Commission Internationale de Microflore du Paléozoique

NEWSLETTER 50 May 15, 1996

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Note of the Secretary-general

This newsletter brings you a report of the meeting and 45 abstracts presented at the International Meeting and Workshop of the CIMP Acritarch Subcommission in Prague, Czech Republic, 10-12 april 1996. You can find the participants on the group photograph taken at the Geological Department of the Charles University. The meeting was appreciated as highly productive by the numerous participants, both by the presentations and discussions at the workshops around slides under the microscope. It will give even more impetus to the study on acritarchs, with its renewed effort to refine the systematical and biostratigraphical resolution of the acritarchs. The CIMP wants to congratulate the organizers for this successful meeting.

Maurice Streel sent the list of all the titles and five abstracts, related to Devonian palynology, presented nearly two years ago at the July 1994 Symposium in Moscow (Russia) on "Devonian Eustatic changes of the World Ocean Level."

Members are asked to check their CIMP subscription on the envelope label and if necessary pay their contribution.

Future meetings are announced, a WWW site with all E-mail addresses of palynologists worldwide and changes of addresses of CIMP members.

In June at the 9th International Palynological Congress, Houston, Texas, USA from 22-29 June 1996 many of us will meet during the many symposia and workshops. We look forward to the **CIMP symposium on Palaeozoic palynology** organized by Reed Wicander. At the conference and after, it will be possible to obtain the long-awaited A.A.S.P. publication "*Palynology: principles and applications*" in 3 volumes with 32 chapters and a total of 1287 pp. (see content and order form on page 21/22).

Together with this Newsletter we distribute the Acritarch Newsletter to the members of this Subcommission and **Palynos** from december 1995 to those who asked to receive the IFPS journal through the CIMP.

The Acritarch Newsletter N°8 contains an short report on the Prague meeting in april 1996, a call for candidates for secretary of the subcommission, news of acritarchs on the Internet. News and current research of 59 acritarch workers and a list of 53 publications on acritarchs in 1995.

CALL FOR CANDIDATES FOR CIMP PRESIDENT AND SECRETARY-GENERAL
It was 6 years ago that the last CIMP elections were held for the position of CIMP president and secretary-general. It is high time to call for new elections. Candidates for both positions can write before 15 october 1996 their candidature to the secretary-general. A written ballot will be sent together with Newsletter N°51 in november 1996. The new team will start in 1997.

Content Newsletter 50 (May 15, 1996)

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MEETING REPORT

CIMP Acritarch Subcommission Meeting & Workshop

Prague, April 10-12, 1996

The Acritarch Subcommission of the *Commission Internationale de Microflore du Paléozoique* (CIMP) is currently undergoing a revival after a long period of dormancy following the numerous meetings of acritarch workers in the 1960's and early 1970's (the last such meeting took place at Boussens, France, in 1973, and gave rise to the collection of papers published in *Review of Palaeobotany and Palynology*, n°18). A very successful joint meeting of the Acritarch and Chitinozoan subcommissions was held in 1991 at Keyworth, Nottingham (papers from this conference are published in *Special Papers in Palaeontology*, n° 48, edited by S.G. Molyneux and K.J. Dorning). A further meeting of the Acritarch Subcommission was held in conjunction with the CIMP *Palynology, Palaeoenvironments and Stratigraphy* Symposium at Sheffield in 1994.

The most recent meeting of the Acritarch Subcommission was held at the Charles University in Prague, Czech Republic (April 10-12, 1996) and was attended by nearly 60 acritarch workers. Prague 1996 is therefore the biggest meeting ever held by the subcommission, and so becomes a major event in its history. Participants came mostly from Europe (Belgium, Bulgaria, Czech Republic, England, Estonia, France, Germany, Hungary, Ireland, Italy, Lithuania, Poland, Portugal, Romania, Spain, Sweden), but other continents were also well represented by specialists from North Africa (Algeria, Morocco, Egypt), Asia (India, Iran, Iraq, Saudi Arabia) and the Americas (Argentina, Canada, U.S.A.).

The Prague 1996 meeting started with an Icebreaker on April 9th. The official opening of the meeting took place on Wednesday morning, April 10th, with welcoming addresses by Olda Fatka (organizing chair), Prof. Dr. Cepek (Dean of the Faculty of Sciences, Charles University of Prague) and Stewart Molyneux (chairman of the Acritarch Subcommission).

Three technical sessions were organized on Wednesday morning (general topics of acritarch research), Thursday morning (Precambrian to Ordovician acritarchs) and Friday morning (Ordovician to Carboniferous acritarchs). About 25 oral contributions and 20 posters were presented.

The afternoons were reserved for the workshop, microscope and poster sessions. On Wednesday afternoon, Alain Le Hérissé (Brest) and Thomas Servais (Liège) presented a glossary of morphographic terms used in the description of the acritarchs. Ken Dorning (Sheffield) reported on the work of the Taxonomy Working Group. The Acritarch Subcommission Business Meeting was held on Wednesday evening. On Friday afternoon, numerous workers took advantage of the microscope session to examine and discuss photographs, slides and preparations. Like its predecessor at the Keyworth meeting in 1991, this session gave workers the opportunity to study the material of their colleagues and proved to be very successful.

A guided tour of the historical city of Prague organized on Thursday afternoon gave participants an insight into one of the most beautiful cities of Europe, including visits to the Old Town, the Jewish Quarter, the Charles Bridge and the Old Square with its famous clock. The gala dinner took place on Friday evening after the closing session of the conference.

A one-day field excursion was organized after the meeting on Saturday, April 13th. Prof. I. Chlupac, Dr. P. Kraft and Dr. O. Fatka led participants to some of the important localities in the Palaeozoic of the Prague Basin, including a stop at the stratotype section of the Silurian/Devonian boundary at Klonk.

In order to publish a complete record of the meeting, all papers presented at the meeting will be included as extended abstracts or short papers in a special issue of ***Acta Universitatis Carolinae, Geologica***, which should be printed in Autumn 1996.

The five days of the meeting and workshop were highly successful: everyone benefitted from the opportunity for open discussions and enjoyed the relaxed atmosphere of the large family of acritarch workers. Many workers wish to meet again in a few years. Four proposals have already been (informally) made for the next International and Meeting and Workshop of the Acritarch Subcommission, which will probably be organized in 1998, possibly jointly with the general meeting of the CIMP.

Submitted by

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ABSTRACTS

SILURIAN PALYNOMORPHS FROM QALIBAH FORMATION, SAUDI ARABIA.

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Qalibah Formation, Silurian, crops out in north-western Arabia as shown on the index map. Lithology and age are presented on the section by Mahmoud et al., 1992.

In K-1, a well which was drilled further north in Jauf area, both lithology and age seem to be different from the type section. The lithology is mainly shale and the age of the upper member, Sharawra Member, appears to be younger. Core samples have yielded very well preserved and diverse palynomorphs, some of which are believed to be new. A preliminary investigation of these palynomorphs suggests a Ludlow age for Sharawra member. This is based on the presence of the following taxa: *Duvernaysphaera aranaides, Onondagella asymetrica, O. deunffii, Perforela perforata, Triangulina alargada, Antruejadina grotesca.*

Some of the above mentioned taxa and others are posted to show the good preservation and diversity of the palynomorphs. Few taxa of that are believed to be new are posted as well.

PALYNOLOGY AND PALEOECOLOGY OF THE SILURIAN SECTION AT ARISAIG, NOVA SCOTIA, CANADA

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A nearly complete Silurian sequence of mudrocks at Arisaig, NS, contains a rich invertebrate assemblage indicating a consistent shallow marine habitat. Palynomorph assemblages are dominated by acritarchs with varying numbers of leiospheres, chitinozoa, cryptospores, trilete spores and microscopic problematica (nematoclasts & cuticles). Acritarch populations are well-mixed and do not show ecological variations within closely sampled measured sections. A progressive decline in taxic diversity seems to parallel that seen in the Welsh Basin and elsewhere. Acritarch diversity seems to be decoupled from sediment size and, thus, does not closely track either sea-level changes or trends in benthic invertebrate composition.

ACRITARCHS FROM THE LOWERMOST ORDOVICIAN OF THE HOLY CROSS MOUNTAINS (Góry Swietokrzyskie) AND THEIR STRATIGRAPHIC POSITION IN THE LIGHT OF CONODONT STUDIES

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First data on the Ordovician *Acritarchs* from the Holy Cross Mountains have been publisbed in earlier papers by H. Górka (1963, 1969) and J. Jagielska (1962).

Górka has described twenty species out of which twelve are new. This assemblage of microfossils derives from siliceous rocks (chalcedonites) interbedding mudstones of the Zbilutka Member (Bednarczyk, 1964, 1981) exposed in the Bardo syncline in the southern part of the Holy cross Mountains.

The stratigraphic position of this member was discussed by some authors (Chlebowski and Znosko, 1976) and defined as a part of Lower Arenigian succession, but in the light of the present author's investigations the Zbilutka Member represents Upper Tremadocian. This position is established on the basis of *Conodont* assemblage, which shows presence of the *Drepanoistodus deltifer pristinus* Subzone in the Ordovician sections of the Holy Cross Mountains (Bednarczyk, 1988, 1995, Bednarczyk & Biernat, 1978). It is worth to note, that the same subzone is characteristic for the Varangu stage (Upper Tremadocian) in the Ordovician scheme of Estonia (Männil, 1990).

UPPER TREMADOCIAN TO LOWER ARENIGIAN ACRITARCHS FROM THE YANGTZE PLATFORM, SOUTHWEST CHINA - PRELIMINARY RESULTS

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Eight localities in the Lower Ordovician Nantsinkuan, Fengshiang and Hunghuayuan Formations (Yangtze Platform, SW-China) have been investigated palynologically for the first time.

The mainly carbonatic and partly dolomitic Tremadoc to lower Arenig succession provides various acritarch assemblages. The shales of the lower part of the Tungtzu (Nansinkuan) Formation (? =*Rhabdinopora flabelliformis* Biozone), the shaly intercalations of the Lower (no macrofossils) and Upper Member (*Adelograptus - Kiaerograptus* Biozone) of the Fengshiang Formation, and few argillaceous beds of the Hunghuayuan (= lowest part of the Meitan) Formation (*T. approximatus* to *A. filiformis* Biozones) yield acritarchs of possibly high biostratigraphical potential.

The assemblages include species of *Dactylofusa*, *Athabascella*, cf.*Vavrdovella*, *Stelliferidium*, *Cymatiogalea*, and *Rhopaliophora*. The assemblages are preliminarilly presented and compared with those from successions of similar age from North China, Newfoundland, Sweden, Britain, Germany, France, and Sardinia.

MIDDLE CAMBRIAN ACRITARCHS AND RADIOLARIANS FROM LUSATIA (GERMANY)

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Acritarchs, unicellular algae and radiolarians were encountered in terrigenous pelitic deposits recovered from a borehole in Lusatia (SE-Germany). The age of the sequence is considered to be early Middle Cambrian according to the acritarchs, which bave been calibrated with trilobite containing strata near Leipzig. The unicellular algae consist of one morphotype which is described as *Lophodiscus* n. gen. It is characterized by a thick wall with a few large warts on one side.

The radiolarians are generally spherical and appear to lack processes. Their size equals those forms known from Arenigian and Llanvirnian strata from Germany (unpubl. data) and are therefore considered to be the oldest undoubted radiolarian faunas.

A very interesting ecologic observation is the fact that often very small acritarchs are included in the radiolarian shells. This leads to the conclusion that already a food chain with phytoplankton (acritarchs) and zooplankton (radiolarians) existed at this time.

REMARKS ON ACRITARCHS AND TAPHONOMV

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Acritarchs are fossils of probably planktic origin, mainly observed and studied in the Palaeozoic but also existing up to the present. Significant morphological features point to a relation of acritarchs to various algal groups, or maybe their precursers.

Are acritarchs in general ancestors of extant taxa? Chrysophytes for instance produce stomatocysts either made of cellulose or of silicate. There obviously couldn't be a greater difference in material application: organic vs inorganic. Somewhere along the time axis this two different modes of protecting the protoplasm must have developed, but when? According to literature, chrysophytes are known since the Tertiary.

One main problem of acritarchs is the uncertainty about the taxonomic relationships of most of the groups partially correlated with their taphonomy. Only few relations have been discovered in depth over the years, as is for instance the case with the prasinophytes. A lot of the difficulties that arise in dealing with acritarchs are subject to taphonomical reasons. From different points of view, this should be dealt with more openminded in the nearby future. It may solve some questions.

The analysis of fossil communities as established in the palaeontological sciences is the study of things absent. Taphonomy seldomly allows the preservation of complete biocoenoses. In most cases, only a fraction of the originally existing material is fossilized. What can be found, is neither a biocoenosis, nor a thanato- or taphocoenosis. What we deal with is a fraction of an oryctocoenosis, a selection of fossils from a site, where the remnants of a former community are buried. But who actually collects everything of such a site?

These remarks are too often not calculated or misunderstood. Even the most thourough analysis is always leading to a model and not to an exact reconstruction of past times. Insofar acritarch study is no more excluded. The analyses of acritarch associations are always incomplete as well.

The necessary comparison to actual habitats of phytoplankton shows a strong correlation to environmental and even seasonal parameters. Combined with diagenetic effects and preservability this even more encreases the difficulty to decipher data from fossil material. Great caution is advised, if assumptions towards former communities and their composition are solely made on the organic material at hand. By the use of quantitative and statistical analyses some problems could probably be solved. For the use in biogeographical applications, the more specimen are present, the better. Even mathematical approaches for better comparison of associations at different localities have to be handled with care.

Concluding the remarks, it is advised, to keep all those problems in mind and not to become overagetated by certain results. But with a certain caution, results should lead to a better understanding where acritarchs can enrich our knowledge.

MORPHOLOGY, ULTRASTRUCTURE, AND CLASSIFICATION OF PALEOZOIC MUELLERISPHAERIDA

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General information: Muellerispheres are hystrichosphaerid Palaeozoic marine microfossils of uncertain biological affinities. General features are (i) globular central body with acanthomorphitic or bulbous processes, (ii) phosphatic wall material (apatite), multilayered with lamellar structure. First description has been done by D. Sannemann (1955) as Hystrichosphaerids from the Upper Silurian-Lower Devonian of the Bavarian Frankenwald (note: not Givet); later on treated as Acritarcha Evitt by Eisenack et al. in the 'Katalog'.

State of previous research: Aldridge & Armstrong (1981) pointed out a primary phosphatic mineralization of the walls. Kozur (1984) erected the new order *incertae sedis* Muellerisphaerida, divided into two families Aldrigeisphaeridae and Armstrongisphaeridae, mainly on the base of process shape. He supposed zooplankton relationship.

New results: Several observations clearly indicate secondary phosphatic alteration of the wall material. Planar gaps within the wall make probable that an unpreserved (?) organic-walled membrane existed. Tentatively this membrane caused before or while its decay a secondary apatite armoring. An advanced classification scheme as flux-diagram can be proposed - but doubts remain whether classification on the base of morphological features is helpful [point of discussion]. The new state of research indicate rather phytoplankton relationships than zooplankton affinities.

THE ORDOVICIAN ACRITARCH *FRANKEA*: SOME CRITICAL REMARKS

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The taxonomy of the acritarch genus *Frankea* Burmann 1970 is clarified. Five species belong to the genus: *breviuscula, hamata, hamulata, longiuscula* and *sartbernardensis.* Intraspecific variability is great, and it is difficult to distinguish the species *sartbernardensis, breviuscula* and *longiuscula,* which show a gradual increase in process length.

The reassignments of several species to the genus *Frankea* by Sarjeant & Stancliffe (1994) and Stancliffe & Sarjeant (1994) are rejected, because none of these taxa agrees with the diagnosis of the genus.

Fatkia Vavrdová 1995 is considered to be a junior synonym of *Frankea.* This taxon was created on the basis of two poorly preserved specimens which represent only an extreme variant of the genus *Frankea.*

PALYNOMORPHS FROM THE DEVONIAN AND THE CARBONIFEROUS ROCKS AND THEIR ENVIRONMENTAL SIGNIFICANCE FROM THE WESTERN HOLY CROSS MTS

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Palynological research on limestones and marls from the borehole Bolechowice IG (the Devonian/Carboniferous boundary) and limestones and shales from the Kowala quarry (the Frasnian/Famenian boundary) reveal existence of acritarcha - miospore - leiosphaeridia assemblages.

Palynofacies analyse of kerogen from both places unequivocally shows different environmental and sedimentation conditions. The content and acritarcha to miospore ratio of samples from Bolechowice testify the nearshore environmental and sedimentation conditions contrary to samples from the Kowala quarry. Their components confirmed argument about sedimentation in restricted environment, far from the shoreline.

The most common Acritarcha and Prasinophytes in the Bolechowice IG 1 borehole are as follow: *Polyedrixium, Dictyotidium, Pterospermella, Maranhites, Cymatiosphaera, Lophosphaeridium, Comasphaeridium, Solisphaeridium, Michrystridium, Veryhachium, Villosacapsula, Unellium* and *Gorgonisphaeridium.*

NEW PALYNOLOGICAL RESULTS FROM THE OVILLE FORMATION AT SW VOZMEDIANO, LEON (NW SPAIN)

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An assemblage rich and well diversified of organic walled microphytoplankton and chitinozoans, has demostrated the Ordovician age in the section of Esta Nappe, at SW of Vozmediano, Cantabrian Mountains. The ocurrence of *Timofeevia, Cristallinium, Zonosphaeridium, Multiplicisphaeridium martae* taxa in these stratigraphic units are rare, clusters and probably rest of algue origin are frequents, and *Veryhachium, Goniosphaeridium, Dasydiacrodium, Ooidium, Multiplicisphaeridium denticulatum, Actinodissus, Buedingisphaeridum, Peteinosphaeridium,* genera are very common. The chitinozoans *Eremochitina, Conochitina* and *Belonechitina* are identified. The range of some taxa are discussed.

BIOSTRATIGRAPHY OF ACRITARCHS IN PALEOZOIC ROCK UNITS IN THE ZAGROS BASIN OF IRAN

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In the Zagros Basin of Iran, the formal Paleozoic rock units are Barut (Pre-Cambrian), Zaigum (Cambrian), Lalum (Cambrian), Mila (middle-upper Cambrian), Ilebek (lower Tremadocian), Zard-Kuh (Tremadocian-Llandvirnian), Seyahou (Upper Ordovician) and Sarchahan (Silurian) formations. The surface and subsurface samples of the above-mentioned rock units were investigated for palynological studies. Among the Paleozoic rock units of Zagros Basin, the Barut, Zaigum and Lalun formations are barren, but the rest of them contain well-preserved and abondant palynomorph entities. 16 acritarch assemblage zones were established in the Mila, Ilebek, Zard-Kuh, Seyahou and Sarchahan formations that they are useful for deep test exploration wells. The encountered acritarch species of Paleozoic sequence of Zagros Basin were compared with those of elsewhere. This comparison reveals that 95% of acritarch species of Zagros Basin are similar to those of Mediterranean Acritarch Province and only 5% of Acritarchs are common with Baltic Province. Therefore, based on palynological data, the Zagros Basin has been part of Peri-Gondwana landmass during the Paleozoic Era.

LOWER PALAEOZOIC ACRITARCHS FROM THE BALTIC SEA AREA

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The Lower Palaeozoic in the Baltic Sea area contains well preserved floras of acid-resistant microfossils such as acritarchs. The thermal influence, largely shown by a thermal alteration index (TAI) ranging from about 1 to 2, has been very mild. In the Central Baltic, south central Sweden, east central Sweden and the Bothnian Sea areas, the previous sedimentary rock cover, presumably consisting of Devonian sandstones, is estimated not to have surmounted 2,000 m. In the Caledonian Mountain Range, the Lockne area, attributed to the autochton, microfossils display an increase of the thermal alteration index up to about 4. This fact is thought to be consistent with a much farther range of the Caledonian mountain range to the east than previously suggested.

ORGANIC-WALLED MICROFOSSILS *INCERTAE SEDIS* FROM THE ORDOVICIAN OF THE ARGENTINE PRECORDILLERA AND BOHEMIA

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Organic-walled microfossils *incertae sedis* are reported from the Arenig/Llanvirn of the Argentine Precordillera and compared with similar specimens from Bohemia. The fossils show a spherical to subspherical central body with an "opening" and a cellular wall structure.The two occurrences belong to different facial areas. The Precordillera is considered to be an attached terrane with faunistic affinities to the Laurentian warm-water area whereas the Prague Basin is part of the cold-water Perigondwana realm. The organic origin of the microfossils is discussed.

LOWER PALAEOZOIC ACRITARCH ASSEMBLAGES FROM THE UPPER SILESIAN BLOCK (USB)

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The Lower Palaeozoic of the USB are represented by platform sediments (total thickness of 3000 - 4000 m). Based on core samples from several boreholes located in the USB four different acritarch populations have been identified.

The Lower Cambrian - Sub - Holmia sediments were deposited only along the eastern margin of the USB. They yield numerous, well preserved assemblages including mainly various leiosphaerid acritarchs and cyanobacterial filaments. The genera *Tasmanites, Leiovalia, Ceratophyton* and *Granomarginata* are common.

The Lower Cambrian - Holmia sediments developed over a much larger area. The samples studied contain taxonomically very rich acritarch populations. Several species of *Skiagia* are the dominant taxa in the investigated material. The other species as: *Estiastria minima, Multiplicisphaeridium dendroideum, Alliumela baltica, Archaeodiscina umbonulata, Tasmanites bobrowskae* are also common.

The Middle Cambrian and Ordovician deposits occur only in the N part of the USB. The Middle Cambrian assemblage is characterized by the domination of *Adara alae, Eliascum lianiscum, Cristallinium cambriense, Micrhystridium notatum.* The Ordovician sediments yield the acritarch populations dominated by following genera: *Peteinosphaeridium, Baltisphaerosum, Ordovicidium, Pirea* and *Veryhachium.*

All Lower Palaeozoic rocks on the USB are proximal clastic sediments developed mainly in the littoral and sub littoral shelf enviroment.

CAMBRIAN ACRITARCH BASED BIOZONATION OF THE BALTIC SYNECLISE

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The value of acritarchs as a tool for the Cambrian biostratigraphy is generally accepted (Volkova, 1968, 1973; Volkova et al , 1979; 1983; Kirjanov, 1969, 1990; Jankauskas, 1972, 1991; Vidal, 1981, 1984; Hagenfeldt, 1989, 1995; Eklund,1990; Moczydlowska, 1989; Downie,1982). Some local schemes of acritarch based biozonation are proposed for different regions of the East European Platform. Cambrian deposits of the Baltic Syneclise are subdivided into "horizons" (within the former USSR) and into the Acritarch assemblages in Scandinavian sequences.

Coeval acritarch assemblages have many differences, but in general they can be directly compared and provide a basis for the proposal of a unified acritarch based biozonation for the Lower and Middle Cambrian. The "horizons" of the East European Platform are based generally on the acritarch evidence and are in fact biostratigraphic zones (Volkova et al., 1979, 1983). Each of them includes an unrepeatable acritarch assemblage. But only some of these "horizons" may be regarded as range zones, because most species of acritarchs have wide ranges which may extend through two or more "horizons". Therefore, it is difficult to show for every "horizon" (zone) an index taxon which does not extend beyond the specific "horizon" (zone). As a nominal taxon, for most of them can be chosen a species making an akme zone in the interval of the "horizon", or having the first appearance in it.

The position of the Precambrian-Cambrian boundary on the East European Platform in the base of the Baltija Group is conform to the recently selected (ratified) Precambrian-Cambrian boundary global stratotype (Landing,1994). In the Rovao "horizon" in the Ukraine, the Lower Cambrian trace fossils *Bergaueria* and *Conichnus* are found (Palij et al., 1979, 1983). In the Rovno "horizon" of Lithuania (Rudamina Formation) and Latvia the oldest shelly (mineralised) rests of a skeletal fauna *Platysolenites antiquissimus* (Volkova et al., 1983; Jankauskas, 1991; Jankauskas, Lendzion, 1992, 1994) are found. Thus, the Rovno "horizon" (or *Sabellidites cambriensis* faunal zone of the East European Platform) is the oldest zone of the Cambrian systeme in this region. It occupies the lower part of the Baltija Group of the East European Platform and is regarded as the *Teophipolia lacerata* acritarch Range Zone.

The Lontova "horizon" is regarded as *Granomarginata prima* acritarch Range Zone which is correlated with the *Platysolenites* faunal Zone. The *"Baltisphaeridium" cerinum* Range Zone corresponds to both the Dominopol and Lyuboml "horizons" and is subdivided into two assemblages zones. The *Estiastra minima - Micrhystridium dissimilare* Assemblage Zone corresponds to the lower part of the *Holmia* trilobite Zone and contains the *Vergale* acritarch Assemblage. The *Volkovia dentifera* Range Zone, comprising the upper part of the Lower Cambrian deposits, is subdivided into two shorter ones and is correlated with the *Holmia kjerulfi* trilobite Zone and with the *Protolenus* tribolite Zone.

The Middle Cambrian deposits are subdivided into two shorter zones. The *Micrhystridium notatum - Lophosphaeridium variabile* Assemblage Zone corresponds to *E. oelandicus* trilobite Zone and comprises the Kybartai Formation and the lower part of the Deimena Group. The *Comasphaeridium strigosum - Timofeevia lancarae* Concurrent Range Zone occupies the Paneriai "horizon" and is of *P. paradoxissimus* age. The Paneriai "horizon" is an earlier synonym of the "Lukovskij horizon" of Volkova et Kirjanov (1995).

TURNOVER IN THE PRECAMBRIAN AND EARLY PALEOZOIC (MAINLY CAMBRIAN) MICROBIOTAS: AN EXEMPLE OF THE BOHEMIAN MASSIF

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Neoproterozoic and Lower Cambrian rocks of the Tepia-Barrandian region and Barrandian area in Bohemia (Bohemian Massif) offer a comparison and enhance the view of the Upper Proterozoic, Early and Middle Cambrian cynobacterial, algal and acritarch assemblages, their stability, radiation and changes within the time span cca 650 - 540 Ma.

The Upper Proterozoic sequence of volcaniclastic metasedimentary rocks with graded greywackes, siltstones, cherts and conglomerates underly the Lower Cambrian clastic deposits with the oldest Phanerozoic macrofauna (arthropods, phyllocarids) and Early Cambrian microfossils. Precambrian microfossils occur as organic sphaerical and filament envelopes of different degree of burial decomposition, mineralization and alteration, consistantly with the thermal and tectogene history of the region. Benthic algal mat, plankters of both unicellular types and colonies and rare spiny acritarchs are the main components of the fossiliferous horizons within the Upper Proterozoic rocks.

The Lower Cambrian complex reflects continued radiation of Cyanobacteria and filamentous algae. Along with leiosphaerid acritarchs, they dominate the Bohemian earliest Cambrian assemblage (Holsiny - Horice formation, Paseky Shale assemblage). Acanthomorph and other ornamented acritarchs are represented up to 1 % only. The special environment with restricted marine influence and lithological pattern of the sedimentary complex (estuarine, lagoonal and riverine/lake deposits) may be responsible for this assemblage composition. It differs from rich taxa composition of the Lower Cambrian platform assemblages. The relatively rich acritarch radiation coincides with the Acadian marine transgression in the Middle Cambrian, reaches its acme in the Ordovician and is decreasing in frequency and taxa in the Silurian.

The Proterozoic and the Early Cambrian microfossil assemblages detected in the mentioned areas do so far not differ markedly. A turnover in the paleobiological record is shown in a new occurrence of megaphytes, microscopic organisms/species of *incertae sedis*, epidermal and exoskeletonic rest of animals, in ichnofossils and in a very special macrofauna of arthropops and phyllocarid crustacean close to *Hymenocaris* and *Canadaspis* in the early Cambrian. The acritarch pattern known up to now is comparable with the informal acritarch zones 2 and 3 (Moczydlowska 1989) in Poland.

MUELLERISPHAERIDA FROM TURKEY AND THEIR STRATIGRAPHIC IMPORTANCE

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The Ordovician-Middle Devonian Muellerisphaerida are problematic planktonic pelagic microfossils *incertae sedis* with the outer morphology of Acritarcha, but with large, double-walled shell consisting of organic matter and radially arranged crystallites of calcium phosphate.

For the first time, Muellerisphaerida were found in the clastic series of western Karaburun peninsula (Turkey) that was assigned in previous papers either to the Lower Carboniferous or to the Scythian-Anisian (Triassic). A Silurian age was proven by Muellerisphaerida, later confirmed by conodonts and radiolarians. Different stages of apertures in the Turkish material suggest that Muellerisphaerida are cysts.

BASIC PRINCIPLES OF ACRITARCH GROUPING AT SUPRAGENERIC LEVEL

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The purpose of this study is to specify the hierarchy of acritarch morphological features and to elaborate a combined polytomic-dichotomic key for determination and arrangment of the acritarch genera. The following subordination of four acritarch taxonomical features is proposed (in descending order): symmetry; vesicle shape; presence or absence of processes and complexity of processes if available; presence or absence of membrane. Using this key, all known acritarch genera could be englobed into five informal symmetry units (sphaerical, polyhedral, polygonal, rotational homopolar and rotational heteropolar), further subdivided into second-order shape subunits, third-order processes subunits and fourth-order membrane subunits.

DERVENTIA GEN. NOV. *INCERTAE SEDIS* - ENIGMATIC SILURIAN ORGANIC-WALLED MICROFOSSILS FROM THE STRANDZIDES OF SE-BULGARIA

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The age of a low-grade metamorphic formation of the Dervent Heights, Strandzides, SE Bulgaria, has recently been proved as Silurian on acritarchs. This formation yielded also cylindro-conical and conical organic-walled microfossils, 0.022-0.090 mm long and 0.008-0.024 mm wide, of unknown affinities. One end is tapering or bluntly oval, the other end is oval or broken. All specimens have a central channel or central body of dark-brown color. A generic name *Derventia* is proposed for eight unnamed species differing by their general outline, shape of the ends and the proportion of central channel width to the total width.

ELABORATION, IN PORTUGUESE, OF GLOSSARIES ON ORGANIC PETROLOGY AND GEOCHEMISTRY, AND PALYNOLOGY: PRESENTING A PROJECT

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The aim of the Project is to elaborate two scientific glosssaries, in Portuguese, on two scientific related domains within the Sciences, *viz.* "Organic Petrology and Geochemistry" and "Palynology'. Each of the glossaries comprises a computer version and will also be accompanied by the respective computerised data base with illustrations. The possibility of conversion of the computer version to different idioms was taken into account.

Such a project is indispensable in order to facilitate the progress and expansion of these scientific subjects at national level, and in the scientific and technological collaborative programs with Portuguese speaking countries. Furthermore, it will facilitate and bring forward terms in common use in such important domains as coal, coke, gas, coalbed methane, and basin stratigraphic analysis. Collaboration with specialists in related subjects (*viz.* acritarchs, scolecodonts, etc) is expected.

SILURIAN PALYNOMORPHS FROM THE HOLY CROSS MOUNTAINS (CENTRAL POLAND)

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This poster presents acritarchs which have been found in dark grey shales occurring in the outcrop Pragowiec placed in south - eastern part of Holy Cross Mountains. The acritarchs assemblage is presented according to stratigraphic division of Silurian based on graptolites. Presented acritarchs come from *Pristiograptus ? ludensis* - the uppermost Wenlockian graptolite biozone (Global Stratigraphic Standard), or *Monograptus ludensis* and *Spinograptus spinosus* -the lowermost Ludlovian graptolite biozone (according to regional stratigraphic division).

THE UPPER FAMENNIAN AT CHANXHE AND TOHOGNE (EASTERN BELGIUM)

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The uppermost Famennian of the Chanxhe I section has been studied in detail lihologically by Conil (1964), and micropaleontologically by Becker & Bless (1974), Conil (1964), Franssen (1974) and Streel (1966). These studies allow accurate biostratigraphical correlations with other sections such as Royseux (Hoyoux valley) and Tohogne (borehole section).

The uppermost Famennian transgression in Chanxhe shows the different facies: alluvio-lagoonal; inshore; offshore which correspond to three different palynofacies with respectivally, sphaeromorphs; *Gorgonisphaeridium* and much more diversified acritarchs.

The acritarchs of Chanxhe are similar to those described from Ohio and Indiana by Wicander (1974), and Wicander & Loeblich (1977).

The distribution compared with the Tohogne borehole section (Vanguestaine, unpublished and 1978) shows some differences, which are probably in relation to differences in facies between the two sections, but some analogies are found, as for example the first occurrence of *Gorgonisphaeridium winslowiae* at the uppermost part of the Famennian, some meters below the Carboniferous boundary.

UPPER CAMBRIAN ACRITARCHS FROM THE BASAL CONGLOMERATE OF THE KALLAVERE FORMATION OF THE PAKRI PENINSULA, NW ESTONIA

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Biostratigraphic information contained in conglomerates is significant for interpreting the incomplete Cambrian-Ordovician sequences in Baltoscandia. An up to 0.5 m thick basal conglomerate of the Kallavere Formation on the Pakri Peninsula, NW Estonia, overlying the Lower Cambrian Tiskre sandstones, yielded two Upper Cambrian acritarch assemblages.

An assemblage from the interior of a sandstone cobble yielded *Cristallinium* ? sp., *Cymatiogalea wironia, Lophosphaeridium* sp. and *Veryhachium dumontii*. The cavity fillings in the cobble and the conglomerate matrix yielded another assemblage including *Acanthodiacrodium* sp., *A.* aff. *echinatum, A. polymorphum, Actinotodissus* sp., *Arbusculidium destombesii, Cymatiogalea columellifera, C. cuvillierii, C.* aff. *velifera, Goniosphaerdium dentatum, Izhoria angulata, Priscotheca complanata, Stellechinatum uncinatum, Stelliferidium* sp., *Trichosphaeridium* sp., *T. hirtum* and *Vulcanisphaera africana.*

These assemblages suggest that the conglomerate formed during the *Acerocare* time contains reworked Upper Cambrian sandstone cobbles of tentative *Parabolina spinulosa* or *Leptoplastus* age. This age range corresponds either to the Ulgase or the Tsitre formation, both distributed not less than 40 km east of the Pakri Peninsula.

In the context of the Estonian Upper Cambrian stratigraphy and the Upper Cambrian fossil finds from the fissure fillings on Aland and conglomerates on Oland, the acritarch data are intriguing for interpreting the Cambrian-Ordovician history of the Baltoscandian basins.

THE STRATIGRAPHICAL SIGNIFICANCE OF *CORYPHIDIUM* MORPHOTYPES IN THE LOWER ORDOVICIAN SKIDDAW GROUP OF THE ENGLISH LAKE DISTRICT

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The Skiddaw Group of the English Lake District (northwest England) provides a reference section for lower Ordovician (Arenig) acritarch biostratigraphy in Avalonian/Gondwanan terranes. Recent mapping and work on the graptolite faunas provide a stratigraphical framework for the correlation of acritarch assemblages.

Altogether, a total of thirteen assemblages and sub-assemblages have been recognized, the most distinctive of which are the *messaoudii-trifidum* assemblage of latest Tremadoc-earliest Arenig age, and the *hamata-rarirrugulata* assemblage of late Arenig age.

Different morphotypes of *Coryphidium*, distinguished by vesicle shape, process shape and size, and process distribution, are represented in these assemblages, and in the intervening strata. Consequently, *Coryphidium* can be used as a stratigraphic guide fossil in the Arenig of northwest England.

SCANNING ELECTRON MICROSCOPY OF POLISHED, SLIGHTLY ETCHED SURFACES OF SILURIAN LIMESTONES FROM GOTLAND (SWEDEN): A METHOD TO OBSERVE ACRITARCHS *IN SITU*

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The method of scanning electron microscopy of polished, very slightly etched rock surfaces of samples from micritic limestone-marl alternations in the Silurian of Gotland, Sweden, provides excellent observation conditions for palynomorphs. Limestones show beautiful, three-dimensionally preserved acritarchs, chitinozoans, and prasinophytes, allowing the study of the outer and inner wall surfaces. Marls and siltstones provide slightly to strongly deformed, partly destroyed specimens, which become completely flattened and crushed when the sediment is highly compacted.

The observation of palynomorphs in polished surfaces can be considered as a complementary method to the standard preparation technique by hydrofluoric and hydrochloric digestion of rock samples, where a part of the palynological spectrum may be lost during the heavy-liquid separation, filtering, centrifugation, or bleaching procedures. The observation of the polished rock surface covers the complete spectrum of organic walled microfossils, including very small specimens. Besides, the method allows a view on the palynomorphs within the sediment (*in situ*) and provides information on the compaction and diagenetic alteration of the specimens.

ORDOVICIAN ACRITARCHS FROM THE HORIA FORMATION, NORTH DOBROGEA COUNTY, ROMANIA

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The Horia Formation outcrops in the Horia and Rediu Hills at the eastern part of the North Dobrogea County. Lithologically, the Horia Formation is composed by two members: the lower, metapsammitic and the upper schistous-phyllitic. The Horia Formation has been submitted to the ankimetamorphic processes.

The content of acritarchs is interesting but it has been mixted of the transgression and last dynamic metamorphism. The youngest stratigraphical acritarch assemblage determined from the upper member attest the Upper Ordovician age. It has been determined also a chitinozoan assemblage.

We have tried to correlate our acritarch's assemblage with the Vaureal Formation (Anticosti Island, Quebec), from the *Dicellograptus complanatus* zone.

ACRITARCH BIOSTRATIGRAPHY IN THE CAMBRO-ORDOVICIAN FROM THE ALGERIAN SAHARA

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Palynological examination of Cambro-Ordovician samples from the Algerian Sahara shows often rich and diverse associations of acritarchs. If many appear as ubiquitous, some of them are characteristic for associations of different ages.

Among the most characteristic Cambro-Ordovician forms are: *Baltisphaeridium klabavense, Eupoikilofusa squama, Veryhachium subglobosum, Eupoikilofusa striata, Veryhachium lairdi, V. longispinosum, Leiofusa pussila.* Theses species are the most abundant and characteristic of the late Ordovician.

The early Ordovician (Tremadoc-Arenig) reveals other forms such as: *Baltisphaeridium llanvirnatum, Evittia flosmaris, Dasydiacrodium ancorriferum, Priscogalea sp., Priscogalea cornula, Cymatiogalea elgasienne.*

The Cambrian is characterised by forms such as: *Eliasium microgranulatum, Micrhystridium sp., Multiplicisphaeridium martae.*

TAXONOMIC DISCUSSION OF THE GENUS *TRICHOSPHAERIDIUM* TIMOFEEV 1966 AND RELATED GENERA

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A high diversified and well preserved Late Cambrian-Early Ordovician palynoflora from borehole Danilov-7 in the Moscow Basin contains abundantly acritarchs assigned to the genus *Trichosphaeridium* Timofeev 1966. The infraspecific and generic variability is discussed and an emendation is proposed.

SELECTED ACRITARCHS FROM THE UPER PROTEROZOIC OF BOHEMIA

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Four characteristic assemblages of acritarchs were distinguished in slightly metamorphosed stromatolites, carbonates, carbonate shales, and black shales of volcanosedimentary-series of NW Bohemian Upper Proterozoic (Upper Riphean - Lower Vendian). Acritarchs record of different taphonomy represents environmental variation within tidal flat/lagoon complex comparable with Spitsbergen Neoproterozoic (Knoll, Swett and Mark, 1991). Both microbenthic - autochtonous tubular and small (= 10 μm) sphaerical microfossils of cyanobacterial character, as well as alochtonous, presumably planktonic forms (20 - 800 μm), some of them with short processes resembling cysts of prasinophyta. Vase-shaped microfossils as well as *Chuaria* - like bodies are present. Permineralized as well as organically preserved tetraedral acritarchs are preserved, this will be discussed in more details.

LATE CAMBRIAN ACRITARCH ASSEMBLAGES FROM THE *PELTURA SCARABAEOIDES* AND *ACEROCARE* TRILOBITE ZONES OF RANDOM ISLAND, SOUTHEASTERN NEWFOUNDLAND

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During the latest Cambrian, sedimentation on Random Island produced shale sequences several hundreds of metres thick, which have yielded trilobites of the *Peltura scarabaeoides* and *Acerocare* zones, and five acritarch microfloras (one with a Tremadoc component).

The oldest of these microfloras is dominated, in its lower part, by a distinctive new species of *Acanthodiacrodium* and in its upper part, by *Calyxiella izhoriensis*. Successive microfloras are characterized respectively by the appearance of *Poikilofusa squama* and *Arbusculidium striatulum*, a new species of *Ladogella*, a new species tentatively assigned to the genus *Ooidium*, *Ooidium rossicum* and *Nellia acifera*, and species of *Nellia*, including *Nellia sukatschevii*. The uppermost Cambrian sediments are succeeded by strata dominated largely by *Nellia* species and *Acanthodiacrodium angustum*. The first appearance of *A. angustum* is taken here as marking the base of the Ordovician.

PALAEOZOIC ACRITARCHS FROM MOROCCO

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The palynological study of Palaeozoic levels in ten wells and two cross sections in western and meridional Morocco allows to establish the inventory of organic microfossils. Acritarchs constitute assemblages more rich and better conserved than Chitinozoans.

The different associations yield from the middle Cambrian to the Caradoc have allowed the setting of a biozonation. This latter consists of 7 biozones based on Chitinozoans and Acritarchs in the lower Paleozoic. The biozones distinguished were based on index taxa of Acritarchs and Chitinozoans which coexist with biostratigraphic microfossils in Morocco or in others regions referred to.

This biozones allowed :
- The indication or the precision of many subdivisions within the Paleozoic of the studied areas (middle Cambrian, middle Arenig, Llanvirn, Lower Caradoc).
- The setting of local, regional and intercontinantal correlations, subsequently : Anti-Atlas, Moroccan Meseta, Algeria, Libya, North America, Canada and Europe.

QUANTITATIVE BIOSTRATIGRAPHY (U.A. METHOD) APPLIED TO EARLY ORDOVICIAN PALYNIFEROUS SEQUENCES FROM NORTHEM ÖLAND

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The authors analysed for acritarch-based biostratigraphy 100 samples from 5 sections along the north-western coast of Öland. Ranges of 29 selected species (among more than 90 species) were treated with Guex's Unitary Association (U.A.) method. Different outputs of Biograph program led to the identification of 9 U.A., representing 6 Biochronozones. These Biochronozones correspond quite well to previously defined, quasi-empirical biozones. A first attempt to test these Biochronozones outside the Baltic Region provides promising results. The limit between Zones 4 and 5 falls inside the stratigraphic interval where the Arenig-Llanvirn boundary is commonly located at Öland.

SILURIAN ACRITACHS FROM SOUTH AMERICA : A REVIEW

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In South America the extension of the Silurian deposits is considerable. Acritarch assemblages have been reported from different basins: in Brazil from the Amazonas, Solimoes, Parnaiba and Parana basins (the latter also extended into Paraguay), in Bolivia from the Eastern Cordillera, in Argentina from the Sierra Subandinas, Chaco-paranense basin and the Precordillera.

The purpose of this work is to point out the importance of the acritarchs, in addition to chitinozoa, and miospores: firstly to precise the stratigraphy of the Silurian sequences, secondly to provide new data about their paleoecological distribution and biogeography worldwide.

LOWER DEVONIAN PALYNOMORPHS FROM THE TALACASTO FORMATION, CERRO DEL FUERTE SECTION, SAN JUAN PRECORDILLERA, ARGENTINA

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The Cerro del Fuerte locality near Jachal village, northeastern San Juan Province shows a good exposure of the characteristic Siluro-Devonian sequence of the Precordillera in Argentina, with the Los Espejos Formation conformably overlain by the Devonian beds of the Talacasto Formation. The Talacasto Formation is characterized by a mud-dominated shelf facies and recent studies on brachiopod have indicated a Lochkovian-Emsian age for this unit. Extensive palynological investigations are being carried out to evaluate the statigraphical importance of marine and non-marine palynomorphs for the Devonian of the Precordillera. Although the preservation of the palynomorphs is not especially good in the samples studied, certain elements allow good correlations with coeval assemblages of the north gondwanan margin and a precision of the regional stratigraphy.

VALUE AND UNDERSTANDING OF THE TERM ACRITARCH

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Some 30 years after the definition of the group *Acritarcha* by Evitt 1963, the value and understanding of the term needs to be be reconsidered. Proposed originally as an informal, utilitarian category to group palynomorphs of unknown affinities, the *Acritarcha* were subsequently regarded by many workers as grouping mainly cysts of algal origin, commonly classified under headings such as "algae *incertae sedis*" or "microphytoplankton". Several specialists proposed their own definitions or published new interpretations concerning the biology of the group. Today, some authors suggest abandonment of the term 'acritarch'. However, because the exact biological affinity of most of the individual acritarch morphotypes is still unknown, the informal grouping of the acritarchs is still valuable, and Evitt's original definition should be retained.

CHUARIA CIRCULARIS WALCOTT 1899 "MEGASPHAEROMORPH ACRITARCH" OR PROKARYOTIC COLONY ?

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Chuaria circularis is known worldwide from mainly Neoproterozoic sedimentary sequences. This simply constructed fossil was interpreted in very different ways since its description in 1899 by WALCOTT. Currently, it is widely accepted as large sphaeromorph acritarch. In Early Neoproterozoic sediments the disk-like C. *circularis* is frequently associated with the ribbon-like form *Tawuia daiensis*, which gave rise to biostratigraphic use of this *Chuaria-Tawuia* assemblage for a Neoproterozoic age (roughly 900 - 700 M a).

Investigations of *C. circularis* from South China indicate a stratigraphic distribution from the Early Neoproterozoic to the earliest Cambrian. The biostratigraphic implication of the *Chuaria-Tawuia* assemblage is discussed here. *Chuaria* and *Tawuia* are regarded as colonies of prokaryotes according to biostatistics, SEM- and TEM-investigations, analyses using palynological methods, and comparisons to Recent Cyanobacteria. Due to close morphologic and structural relations, *Tawuia daiensis* possibly may be interpreted as an ecophene of *Chuaria circularis*.

SOME ACRITARCHS OF THE UPPER PALAEOZOIC FROM THE WESTERN POMERANIA (NW POLAND)

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The upper Frasnian, Famennian and the lowest Carboniferous deposits of Western Pomerania are composed of dark grey and black shales, and shaly intercalations within limestones.

Limited, but relatively well preserved microflora can be easily correlated with the European standard miospore division. Seven miospore zones can be distinguished within the Upper Palaeozoic in Western Pomerania (Kolobrzeg region): DT, RD, RB, Im, VR, Ra i Ma.

In some cases there are no characteristic miospores, so it is difficult to point out the miospores level. But in these levels acritarchs are present, so proper data can be obtained (i.e. *Daillidium quadridactilites* Staplin et Willer 1962 and *Villosacapsula ceratoides* (Stockmans et Willer) Martin 1982).

ANY CATASTROPHIC EVENT AT THE FRASNIAN-FAMENNIAN BOUNDARY?

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At Hony, in the northern flank of the Dinant Synclinorium (Belgium), a continuous railway section cuts the Frasnian-Famennian boundary. Streel and Vanguestaine (1989) documented that the 138 cm thick shales between the last Frasnian and first Famennian conodonts bearing limestones, display important organic content variations, from bottom to top: high spore and spined-acritarch concentration; drastic reduction of the organic content with local disappearance of spined-acritarchs; progressive return to the first situation. These variations are interpreted as a sudden acceleration of the sedimentation rate (Hony Event) within a short-term regressive phase.

In the same section, at this Event, Claeys and Casier (1994) have discovered a glass spherules layer assigned to tectites.

Detailed quantitative analyses of acritarch populations confirm Streel and Vanguestaine's (1989) hypothesis. The regressive phase is marked by a remarkable succession of acritarch assemblages (thin-spined forms; *Gorgonisphaeridium* spp.; *Tasmanites stockmansii*). Marine influence and distality indexes clearly demonstrate an offshore, inshore, offshore evolution of the depositional environment at the Frasnian-Famennian boundary.

Careful analysis of several contemporaneous sections are necessary before any definitive answer can be given on the title question. We think that quantitative palynology integrated in interdisciplinary studies could bring a major contribution.

ACRITARCH ASSEMBLAGE FROM TRIASSIC SEDIMENTS OF TALCHER COALFIELD, ORISSA, INDIA

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The Gondwana sediments have evidences of acritarch occurrence at various intervals through time during Permian and Triassic. The palynological analysis revealed qualitative diversification with high frequency of acritarchs in specified palaeoecological conditions through Permian. Their record in the Triassic sediments is not much. Recenly an acritarch dominating assemblage has been observed in the Supra-Barakar Kamthi sediments of Talcher Coalfield, Orissa. These sediments have been palynologically dated as Late Early Triassic having high frequency of palynomorphs *Lundbladispora* and *Lunatisporites*. The other qualitatively important taxa are *Playfordiaspora* spp., *Densoisporites, Gottatisporites, Ringosporites, Polycingulatisporites* and *Goubinispora* etc. The acritarch group is represented by *Lelosphaeridia, Lophosphaeridium, Pliasporites, Hemisphaerium, Muraticavea, Dictyotidium, ?Schismatosphaeridium, Botrycococcus* and *Tympanicysta*. The high incidence of acritarchs reveal increased salinity during the deposition of early Triassic sediments in this area.

PALYNOFACIES IN THREE NEAR-TO OFF-REEF SHALY DEPOSITS FROM LATE MIDDLE TO LATE FRASNIAN AGE (UPPER DEVONIAN) AT NEUVILLE AND FRASNES (DINANT SYNCLINORIUM, BELGIUM)

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Three stratigraphically and sedimentologically well constrained perireefal to off-reef sections in the type area of the Frasnian Stage have been sampled in the middle and southern border of the Dinant Synclinorium in order to determine their palynofacies.

Based on quantitative analyses, three main acritarch assemblages are recognized :

1. the first shows a strong dominance of thin-spined acritarchs (*Micrhystridium/ Solisphaeridium* spp.,*Veryhachium* spp. and *Villosacapsula ceratioides*);
2. the second is dominated by thick-spined acritarchs (*Baltisphaeridium* spp., *Multiplicisphaeridium* sp., *Visbysphaera fecunda*, amongst others). It displays a high diversity and shows the features of the Vf assemblage-zone (Vanguestaine et al., 1983);
3. a low amount of spined acritarchs and large quantities of laevigate and papillate sphaeromorphs (*Leiosphaeridia* spp., *Lophosphaeridium/Gorgonisphaeridium* spp.) characterize the third assemblage. In the same samples, high pourcentages of miospores, chitinozoa and scolecodonts are also recorded.

These three associations are clearly correlated with depositional environments which have been independently defined by a sedimentological-sequential approach (Boulvain and Herbosch, 1996):

- acritarchs assemblage 1 characterizes perireefal environments;
- a deep off-reef facies displays the 2nd association;
- the 3rd assemblage is recorded at the base of a transgressive system tract, with remobilisation of relatively restricted sediments originating from an inner part of the ramp.

Gradient of ecological factors (salinity, amount of nutrients and/or redox potential) are pertinent keys to explain these relationships. However, transportation must be evocated to accomodate deep off-reef facies with the second (thin-spined) and the third (acritarchs depleted) assemblages.

AFFINITIES OF LATE DEVONIAN ACRITARCHS FROM THE MADRE DE DIOS BASIN, BOLIVIA

Milada VAVRDOVÁ
Geological Institute, Academy of Sciences of the Czech Republic
Prague, Czech Republic

Peter E. ISAACSON
University of Idaho
Moscow, Idaho, U.S.A.

Acritarchs and terrestrial plant microfossils have been obtained from the subsurface clastic sequences of Madre de Dios Basin, northern Bolivia. Sixty samples have been processed so far, most of them productive. Samples from the Manuripi X-1 borehole yielded approximately same number of plant microfossils of terrestrial and marine origin. Givetian, Frasnian, Famennian and Early Carboniferous assemblages were recognized. Lowermost samples from the Pando X-1 borehole (depth 1914-1932 m) contained Silurian and Lochkovian palynomorphs (*Dateriocradus - Fimbriaglomerella - Riculasphaera*). Tomachi and Toregua Formations of Middle and Late Devonian age characterize taxa *Umbellasphaeridium* and *Maranhites*. Bolivian acritarch assemblages of Late Devonian age are distinguished by the presence of *Umbellasphaeridium* with cristate sculpture on central body. Associations from the South American intracratonic basins reveal close affinities to north African Ghadamis, Murzuq, and Illizi basins as well as to Appalachian region. Analogical relationship can be traced between Gondwanan and Euramerican microfloras of Devonian age.

BIBLIOGRAPHY OF GONDWANA PALYNOLOGY AND GEOGRAPHICAL AND STRATIGRAPHICAL INDEX

Roseline H. WEISS
Geologisches Institut, Universität zu Köln
Cologne, Germany

The BIBLIOGRAPHY OF GONDWANA PALYNOLOGY is a database containing 3214 literature citations on Gondwana palynomorphs. The bibliographical data have been registered with all significant information necessary for a quick and unequivocal identification. This volume was published in december 1995.

The Bibliography will be completed by a GEOGRAPHICAL AND STRATIGRAPHICAL INDEX now in preparation. The Index contains tabulated data with complementary information on geographical and stratigraphical distribution of all microflora assemblages cited in the bibliography.

A PRELIMINARY STUDY OF LATE DEVONIAN ACRITARCHS FROM RIESCHEID, NORTH RHENISH SLATE MOUNTAINS, GERMANY

S. WELDON
University College Cork
Cork, Ireland

Diverse, well-preserved acritarchs are recorded from the Late Devonian greenish/grey silty shales (equivalent to the Hangenberg Schiefer). These sediments, are assigned to the Late Devonian LE - LN miospore biozones (Higgs & Streel, 1984 and Higgs, 1993). Morphological features and stratigraphic distribution of these acritarchs are presented.

A NEW BILAYERED VERYHACHID FROM THE LLANDOVERY OF THE MIDCONTINENT AND EASTERN UNITED STATES

Gordon D. WOOD

Amoco Exploration
Houston, Texas, U.S.A.

A new bilayered polygonomorph, tentatively assigned to *Beromia*, has been recovered from the Lower Sodus Shale of New York, the Lulbegrud Shale Member of the Noland Formation (Crab Orchard Group) of Kentucky and the Red Mountain Formation of Alabama and Georgia. This new form is tetragonal-pyramidal in shape. Processes emanate from the corners of the tetrahedron and are distally acuminate. The endoderm is congruent with the periderm and endodermal processes are thin, ribbon-like. The excystment mechanism is via an epityche that forms on the endoderm and associated with a simple lateral split on the periderm. This is the first report of a bilayered acritarch with a combination excystment structure consisting of two different mechanisms.

The wide geographic distribution and apparent short stratigraphic range of this acritarch suggests this species may be significant in correlation of upper Llandovery strata in the eastern North American Platform. This new form of *Beromia* occurs with a diverse and abundant organic-walled microphytoplankton assemblage suggesting deposition in nearshore marine to slighty offshore environments (*Eocoelia to Chlorindia* community).

PRE-CARBONIFEROUS CHLOROPHYTA: NEW OCCURRENCES OF HYDRODICTYACEAE, ? SCENEDESMACEAE AND ZYGNEMATACEAE

Gordon D. WOOD and Merrell A. MILLER

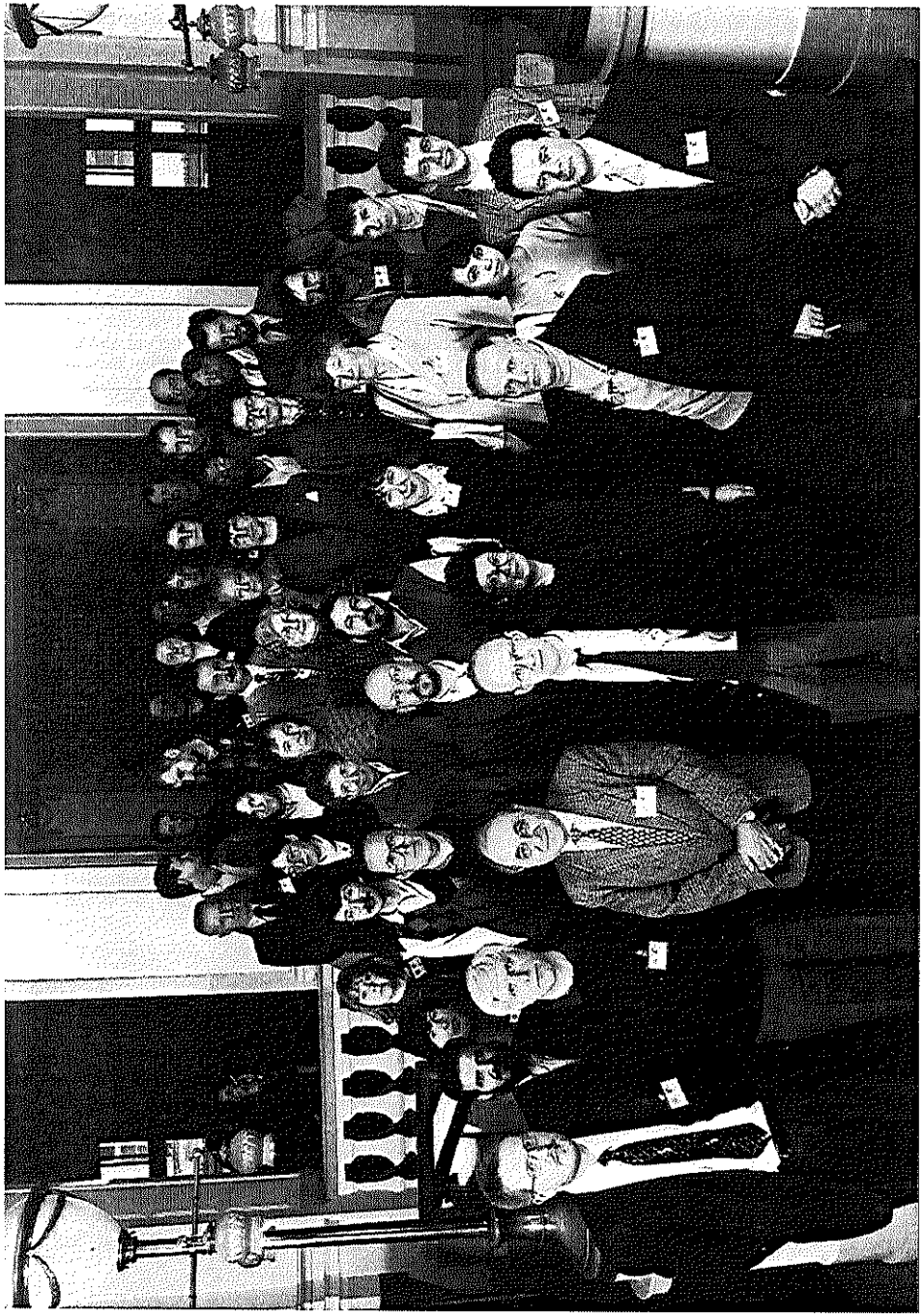
Amoco Exploration
Houston, Texas, U.S.A.

Pre-Carboniferous microfossils attributable to the Order Chlorococcales (Families Hydrodictyaceae and Scenedesmaceae) and Order Zygnematales (Family Zygnemataceace) are rarely reported in the palynological literature. Evidence suggests that harsh chemical and/or mechanical processing can destroy these fossils. This paper discusses and illustrates several new pre-Carboniferous species with morphologies comparable to known taxa of the Division Chlorophyta.

The oldest reported Hydrodictyaceae were from the Late Silurian (e.g. *Deflandrastrum* Combaz 1962). Information presented here extends the range of geometrically arranged, planar coenobia to the "middle" Ordovician as well as documenting their occurrences in younger Paleozoic systems. Coenobial species are recorded here from the Ordovician (Bromide Formation, Prarie du Chein Formation); Silurian (Neahga Shale, Cabott Head Shale, Osgood Shale), U.S.A.; and Devonian (Iquiri Formation), Bolivia, unnamed subsurface units, Paraguay and Poland. Probable non-planar algal coenobia are also illustrated from the Precambrian ("Nonesuch Shale") of Michigan and unnamed Upper Cambrian strata from the U.S.A. and Oman.

Scenedesmaceae have been reported from the Mesozoic and Tertiary. Specimens with morphologies attributable to ? *Scenedesmus* were recovered from the Lower Devonian (Holland Quarry Shale), U.S.A. Several zygnematacean taxa have beeen reported from the Paleozoic (e.g. *Tetraporina* Naumova 1939, *Peltacystia* Balme and Segroves 1966, *Lacunalites* Hemer and Nygreen 1967). Examples of this family are illustrated from the Devonian of Poland and U.S.A.

Although uncommon in most Paleozoic palynomorph assemblages, our studies indicate the presence of these algae are paleoecologically significant. They are, with few exceptions, usually present in lithological sequences representative of shallow near-shore depositional settings (e.g., in black laminae in major sand sequences), palynofacies indicative of freshwater influence (dominated by spores and terrestrial plant debris) or occurring with benthic megafossil assemblages indicative of shallow marine, near-shore settings.



PROGRAMME
ABSTRACTS
LIST OF PARTICIPANTS

Commission Internationale de Microflore du Paléozoïque
(C.I.M.P.)
Acritarch Subcommission

INTERNATIONAL MEETING AND WORKSHOP

PRAGUE
1996

Prague, Czech Republic, April 10-12, 1996

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SUBCOMMISSION ON DEVONIAN STRATIGRAPHY
PALAEOZOIC MICROVERTEBRATES PROJECT 328 JOINT MEETING

DEVONIAN COMMISSION OF THE RUSSIAN INTERDEPARTMENTAL STRATIGRAPHIC COMMITTEE

ABSTRACTS

July, 9–22 1994 Moscow Symposium "Devonian Eustatic Changes of the World Ocean Level", MOSCOW AND UKHTA

JOINT SUBCOMMISSION ON THE DEVONIAN STRATIGRAPHY, DEVONIAN COMMISSION OF THE INTERDEPARTMENTAL STRATIGRAPHIC COMMITTEE OF RUSSIA AND IGCP "PALAEOZOIC MICROVERTEBRATE BIOCHRONOLOGY AND GLOBAL MARINE–NON–MARINE CORRELATION" PROJECT No. 328 Meeting

Edited by

Prof. M. HOUSE

compiled by

O.A. Lebedev

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National Committee of the Geologists of Russia
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PUBLISHED IN THE PALAEONTOLOGICAL INSTITUTE OF RAS

MOSCOW, 1994

CONTENTS

THE ONSET OF THE GLOBAL FAMENNIAN REGRESSION AND ITS EVOLUTIONARY CONSEQUENCES

BECKER R. TH., Palaontologisches Institut, Freie Universität Berlin, 74-100 Malteserstrasse Haus D, 12249 Berlin, Germany.

The change from the Frasnian and Lower Famennian eustatic high to the regressive phase of the later Famennian has been named as Condroz Event. High resolution stratigraphic investigations in Germany, southern France, North Africa and Western Australia using conodont data and new ammonoid zonations enable the precise dating of eustatic movements in in the Nehdenian (Upper Devonian II). The first overregional shallowing pulse (Lower Condroz Event) is recognized at the crepida/rhomboidea Zone transition (upper part of Paratorleyoceras globosum Zone, UD II-D). This eustatic fall terminated the deposition of black shales in many shelf basins and led to the accumulation of the lowest unit (Esneux Formation) of the name-giving Condroz Sandstone Group in the classical Belgian Famennian. Following a widespread *Praemeroceras* level (UD II-E) the second shallowing pulse occured in the late part of the rhomboidea Zone, preceeding the spread of Paratornoceras (UD II-F) in the basal marginifera Zone. The classical upper Nehdenian is marked by a sudden transgression reverting briefly the overall regressive trend (Maeneceras biferum Zone, UD II-G). The two pulses of the Condroz Event caused a significant global extinction in tornoceratids and cheiloceratids including all survivors of the even more drastic end-Frasnian Upper Kellwasser Event.

MARINE INFLUENCES IN THE ORCADIAN BASIN, SCOTLAND

MARSHALL J.E.A., Department of Geology, The University, Southampton, SO17 1BJ, U.K.

In northern Scotland there is a major development of lacustrine sediments in the Orcadian Basin. Towards the top of the sequence the basin becomes low lying and develops a sandy sabkha facies (Rogers, pers. comm.) within which a short lived marine incursion occurs. This incursion is late Givetian in age and tentatively correlated with the Taghanic Onlap. An offshore well section, palynologically dated within the interval latest Givetian to mid Frasnian contain definitely two and probably three similar marine events. Palynological assemblages from this section contain *Archaeoperisaccus*, hitherto been regarded as restricted to northern Laurasia. The marine incursions are attributed to the early Frasnian transgressive pulses. The sediments in this well section have a well developed pattern of cyclicity interpreted as controlled by orbital forcing and attributed to 123 ky and 414 ky periodicities. The marine incursions occur at the mid points of the 414 ky cycles thus establishing a link between the orbital cycles and transgressive events. Recognition of these short lived marine incursions into the continental sediments of the Orcadian Basin will ultimately permit a more precise correlation with the marine Devonian standard. This northern occurrence of marine incursions can be linked with the marine Devonian limestones in the Central North Sea but it is believed that the route taken by the marine incursions was from the east.

ZONAL SUBDIVISION OF THE SOUTH TIMAN FRASNIAN DEPOSITS BY PLANT SPORES

OBUKHOVSKAYA T.G. BelNIGRI, Staroborisovsky tract, 14, Minsk 220114, Belarus.

Palynological information makes it possible to carry out detailed stratigraphic subdivision and correlation of the South Timan Frasnian and adjacent deposits. Here in a practically continuous section all miospore zones and subzones characteristic for the Frasnian of the East-European platform are established (Avkhimovich et al., 1993).

The level of the lower boundary of the Frasnian accepted by the International Subcommission on Devonian Stratigraphy, according to the palynological analysis data is closest to the base of the Ust' Yarega Formation and coincides with a boundary of local palynozones A. variabilis-C. triangulatus and A. variabilis insignis. The upper boundary of this stage is established in the base of C. vimineus-G. vasjamica Zone (local palinozone C. imperpetuus) corresponding to "pre-Zadonskian" regional stage.

References.

AVKHIMOVITCH V.I., TCHIBRIKOVA E.V., OBUKHOVSKAYA T.G., NAZARENKO A.M., UMNOVA V.T., RASKATOVA L.G., MANTSUROVA V.N., LOBOZIAK S. and STREEL M., 1993. Middle and Upper Devonian miospore zonation of eastern Europe. Bull. Centres Rech. Explor.-Prod. Elf Aquitaine, 17, 79-147.

CRYPTOSPORES, MIOSPORES, INTERFACIES CORRELATION IN THE DEVONIAN

RICHARDSON J.B. Department of Palaeontology, Natural History Museum, Cromwell Road, London, SW7 5BD England.

Beautifully preserved spores are recorded in many sections of terrestrial deposits but in distal marine environments spores are often rare and badly preserved. Progress in interfacies correlation is hampered by inconsistencies in taxonomy, nomenclature and inadequate illustration but is proving possible through inter-disciplinary palynological studies. Spores are abundant and varied in both terrestrial and neritic environments whereas chitinozoa are present in a wider variety of offshore environments. Progress in the correlation of Silurian/Devonian boundary and some key Devonian spore events are discussed.

A MAJOR APPALACHIAN LATE DEVONIAN EVENT

WOODROW D.L., SEVON W.D., RICHARDSON J.B. Department of Palaeontology, Natural History Museum, Cromwell Road, London, SW7 5BD England;
AVKHIMOVICH V.I. BelNIGRI, Staroborisovsky tract, 14, Minsk, 220114, Belarus.

Polymictic diamictites with boulders up to 0.5m in diameter (base of unit), gravelly mudstones with cobble-size exotic clasts and laminites with isolated small pebbles (top of unit) form a fining-upward sequence of greatly thickness in Late Strunian (Devonian) sections in the central Appalachians. These rocks are exposed wholly or in part at 30 localities along a 400 km strike belt in Pennsylvania and Western Maryland and are unique in the Appalachian Basin. The sequence overlies disconformably fluvial facies of the Catskill Formation or shoreline facies of the Hampshire Formation and was, at least in part, deposited in a subaqueous environment. The only fossils found, spores and plant remains, indicate that the strata immediately above and below the sequence belong to the LE subzone. In western New York and Pennsylvania, in marginal marine sequences, the Oswayo (LE Subzone) is separated from the overlying Knapp (LN subzone, latest Devonian) by an unconformity. The unique rock types and their wide distribution indicate a major event of at least regional significance.

We hypothesize that the sequence formed in response to a bolide impact, although one of the authors thinks that it may have formed in response to major tectonic/pluvial event.

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9th INTERNATIONAL PALYNOLOGICAL CONGRESS, HOUSTON, TEXAS, USA (22-29 June 1996) with a **CIMP symposium on Palaeozoic palynology** organized by Reed Wicander. (see also program)
Contact: Sarah P Damassa, 3 Ridge Street, Winchester, MA 01890 USA or D.J. Nichols; Fax: 1/303-236-5690; E-mail: dnichols@greenwood.cr.usgs.gov.
or Reed Wicander, Dept. Geology, Central Michigan Univ., Mount Pleasant, MI 48859, USA; fax: 1/517-774-2142; E-mail: 3yjwexp@cmovm.csv.cmich.edu.

INTERNATIONAL ORGANIZATION OF PALEOBOTANY CONFERENCE (IOPC-V), SANTA BARBARA, CALIFORNIA, USA, June 30 - July 5, 1996.
Contact: Bruce Tiffney; E-mail: tiffney@magic.geol.ucsb.edu.

THIRD BALTIC STRATIGRAPHIC CONFERENCE, TALLINN, ESTONIA (8-11 October, 1996). The main topic will be high-resolution biostratigraphy and Baltic regional stratigraphy. Two days excursion for study of early Palaeozoic outcrops around Tallinn.
Contact: Jaak NÕLVAK, Correspondence Secretary, Institute of Geology, 7 Estonia Ave, EE 0001, Tallinn, Estonia. Fax 372.6.312074, E-mail: jaak@pzgeol.gi.ee

30TH INTERNATIONAL GEOLOGICAL CONGRESS, BEIJING, CHINA, (4-14 August 1996). 30th IGC, P.O. box 823, Beijing 100037, P.R. China.

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"Lycospora" First Occurrence Working Group
Contact person: Elzbieta Turneau, Instytut Nauk Geologicznych,
Polska Akademia Nauk, Ul. Senacka 1/3, 31-002 Krakow, Poland.

Upper Devonian "Grandispora" Working Group
Contact person: Ken Higgs, Department of Geology,
University College Cork, Cork, Ireland.

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Secretary: Thomas Servais, Lab. ass. de Paléontologie,
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CIMP SYMPOSIUM ON PALEOZOIC PALYNOLOGY

Monday, June 24, 1996

Reed Wicander, Organizer

8:00 - 9:40 **Reed Wicander**, Chairman.

8:00 - 8:20 **Vidal, G. & Marti, M.** Early Neoproterozoic biomineralised protist and accompanying acritarchs.

8:20 - 8:40 **Vidal, G. & Moczydlowska, M.** Biodiversity, speciation and extinction of Neoproterozoic and Cambrian phytoplankton.

8:40 - 9:00 **Olaru, L.** About the correlation of differrrent zones with metamorphic formations from Roumania by the acritarchs assemblage data.

9:00 - 9:20 **Moczydlowska, M.** Cambrian acritarch biochronology and the duration of acritach zones.

9:20 - 9:40 **Miller, M.** Late Cambrian acritarch biostratigraphy of the Upper Mississippi River, Midcontinent, USA.

10:00 - 11:40 **Gonzalo Vidal**, Chairman

10:00 - 10:20 **Knight, R.** The splendours and oddities of Omans' Lower Paleozoic Haima Supergroup.

10:20 - 10:40 **Molyneux, S. G. & Servais, T.** The *messaoudii-trifidium* assemblage: High resolution acritarch biostratigraphy in the Peri-Gondwanan Lower Ordovicium.

10:40 - 11:00 **Pittau, P.** Biostratigraphy of the Ordovician Chitinozoa of Northwestern Libya.

11:00 - 11:20 **Asselin, E, Achab, A. & Lavoie, D.** Upper Ordovician Chitinozoa from the Lac Saint-Jean outlier, Laurentian craton of East Canada.

11:20 - 11:40 **Steemans, P, Rubinstein, C. & Le Herissé, A.** Precisions on the palynostratigraphy of the Siluro-Devonian boundary in Libya.

1:00 - 2:40 **Thomas Servais**, Chairman.

1:00 - 1:20 **Paris, F.** Stable carbon isotope ratios of sorted organic walled microfossils of Early Paleozoic age.

1:20 - 1:40 **Playford, G. & Hashemi, H.** Upper Devonian palynoflora from the Central Iran Basin.

1:40 - 2:00 **Marshall, J. E. A.** *Rhabdosporites langii*, *Geminospora lemurata* and *Contagisporites optivus*: An origin of heterospory within the Progymnosperms.

2:00 - 2:20 **Cashman, P.** Devonian spores of the Prairie Evaporite Formation and their importance to interpreting the formation of the potash deposits.

2:20 - 2:40 **Hartkopf-Fröder, C.** Palynology and organic geochemistry of thermally imature Late Upper Devonian sediments of the Paffrath syncline, Rhenish Slate Mountains, Germany.

3:00 - 5:40 **Geoff Playford** and **Geoff Clayton**, Co-chairman.

3:00 - 3:20 **Higgs, K., Avchimovitch, V. I., Loboziak, S. Stempien-Satek, M. & Streel, M.** Systematic and stratigraphic study of the *Grandospinosa* complex in the Famennian ot Northwest and East Europe.

3:20 - 3:40 **Riegel, W.** The geologic significance of the Late Paleozoic phytoplankon blackout.

3:40 - 4:00 **Carson, B. & Clayton, G.** The Mississippian palynostratigraphy of Rügen, Germany.

4:00 - 4:20 **Pitau, P. & Del Rio, M.** The Carboniferous-Permian miospores from Sardinia (Italy). An example of plant migration from Far East an South East Pangea to Southern Europe at the end of the Carboniferous.

4:20 - 4:40 **Visscher, H. & Van Houte, M.** The continental Permian (Rotliegend) of Nortwestern Europe: Integration of Tectonostratigraphy, magnetostratigraphy and palynostratigraphy.

4:40 - 5:00 **Wood,G., Krainer, K. & Hartkopf-Fröder, C.** Sedimentological and palynological characterization of the Bolzano Volcanic Complex, Southern Alps, Italy.

5:00 - 5:20 **Ghavidel-Syooki, M.** Palyno-biostratigraphy of the Lower Paleozoic strata in Northeastern Alborz Range of Iran.

5:20 - 5:40 **Ghavidel-Syooki, M.** Palyno-biostratigraphy of Devonian strata in Northeastern Esfahan City, Central Iran.

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