Commission Internationale de Microflore du Paleozoique

NEWSLETTER 42

President: Dr. G. Clayton, Dept Geology, Trinity College, Dublin 2 Ireland.

Secretary-General: Dr. J. Verniers, Vrije Universiteit Brussel, KWAR, Pleinlaan 2, B-1050 Brussels, Belgium.

Contents Newsletter 42 (December 5, 1991)

Presidential Address

Bernard Owens retired recently as President of the C.I.M.P. after seven years of dedicated service. During his extended term as President, and earlier for seven years as Secretary-General, Bernard personally initiated several projects which extended the role of the C.I.M.P. well beyond its historic limits of Palaeozoic palynology. Perhaps the most significant of these ventures was the C.I.M.P. Libyan project which culminated in the production of two major publications on Libyan palynostratigraphy. More traditional activities, such as the U.S.S.R.-Poland-Western European miospore correlation project are proving equally successful. Though what has been a relatively difficult decade for palynology, Bernard has steered C.I.M.P. by his informal but very effective leadership to its present position of strength with 558 persons worldwide, receiving the Newsletter. On behalf of the C.I.M.P., I wish to thank Bernard for his tireless work, and wish him every success in his research and other activities at the British Geological Survey. Fortunately, his involvement in several current C.I.M.P. projects will ensure his continuing association with C.I.M.P. for many years to come.

Note of the Secretary

This newsletter comes two months later than promised, but it allowed to incorporate abstracts of the AASP October 91 meeting.

The next newsletter (end of march 1992), will contain the C.I.M.P. Membership Directory. A first version will be send soon to the regional responsibles for corrections. A list of the current C.I.M.P. working groups, subcommissions and their responsibles or contact persons will be added. Other messages, announcements or abstracts should reach the Secretary by March 15 1992.

On your address label we marked several codes. **M** means that we received your form for the C.I.M.P. Membership Directory (winter 1990); **N** means your name is in the database because either you are a long time member, but your form did not reach us in 1990 or because you attended recently a C.I.M.P. meeting, or your name was suggested by your colleague or supervisor. The numbers (89, 91, 92, etc) are the years with your last C.I.M.P. contribution (to our knowledge). No number means that we are not aware of any! If we made a mistake please do not hesitate to contact us to rectify any errors. It should be added that a C.I.M.P. custom exempts the members from countries with a currency deficiency from their contributions (Eastern Europe, Third World).

In recent years the contributions have been too low, especially in countries with no local or regional representative, to cover completely the xeroxing and mailing of the Newsletter. We are looking for some volunteers from e.g. Scandinavia, Germany, The Netherlands or other countries/regions with more than ten members who will act as regional responsible to collect more regularly the contributions. An effort will be done also at the issue of C.I.M.P. meetings and conferences.

24th ANNUAL MEETING

THE AMERICAN ASSOCIATION OF

STRATIGRAPHIC PALYNOLOGISTS, INC.

Program and Abstracts

October 20 - 23, 1991

San Diego, California, USA

SILURIAN-DEVONIAN DIACHRONOUS PROGRADATION OF OLD RED SANDSTONE MAGNAFACIES

Michael G. Bassett

Department of Geology, National Museum of Wales, Cardiff CF1 3NP, Wales, U.K.

Throughout the Caledonian-Appalachian Orogen there is a general north to south (present day direction) younging in the upward stratigraphic transition from marine facies into terrestrial deposits of the Old Red Sandstone magnafacies. This diachronism spans an interval from at least the early or mid-Llandovery to the Emsian. Dating and correlation of the oldest Old Red sediments in any one region is commonly tenuous, so that there is primary reliance on the evidence of the underlying youngest preserved marine fossils for dating the progressive onset of regression.

The diachroneity of the facies changes closely mirrors the diachroneity of tectonism resulting from closure of the Iapetus Ocean and the suturing of Laurentia with Baltica. In turn these features indicate that the continent to continent collision was not orthogonal but was obliquely scissors-like, with progressive closure from north to south.

MULTIVARIATE ANALYSIS OF ORGANIC-WALLED PHYTOPLANKTON ASSEMBLAGES FROM TWO SUITES OF PALEOZOIC SAMPLES

G. Kent Colbath

Department of Earth Science, Cerritos Community College, Norwalk, California 90650

In contrast to traditional statistics, multivariate methods are more useful in developing hypotheses than in testing them. Multivariate plots also provide convenient graphical summaries of large, complex data sets.

Factor analysis of samples from 5 Lower Silurian sections, southern Appalachians, identified three recurrent plankton associations which varied with distance from the ancient shoreline. Although the same pattern was evident during visual inspection of the data, the factor analysis proved superior in 1) providing explicit criteria for recognizing associations; and 2) allowing display of the entire data set on a single diagram.

Data from a second suite of samples from a Devonian reef complex, Western Australia, exhibited no apparent pattern during initial inspection. Extreme variation between adjacent samples and little correlation with lithofacies rendered these data particularly baffling. Following correction for possible winnowing of specimens less than 20μ in diameter, the data were subjected to log transformation and principal components analysis. When plotted sequentially on the first two principal component axes, samples from individual boreholes exhibited a clear pattern, here interpreted as reflecting deepening-upward conditions during deposition. First appearances of species thus represent environmental rather than evolutionary events.

A NEW HYDROFLUORIC ACID DIGESTION TECHNIQUE FOR PALYNOLOGICAL PREPARATIONS

Stephen J. Ellin and Duncan McLean

Centre for Palynological Studies, University of Sheffield, Mappin Street, Sheffield S1 3JD, U.K.

Industrial applications of palynology often require rapid preparation of rock samples for analysis. As well as time constraints the palynologist must consider limitations of laboratory space, chemical costs and workplace hazard, particularly in wellsite situations. One of the time consuming and probably the most hazardous procedure applied in industrial palynological preparation is the use of hydrofluoric acid (HF) to digest silicate minerals in rock samples. Rapid silicate digestion usually involves heating of HF in open containers. The novel application of a commercially available microwave digestion system (MDS) allows this standard rapid digestion procedure to be replaced by a quicker and safer method.

MDS rapid digestion for palynology involves microwave heating of HF in pressurized vessels. Pressurization allows high acid temperatures, and hence more rapid digestion of silicates, to be achieved.

Experimental use of the MDS for HF digestion indicates that considerable savings in time, laboratory space and chemical costs can be made using this technique. The system has several safety design features and, in terms of laboratory hazard, compares favourably with existing methods of rapid sample digestion. The need for relatively small amounts of HF also reduces potential hazards associated with the new technique.

Palynological assemblages recovered from MDS macerated samples compare favourably with control samples prepared using standard techniques. This is true for samples of diverse lithologies of Palaeozoic, Mesozoic, Cenozoic and Recent ages, and for samples of different thermal maturities. Comparative studies with control preparations show that assemblages of fossil miospores, pollen or dinocysts prepared using the MDS are suitable for palynological analysis.

PROBLEMS IN THE REFINEMENT OF DEVONIAN VERTEBRATE CORRELATIONS

David K. Elliott[1] and Richard G. Thomas[2]
[1]Department of Geology, Northern Arizona University, Flagstaff, Arizona 86011
[2]116 12th Avenue N.W., Apt. 6, Calgary, Alberta T2M OC3, Canada

In Lower Devonian biostratigraphic studies the bulk of nonmarine-marine sequence correlation involves palynomorphs and vertebrates, but for many coarse clastic, redbed dominated sections vertebrates are the sole diagnostic fossil. Using the Canadian Arctic-Spitsbergen example, it is shown that recent faunal revisions allow improvements in correlation; however, the level of stratigraphic precision possible is still comparatively coarse. Is it feasible that the current trend towards increased sophistication apparent in Lower Devonian palynostratigraphy can be duplicated in the vertebrate zonation?

Taphonomic studies of several Canadian Arctic vertebrate faunas (and comparison with a Spitsbergen example) highlight some of the problems that may impede additional refinement. For instance, faunal variations can be discerned across the lithologically distinct facies belts of the nonmarine-marine Peel Sound Fm. flanking the Boothia Uplift. Difficulties in explaining these differences result from lack of knowledge concerning: a) the paleoecology of non-lacustrine fish communities; b) the ways in which mechanisms of hydraulic concentration and dispersal prevalent in fluvial and shallow marine realms operate to influence vertebrate faunal composition; and c) the effects of other taphonomic and diagenetic "filters" on *preserved* faunal composition. One may also ask if in the Lower Devonian there were any truly anadromous fish that might occur in marine and fluvial sequences of equivalent age. Success in improving the efficacy of Lower Devonian vertebrate zonations will depend on the extent to which these and other problems can be resolved.

THE DEVONIAN OF NORTH DEVON, GREAT BRITAIN, A PALYNOLOGIST'S DREAM OR NIGHTMARE?

Richard R. W. Knight
Shell International Petroleum Maatschappij, Bv, Oostduinlaan, 75, Postbus 162, 2501 AN, Den Haag, Netherlands

Part of the indurated marine and non-marine Devonian sediments of north Devon are widely considered impoverished of fossils. An integrated micropalaeontological study of the Lynton Formation, Hangman Sandstone Group, Ilfracombe and Morte Slates has revealed the marine sediments to contain varied and locally prolific palynomorphs. Despite problems of high rank and the low total organic carbon content of the rock, the recovered palynomorph assemblages are dominated by well preserved, terrestrially derived material, comprising isolated miospores, complete tetrads and "woody" palynomacerals. Acritarchs, chitinozoa and scolecodonts are infrequent but diverse.

Low diversity, low abundance, shallow water (icriodid dominated) conodont faunas have been recovered from a limited number of localities within the Lynton Formation and Ilfracombe Slates.

Relying principally upon the palynology, the micropalaeontology documented from the Lynton Formation and basal Hangman Sandstone Group indicates a late Emsian/early Eifelian age. The majority of the continental Hangman Sandstone Group proved barren. Palyniferous strata towards the top of this group yielded assemblages of late Eifelian/earliest Givetian aspect. The rich, diverse palynomorph assemblages recovered from the overlying Ilfracombe Slates, together with conodont data indicate a Givetian age. Late Givetian/Early Frasnian miospores were isolated from the Upper Ilfracombe Slates. The age of the overlying Morte Slates is somewhat problematic due to the absence of widely recognized index taxa: the uppermost Morte Slates are conceivably ?earliest Famennian in age.

This study demonstrates the value of integrating both palynological and conodont data in a regional biostratigraphical study, and furthermore identifies the ca. 3km thick Devonian sequence of north Devon as an important continuous reference section for Devonian miospore palynostratigraphy.

THE AMSTERDAM PALYNOLOGICAL ORGANIC MATTER CLASSIFICATION

Maria Lorente
Hugo de Vries Laboratory, University of Amsterdam, Amsterdam, The Netherlands

In June 1991, a group of 72 palynologists from 20 countries met in Amsterdam at the *Open Workshop on Organic Matter Classification* in an attempt to solve the problem of finding a standardized classification system for palynological organic matter. Palynologists present expressed general agreement on the need for a hierarchical classification, including different levels of complexity suitable for different applications. The basic classification should be based upon transmitted white light, but incorporate additional resolution for those with access to incident fluorescence and/or white light. On the basis of a wide diversity of views presented and discussed, a classification framework was established. Most participants wished to avoid the creation of new jargon. The classification will be published within three years as a color photoatlas with accompanying text giving clear, practical definitions for all categories and terms used.

Eight working groups were established in order to address problems associated with types of kerogen and integrating terminology with other disciplines. The working groups are: 1) Incident Light (fluorescent and white light) Level; 2) Thermally Altered Materials; 3) Preservation Scale; 4) Organic Petrology Terminology; 5) Geochemistry; 6) Definitions; 7) Environmental Relations (*i.e.*, taphonomy, biological affinity and modern sediments); and 8) Standards in Preparation Methods. An International Committee was set up to coordinate the project. All those who would like to become actively involved in the Working Groups and/or contribute photographic material for potential inclusion in the Atlas are encouraged to contact the Committee or Working Group convenors. A second Workshop will be convened in Bergen, Norway in June of 1992 in order to review findings of the working groups and determine if revisions to the classification framework are needed. A standardized system for palynological organic matter classification is very important, especially as organic matter assemblages are increasingly being used to interpret environments of deposition. All palynologists are encouraged to participate in the development of this classification.

THE ORCADIAN BASIN, SCOTLAND; EXTERNAL CORRELATION AND MARINE INCURSIONS

John E. A. Marshall
Department of Geology, University of Southampton, Highfield, Southampton, S09 5NH, U.K.

The Orcadian Basin is a sequence of Devonian lacustrine sediments of classic Old Red Sandstone (ORS) facies. It was deposited following the collapse of crust over-thickened during the Caledonian orogeny with the development of half-grabens. During the Mid-Devonian interval the sediments were dominated by cyclic lacustrine facies with a Milankovitch based climatic control. This gives a monotonous repetitive sequence of sediments with few lithostratigraphic marker beds. The nature of these sediments means that lithostratigraphical correlation is difficult and it is now realized that much of the established stratigraphy is invalid. Thick successions described and believed typical of the ORS are in reality thin. Much effort is directed at establishing a secure stratigraphic framework for the basin.

Detailed palynological studies have been carried out on long sequences in both the Eday Group (Orkney) and the Cadboll Formation (Easter Ross). All sections yielded excellent palynological assemblages showing many event markers in common with the marine stratotypes. A notable example is *Geminospora lemurata*. Importantly these are from continuous sequences, easily correlatable using lacustrine cyclicity and with an inherent "Milankovitch" time base.

Further palynological discoveries include the Frasnian spore *Archaeoperisaccus*, not previously reported in NW Europe. Its biogeographical significance is discussed.

Marine palynomorphs have also been discovered in Orkney and offshore in the Moray Firth. This indicates periodic lacustrine incursions into the ORS continent during the waning phase of the Orcadian Basin. These marine incursions are associated with climatic cyclicity. These cycles should provide the best method of high resolution correlation to the marine Devonian.

This work has been done in collaboration with T.R. Astin (Reading) and D.A. Rogers (Glasgow).

ASPECTS OF MID-PALAEOZOIC PALYNOLOGY, FACIES AND CORRELATION

John B. Richardson
The Natural History Museum, London, Department of Palaeontology, Cromwell Road, London SW7 5BD, U.K.

The work of international stratigraphic subcommissions has stimulated much excellent and new stratigraphic work, and not a little heated controversy, in the search for suitable boundary stratotypes. In the case of the Devonian, golden spikes have been placed mainly in sequences containing graptolites, conodonts, goniatites, and tentaculites from distal, broadly basinal environments (Bohemian magnafacies). For palynologists working in both terrestrial (Old Red Sandstone magnafacies) and shelf marine sequences (Rhenish magnafacies), this poses particular problems. These problems are discussed with reference to inter- and intra-regional correlation of systems and stage boundaries in the Silurian and Devonian. International taxonomic sporomorph working groups are making considerable progress in inter-regional correlation, but interdisciplinary research is needed to effect major progress and refinement in correlation with Bohemian magnafacies.

INFERRED NON-MARINE EPISODES IN THE DEVONIAN OF SE ALASKA

Norman M. Savage
Department of Geological Sciences, University of Oregon, Eugene, Oregon 97403

Biostratigraphic and sedimentologic studies in southeastern Alaska indicate at least six gaps in the marine Devonian sequence. These gaps occur where marine sediments were either not deposited or were eroded before deposition recommenced. The marine facies that do occur suggest generally shallow open marine to shallow restricted marine conditions, characterized by conodont polygnathid biofacies in the Lower and Middle Devonian, and by polygnathid and polygnathid-icriodid biofacies in the Upper Devonian. Regressive events that affected the Old Red Sandstone Continent and parts of North America appear to have been effective in the Alexander terrane, and the shallow marine environments seemingly were sensitive to these eustatic changes.

The first regression occurred during the Lochkovian and is evidenced by the absence of the *eurekensis* to *pesavis* conodont zones and the presence of widespread red beds at this level. The red beds are particularly evident on the northern part of Prince of Wales Island, and on Tuxekan and Kosciusco islands. The second regression evidently occurred during Emsian time, as suggested by the apparent non-occurrence of the *inversus* to *patulus* conodont zones. The third seems to have taken place during late Givetian time as indicated by the lack in our conodont collections of any diagnostic representatives of the *varcus* zone. The fourth break occurred during the early Frasnian as evidenced by the seeming absence of representatives of the *disparilis* zone. A fifth break during the early Fammenian is indicated by the absence of conodonts from the Middle *Palmatolepis trianqularis* to *rhomboidea* zones, and a sixth break during the latest Fammenian is implied by the lack of representatives of the *postera* to *praesulcata* zones.

Only the earliest of these breaks in the marine sequence is characterized by non-marine deposits. These include gray and reddish-brown conglomerates, graywackes, sandstones, siltstones, and shales. Some sandstones and shales display cross-bedding, ripple marks and mud cracks. This terrestrial lithofacies may be of biogeographic interest in terrane provenance studies, particularly if non-marine faunas and floras can be recognized.

PALEOECOLOGY OF PRE-DEVONIAN PALYNOMORPHS

Paul K. Strother
Department of Geology, Boston University, Boston, Massachusetts 02215

Paleoecological interpretations of palynological assemblages from pre-Devonian sediments are hampered by the lack of recognizable terrestrial indicators. Low diversity assemblages dominated by sphaeromorph acritarchs have been used as evidence of both deep water and near-shore (stressed) habitats. They have been cited as possible examples of phytoplankton blooms and may also occur in freshwater deposits. I set out to demonstrate that cysts from temporally separated phytoplankton blooms would produce overlapping distributions in most situations, dampening out the signal (spike) represented by bloom-formers. Instead, given the assumption that phytoplankton cysts act as Stokesian particles, I found that fallout times are rapid for cysts of moderate size in 100 m water depths. With rapid enough sedimentation rates and the lack of bioturbation during the Precambrian, phytoplankton blooms are expected to be preserved in the sedimentary record.

A survey of published monographs shows that the majority of sphaeromorph acritarchs do not have excystment structures. This may mean that the bulk of specimens recovered from Precambrian strata are failed cysts, a condition which appears to be quite different from the Phanerozoic record of marine phytoplankton.

Cyanobacterial sheaths are common in Proterozoic palynological macerations. They may be terrestrial, freshwater, shallow-water benthic, or open marine in origin. Mats of intertwined sheaths seen in thin section and in maceration are evidence of shallow habitats, but, given the expanded ecological diversity seen in the Proterozoic cyanobacterial record, occurrences of isolated sheaths cannot rule out open marine sources. Filamentous cyanobacteria could possibly be used as terrestrial and freshwater indicators if a more rigorous approach to understanding their distribution is undertaken. The very presence of cyanobacterial sheaths in palynological macerations expands the list of biopolymers which are known to survive sedimentation and subsequent acid maceration. Their rarity in macerations of younger age is somewhat of a puzzlement.

XII INTERNATIONAL CONGRESS ON CARBONIFEROUS - PERMIAN
BUENOS AIRES, ARGENTINIA, 22-27 September 1991.

Selection of the ABSTRACTS XII ICC-P

CONTROLS ON THE ULTRASTRUCTURAL PRESERVATION OF MEGASPORE WALLS

A. HEMSLEY and A. C. SCOTT

Geology Department, Royal Holloway and Bedford New College, University of London, Egham, Surrey, TW20 OEX. G. Britain.

Ultrastructural studies using SEM and TEM have been undertaken on several Carboniferous megaspores. *Lagenicula crassiculeata* has been obtained from several facies at the same Lower Carboniferous localities in Scotland, including limestones and shales. Both have had a similar thermal history. *Tuberculatisporites mammilarius* has been obtained from coals, shales and oolitic ironstones from the Westphalian B of Yorkshire, again having similar thermal histories. Ultrastructural preservation of the same species from different facies varies considerably. We have observed excellent preservation in the spores from facies which underwent early diagenetic cementation. We conclude that compression, rather than rank (temperature), is the main control of ultrastructural preservation of megaspore exines. We also present a new method: Scanning Acoustic Microscopy, for the study of ultrastructure in megaspores from sequences of high rank.

PALYNOFACIES FROM THE UPPER CARBONIFEROUS COAL MEASURES OF YORKSHIRE, ENGLAND

P. HIGHTON, A. PEARSON and A. C. SCOTT

Geology Department, Royal Holloway and Bedford New College, University of London, Egham, Surrey, TW20, OEX, England.

Westphalian palynofacies have been studied from four different aspects: organic particle size analysis, kerogen analysis, miospore analysis (for particles smaller than 200 microns), and palynodebris analysis (for particles over 200 microns). Our kerogen classification scheme is presented based primarily on the general form and appearance of organic particles, rather than having any botanical basis. Image analysis is especially useful in obtaining quantitative data. Sample preparation and study methods are detailed and illustrated with examples from the Westphalian B of Yorkshire, England. All methods give valuable information which can be used for palynofacies definition, facies correlation, palaeoenvironmental analysis and palaeoecological interpretations. Results suggest that this approach is particularly powerful when dealing with the mudstone sequences, easily separating lacustrine, marine and floodplain facies. In the light of these results future work will be outlined.

SIMILARITIES AND DIFFERENCES IN PERMIAN PALYNOFLORAS OF GONDWANA. A REVIEW AND NEW EVIDENCE

Poster

C. B. FOSTER[1], *G. D. WOOD*[2] *and G. W. BARKER*[2]

[1]Bureau of Mineral Resources, Geology and Geophysics, GPO Box 378, Camberra, ACT, Australia, 2601.

[2]Amoco Production Company, P. O. Box 3092, Houston, TX 77253, U.S.A.

Recent evidence, combined with published information, indicates that good palynological correlations exist at the species level for the latest Carboniferous/early Permian and latest Permian/earliest Triassic in Gondwana. These data confirm the presence of broadly correlatable, inter-regional palynozones and permits recognition of local floral diversification. Evident intra-Gondwana provincialism can be related to ecologic and tectonic controls which affect plant migration.

The Lower Permian (?late Asselian-early Sakmarian) is manifest by the occurrence of the *'Granulatisporites' confluens* Oppel-zone in Australia, Africa, South America, India and Antarctica. Key species include probable representatives from: ferns, *Apiculatisporis cornutus, Horriditriletes ramosus, G. confluens, Microbaculispora tentula, M. grandegranulata;* lycopods, *Densoisporites* spp. *Jayanisporites* spp., *Cristatisporites* spp; and gymnosperms, *Caheniasaccites* spp., *Cannanoropollis* spp., *Plicatipollenites* spp., and *Stellapollenites* spp. Palaeoenvironmental indicators of water salinity include algal remains of *Botryococcus, Tetraporina* and spinose acritarchs. Quantitative compositional differences do occur between these Gondwanan assemblages, but their association with diamictites and evidence of glacial activities is everywhere apparent.

Provincialism, both real and affected by lack of data, is evident throughout Gondwana during the latest Sakmarian-Djulfian. *Dulhuntyispora* a zonal marker in the Australian Permian has been recovered (*in situ*) only from southern Africa. *Lueckisporites* spp. and *Guttulapollenites,* common in Early to Late Permian assemblages from South America, Central Africa, Madagascar, Pakistan and Euramerica appears in the Australian record near the end of the Permian (coincident with the termination of coal measure sedimentation). This provinciality is evident following the initial rifting of Gondwana, however, key species persist that allow inter-regional correlations. For example, *Pseudoreticulatispora pseudoreticulata* from Sakmarian equivalents in Argentina also occurs in Africa, India and South America. Other mutually occurring forms include *Marsupipollenites triradiatus, M. striatus, Apiculatisporis cornutus, Didecitriletes ericianus* and *Praecolpatites sinuosus.*

Significant Gondwana-wide changes in the flora occurred during the last 7 million years of the Permian (Djulfian to Dorashamian). Key time markers, including *Triplexisporites playfordii,* appeared in the succession and allow widespread correlation in India, Australia, Africa, Israel, Salt Range, and Malagasy. In eastern Australia, other species which make their initial appearance with *T. playfordii* include: *Triquitrites proratus, P. cancellosa* and *Brevitriletes hennellyi.* At similar (?slightly older) horizons in northern and western Australia monolete spores of *Yunnanospora radiata,* first described from the Chinese Permian (Ouyang, 1979), appear. Widespread floral migration must have taken place immediately prior to or during this period, concomitant with global lowstands. The close of the Permian is also marked by the introduction of significant numbers of gymnospermous representatives including of *Lunatisporites* spp. and *Protohaploxypinus microcorpus* however, overall the diversity of disaccate, straite grains decreases.

PALYNOLOGICAL CHARACTERISTICS OF STRATA CONTIGUOUS WITH THE DEVONIAN-CARBONIFEROUS BOUNDARY

G. PLAYFORD

Department of Geology and Mineralogy, The University of Queensland, Brisbane, Australia 4072

Palynological analyses of sedimentary rocks in many parts of the world that are bracketed within the interval of latest Devonian (Strunian)-earliest Carboniferous (Tournaisian) have focused mainly on the nature and distribution of miospores. However, increasing attention is being paid also, in marine strata, to associated organic-walled microphytoplankton (acritarchs and prasinophyte phycomata). Among the miospore taxa, the species *Retispora lepidophyta* (Kedo) Playford, 1976 has near-global distribution and is preeminent as a palynostratigraphic index, as its exit approximates or coincides with the Devonian-Carboniferous boundary. Other widely distributed miospore species that occur within strata in the vicinity of the systemic boundary include *Tumulispora rarituberculata* (Luber) Playford, 1990, *Grandispora echinata* Hacquebard, 1957, *Pustulatisporites dolbii* Higgs, Clayton, and Keegan, 1988, *Dibolisporites abstrusus* (Playford) Playford, 1976, *Cyrtospora cristifera* (Luber) emend. Van der Zwan, 1979, *Cordylosporites marciae* Playford and Satterthwait, 1985, *Vallatisporites* spp., *Verrucosisporites nitidus* Playford, 1964, and *'Lophozonotriletes' concentricus* (Byvscheva) Higgs, Clayton and Keegan, 1988. Associated marine phytoplankton components include *Gorgonisphaeridium winslowiae* Staplin, Jansonius and Pocock, 1965, *G. plerispinosum* Wicander, 1974, *G. ohioense* (Winslow) Wicander, 1974, *Stellinium micropolygonale* (Stockmans and Willière) Playford, 1977, *Maranhites mosesii* (Sommer) Brito, 1965, *M. brasiliensis* Brito, 1965, and *Cymatiosphaera perimembrana* Staplin, 1961. The stratigraphic significance of these and other palynomorph taxa, in terms of their exit or entrance levels, is evaluated with reference to both Euramerican and Gondwanic palynofloras.

ORGANIC MATTER TYPES IN THE UPPER PALEOZOIC DEPOSITS IN THE PRECASPIAN DEPRESSION ACCORDING TO PALYNOLOGICAL DATA

N. N. PODGAINAYA

T. S. L. Nizhnevolzhsk geol., Saratov, U.S.S.R.

Along with palynostratigraphic studies of the Upper Carboniferous and Lower Permian gas- and oil-bearing deposits in southwestern part of the Precaspian syneclise the investigation of microcomponent composition of kerogens and also colour alteration of microphytofossil capsules has been carried out aimed at identification of types of trace organic matter (TOM) and its maturity degree proper for gas and oil generation processes. The analysis of distribution peculiarities of the insoluble organic matter in certain sections has shown that the Upper Carboniferous and Assel-Artinsk deposits are quite rich in organic matter. Amorphogenic, alginite, exinite-cutin, coaly and mixed types of TOM have been distinguished for them. Exinite-cutin and coaly types of TOM predominate in the Upper Carboniferous flyshoid-terrigenous deposits. Assel-Lower Artinsk flyshoid-molasse deposits contain TOM of alginite, coaly and mixed exinite-cutin type with the admixture of alginite components, i.e. capsules of the one-celled alga Tasmanites New. Amorphogenic type of TOM is also present in the Upper Artinsk sulphateterrigenous deposits. Assel carbonates and salts from the Kungur stage are impoverished in insoluble organic matter.

Judging by the colour of microphytofossils most organic matter accumulations are in the oil generation zone or in its completion stade. Artinsk deep-sea and relatively shallow shelf deposits have the greatest oil-source potential.

MEGASPORES FROM THE UPPER CARBONIFEROUS COAL-BEARING SEQUENCE OF WESTFIELD, FIFE, SCOTLAND

A. C. SCOTT, D. PARSONS and A. HEMSLEY

Geology Department, Royal Holloway and Bedford New College, University of London, Egham, Surrey, TW20 OEX, England.

The Carboniferous coal basin of Westfield, Fife, Scotland is unusual as it contains an unusually thick coal sequence (up to 200 meters) ranging in age from early Namurian to Mid-Westphalian. The Coals are dominated by dull durain-rich coals but the main Bogside Thick Coal is 50 metres thick and of Namurian B age. 60 samples of coal and shales between the coals were macerated for megaspores which were studied both by SEM and TEM. The assemblages were less diverse than those from equivalent coals elsewhere with a significant degree of similarity between coals suggesting relatively constant conditions in the coal basin over a considerable time. *Setosisporites* dominated all assemblages but in addition *Tuberculatisporites* and *Zonalesporites* were common at some levels. The significance of the assemblages will be assessed and comments will be made on the evolution of some species which occur throughout the sequence.

PALYNOLOGY OF PERMIAN (KUNGURIAN? TO KAZANIAN) ROCKS OF THE SVERDRUP BASIN, CANADIAN ARCTIC ARCHIPIELAGO

J. UTTING

Geological Survey of Canada, 3303 33rd St., N. W., Calgary, Alberta, Canada, T2L 2A7.

In the Sverdrup Basin marine, shallow-water platform rocks of the Lower Permian (Kungurian? and Ufimian) and Upper Permian (Kazanian) contain assemblages of well preserved palynomorphs. Lower Permian assemblages are diverse and contain abundant trilete spores (*Apiculatisporis, Calamospora, Kraeuselisporites, Lophotriletes, Raistrickia,* and *Waltzispora*), striate disaccate pollen (*Protohaploxypinus*) and polyplicate pollen (*Weylandites* and *Vittatina*). Nonstriate disaccate pollen (*Alisporites* and *Jugasporites*) are present. A humid climate is suggested by these diverse assemblages and abundance of trilete spores; this is supported by the presence of thin, coaly intercalations in the lower part of the unit composed mainly of medium and coarse sandstone. Overlying beds consist of medium bedded, fine-grained, calcareous, and glauconitic sandstone with minor amounts of silt and clay. Upper Permian (Kazanian) assemblages are dominated by striate disaccate and polyplicate pollen. *Scutasporites, Taeniaesporites* and *Lueckisporites* appear, along with the trilete spore *Ahrensisporites*. The abundance of striate grains suggests an arid climate. Rock types consist of thin to thick bedded, and massive, fine to coarse, quartzose sandstone, which is variably calcareous and glauconitic. An absence of post-Kazanian sediments indicates a hiatus at the basin margin between the Kazanian and overlying Lower Triassic (Griesbachian).

From the palynological data the Sverdrup Basin may be assigned to the sub-Angaran floral province. Microfloras from Angara to the north and Euramerica to the south are different, but each has some features in common with sub-Angara. Also there are similarities between the Sverdrup Basin material and that from parts of Gondwana such as central Africa, which in the Permian occupied a similar latitude in the southern hemisphere as the Sverdrup Basin in the north.

PALYNOLOGICAL INVESTIGATIONS IN THE UPPER CARBONIFEROUS OF WELL DE LUTTE-6 (TWENTE, THE NETHERLANDS)

J. G. M. van de LAAR[1] and C. J. van der ZWAN[2]

[1]Geological Survey of The Netherlands, P.O. Box 126, 6400 AC Heerlen, The Netherlands.

[2]N.A.M., XGS/31, P.O. Box 28000, 9400 HH Assen, The Netherlands.

Well De Lutte-6 was drilled in 1989 as a joint project by the N.A.M. (Dutch Oil Company) and R.G.D. (Dutch Geological Survey). The deviated borehole reached a total depth of 3193.67 m (along hole) and penetrated Carboniferous strata at a depth of 2231.70 m; the complete Carboniferous interval was cored. As no sufficient time-diagnostic palynomorphs were found, the chronostratigraphical framework is best provided by palaeobotanical results, indicating a Westphalian C to D age. Only the lowermost 420 metres of the cored sediments provided samples which yield recognizable palynomorphs. Three different miospore assemblages, alternating with barren intervals, can be recognized. From old to young these are: Assemblage III, a mixed diverse spore-pollen assemblage dominated by Indet. monosaccate pollen; Assemblage II, a diverse sporomorph assemblage, dominated by *Calamospora* spp.; Assemblage I, an impoverished pollen assemblage dominated by *Potonieisporites novicus*.

The abundance of *Potonieisporites* pollen and the almost complete absence of monolete spores in the Westphalian D of this well is not comparable to the established floristic development at this stratigraphic level in Western Europe. Palynofacies analysis, combined with palynoflora data, indicate a gradual transition from a waterlogged floodplain characterized by a diverse Lycopod/Cordait palynoflora, to a well-drained floodplain with an impoverished Cordait/Conifer palynoflora. In these floodplains fluvial deposits alternate with swamp and lake deposits. The transition from waterlogged floodplain to well-drained floodplain coincides with the transition from intervals characterized by seat-earth soils, indicating humid conditions, to intervals characterized by immature calcic soils, indicating semi-humid to semi-arid conditions.

ENVIRONMENTAL INFLUENCE ON VITRINITE REFLECTION IN CARBONIFEROUS COALS AND SHALES

H. VELD[1-2], N. N. M. JANSSEN[2], W. J. J. FERMONT[1] and H. J. M. PAGNIER[1]

[1]Geological Survey of the Netherlands, P.O. Box 126, 6400 AC Heerlen, The Netherlands.

[2]Laboratory of Palaeobotany and Palynology, University of Utrecht, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

Four coal seams of well Limbricht-1/1a (S. Netherlands) were selected for an integrated organic petrological and sedimentological study. Within the investigated interval three major sedimentary cycles are recognized. Each cycle consists of a series of sediments deposited in: 1) floodplain, 2) swamp, and 3) lake/lake margin environments. The onset of peat formation as recognized in the coal intervals shows a comparable pattern in each cycle. The termination of peat formation is different in each cycle, i.e. abrupt to relatively gradual. Clastic partings show that peat formation generally has not been a continuous process.

On the basis of quantitative maceral analyses several depositional subenvironments can be recognized within a single coal seam. The presence of these subenvironments can partly explain the observed deviations in vitrinite reflectance values. However, this relationship is not consistent in all cases, indicating that other factors may influence the vitrinite reflectance as well. Oxidation and reduction phenomena are generally considered to have played a prominent role in the early diagenetic transformation of vitrinite precursors. Apparently, these are in turn related to fluctuating ground-water levels. These phenomena are evidenced by variations in maceral composition (e.g. Tissue Preservation Index and Gelification Index). However, such changes in physical and chemical conditions during and after the accumulation of organic matter represent just two extremes within a suite of (bio)degradation processes. Because anaerobic conditions are a prerequisite for vitrinite formation and preservation, the interplay between the various anaerobic (bio)degradation processes are considered to be of particular importance for the explanation of fluctuations in vitrinite reflectance values.

ON *CORDAITES* LEAVES IN ORGANIC CONNECTION WITH A STEM IN THE ARGENTINE CARBONIFEROUS

J. C. VEGA

Virasoro 1531, Depto. 2, 2000 Rosario, Santa Fe, Argentina.

The cordaitales are an important component of several Carboniferous and Permian megafloristic associations in Argentina. However, they were almost unknown in the carboniferous Jejenes Formation in which they have now proved to be an important component of the plant assemblages. They were found in carbonaceous shales at La Rinconada, in San Juan province. For these remains, a new species of the genus *Cordaites* is proposed. The type specimen is a stem-like fragment, with several leaves attached, helically arranged, wedge-shaped, with opened and dichotomous venation, lacking interveins. These leaves are closely associated with a strobiloid fructification.

PALYNOSTRATIGRAPHY OF THE NEOPALEOZOIC SEQUENCE IN THE CHACOPARANENSE BASIN, ARGENTINA

M. del M. VERGEL

Facultad de Ciencias Naturales e Instituto Miguel Lillo - CONICET, Miguel Lillo 205 (4000) S. M. de Tucumán, Argentina.

Recent palynological studies of neopaleozoic sediments from the subsurface of the Chacoparanense Basin (Argentina), increase the knowledge of the composition and distribution of assemblages related to the *Potonieisporites-Lundbladispora (PL), Cristatisporites (C)* and *Striatites* palynozones. A new biostratigraphic zonation scheme is proposed, including some additions. 1) New pollen components have been found at the basal part of the PL zone: they are known to occur also in the Late Carboniferous strata of the Paganzo Basin. This suggests that at its base, the zone is slightly older than previously suspected. 2) The *Cristatisporites* zone is subdivided into three units, taking into account the differential distribution of spores and monosaccate pollen grains with respect to striate pollen grains. Finally, the biostratigraphic status of the *Striatites* zone is maintained. The microfloristic assemblages and the new biostratigraphic zonation scheme are both compared and correlated with previously described associations in the Chacoparanense Basin, and other close gondwanic areas. A neocarboniferous (Stephanian) to neopermian (Kazanian) age is suggested for this palynological sequence.

FIRST PALYNOLOGICAL RECORD OF THE UPPER CARBONIFEROUS IN THE NORTHERN MARGIN OF PAGANZO BASIN, LOS JUMES, CATAMARCA, ARGENTINA

M. del M. VERGEL, L. A. BUATOIS and M. G. MANGANO

CONICET. Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán. Miguel Lillo 205, 4000 S. M. de Tucumán, Argentina.

The presence of a plant microfossil assemblage recovered from a lacustrine sequence at Cantera La Laja, Los Jumes area (Catamarca), northern margin of the Paganzo basin is documented. The plant microfossils derived from the Agua Colorada Formation are of Late Carboniferous age. Among many others, the following spores have been recognized: *Lundbladispora braziliensis; L. irregularis; Vallatisporites ciliaris; Cristatisporites menendezii* and *Calamospora hartungiana*. Pollen grains are also represented, e.g. *Plicatipollenites malabarensis; P. gondwanensis; Cannanoropollis densus;* etc. Freshwater components include *Brazilea scissus* and *Tetraporina* sp. Palynological data suggest a Westphalian age. The palynoassemblage is dominated by spores. Monosaccate pollen grains are less common, whereas striate pollen grains are absent. The presence of Pteridophytes, Lycophytes and Sphenophytes at the lake margin is suggested. Gymnospermae, -Cordaitopsida and Coniferopsida- were probably developed near these water bodies. The palynoassemblage is present in laminated, very fine sandstones and siltstones, deposited by underflow currents related to fluvial input.

A PALYNOLOGICAL SUCCESSION ACROSS THE DEVONIAN-CARBONIFEROUS TRANSITION, SOUTH EASTERN POLAND

Poster

G. D. WOOD[1], *E. TURNAU*[2] *and G. W. BARKER*[3]

[1] Amoco Production Company, P. O. Box 3092, Houston, Texas 77253. U.S.A.

[2] Institute of Geological Sciences, Senacka 3, 31-002 Krakow, Poland.

[3] Amoco Production Co., Research Center, P. O. Box 3385, Tulsa, OK 74102. U. S. A.

A diverse and well preserved palynomorph assemblage was recovered from core material from the Polish National Oil Company Chmielno #1. The Carboniferous spores include *Auroraspora macra, Convolutispora major, C. mellita, Corbulispora cancellata, Dibolisporites distinctus, Dicernisporites micromanifestus, Grandispora cornuota, Knoxisporites literatus, K. triangulatus, K. triradiatus, Kraeuselisporites hibernicus, Lophozonotriletes bellus, L. triangulatus, Raistrickia corynoges, R. minor, R. variabilis, Rugospora flexuosa, Spelaeotriletes balteus, Spirozonotriletes uncatus, Tripartites cf. T. incisstrilobus, Tumulispora rarituberculata* and *Verrucosisporites nitidus*. The Devonian is manifest by the occurrence of *Lophozonotriletes malevkensis, Retispora lepidophyta, Vallatisporites pusillites* and several additional forms that span the boundary. The first downhole occurrence of *R. lepidophyta* is also associated with the presence of the acritarchs *Baltisphaeridium flandrum, Cymatiosphaera* spp., *Gorgonisphaeridium winslowii, Stellinium comptum, S. micropolygonale* and *Veryhachium* spp.

The stratigraphic occurrence of these palynomorphs is extremely similar to existing zonations. The assemblage falls in the GU through MA zones erected for northern Poland. This is roughly equivalent to the LL through PC zones erected from studies in the United Kingdom.

PERMIAN SPORES AND POLLEN FROM LAURENTASIA: COMPARISON OF ASSEMBLAGES FROM THE UNITED STATES, CANADA, WESTERN EUROPE, SOVIET UNION AND CHINA

G. D. WOOD, G. W. BARKER and L. E. EAMES

Amoco Production Company, P. O. Box 3092, Houston, TX 77253. U.S.A.

The published Permian palynological database of North America has been enhanced by new studies from ditch-cuttings, core and outcrops from the United States. This new information includes palynological recovery from key independently dated (using fusulinids and/or other foraminifera) sections. The genera now reported from the United States mid-continent and southwest include: *Alisporites, Angulisporites, Apiculatisporites, Bifurcatisporites, Cadiospora, Calamospora, Columnisporites, Convolutispora, Costatapollenites, Crassispora, Crucisaccites, Cycadopites, Cyclogranisporites, Endosporites, Florinites, Gillespieisporites, Granulatisporites, Guthörlisporites, Hamiapollenites, Ibrahimisporites, Illinites, Knoxisporites, Krauselisporites, Latipulvinites, Leiotriletes, Lophotriletes, Lundbladispora, Maculatisporites, Microreticulatisporites, Peppersites, Pilosisporites, Pityosporites, Platysaccus, Playfordiaspora, Potonieisporites, Protohaploxypinus, Pseudopodocarpus, Punctatosporites, Raistrickia, Thymospora, Schizaeosporites, Schopfipollenites, Striatites, Striatoabieites, Striatohaplopinites, Striatopodocarpites, Striatosuccites, Verrucosisporites, Vesicaspora* and *Vittatina*.

Comparison of Lower Permian strata (where information is available) indicates that broadly correlatable palynozones exist between Laurentasian regions. However, comparison of these areas are hampered by such factors as taxonomic inconstancy and artifacts of processing.

PERMIAN MEGASPORES IN CHINA

YANG JIDUAN and SUN SUYING

Institute of Geology, Chinese Academy of Geological Sciences, Baiwanzhuang Road, Beijing, P. R. China.

The Permian of China is well developed in two sedimentary domains separated by Kunlun and Qingling Mts. The megaspores in the northern domain, mainly composed of continental sediments, are characterized by the predominance of *Calamocystes mathieui* and *Triangulatisporites* spp. In the southern sedimentary domain, the Permian consists mostly of marine deposits and locally of an alternation of marine and continental deposits, yielding abundant *Triangulatisporites* spp, *Echitriletes spinculatus* and *Erlansonisporites*.

Abstracts

Commission Internationale de Microflore du Paleozoique:
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RECOGNITION OF *URNOCHITINA URNA, EISENACKITINA BOHEMICA* AND *MARGACHITINA CATENARIA* MICROFAUNAS IN THE CHALEURS GROUP, EASTERN CANADA.

ACHAB, A. and ASSELIN, E., Centre géoscientifique de Québec, 2700 Einstein, C.P. 7500, Sainte-Foy, Québec, G1V 4C7 Canada

This study is a preliminary investigation on Upper Silurian and Lower Devonian Chitinozoa from Eastern Canada. Samples were collected in the upper part of the Chaleurs Group. The studied interval comprises the Roncelles Formation and the first three members of the Indian Point Formation: the Rosebush Cove, Petit Portage and Quay Rock members.

This fine-grained siliciclastic succession is interpreted as sediments deposited in a deepening outer shelf environment. The documented deepening event seems to be expressed by an upward increase in abundance and diversity of chitinozoan microfaunas and by an improvement of the state of preservation of the organic microfossils.

The Roncelles Formation yielded a microfauna mainly composed of *Ancyrochitina* and *Angochitina* species. Each of the three members of the following Indian Point Formation is characterized by a distinctive chitinozoan assemblage. The Rosebush Cove Member contains a microfauna in which *Muscochitina* aff. *muscova* and *Urnochitina urna* are the diagnostic species. These species suggest a more likely Pridolian rather than Lockhovian age, as previously assigned. This attribution seems to be reinforced by the presence, in the succeeding Petit Portage Member, of an other typical Pridolian assemblage composed of *Linochitina klonkensis* and *Pterochitina perivelata*. The first Lochkovian chitinozoan microfauna is encountered in the Quay Rock Member, diagnostic species are *Eisenackitina bohemica* and *Margachitina catenaria*.

NEW MORPHOLOGICAL CHARACTERS OBSERVED IN THE *OPERCULATIFERA* AND THEIR IMPLICATION FOR THE SUPRAGENERIC CLASSIFICATION.

ACHAB, A., ASSELIN, E. and SOUFIANE, A., Centre géoscientifique de Québec, 2700 Einstein, C.P. 7500, Sainte-Foy, Québec, G1V 4C7 Canada

Within the currently used suprageneric classification of Chitinozoa, two orders are distinguished on the basis of the presence of an operculum or a prosome. These two orders are further subdivided into three families, on the basis of the neck differentiation whereas the structure and ornaments of the outer layer are used as sub-family criteria. The arrangement, location and development of these morphological features and the shape of the vesicle are in turn used for the generic assignments.

During palynostratigraphic studies, three morphological characters common to the *Prosomatifera*, but previously not identified within the *Operculatifera*, have been encountered. These reports suggest that the same morphological characters can be used, in all the families, as sub-family and genus criteria.

The first feature has been observed in a Lower Ordovician microfauna of Sahara on Desmochitinidae forms bearing an unsticked sleeve, like the one observed in the *Velatachitina* genus of the *Prosomatifera* Order. The second one is reported from Eisenackitininae specimens of the Upper Ordovician of Morocco. The morphological character consists of an ornamentation in longitudinal rows, like in the *Hercochitina* genus in the *Prosomatifera*. The third feature has been encountered in an Upper Silurian assemblage from Eastern Canada. It consists of a ring of spines limited to the basal part of the chamber, like in the *Spinachitina* genus in the *Prosomatifera*. These important diagnostic features favour the establishment of three new genus and possibly two new sub-families.

THE BIOLOGY OF THE CHITINOZOA AND A NEW CLASSIFICATION SCHEME

Cashman, Patrick B., Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0

Recently, the hypothesis that the chitinozoa are an extinct group of rhizopods has been reintroduced, following the discovery of fossil juvenile stages. It is now apparent that the ultrastructure of the chitinozoan test is that of a laminated wall. The mucron is reinterpreted as a second aperture, rather than as representing a scar from the detachment of two tests; the presence of a mucron is considered indicative of a solitary lifestyle. The prosome is an extension of the many wall layers present in the test; prior interpretations of the prosome as being a type of plug were a consequence of the diagenetic processes that the chitinozoan test underwent shortly after being deposited into the substrate. The colonial chitinozoans are a unique group of chitinozoans that may or may not have had a copula for the connection of two tests. Moreover, these chitinozoans possess a unique system of pores for pseudopodial emergence, which influence the shape and size of their operculum. A new classification system is proposed which erects two new orders of chitinozoans -- the CATENATIFERA and the MUCRONATIFERA. The previously existing orders -- the Prosomatifera and the Operculatifera -- are emended and reduced to subordinal status within the Mucronatifera.

THE DECLINE OF THE CHITINOZOA: A POSSIBLE CAUSE

Cashman, Patrick B., Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0

The association of chitinozoans in sedimentary rocks with the remains of graptolites and other metazoans has been documented by numerous researchers. The hypothesis that this may be evidence that chitinozoans were the egg or larval stages of some marine metazoan has been rejected, following the discovery of juvenile stages. Instead, it is concluded that chitinozoans were rhizopods and probably served as a major food source for these metazoans. This recognition has resulted in a revised theory for the extinction of the graptolites and the chitinozoans. The diversity of the chitinozoans is considered and compared with that of acritarchs and graptolites. A hypothesis that the Ceratoikiscid radiolarians, which are widespread in the Ludlovian, outcompeted and restricted the normal distribution of the colonial cateniferid Chitinozoa, gradually causing their extinction is proposed. The extinction of the graptolites may have been a consequence of the failure of the graptolites to adapt from feeding on the colonial chitinozoans to a silicious rich diet of radiolarians. It is also suggested that the increase in diversity of the ceratoikiscid radiolaria during the early Middle Devonian restricted the mucronatiferid Chitinozoa to the shallower regions of the continental shelf and also contributed to their demise during the Famennian. It is known already that the effect of evolutionary changes within one group of organisms may induce a crisis for other organisms that share the same niche: the extinctions of the chitinozoans and graptolites are considered examples of this.

LATE ORDOVICIAN AND SILURIAN SEQUENCE STRATIGRAPHY, ACRITARCH ASSOCIATIONS AND CHITINOZOAN ASSEMBLAGES OF THE WELSH BASIN, ENGLAND AND WALES

DORNING, Ken J. Pallab Research, 58 Robertson Road, Sheffield S6 5DX, England

The Hirnantian to Ludlow marine succession in the Welsh Basin may be divided into five marine depositional sequences.

The Hirnantian to Aeronian sequence includes the Helosphaeridium citrinipeltatum, Tylotopalla robustispinosa, Multiplicisphaeridium fisherii and Oppilatala eoplanktonica acritarch biozones.

The Aeronian to Sheinwoodian sequence includes the Ammonidium microcladum, Dactylofusa estillis, Deunffia monospinosa, Deunffia brevispinosa and Deunffia brevifurcata acritarch biozones.

The Sheinwoodian to Homerian sequence includes the Cymatiosphaera pavimenta, Eisenackidium wenlockensis and Dictyotidium amydrum acritarch biozones.

The Gorstian sequence includes the Leptobrachion longhopense, Tylotopalla pyramidale and Florisphaeridium castellum acritarch biozones.

The Ludfordian sequence includes the Leoniella carminae and Visbysphaera whitcliffense acritarch biozones.

These marine sedimentary sequences may be recognised using quantitative palynological techniques, including acritarch associations, chitinozoan and spore assemblages. In addition, the palynological assemblages may be utilised to recognise palynological events and subdivide the sequences into multiple parasequences of value in stratigraphical correlation and basin analysis.

CHITINOZOANS AND ACRITARCHS FROM THE ORDOVICIAN - SILURIAN BOUNDARY OF THE PRAGUE BASIN (BARRANDIAN AREA, CZECHOSLOVAKIA).

DUFKA, P. and FATKA, O., Geological Survey, Malostranské nám. 19, 118 21 Praha 1, Czechoslovakia.

Uninterrupted sedimentation across the Ordovician - Silurian boundary in the Prague Basin is characterized by a considerable lithological change, where the uppermost Ordovician bioturbated light mudstones of the Kosov Formation (? G. persculptus Zone) are followed by dark graptolitic shales of the basal Silurian Zelkovice Formation (A. ascenus Zone). Palynological investigations close to this boundary have provided determinable acritarchs and chitinozoans in two outcrops (Karlík and Hlásná Trebán).

Typical Ordovician acritarch assemblages and cryptospores occur in the uppermost layer of mudstones above the sequence containing exclusively cryptospores. Acritarchs are missing in the overlying black shales. The only lower Llandovery acritarch assemblage recorded in a thin layer of pale claystone of the A. acuminatus Zone contains taxa different from the upper Ordovician assemblage.

In contrast to acritarchs, which are missing, the lower Silurian black shales contain abundant, badly to moderately preserved chitinozoans including several lower Llandoverian index taxa. Chitinozoans are rare and poorly preserved in the upper Ordovician; the only moderately preserved specimens are recorded several cm below the Ordovician - Silurian boundary.

MAZUELLOIDS : A REVIEW.

DUFKA, P.[1] and LE HERISSE, A.[2]

1. Ustredni ustav geologicky, Malostranske 19, 11821 Praha, Czechoslovakia.
2. Laboratoire de Paléontologie, Université de Bretagne Occidentale, 6 avenue Le Gorgeu, 29287 Brest Cédex, France.

The informal term mazuelloid was erected by Aldridge and Armstrong (1981), to accommodate simple spiny hollow spheres, found in marine sediments, and composed of minerialized and organic substances, which are distinguished from Acritarchs principally by their greater size and differences in composition. The past few years have seen a marked increase in the study of these enigmatical microfossils which appear in the fossil record in the Ordovician and persist through the Silurian and Devonian times. Up to now they have been reported mainly in deep water or distal facies, currently associated with radiolarians, sponge spicules, graptolitic remains, scolecodonts, chitinozoans, but rarely with Acritarchs. Their distribution may be in part a result of selective fossilization or should be indicative that they were restricted to a special type of environment. According to their know geographic distribution, their presence in marine waters does not seem to be influenced by temperature.

This contribution is devoted firstly to a review of current knowledge that concern the mazuelloids, with references to rich assemblages recovered from the Barrandian area in Bohemia, the Silurian of Vendée (South of the Armorican Massif) and Aquitaine, France, and rare specimens from the Silurian of Gotland, Sweden. Secondly we discuss many remaining questions concerning their composition, taxonomy, biological significance and distribution.

SELECTED MICROFOSSILS ACROSS THE GORSTIAN-LUDFORDIAN BOUNDARY.

ELLIOTT, R.E., Department of Geology, University of Leicester, Leicester LE1 7RH, U.K.

The international stratotype section for the base of the Ludfordian Stage at Sunnyhill Quarry, Ludlow, shows well exposed shallow marine strata. This section has been sampled in detail and processed for the recovery of palynomorphs, ostracods, conodonts and other microfossils. The microflora consists dominantly of acritarchs, which are recorded in abundance throughout the Upper Bringewood and Lower Leintwardine. Amongst 25 separate genera, the following are common: Visbysphaera, Veryhachium, Micrhystridium, Diexallophasis and Percultisphaera. Sphaeromorphs are also abundant.

CHITINOZOANS AND ACRITARCHS IN EARLY ARENIG SEDIMENTS OF THE PRAGUE BASIN (BARRANDIAN AREA, CZECHOSLOVAKIA).

FATKA, O., Geological Survey, Malostranské nám. 19, 118 21 Praha 1, Czechoslovakia.

The Upper Tremadoc Milina Formation (correlated recently with the Ceratopyge regressive event) is characterized by shallow water and lagoonal bedded cherts, containing a diversified benthic fauna with trilobites, brachiopods, sponges and echinoderms; graptolites, acritarchs and chitinozoans are missing. Deepening and expansion of the Prague Basin, associated with the sedimentation of shales in the lower part of the overlying Klabava Formation fits well with the transgressive character of the early Arenig.

The oldest exposed layers of the Klabava Formation contain a poor assemblage of Clonograptus and other graptolites with acritarch taxa such as Caldariola glabra, Cymatiogalea ?messaoudi, Rhopaliophora palmata, Tetraniveum arenigum, the Veryhachium trispinosum group and other species of the genera Acanthodiacrodium, Baltisphaeridium, Gorgonisphaeridium, Peteinosphaeridium, Polygonium, Solisphaeridium and Stelliferidium.

Shales of the Klabava Formation exposed at another site (without graptolites) contain C. glabra, C. ?messaoudi, Tectitheca sp. and some of the above mentioned genera in association with Amphorachitina ?conifundus and Conochitina symmetrica.

Some taxa typical of the Arenig - Llanvirn boundary interval, such as Pirea, Striatotheca, Frankea and Coryphidium occur for the first time in the overlying graptolite zone of Corymbograptus v-similis.

SILURIAN ACRITARCHS FROM THE LOWER ELTON FORMATION, NORTHERN WENLOCK EDGE, SHROPSHIRE, ENGLAND

GERRCKE, Ian M. Centre for Palynological Studies, University of Sheffield, Mappin Street, Sheffield S1 3JD, England.

Diverse, well preserved acritarch assemblages are preserved throughout the Lower Elton Formation from the northern Wenlock Edge area, Shropshire, England. The organic geothermal alteration is low, in common with the Llandovery to Ludlow succession in the Much Wenlock area. The acritarch assemblages are broadly comparable to those recorded from the Leptobrachion longhopense Biozone in the type Ludlow area, and suggest correlation with the early Ludfordian Lower Elton Formation from sections in Mortimer Forest, west of Ludlow in Shropshire.

BIOSTRATIGRAPHY OF LOCHKOVIAN (LOWER DEVONIAN) CHITINOZOANS FROM NORTH BULGARIA.

LAKOVA, I.C., Geological Institute, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria.

Recent study of chitinozoans from the subsurface of North Bulgaria proved the Lochkovian Stage and enabled its subdivision into four biostratigraphic zones. Core samples from the boreholes R-1 Dalgodeltsi, R-119 Kardam and others yielded relatively rich, diverse and well preserved fauna. Some 40 chitinozoan species have been identified belonging to the genera Bursachitina Taugourdeau, Margachitina Eisenack, Eisenackitina Jansonius, Cingulochitina Paris, Lagenochitina Eisenack, Urochitina Taugourdeau & Jekhowsky, Angochitina Eisenack, Fungochitina Taugourdeau, Sphaerochitina Eisenack and Ancyrochitina Eisenack.

The definition of Bulgarian zones and their correlation with chitinozoan zones and subzones established earlier in France, Czechoslovakia, Roumania, Tunisia and Algeria is based on the vertical ranges of the following distinctive taxa already known from the Lochkovian worldwide: Angochitina chlupaci Paris & Laufeld, Fungochitina pistilliformis lata Taugourdeau & Jekhowsky, Urochitina simplex Taugourdeau & Jekhowsky, Ancyrochitina tomentosa Taugourdeau & Jekhowsky, Eisenackitina taugourdeaui (Rauscher & Doubinger) and Cingulochitina plusquelleci Paris.

SILURIAN AND EARLY DEVONIAN ACRITARCHS FROM THE NORTH GONDWANA REGIONS.

LE HERISSE, A. Laboratoire de Paléontologie, Université de Bretagne Occidentale, 6 Avenue Le Gorgeu, 29287 Brest Cedex, France.

Rich assemblages of Acritarchs have been recorded from numerous boreholes sequences and sections through the Silurian - early Devonian marine series from the North Gondwana regions. Most of the available data deals hitherto with material from the Ibero-Armorican regions, central Europe and North Africa (mainly the Algerian Sahara and Northeast Libya), and to a lesser extent with material from South America. The synthesis given here also refers to some results of recent investigations about :

- the Llandovery-Wenlock boundary in boreholes from the Tindouf basin (Algeria), where some *Deunffia-Domasia* species are present in a very peculiar assemblage ;
- core samples of the Ludlow, Pridoli and Lochkovian from Libya. and Tunisia
- the siluro-Devonian boundary in Bolivia.

The aim of this paper is, in addition to comments about Systematic, a resumption of discussion about Acritarch provincialism and facies relationships during the Silurian and early Devonian times. We propose an alternative to the Cramer's climate-controlled provincialism model (1969-1974) concerning Silurian Acritarchs, on the basis of important irregularities which have been recognized in the two major realms, the low latitude *Deunffia-Domasia* realm and the high latitude *Neoveryhachium carminae* realm. The potential, as stratigraphical markers, of certain Acritarch taxa restricted to the North Gondwana during the studied period is also considered here, as well as the interest in the presence of cosmopolitan species for worldwide correlations.

ACRITARCH BIOSTRATIGRAPHY IN THE SKIDDAW GROUP (TREMADOC - LLANVIRN) OF NORTHERN ENGLAND.

MOLYNEUX, S.G., British Geological Survey, Keyworth, Nottingham NG12 5GG, U.K.

The Skiddaw Group comprises the early Ordovician (Tremadoc - Llanvirn) greywackes and siltstones of the Lake District and adjacent areas in northern England. The group is present in three fault bounded tracts, the succession in each tract differing from that in the adjacent tracts.

The oldest acritarch assemblages, of early Tremadoc age, occur in the central tract. Their juxtaposition with assemblages of late Tremadoc, early Arenig and late Arenig age constitutes part of the evidence for a major slump deposit in this area. The lowest part of the succession exposed in the northern tract contains Acanthodiacrodium? dilatum, Caldariola glabra, Cymatiogalea deunffii, C. messaoudii, Stelliferidium trifidum, Striatotheca prolixa and other species, forming a distinctive and diverse assemblage of latest Tremadoc age. Slightly younger assemblages, of probable earliest Arenig age, lack this diversity, and many of the species recorded from the latest Tremadoc are absent. Coryphidium is a notable addition. With a few exceptions, lower and middle Arenig assemblages are sphaeromorph dominated and generally sparse. The exceptions suggest that Polygonium spp. are important components of acritarch floras of this age. Upper Arenig assemblages are more diverse, species of polygonomorph acritarch genera such as Frankea hamata, Marrocanium simplex, Striatotheca principalis, S. rarirrugulata and Veryhachium trispinosum being particularly characteristic, accompanied by other forms such as Coryphidium aff. bohemicum. Llanvirn assemblages have not been studied in detail, but certain taxa e.g. Arkonia spp., Dicrodiacrodium spp., Frankea hamulata, Stellechinatum celestum and Striatotheca quieta, may distinguish them from older assemblages.

PROVINCIALISM EVALUATION OF DEVONIAN CHITINOZOANS

PARIS F. Laboratoire de Paléontologie et Stratigraphie. Université de Rennes I, 35042 Rennes-cedex, France.

For a long time, data concerning devonian chitinozoan were practically restricted to a few regions (e.g. North America, North Africa and to a lesser extent, Brasil). During the last decade numerous additional informations from China, Australia, south America, Europe ... have been published and provide a larger documented database for the evaluation of the provincialism of devonian chitinozoans. Diverse formulas exist (e.g. coefficient of similarity, Sympson's Index ...) for assessing the provincialism of living and fossil organisms. As far as devonian chitinozoans are concerned, the disparity of the available data, however, make such formulas hard to put in practice. Therefore comparisons will be only made between chitinozoan populations from areas where both the density and the accuracy of the data seem acceptable. During Early Devonian the chitinozoan assemblages from Near East to Morocco and from Western Europe to the Black Sea display great similarities (occurence of the same genera). These strong affinities are even expressed at the specific level (e.g. occurence of *Urochitina simplex*, *Cingulochitina ervensis*, *Margachitina catenaria* ...). Relationships at generic level are in addition noticed with more remote regions such as South America. In this case, however, some local distinctive feature have to be stressed (e.g. occurence of *Cladochitina*).

The very slight provincialism of eodevonian chitinozoans fade away during the Middle Devonian when numerous species show a worldwide distribution (e.g. *Alpenachitina eisenacki*, *Gotlandochitina milanensis*, *Eisenackitina* e.g. *castor* ...).At present informations concerning Upper Devonian chitinozoans are too sparce to document valuable palaeobiogeographic conclusions.

To sum up, devonian chitinozoans do not show pronounced provincialism and therefore are regarded as excellent biostratigraphic tools, even for long distance stratigraphic correlations.

LATE CAMBRIAN ACRITARCHS FROM BELGIUM AND NORTHERN FRANCE

RIBECAI, C. , University of Pisa, Italy and VANGUESTAINE, M. , University of Liège, Belgium

Four acritarch associations of Late Cambrian age from different localities, already discussed in previous papers, are fully described and illustrated. They belong to the upper part of the Revin Group of the Stavelot and Rocroi Massifs in Belgium and northern France and are compared to similar assemblages of eastern Newfoundland and the East European Platform.

A NEW FRESHWATER ACRITARCH FROM THE MIDDLE JURASSIC OF NORTH YORKSHIRE

RIDING, J,B., British Geological Survey, Keyworth, Nottingham NG12 5GG, U.K.

During the palynological study of the Saltwick Formation (Middle Jurassic, Aalenian) from a borehole at Ravenscar, North Yorkshire, an unusual, undescribed acanthomorph acritarch was discovered. The Saltwick Formation is known to be a freshwater deposit and the remainder of the palynoflora and kerogen from the single acritarch-bearing sample was entirely terrestrially-derived. This new form, therefore, is interpreted as being a freshwater species, the first such taxon to be described from the Jurassic. It has a relatively robust vesicle wall, is ellipsoidal and covered in relatively short, proximally flaring and distally truncate spines. It is known from coeval strata in the Northern North Sea.

ACRITARCHS FROM THE UPPER SILURIAN OF SAN JUAN, ARGENTINA: BIOSTRATIGRAPHY AND PALEOBIOGEOGRAPHY.

RUBINSTEIN, C.V. Unidad de Bioestratigrafía y Paleoecología (PRIBIPA), CRICYT-Me, C.C. 131, 5500 Mendoza, Argentina.

Correlations were made with the microplankton from other world regions based on the composition of assemblages from Late Ludlovian- Pridolian? age found in the San Juan Precordillera.

The age assigned to those assemblages is the first mention of a probable Pridolian in Argentina.

There are important coincidences with Upper Silurian assemblages from Bretagne (France), NW of Spain and Northern Africa, and there also exist similitudes with the paleomikroplancton from Great Britain and Belgium.

According to the assemblages composition it is possible to infer that they do not correspond with the palynofacies model proposed by Cramer for the Silurian, since due to their paleolatitudinal location (75°S) they should be included in the Brazilian Realm of the Neoveryhachium carminae facies, of cold climate and high paleolatitudes. On the other hand, they are analoge with assemblages from very dissimilar paleolatitudes with tropical and subtropical climates. These disturbances shown in the palynofacies disposition according to the paleoparallels have already been pointed out by other authors.

The most recent paleogeographic reconstructions carried on for the Middle to Upper Silurian lead to deduct that those analogies are verified with assemblages from the Gondwanic and peri-gondwanic areas. This would show rather a continental relation more than a climatic dependence for the Upper Silurian acritarchs.

CLASSIFICATION OF THE MICRHYSTRIDIUM AND VERYHACHIUM GROUP OF ACRITARCHS: A MODIFIED APPROACH.

SARJEANT, W.A.S. and STANCLIFFE, R.P.W., Department of Geological Sciences, University of Saskatchewan, Saskatoon, Canada S7N 0W0.

The classification of acritarchs, although founded upon morphology, is essentially arbitrary in view of their uncertain relationships and life-cycle function. The approach here presented to the classification of acanthomorph and polygonomorph acritarchs involves no new philosophies, but serves as an attempt to rationalize and stabilize a confusing situation of overlapping and ill-thought-out generic and specific diagnoses.

Twenty-five genera are considered, of which five are rejected as subjective junior synonyms. The revisions proposed involve the generic re-assignment of some 260 species.

BIBLIOGRAPHY AND INDEX OF THE ORDOVICIAN ACRITARCHS

SERVAIS, T. , University of Liège, Belgium

The acritarchs attain their largest diversity during Ordovician and Silurian times. More than 400 publications, theses and abstracts deal with acritarchs of Ordovician rocks.

Over 190 genera, comprising more than 1000 species, have been described up to now from this period. Nearly a third of these genera are monospecific. At the moment more than 300 species are grouped into the following four genera : *Baltisphaeridium* , *Acanthodiacrodium* , *Veryhachium* and *Micrhystridium* .

An index of the ordovician acritarch genera and our list of references are presented.

THE ORDOVICIAN ACRITARCH GENUS *FRANKEA* BURMANN 1970

SERVAIS, T. , University of Liège, Belgium

Veryhachium sartbernardense was first described in 1966 by Martin from the Ordovician of Belgium. In 1970, Burmann transferred this species into the new genus *Frankea* and described from the Llanvirnian of eastern Germany the five species currently attributed to this genus : *Frankea hamata* (type species) , *F. breviuscula* , *F. hamulata*, *F. longiuscula* and *F. sartbernardensis* .

Until now, the genus *Frankea* has been cited in more than 60 publications.

The original diagnoses, the stratigraphical ranges and geographical distributions of the species of *Frankea* are critically evaluated on the basis of a revision of the literature published up to now and of our own studies on material from Belgium, Germany and Bohemia.

The Ludlow Chitinozoans of the Type Sections around Shropshire

Stuart J. E. Sutherland, Department of Geology, University of Leicester.

The chitinozoans of the type Ludlow sections around Shropshire are providing useful biostratigraphic and taxonomic information. After initially being dominated by abundant *Conochitina*, the lowermost Gorstian (Lower Elton Formation) provides very sparse chitinozoan returns. Within the Middle Elton Formation faunas are more diverse and include *Angochitina, Ancyrochitina* and especially *Cingulochitina*. The Lower and Upper Bringewood Formations (Upper Gorstian) are dominated by *Belenochitina,* but a significant high-diversity fauna is recorded around the contact between the two. This fauna includes examples of *Angochitina, Ancyrochitina, Calpichitina, Cingulochitina, Eisenackitina* and *Fungochitina*. An almost identical fauna is found around the Gorstian / Ludfordian contact. *Eisenackitina* replaces *Belenochitina* through the Lower Ludfordian and Upper Ludfordian where there is a reduction in chitinozoan abundance and diversity. It is possible that the cyclicity noted in some of the chitinozoan faunas may be related to lithology which in turn may reflect oceanic change as proposed by Jeppsson (1990).

PALYNOLOGY OF A LOWER WENLOCK (SILURIAN) SHELF-BASIN TRANSECT, WALES AND THE WELSH BORDERLAND.

SWIRE, P.H., The Robertson Group plc, Llandudno, Gwynedd, LL30 1SA, U.K.

Well-exposed lower Wenlock sections and borehole sequences, representing various facies along a shelf-basin transect in Wales and the Welsh Borderland, have been samples for palynomorphs. Total organic residues were recovered using quantitative processing techniques and absolute palynomorph abundances were determined.

From the biostratigraphical results an acritarch biozonational scheme for the early Wenlock is proposed, based on the recorded stratigraphical ranges of diagnostic taxa. Three existing acritarch biozones (the *Deunffia brevispinosa*, *Deunffia furcata* and *Eisenackidium Wenlockensis* biozones) have their boundaries changed on new stratigraphical range information and one new zone, the *Helosphaeridium malvernensis* Biozone is proposed.

In addition to vertical palynomorph distributional patterns through a studied section, palynomorph assemblage distributional patterns are also discussed and illustrated by graphical representations for the different palaeoenvironments represented by the shelf-basin transect. It is noted that the chitinozoans appear to prefer deeper water, as do small thick-walled lelospheres and short-spined, fat-bodied *Veryhachium*. Nearshore/shallow water environments are dominated by thin-walled lelospheres and short spined *Michrystridium*.

The thermal maturity of the different sections is calculated by the use of the Acritarch Alteration Index (AAI) of Legall *et al.* 1981. For the shelf sections the AAI is low and varies between 2 and 4 (indicating palaeotemperatures of 60-70°C); in contrast the basinal sections are much higher, with an AAI of 5 showing palaeotemperatures in the range 90-450°C and probably towards the higher end of that range.

CHITINOZOA AS THERMAL MATURITY INDICATORS.

TRICKER, P. M., Department of Geology, The University, Southampton, SO9 5NH, U.K.

The determination of organic maturation in sediments provides invaluable geological information for the determination of hydrocarbon source rock maturity, burial modelling, structural/stratigraphic interpretation and regional mapping of low grade metamorphism. Quantitative thermal maturity data is now obtainable from Lower Palaeozoic sediments by utilising an innovative technique called chitinozoan reflectivity (Rch). Optical reflectance measurements from polished test walls can be made with the same accuracy and precision as for vitrinite reflectivity (Rv), the established thermal maturity scale. Calibration of the Rch and Rv scales, with late-Silurian and Devonian samples, establishes a strong linear relationship between the two. This research demonstrates the applications of Rch, and the advantages of using it over alternative potential Lower Palaeozoic indicators.

Organic maturation of the Welsh Lower Palaeozoic Basin has been examined with the aid of chitinozoan reflectivity. The spatial and temporal distribution of maturity has been investigated. Rch describes a transition from low maturities, in the palaeo-platform sequences (Welsh Borders) along the eastern Basin margins, through to high maturities in the palaeo-basin (central Wales). The transition between low and high maturities is strongly controlled by the Welsh Borderland Fault System. Problems in regard to the nature, timing and extent of Caledonian metamorphism can be investigated using this technique.

The method can also be applied as a thermal maturity indicator in the evaluation of source rocks for hydrocarbon generation. Maturity data can be used directly to determine maturity state or in constraining basin modelling and thermal maturity predictions.

PROVINCIALISM IN THE DISTRIBUTION OF ACRITARCHS FROM EASTERN BANDA SEA SURFACE SEDIMENTS (INDONESIA)

ISABEL M. VAN WAVEREN

Lab. of Paleobotany and Palynology, State University of Utrecht, 3484 CS Utrecht, The Netherlands

Surface sediments-samples from three transects trough the eastern Banda Sea were sujected to palynological treatment. For each sample 200 newly described acritarchs were counted (Van Waveren, in press). The ratio of each acritarch type to the total sum of acritarchs was used for a clustering analysis of the samples. This clustering resulted in two geographically distinct sample groups: a northern and central cluster (1), and a southern cluster (2). The change in acritarch-assemblage composition from north to south is shown to be gradual. The acritarch-assemblage distribution and concentration in the samples is interpreted in relation to nutrient sources, and Indo-Pacific water mixing in the eastern Banda Sea.

Van Waveren, I. M. (in press). Morphology of probable plankonic crustacean eggs from the Holocene of the Banda Sea (Indonesia). AASP Contribution series on Neogene and Holocene dinoflagellate cysts.

MORPHOLOGY OF COPEPOD (CRUSTACEAN) EGGS

ISABEL M. VAN WAVEREN * AND NANCY H. MARCUS**

*Lab. of Paleobotany and Palynology, State University of Utrecht, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.
**Dept. of Oceanography, Florida State University, Tallahassee, Fl-32306-3048, United States.

The freshly spawned eggs of the copepod species Paracalanus sp., Acartia tonsa, Centropages hamatus, Labidocera aestiva and Anomalocera patersoni were collected in small sieves and subjected to different acid bathes (24 hours in HCl 30%, 24 hours in HF 40%, and 24 hours in HCl 30%) in order to reproduce the treatment used to obtain a palynological residue from a sediment sample. Four of the five considered species produced eggs that were sufficiently resistant to strong acids to enable the systematic description of 40 specimen for each species.

The compilation of the descriptions, giving information of the size of the egg remains, the structure, the ornamentation and the colour of their walls, and the type of aperture observed, are presented. These descriptions are used for comparison to sub-recent acritarchs from the eastern Banda Sea (Van Waveren, in press).

Van Waveren, I. M. (in press). Morphology of probable planktonic crustacean eggs from the Holocene of the Banda Sea (Indonesia). AASP Contribution series on Holocene and Neogene dinoflagellate cysts.

A SUCCESSION OF ACRITARCH ASSEMBLAGES IN LATE ARENIGIAN SEQUENCES: AN ATTEMPT AT ZONATION.

VAVRDOVA, M., Geological Institute, Academy of Sciences, Rozvojová 135, Praha 6, 165 00, Czechoslovakia.

Associations of organic-walled microfossils of early Ordovician age from the Prague Basin were investigated in detail to determine the succession of microplankton assemblages in sequences of Arenigian/Llanvirnian age. Selected species of microplankton are presented with the aim of corroborating the standard zonation based on acritarch communities from the Perigondwanian region.

STROMATOLITIC STRUCTURES IN DARK CHERTS OF PRECAMBRIAN AGE FROM WESTERN BOHEMIA, CZECHOSLOVAKIA.

VAVRDOVA, M. and MRAZEK, P., Geological Institute, Academy of Sciences, Rozvojová 135, Praha 6, 165 00, Czechoslovakia.

Epibiontic cyanobacterial colonies were studied in slides and thin sections of dark-coloured, laminated silicites and siliceous shales rich in organic matter. Ten localities, situated in the Teplá - Barrandian region were investigated.

Apart from frequent unicells, rare acritarchs and filamentous bodies, relatively large (up to 800µm) vase shaped microfossils were observed in thin sections, the regular distribution of which implies a sessile way of life. A benthic, subtidal to supratidal setting (sabkha environment) may be presumed for some of the in situ preserved fossil communities recovered.

STATE OF RESEARCH ON THE SILURIAN CHITINOZOA BIOZONATION IN BELGIUM.

J. VERNIERS (1) & G. VAN GROOTEL (2)
(1) Vrije Universiteit Brussel (KWAR), Pleinlaan 2, B-1050, Brussel, Belgium. (2) INRS-Géoressources, 2700 rue Einstein, Case Postale 7500 Sainte Foy, Québec, G1V 4C7 Canada.

The Chitinozoa biozonation of the Silurian in Belgium is assembled from the published and unpublished data from F. MARTIN and the two authors. The Silurian was studied in the Caledonian folded Brabant Massif and in Variscan upthrusted rocks outcropping in the Sambre and Meuse Belt (also called Condroz Ridge). Preservation is generally poor, and the Chitinozoa are mostly flattened and opaque. However, a rather complete biozonation can be established from basal Llandovery to lower Ludlow (22 zones and subzones), with two higher assemblages in isolated levels of the upper Ludlow and the Pridoli. This Chitinozoa zonation based on a combination of concurrent range zones and Oppel zones will be presented. A graptolite biozonation is known only in parts of the column and in some samples acritarchs were described. Other fossil groups that could give a date are absent in these mostly very deep shelf sediments.

From uppermost Llandovery to lower Ludlow the abundant Cingulochitina spp. are used in the zonation. Because this genus is mostly present in deep neritic conditions and absent from shallower water the zonation is applicable only in deep neritic sediments. A correlation with other published biozonations (LAUFELD, NESTOR, PARIS, etc.) for shallower conditions in other areas of Europe and North America will be presented.

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Workers active in the palynological study of Triassic - Jurassic boundary sequences are invited to contact the Secretary of this group, Dr G. Warrington, at the following address, indicating their interest and geographical area of activity, and listing relevant publications:

Dr G. Warrington
British Geological Survey
Keyworth
Nottingham NG12 5GG
Great Britain

Telephone: 06077 6111
FAX: 06077 6602

IUGS Subcommission on Triassic Stratigraphy: Symposium on Triassic Stratigraphy, Lausanne, Switzerland, 20 - 23 October 1991

This meeting, organised by Dr Aymon Baud, attracted participants from more than 20 countries. Forty contributions were presented, amongst which the following included palynological information:

Frechengues, M. and Peybernes, B. (Univ. Paul-Sabatier, Toulouse, France): Depositional sequences within the Mid and Late Triassic series from Pyrenees.

Goczan, F. (Hungarian Geological Survey, Budapest, Hungary): Palynological dominance zonation as a biostratigraphical method, illustrated by the subdivision of the Hungarian Scythian.

Oravecz-Scheffer, A. and Goczan, F. (Hungarian Geological Survey, Budapest, Hungary): Foraminiferal and palynological characterization of Carnian substages and their boundaries in Balaton Highland, West Hungary.

Tiwari, R. S. (Birbal Sahni Institute of Palaeobotany, Lucknow, India): Permo-Triassic transition in Indian Gondwana - a mass extinction or high turnover of palynoclades.

Vijaya (Birbal Sahni Institute of Palaeobotany, Lucknow, India): Palynological synchroneity of events at Permo-Triassic boundary in terrestrial deposits of India.

Contributions to the symposium will be published in a volume of Memoires de Geologie, Lausanne. Contact Dr A. Baud, Geological Museum, UNIL - BFSH2, CH - 1015 Lausanne, Switzerland (Telephone: 692 48 20; FAX: 692 48 99) for further information.

272 IGCP MEETING

Vladivostok, Sept. 6-12, 1992

International Field Conference

"LATE PALAEOZOIC AND EARLY MESOZOIC CIRCUM-PACIFIC BIO- AND GEOLOGICAL EVENTS"

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	Yes	No
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-Micropaléontologie (Foraminifères, Algues, Spores et Pollens), Biostratigraphie et Paléobiogéographie(Micropaleontology, Biostratigraphy and Paleobiogeography).
-Evaporites de haut et bas niveau marin. (Evaporites from highstand and lowstand systems tract).
-Sédimentologie du Grès Rouge (Sedimentology of the Red Sandstone).
-Magmatisme triasique (Triassic vulcanism).
-Trias métamorphique; halocinèse (Triassic metamorphic series; halokinesis).

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272 IGCP Meeting
Vladivostok (USSR) Sept. 6-12, 1992

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"LATE PALAEOZOIC AND EARLY MESOZOIC CIRCUM-PACIFIC BIO- AND GEOLOGICAL EVENTS"

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Correspondence (for our Committee) please send at the Vladivostok address given below.

Yu.D.Zakharov. Far-Eastern Geological Institute. Vladivostok-22, 690022 USSR. Tel. 2-96-547 (home tel. 2-5-30-93); Telex: 213212 FE BAS SU.

Scientifec sessions. A meeting in Vladivostok will be arranged to fit in with the 29th International Geological Congress. It will be held just near a famous Lower Triassic section in Ussurian Gulf, betweem Lazurnaya and Gornostai bays (in Boarding-House "Zolotoi Bereg").

Tentative Meeting schedule:

September 5 (Saturday): PM - 6.00-7.00 - Registration (before a Pre-Meeting excursion).

September 7 (Monday): AM - 8.30-12.30 - Plenary Session
PM - 2.00-7.00 - Plenary Session

September 8 (Tuesday): AM - 8.30-12.30 - Plenary Session

Each presentation (with demonstration some slides - 35 mm) is restricted in 15-20 minutes including 5 minutes discussion.

Field Trips. Before and after the scientific sessions the following field trips are preliminarily proposed.

a) F i e l d T r i p (Pre-meeting): 1 day, September 6, Sunday: (1) Ussurian Gulf - investigation of the Lower Triassic sediments with ammonoids, bivalves, gastropods and conodonts; (2) environs of Pushkin Street in Vladivostok - for visit of the Upper Permian volcanogenic intermediate rocks of the Lower Vladivostokian Formation; (3) Pervaja Retchka river in Vladivostok - the section of the Upper Permian intermediate and acid volcanogenic rocks and clay sediments with plant remains (Lower and Upper Vladivostokian Formation); (4) Bogataja river (Vladivostok) - the section of marine Ladinian with Daonella and Carnian coal sediments; (4) Pestchanka river (environs of Vladivostok) - Upper Triassic coal sediments with plant remains. Night in Vladivostok (Boarding-House "Zolotoi Bereg").

b) F i e l d T r i p 2 (Post-meeting): 1.5 days, September 8 (Tuesday) - 9(Wednesday): (1) Visual inspection of geological composition of some islands in Japan sea during marine trip Vladivostok - Nakhodka (Middle Palaeozoic granitoids with micaceous shale xenolites and overlyng Lower-Upper Permian and Lower-Middle Triassic sediments with plant and ammonoid remains); (2) Senkina Shapka Moumtain in Partizansk region - Upper Permian (Midian) limestones with abundance of foraminiferes and brachiopoods (stratotype of Chandalaz Formation); (3) Nakhodka Town - Upper Permian (Midian) reef limestones with small foraminifers, brachiopods, bivalves, ammonoids and diverse Sphinctozoa (uppermost part of Chandalaz Formation) and overlying clay sediments of Lower Luudjanzian Formation with ammonoids (Cyclolobus kiselevae zone, Upper Midian). Night in Nakhodka or its environs (Avangard bay).

c) F i l d T r i p 3 (Post-meeting): 3 days, September 10 (Thursday) - 12 (Saturday): (1) Visual inspection of some outcrops during a trip (by bus) Nakhodka - Dalnegorsk (about 500 km); night in Dalnegorsk; (2) Dalnegorsk region in Eastern Sikhote-Alin the section of Cretaceous olistostrome sediments with Permian-Triassic blocks of limestones (with corals, bivalves, and conodonts), basalts and siliceous plates, characterized by radiolarians and conodonts; night in Dalnegorsk; (3) Return to Vladivostok by bus (during a day). Night in Vladivostok ("Zolotoi Bereg").

NONMARINE TRIASSIC SYMPOSIUM

Reply Form

Return by November 30, 1991 to:
Spencer G. Lucas and Michael Morales
c/o New Mexico Museum of Natural History
1801 Mountain Road, NW
Albuquerque, New Mexico 87104, USA

(Please use a typewriter.)

Name (in the form you prefer): _____

Address: _____

_____

_____

Telephone : _____

Triassic topic(s) on which you might give a presentation: _____

_____

Other Trassic topics in which you are most interested: _____

_____

We are seeking travel funds to help bring to the symposium and field trip foreign scientists who could otherwise not attend. To help us with funding agencies in this matter, we ask that you also fill in the following note of support.
Spencer G. Lucas and Michael Morales

I support the organizers of the international NONMARINE TRIASSIC SYMPOSIUM in their efforts to bring together scientists from all over the world to communicate the latest information and interpretations about this important aspect of the earth's geological and biological history. (Mark one of the following boxes.)

☐ It is probable that I will require financial assistance to attend.

☐ It is possible that I will require financial assistance.

☐ It is probable that I will not require financial assistance.

Name (signature): _____

(typewritten): _____

Position/Title: _____

Address: _____

_____

_____

NONMARINE TRIASSIC SYMPOSIUM

An International Symposium
with Field Trip in Arizona and New Mexico, USA
October 17 through 24, 1993

A three-day international symposium on all aspects of the nonmarine Triassic will be hosted by the New Mexico Museum of Natural History in Albuquerque, New Mexico, USA. The symposium will be followed by a four-day field trip exploring continental Triassic deposits of the Lower-Middle Triassic Moenkopi Formation and the Upper Triassic Chinle Group in Arizona and New Mexico.

The symposium, to which contributions are invited, will be held on October 17 through 19 and will focus on Triassic nonmarine stratigraphy and correlation, chronology, paleontology, sedimentology, paleoclimatology, paleoecology, and paleogeography/paleobiogeography. Short papers of oral presentations will be published for the meeting, and a post-symposium volume is planned. Also, the Subcommission on Triassic Stratigraphy has been invited to hold a meeting in conjunction with the symposium.

The field trip, beginning immediately after the symposium, will run from October 20 through 24. It will leave Albuquerque heading westward to examine classic nonmarine Triassic strata of the southern Colorado Plateau, including the Petrified Forest National Park, the Painted Desert, and Meteor Crater. A guidebook will be published for the field trip. A one-day additional trip to see the Grand Canyon is possible on October 25. The field trip will end in Flagstaff, Arizona.

The symposium and field trip will immediately follow the annual meeting of the Society of Vertebrate Paleontology, which will be held in Albuquerque on October 13 through 16, 1993.

If you are interested in attending the international Nonmarine Triassic Symposium or receiving more information about it, please fill in the accompanying form and return it by November 30, 1991 to the organizers:

Spencer G. Lucas and Michael Morales
c/o New Mexico Museum of Natural History
1801 Mountain Road NW
Albuquerque, New Mexico 87104 USA

THE AMSTERDAM PALYNOLOGICAL ORGANIC MATTER CLASSIFICATION

International Committee for Palynological Organic Matter Classification

All those engaged in palynology, palynofacies and organic facies studies will be well aware of the need for a standardised system for describing and classifying the organic matter observed in palynological preparations. The Open Workshop on Organic Matter Classification (University of Amsterdam, 27th - 28th June 1991) was convened to address this problem. The workshop participants (72 workers from 20 countries) resolved to publish a standard classification within three years. This will take the form of a colour photo atlas with an accompanying text that gives clear practical definitions for all categories and terms used.

Although the Workshop was attended by only a small proportion of the palynological community, a wide diversity of views were presented and discussed. A classification framework was established by voting on a variety of proposals from the floor. The collective view of the participants was that the creation of new jargon should be avoided, and that the classification should be hierarchical (i.e. include different levels of complexity suitable for different applications). The view was taken that the basic classification should be based upon transmitted white light, but incorporate additional resolution for those with routine access to fluorescence (only 60% of the workshop participants) and/or microscopes with incident white light illumination.

A number of working groups were established to look at difficult or contentious areas (e.g. amorphous materials, degrees of preservation, maturation, etc.), and areas of overlap with other disciplines (e.g. organic petrology, geochemistry). The names of the working group convenors are given below. It was proposed that a second Workshop be held in June 1992 in Bergen (Norway), to consider revision of the framework in light of the findings of the working groups. An international committee chaired by M. A. Lorente (Amsterdam) was set up to coordinate the project: D.J. Batten (Aberystwyth), J.F. Raynaud (Pau), W. Riegel (Göttingen), R.V. Tyson (Newcastle upon Tyne), P. van Veen (Bergen) and R. Witmer (Brea, USA).

The framework agreed by the Workshop is not a final product, and the Committee do not wish to prejudice its chances by premature publication. All those who would like to see a copy of the provisional classification, to become actively involved in any of the working groups, or who would be willing to submit photographic material for potential inclusion in the Atlas are urged to contact the Committee or Working Group Convenors at the earliest opportunity. Every one can play a part.

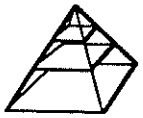
The working groups and the convenors are:

AMSTERDAM PALYNOLOGICAL ORGANIC MATTER CLASSIFICATION

International Committee for Palynological Organic Matter Classification

M.A. Lorente (Chairman)

Batten, Dr D.J.	
Institute of Earth Sciences University of Wales	UCW Aberystwyth ABERYSTWYTH S423 3DB United Kingdom
Lorente, Dr M.A.	
Hugo de Vries-Laboratory University of Amsterdam	Kruislaan 318 1098 SM AMSTERDAM The Netherlands
Raynaud, Dr J.F.	
Biostratigraphy Societe Nationale Elf Aquitaine (Production)	64018 PAU Cedex France
Riegel, Prof. Dr W.	
Institut und Museum für Geologie und Paläontologie	Goldschmidtstrasse 3 3400 GÖTTINGEN Germany
Tyson, Dr R.	
Fossil Fuels and Environmental Geochemistry Institu University of NewCastle upon Tyne	Drummond Building NEW CASTLE UPON TYNE NEI 7R4 United Kingdom
Veen, Dr P. van	
Norks Hydro Research Center	P.O. Box 4313 15028 BERGEN Norway
Witmer, Dr R.	
UNOCAL Science & Technology Division	P.O.Box 76 BREA U.S.A. 92621 California



AMSTERDAM PALYNOLOGICAL ORGANIC MATTER CLASSIFICATION

International Committee for Palynological Organic Matter Classification

M.A. Lorente (Chairman)
D.J. Batten
J.F. Raynaud
W. Riegel
R. Tyson
P. van Veen
R. Witmer

List of working groups

ENVIRONMENTAL RELATIONS (Taphonomy, Biological affinity, Modern sediments)
R.A. Spicer (Convener)

STANDARDS IN PREPARATION METHODS (including sample processing)
H. Kerp (Convener)

DEFINITIONS (photo atlas?)
R. Tyson (Convener)

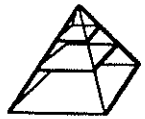
PRESERVATION SCALE
E.Williams (Convener)

ORGANIC PETROLOGY TERMINOLOGY
J. Marshall (Convener)

GEOCHEMISTRY
P.F. van Bergen (Convener)

THERMALLY ALTERED MATERIALS
R. Witmer (Convener)

INCIDENT LIGHT (FLUORESCENT AND WHITE LIGHT) LEVEL
(proposed subgroups: Woody, Structured debris, Opaque, Amorphous)
M. Collinson (Convener)
P. van Veen (Convener)



AMSTERDAM PALYNOLOGICAL ORGANIC MATTER CLASSIFICATION

WORKING GROUP CONVENERS

Bergen, Drs P.F. van
L.P.P. Foundation
University of Utrecht
Heidelberglaan 2
3584 CS UTRECHT
The Netherlands

Collinson, Dr M.E.
Biosphere Sciences Division
Kings College
Camden Hill Road
LONDON W8 7AH
United Kingdom

Kerp, Dr H.
Laboratory of Paleobotany and Palynology
University of Utrecht
Heidelberglaan 2
3584 CS UTRECHT
The Netherlands

Marshall, J.
Department of Geology
University of Southampton
Highfield
SOUTHAMPTON SO9 5NH
United Kingdom

Spicer, Prof. Dr R.A.
Department of Earth Sciences
University of Oxford
Parks Road
OXFORD OX1 3PR
United Kingdom

Tyson, Dr R.
Fossil Fuels and Environmental Geochemistry Institu
University of NewCastle upon Tyne
Drummond Building
NEW CASTLE UPON TYNE NEI 7R4
United Kingdom

Veen, Dr P. van
Norks Hydro
Research Center
P.O. Box 4313
15028 BERGEN
Norway

Williams, Dr V.E.
UNOCAL
Science & Technology Division
P.O. Box 76
BREA
U.S.A. 92621 California

Witmer, Dr R.
UNOCAL
Science & Technology Division
P.O.Box 76
BREA
U.S.A. 92621 California

(part of) SECOND CIRCULAR

8th INTERNATIONAL PALYNOLOGICAL CONGRESS

AIX-EN-PROVENCE (FRANCE)

September 6-12, 1992

DEADLINES

REGISTRATION FORM REGISTRATION FEES (reduced), ABSTRACTS, EXCURSION FEES, ACCOMMODATION FORM	March 1, 1992
ARRIVAL FORM	August 1, 1992
MANUSCRIPTS (Symposia)	December 1, 1992

CORRESPONDENCE

All correspondence concerning the Congress, the Excursions and the Registration Fees checks should be sent to:

Jean-Pierre SUC
Secretary - 8th International Palynological Congress
Laboratoire de Palynologie (case 061)
Université de Montpellier II
F-34095 Montpellier cedex 5 (France)

Tel. (33) 67 14 32 69
(33) 67 14 37 26
Fax. (33) 67 04 20 32
Telex 490944 F USTMONT

SCIENTIFIC EXCURSIONS

By organizing 10 pre- or post-Congress scientific excursions the Organizing Committee intends to give the participants the opportunity to study in the field the main recent palynological results in stratigraphy and in paleoenvironmental reconstructions in France and in the surrounding countries, with a special attention to the present vegetation in the Mediterranean area and in mountains.

Pre-Congress:

A. Paleozoic in Western Brittany
Leaders: Fl. PARIS and A. LE HERISSE

B. Mesozoic in Southern Alps
Leader: R. JAN DU CHENE and E. MONTEIL

C. Paleogene in the Paris Basin and Belgium
Leader: M. SCHULER

D. Vegetation, lakes and volcanoes in the French Massif Central since the Mid-Pleistocene
Leader: M. REILLE

Post-Congress:

E. Permian basins in the French Massif Central
Leader: J.-J. CHATEAUNEUF

F. Jurassic in South-West Germany
Leader: S. FEIST-BURKHARDT

G. Neogene and Lower Quaternary in Southern France and Northeastern Spain
Leader: J.-P. SUC

H. Modern vegetation and prehistoric sites in French and Italian Riviera
Leader: J. RENAULT-MISKOVSKY

I. Long pollen sequences and the last glaciations from Southern Alps to Vosges mountains
Leader: J.-L. DE BEAULIEU

J. History of the vegetation in the Pyrenees mountains
Cancelled

K. Modern vegetation of Provence and Southern Alps, Late Glacial-Holocene history
Leader: A. PONS

SCIENTIFIC PROGRAM

Topics	General Sessions	Symposia
Palynology, Systematics, Phylogeny (A. Le Thomas)	A	A1 to A5
Allergology, Genetics, Melissopalynology (S. Nilsson)	B	B1 to B3
Palynology, Stratigraphy (M. Streel)	C	C1 to C6
Dinoflagellate (E. Masure)	D	D1
Palynology and Vegetational History (J.-L. de Beaulieu)	E	E1 to E4
Palynology and Global Climatic Changes (R. Bonnefille)	F	F1 to F6
Palynology and Archeology	G	G1
Workshops		W1 and W2

Symposia.

A1. The significance of pollen and spore morphology in Biology, Evolution and Systematics
Conveners: I.K. **Ferguson**, A. Le Thomas, J. Kress, W. Punt

A2. Ultrastructure of fossil spores and pollen, fossil and living groups
Conveners: **M. Kurmann**, J. Doyle, M.S. Zavada

A3. The Tapetum: cytology, function, biochemistry and evolution
Conveners: **M. Hesse**, E. Pacini, M.T.M. Willemse

A4. Sporoderm ontogeny and differentiation
Conveners: **B. Lugardon**, M. Takahashi

A5. Sporopollenin: composition, biogenesis and evolution
Conveners: **W.G. Chaloner**, A.R. Hemsley

B1. Pollen banks and genetic resources
Conveners: **M.-Th. Cerceau-Larrival**, S. Mercier, C. Dumas

B2. Aeropalynology and its clinical applications
Conveners: **F.Th. Spleksma**, S. Nilsson, M.R. Ickovic

B3. Ecological relationships of pollen and bees, Melissopalynology
Conveners: **D.Lobreau-Callen**, H. Dobson, M. Suarez-Cervera

C1. Paleozoic palynomorphs of the Gondwana-Euramerican interface
Conveners: **A. Le Hérissé**, B. Owens, Fl. Paris

C2. Paleofloristic and Paleoclimatic changes in Cretaceous and Tertiary times
Conveners: **E. Planderova**, B. Venkatachala, D. Nickols, C. Caratini

C3. Marine quantitative palynology: tectonic, climatic and eustatic control
Conveners: **J. Verniers**, M.J.M. Bless, Cl. Poumot

C4. Palynofacies: modern analogs and ancient examples; reworked palynomorphs
Conveners: **D.J. Batten**, D. McLean, M. Streel

C5. Palynology and sequential stratigraphy
Convener: **L.E. Stover**

C6. Marine pollen sequences over the last 3 Myrs, processes and paleoecology
Conveners: **L. Heusser**, Y. Igarashi, H. van de Kaars

D1. Dinoflagellate ecology and paleoecology
Conveners: **B. Dale**, A. de Vernal, J.-L. Turon

E1. Floral and vegetational history of mediterranean climate regions
Conveners: **S. Bottema**, C. Heusser, A. Pons

E2. Modern pollen rain and fossil pollen spectra
Conveners: **M.-J. Gaillard**, S. Hicks, J. Ritchie

E3. Palynological record of past and present human impact
Conveners: **K. Behre**, B. Berglund

E4. Vegetation dynamics and pollen analysis
Conveners: S. Bortenschlager, K.D. Bennett, M.B. Davis, C. Lang

F1. Long continental pollen sequences
Conveners: **M. Reille**, D. Adam, E. Gruger

F2. Records of the last deglaciation around the North Atlantic
Conveners: **B. Huntley**, J.J. Lowe, M.J.C. Walker

F3. Global Younger Dryas ?
Conveners: **D. Peteet**, N.A. Khotinskiy, R. Mathewes

F4. Paleohydrology of the last 15 kyrs, biostratigraphical methods
Conveners: **G. Digerfeldt**, J. Almendinger, H. Richard

F5. Extra-tropical paleoclimates in the Western Hemisphere
Conveners: **V. Markgraf**, C. Villagran, P. Richard

F6. Tropical palynology and global changes
Conveners: **R. Bonnefille**, P. Colinvaux, P. Kershaw

G 1. Pollen analysis of archeological sites
Conveners: **O.K. Davis**, R. Scaife

Workshops.

W1. Computer and Palynology
Conveners: **L.J. Maher**, J. Guiot, E.C. Grimm

W2. The elusive fossil species
Conveners: **J. Anderson**, N. Hughes, M. Boulter

Symposia organizer.

R. BONNEFILLE [Tel. (33) 91269635 - **Fax** (33) 91266638].

Languages of the Congress.

Official languages of the Congress will be **English** and **French**.
No simultaneous translation will be provided.

Oral and Poster presentations.

As first author, individuals are limited to two contributions.
All oral presentations will be restricted to 15mn talks followed by 5mn for questions. Two simultaneous standard 35mm slide projectors and one overhead projector will be available. Time and place of contributions will be indicated in June, 1992.
Each poster presentation will have available a 0.95m (vertical) by 1.2m (horizontal) panel. A large surface will be devoted to posters and poster sessions will be planned.

Publications of the Congress.

Official publications of the Congress will be the Abstract Volume and the Excursion Guide-book (including all the excursions).
Symposia will be published in Specialized Journals.