramen Chapman and Parr, Spirorutilis pseudocarinata (Cushman), S. fistulosa (Brady), Arenoparrella asiatica Polski, Cribrobigenerina robustiformis Zheng, Textularia porrecta Brady, T. candeiana d'Orbigny, and T. conica d'Orbigny. According to the distributional trends of relative abundance, the agglutinated foraminifera may be grouped into 1) inner shelf assemblage characterized by Arenoparrella asiatica, Textularia candeiana, T. conica Ammoscalaria pseudospiralis (Williamson), Ammobaculites agglutinans (d'Orbigny), etc., which are very abundant at water depths < 50 m; 2) middle shelf assemblage characterized by Textularia foliacea, T. pseudogramen, Cribrobigenerina textularioidea (Goës), etc., which are very abundant at water depths of 40-90 m; 3) middle to outer shelf assemblage characterized by Bigenerina nodosaria, Cribrobigenerina robustiformis, Textularia paragglutinans Zheng, etc., which are very abundant at depths of 50-110 m; 4) outer shelf assemblage characterized by Spirorutilis fistulosa, S. pseudocarinata, Vulvulina sinensis Zheng, Pseudoclavulina juncea Cushman, etc., which are very abundant at depths of 100-230 m; 5) deep-water assemblage characterized by stenobathyal species such as Karreriella parkeri Uchio, Trochammina globulosa Cushman, Cribrostomoides nitidum (Goës), Cyclammina pusilla Brady, etc., which have their first occurrence at 1010 m. R. ocicula, H. distans, G. charoides, Haliminopsis

Diversity trends inversely correlated with bottom temp.; f(Bathymetry)

Dominance Ranking
spp — average depth —
} These depths are different for each species.

Dominance Ranking contours are different than relative abundance contours, or Absolute abundance contour

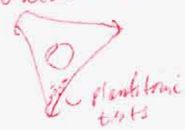
5 Assemblages; listed Rank Dominance for 5 most common species.

- Primitive agglutinates were found in the bathyal assemblages
- Middle Shelf - highest abundance. Bathyal - highest Diversity

OLE TENDAL : Xenophyophoria

multinucleate, plasma contains barite xls.

Galatheammina



Syringammina

cross section

stercomata: animals make them.

Genus Stanophyllum
- true abyssal species

Highest Diversity - 3,000-5,000 m

Xeno's

epifaunal, attached on rocks
infaunal
"Paleodyction"

Barite xls:

found in sediment too. Are animals picking them up or are they secreting them? ?Animals release them when they die.

Poster

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Present distribution of agglutinated foraminifera and tecamoebians in shallow water and surrounding mangroves in Guaratuba Bay, Paraná State- Brazil. Preliminary results (1)

The study of two mangrove surface transects and three estuarine underwater transects samples were used to determine the present foraminiferes and tecamoebians distributions in Guaratuba Bay, South Brazil.

The mangrove distribution of agglutinated foraminifera and tecamoebians is related to the vegetation patterns and the tidal cycles. In the estuary it seems that the most important ecological parameter in the distribution of such organisms is salinity.

A preliminary observation of estuarine foraminiferal revels a predominant occurence of *Miliammina fusca* and *Ammotium salsum* as living representatives, and *Arenoparella mexicana*, *Trochammina macrescens*, *Polysaccammina ipohalina* and *Reophax nana* as dead ones.

In the mangrove samples it was observed only living specimens of *Haplophragmoides wilberti*, H. *manilaensis*, *Arenoparella mexicana*, *Ammoastuta inepta*, *Trochammina inflata* and T. *macrescens*.

The tecamoebians observed in the estuary were dead and are represented by *Difflugia oblonga*, *Centropyxis aculeata* and C. *constricta*. In the mangrove occur living species such as *Centropyxis aculeata* and C. *constricta*.

Perhaps the number of dead organisms in the upper estuary is related to low salinity parameter observed (less than 10 ‰).

(1) This project is financial supported by FAPESP.

ARCELLACEANS AS PALEOECOLOGICAL INDICATORS

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The members of the polyphiletic "group" Thecamoebians in general, but particularly those of the superfamily Arcellacea, are potentially ideally suited as paleolimnological tools. These organisms are testate rhizopods with organic or agglutinated tests which are resistant to dissolution in conditions of low pH (many of them can even withstand the harsh treatment reserved to pollen samples). The small size of arcellacean tests, their abundance and their world-wide distribution in a variety of freshwater environments, ensures that even in samples of relatively small volume, statistically significant numbers of tests will commonly be found. Their stratigraphic range, which is extremely poorly known, extends back to the Carboniferous. The lack of baseline studies on modern arcellacean biogeography, however, makes the paleoecological interpretation of core material, by reference to modern analogues, impossible. In this study, which is a composite of a number of independent ongoing projects, we have attempted to improve our understanding of the arcellacean ecology and paleoecology through a two-prong approach: 1) We have studied the distribution of modern Arcellaceans in several lakes along a transect of eastern North America, from Baffin Island (63°N) to southern Florida (27°N). Not surprisingly, the results suggest that the geographic distribution of arcellacean faunae can ultimately be attributed to climatic conditions. 2) We have also studied the late glacial/postglacial arcellacean succession from three lakes in Atlantic Canada. The climatic and limnological succession in these cores was interpreted from coincident pollen records. From this we could conclude that the three lakes contain late glacial, early Holocene, mid Holocene (**hypsithermal**), and late Holocene arcellacean assemblages. This is confirmed by faunal changes which coincide with the major vegetational (i.e. climatic) ones. Comparison between the data from the lakes and those from the cores reveals amazing similarities between the faunal associations of the various chronological climatic intervals and those of the appropriate latitudinal intervals.

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Distributions and populations of agglutinated foraminifera in the Cananéia-Iguape region, São Paulo State,South Brazil -Preliminary notes. (1)

This paper reports a series of data on foraminifera distribution and its relation with salinity and organic carbon measured in the Cananéia-Iguape region.

Approximately 50 samples were used to determine the mangrove and estuarine foraminiferal distributions.

We have identified until now eleven species of living benthic foraminifera in the mangrove sediments.

The most representative species are:

Miliammina fusca, *Trochammina inflata*, *Trochammina macrescens*, *Arenoparella mexicana*, *Ammotium salsum* and *Ammobaculites foliaceus*.

(1)Financial supported project by FAPESP.

STRATIGRAPHY AND PALEOBATHYMETRY OF UPPER CRETACEOUS-LOWER TERTIARY SUCCESSION EXPOSED IN BERIS-DOUSH AREA, KHARGA OASIS, WESTERN DESERT, EGYPT

By

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ABSTRACT

The detailed study of the Upper Cretaceous-Lower Tertiary succession exposed in Beris-Doush area enabled the subdividing of this succession into number of rock units well known in the Nile Valley facies areas in Egypt in addition to a thin part of the Kurkur Formation of the Garra-Arbain facies. 96 foraminiferal species were identified and used to classify the studied succession into number of benthonic and planktonic foraminiferal biostratigraphic zones. This foraminiferal assemblage is composed mainly of simple interiors arenaceous foraminifera in addition to rare calcareous benthonic and planktonic elements. Thus, a littoral to inner shallow shelf environment with fresh water supply is suggested for the Late Cretaceous part of the succession and a littoral to shallow middle shelf environment for the Early Tertiary part.

During the Late Cretaceous-Early Tertiary time, over Beris-Doush area, three transgressive phases were detected; at the Middle Maestrichtian (<u>G. gansseri</u> Zone), at the early Middle Paleocene (<u>M. uncinata</u> Zone) and at early Late Paleocene (<u>P. pseudomenardii</u> Zone).

The <u>Nummofallotia</u>, Barrier and Neumann, 1959 is recorded for the first time in Egypt in the Early Maestrichtian sediments in the studied area.

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Distribution patterns of agglutinated foraminifera in Upper Cretaceous rudistid-dominated palaeoenvironments

Palaeoecological analysis of Santonian calcareous shallow-water deposits of the Eastern Alpine Gosau Group indicated characteristic agglutinated foraminifera associations from different, near-shore, insular shelf areas dominated by solitary and colonial rudistids (radiolitids and hippuritids).

* Open shelf environments:

rudistid floatstones and packstones indicating former radiolitid clusters (transgressive facies of high water energy): 1) attached lituolid association with flat, thick-walled coarse-agglutinated *Placopsilina* and *Haddonia* adherent to bioclasts and algal encrustations; 2) epibenthic ataxophragmiid association with triserial and trochoid thick-walled morphotypes (subfamilies Verneuilininae and Globotextulariinae) and 'intrareticulate' *Dictyopsella*; as well as 'agglutinated' *Quinqueloculina*.

* Reefal and adjacent environments:

- monospecific hippuritid bioherm: small-sized 'agglutinated' nubeculariids adherent to hippuritid shells;
- detrital fore-reef zone: rudistid wackestones and packstones (intermittently agitated water energy): attached lituolid-nubeculariid association with relatively thick-walled *Placopsilina*-morphotypes lacking the basal wall and forming a series of convex chambers arranged in successive layers similar to the Triassic *Tolypammina*-'microreefs' (WENDT 1969): growth probably by multinuclear parthenoschizonts (similar chamber arrangements also in the calcareous *Planorbulina*);
- back-reef lagoon: coral floatstones and foraminiferid wackestones (mostly quiet water conditions): miliolid-dominated foraminifera assemblage with epibenthic lituolid-textulariid-cuneolinid association: thin-walled, fine-grained *Ammobaculites, Textularia, Cuneolina* (flabelliform and subflabelliform morphotypes).

Distribution patterns, morphotypes and diversity of the agglutinated foraminifera associations reflect adequately the different hydrodynamically controlled Gosau palaeoenvironments based on interpretations of algal and megafossil assemblages (HÖFLING 1985). The 'intrareticulate' Lituolacea *Dictyopsella* and *Cuneolina* prove to be characteristic Upper Cretaceous shallow-water microfaunal elements.

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PARTITIONS AND FISTULOSE CHAMBERLETS IN TEXTULARIINA

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Abstract: Representatives of the genera *Spirotextularia, Plotnikovina, Siphoniferoides* and *Sahulia* possess fistulose chamberlets, formed by the outer pavement and separated from the main chamber lumen by a partition which is always pseudoporous in both solid-walled and in pseudoporous genera. In some species fistulose chamberlets are replaced during ontogeny by elongated chamber lobes. In certain species of *Sahulia* irregular cavities are produced between pseudoporous wall and pavement. Lobes and cavities probably serve the same function as fistulose chamberlets. Forms with fistulose chamberlets seem characteristic of well-oxygenated, warm, normal to hypersaline marine environments. The function of pseudopores and of the chamberlets is unknown; it may be connected with uptake of dissolved organic matter by diffusion.

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Late Cretaceous Komoki-like microfossils from Tethyan deep-water limestones: A preliminary report

Hitherto undescribed species of komoki-like foraminiferan microfossils are preserved in acid residues from upper Cretaceous deep-water limestones from the western Mediterranean region. Although modern komokiaceans are abundant in the world ocean, to our knowledge no fossil specimens have ever been reported in the paleontologic literature. The main purpose of this poster is to call attention to the unusually good preservation of agglutinated foraminifera in deep-water limestones, illustrate some of the common morphotypes, and propose a taphonomic model which explains why they occur as fossils.

Komoki-like microfossils occur as minor components of a diverse DWAF assemblage in reddish, upper Cretaceous pelagic limestones. In our initial study, we recognized 10 morphotypes belonging to 3 genera, but the true diversity of these forms is probably much higher. The building plan of the majority of komoki-like microfossils is that of an undivided tube which forms more or less regular loops radiating out from the center of the test at various angles. The tubule may increase in diameter within the loop, and therefore may be analogous to the swellings in the recent genus *Normania*. Based on this parallel with *Normanina*, we argue that these microfossils belong in the superfamily Komokiacea Tendal and Hessler, 1977.

The presence of fragile agglutinated forms preserved in the upper Cretaceous Scalia Rossa is ascribed to unique early diagenetic conditions in the chalk substrate. Silicification of agglutinated foramiferal tests probably takes place during the "initial" stages of diagenesis when the pH of pore waters drops due to microbial activity. Silica replaces the organic matrix cementing the test. According to our taphonomic model, pore waters must remain oxygenated long enough for opal to be converted to quartz. Our findings extend the known geologic history of the komokiacean group by at least 80 million years.

Both of these submissions will be posters.

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Agglutinated Foraminifera from across the Albian-Cenomanian boundary from SE England.

The agglutinated foraminifera from across the Albian-Cenomanian boundary will be documented and their relationship to facies changes noted. It is hoped to give some quantitative data on the type of grains used in test formation for some genera and to note any relationships with facies.

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Low oxygen tolerant agglutinated foraminifera from the chalk facies of NW Europe.

The agglutinated foraminifera from oxygen poor horizons of the Cretaceous chalk facies will be documented and models for their life habits will be offered.

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Benthic foraminiferal assemblages from the eastern Weddell Sea between 68 and 73 °S : distribution, ecology and fossilization potential

Surface sediment samples taken with a vented box corer from the eastern Weddell Sea on four profiles perpendicular to the continental margin have been investigated for their benthic foraminiferal content. The live fauna was differentiated from empty tests comprising the foraminiferal death assemblage. Based on the dead assemblages, potential fossil assemblages were calculated to facilitate the analogy with late Neogene core material. Five distinct live assemblages inhabit the continental margin today. Six dead assemblages and five potential fossil assemblages, respectively, correspond to these biocoenoses.

A predominantly live calcareous fauna dominated by *Trifarina angulosa* is correlated with strong bottom currents and sandy sediments at the shelf break and on the uppermost continental slope. Below this, on the upper slope down to 2000 m water depth, the predominantly calcareous *Bulimina aculeata* assemblage coincides with the core of warm Weddell Deep Water and with fine and more organic-rich sediments. These calcareous live assemblages completely change composition during early diagenesis because of calcite dissolution within the uppermost sediment, which depends largely on the grain size distribution of the sediment and the fluxes of organic matter. Therefore, a still calcareous *T. angulosa*-dominated fossil assemblage indicates the sandy substrates on the shelf break and the upper slope, whereas the deeper slope with hemipelagic calm sedimentation and with high fluxes of organic matter is indicated by *Martinottiella nodulosa*, the characteristic arenaceous fossil remnant of the former predominantly calcareous live *B. aculeata* fauna.

On a continental terrace between 2500 and 3500 m water depth *Cribrostomoides subglobosus* dominates the live fauna, but because of rapid disintegration of the empty tests of this agglutinated species a predominantly calcareous fauna characterized by *Oridorsalis umbonatus* and *Epistominella exigua* comprises the dead assemblage and the potential fossil assemblage, respectively.

On the lower continental slope, between the carbonate lysocline (3500 m) and the carbonate compensation depth (4000 m), tests of *Nuttalides umbonifer* are the characteristic dead and potential fossil remnants of a former predominantly arenaceous live fauna, which is associated with the lower part of the Antarctic Bottom Water (AABW). This corroborates earlier investigations suggesting a relationship between the carbonate-corrosiveness of water masses and the distribution of *N. umbonifer*.

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CONSERVATIVE EVOLUTION IN A HOSTILE ENVIRONMENT — AGGLUTINATED FORAMINIFERS FROM ORGANIC-RICH CRETACEOUS SHALES, BEAUFORT-MACKENZIE BASIN, ARCTIC CANADA

Three episodes of marine black shale deposition are a well-documented global feature of the Cretaceous System. During these three episodes, benthic foraminifers were widely excluded from colonizing organic-rich substrates that became oxygen depleted through bacterial decay of organic material. Despite overall unfavourable conditions, low-diversity assemblages of distinctly similar species have been recovered from organic-rich shales of Early Albian, Turonian, and Santonian-Campanian age in the Beaufort-Mackenzie Basin. The assemblages are composed of **Bathysiphon, Saccammina, Ammodiscus, Haplophragmoides, Trochamminoides**, and **Trochammina.** Specimen size is generally small, species diversity low, and numbers of specimens high.

Regardless of the long period of time spanned by these assemblages, there was remarkably little variation in their generic composition. In addition, nearly identical morphological and textural features were developed in similar species of each assemblage. Specialized adaptation to a narrow, probably hostile, ecological niche appears to be the explanation for such conservative evolution.

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Agglutinated foraminiferal stratigraphy of Middle Jurassic to basal Cretaceous shales, central Spitsbergen.

Foraminiferal distribution data have been used for stratigraphical zonation of a 230 m thick series comprising the Agardhfjellet and basal Rurikfjellet formations (Callovian to Ryazanian) in central Spitsbergen. The dominant lithologies are organic rich shales, but siltstones and silty shales with intermediate to low organic content also occur.

The faunas consist almost exclusively of agglutinated taxa; totally 45 agglutinated and 10 calcareous (Lagenid) species are recorded. The faunal succession is subdivided into eight zones by using first appearence of marker species. Age assignments of zones are based on regional correlation of foraminiferal species occurences combined with macrofaunal association. The proposed zones include: (1) Trochammina rostovzevi Zone-Callovian; (2) Recurvoides disputabilis Zone - Oxfordian; (3) Haplophragmoides canuiformis Zone - Lower and Upper Kimmeridgian; (4) Trochammina rosacea Zone-uppermost Kimmeridgian and Lower Volgian; (5) Ammodiscus zaspelovae Zone - Middle Volgian; (6) Trochammina cf. parviloculata Zone - Middle and Upper Volgian; (7) Recurvoides obskiensis Zone - Upper Volgian and lowermost Ryazanian; (8) Gaudryina aff. milleri Zone-Ryazanian.

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Paleoecological Significance of Intertidal Benthic Foraminiferal Biofacies From the Fraser River Delta, British Columbia, Canada

Six foraminiferal biofacies were recognized in the marshes and tidal flats of the Fraser Delta, British Columbia. Based on the distribution of these biofacies, the marsh may be divided into two major faunal zones; a High Marsh Zone (≈>0.75 m above mean sea level [a.m.s.l.]) and a Low Marsh Zone (≈0.00 to 0.75 m a.m.s.l.). The fauna identified from the High Marsh Zone included the Jadammina macrescens Biofacies and the Jadammina macrescens /Trochammina inflata Biofacies. The Jadammina macrescens Biofacies was most prominant in samples obtained from the marshes flanking Sturgeon and Robert's Bank which most likely are relatively low in salinity. Fauna from the marsh flanking Boundary Bay, also in the High Marsh Zone, was characterized by the presence of the Jadammina macrescens /Trochammina pacifica Biofacies. This area is more directly influenced by marine conditions, and thus most likely has relatively high salinity. A higher salinity phenotype of Jadammina macrescens , characterized by prominant areal supplementary apertures, was also more common in the marsh flanking Boundary Bay, than in the Sturgeon and Robert's Bank marshes. This phenotype was almost entirely absent in samples collected from the Sturgeon and Robert's Bank marshes.

The Low Marsh Zone was characterized by the Ammonia beccarii Biofacies. Similar to the High Marsh Zone, the Low Marsh Zone also may in places be subdivided into a Higher Low Marsh Zone (≈ +0.45 to +0.75 m a.m.s.l.) characterized by the presence of the Cribroelphidium gunteri Biofacies, and a Lower Low Marsh Zone (≈ 0.00 to +0.45 m a.m.s.l.) delineated by the Miliammina fusca Biofacies. The Miliammina fusca Biofacies, however, was also found in areas of the tidal flat outside the marshes, down to an elevation of -0.82 m below mean sea level (b.m.s.l.), in areas vegetated by Zostera marina (eel grass). The Trochammina pacifica Biofacies found exclusively in the area of the tidal flat (-1.13 to -0.52 m b.m.s.l.) between the Robert's Bank Port Causeway and the Tsawwassen Causeway, may have developed in response to the high organic content of these viscous sediments.

The identification of these related biofacies whose differences most likely indicate elevation, salinity and high organic content in the surficial sediments from the Fraser Delta, demonstrates that marsh and tidal flat foraminiferal assemblages may be very useful in determining paleoenvironmental conditions and former sea levels of the delta.

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The Xenophyophorea - giant protists of the deep-sea.

The xenophyophores, among friends called "xenos", are large protists, classified as agglutinated rhizopods, forming a taxonomic unit at present comprising 14 genera containing 49 species. They are marine, benthic, heterotrophic organisms living in the deep-sea, being widely distributed on bathyal, abyssal and even hadal bottoms.

Most xenophyophores are lumpy, and range from a few mm to about 7 cm in maximum dimension. The largest reported specimen was of flat form, 1 mm thick and 25 cm in diameter.

A xenophyophore is organized as a plasmodium enclosed by a branched tube system made of a transparent, organic substance. Besides numerous nuclei the cytoplasm contains huge numbers of barite crystals, generally 2 - 5 µm in size. Pseudopodia are supposed to be extended through the free ends of the plasmodiumtube branches. Stercomata are retained outside the tube system as easily visible dark strings or masses. The agglutinated xenophyophore test surrounds the plasmodiumtube system and the stercomata strings. In one group of xenophyophores the test also contains a filthy mass of extracellular, proteinaceous, 2 - 3 µm thick fibers. The test can be hard, brittle or more or less flexible.

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The Upper Jurassic-Lower Cretaceous paleoecologic distribution of the lituolid foraminifera in outcrop sections in the Lusitanian Basin of western Portugal.

A study has been made of the paleoecologic distribution of the lituolid foraminifera ('larger' and 'smaller' forms) in Upper Jurassic and Lower Cretaceous outcrop sections in Praia Azul, Ericeira and Cabo Espichel in the Lusitanian Basin of western Portugal. Six biofacies are recognised from shallow marine environments. Each is characterised by its lithofacies, foraminifera and ostracod associations and foraminiferal test morphologies ('complex' endoskeleton, 'less complex' endoskeleton, 'simple' uncoiled and 'simple' lenticular).

Protected shelf facies (interbedded marls, nodular and massive limestones) yield the highest diversity assemblages. The planispiral internally complex forms *Anchispirocyclina lusitanica* , *Pseudocyclammina muluchensis* and species of *Choffatella* are more abundant in the limestones, while the uncoiled and morphologically less complex species of *Rectocyclammina* and *Everticyclammina* are more abundant in the marls. The ostracod assemblages contain euryhaline marine species of *Schuleridea*, *Cytherella*, *Cytherelloidea* and *Asciocythere*. Coral biostromes and back-reef (lagoonal) muds contain abundant, morphologically less complex species of *Mesoendothyra* , *Rectocyclammina* and *Everticyclammina* . The ostracoda are dominated by *Cytherella* and the alate form *Cytheropteron* , both regarded as euryhaline marine. Restricted (hypersaline) lagoonal facies characterised by sandy dolomitic limestones and algal laminated limestones contain abundant *Anchispirocyclina lusitanica* in the large asexual 'B' form and *Pseudocyclammina muluchensis*, the 'simple' lenticular form *Haplophragmoides nonoinoides* and large-coiled specimens of *Ammobaculites subcretaceous* ('simple' uncoiled) . *Fabanella boloniensis*, a controversial non-marine indicator, dominates the ostracod assemblages. Brackish lagoonal fine siliciclastic facies are dominated by *Choffatella tingitana* ('complex' endoskeleton). The ostracod assemblages are made up of *Fabanella boloniensis* and the unequivocable non-marine species *Darwinula leguminella* and *Cypridea* spp. Brackish bay facies (fine siliciclastics) yield a more diverse assemblage of the less complex forms *Rectocyclammina arrabidensis*, *Everticyclammina virguliana* , and *Mesoendothyra* and the 'simple' lenticular forms *Freixialina planispiralis* and *Haplophragmoides concavus* .The ostracod assemblages contain euryhaline marine species of *Cytherella* , *Cytheropteron* , *Schuleridea* and local floods of *Paranotacythere pustulata* . Marsh facies (dark grey silts) contain low diversity, often monospecific, asssemblages of *Trochammina* ('simple' lenticular) and *Ammobaculites* ('simple' uncoiled), but no preserved ostracoda.

Salinity appears to be the main factor controlling the broad-scale distribution of the assemblages. *Mesoendothyra* , *Freixialina* and *Rectocyclammina* are more stenohaline, while *Everticyclammina*, *Choffatella* and *Anchispirocyclina* are more euryhaline. However, within any particular salinity range, the dominant test morphology may change, believed to reflect changes in nutrient supply.

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