**Commission Internationale de Microflore du Paléozoïque**

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Image: *Reduviasporonites chalastus* (Foster) Elsik 1999 from Saudi Arabia. The scale bar represents 5 microns.
Editorial

Most of this issue of the Newsletter is taken up with some of the abstracts of CIMP contributions to the IPC 2004 in Granada. Those of you who attended IPC 2004 will have been heartened by the sheer volume and quality of work being done in palynology today, whether it be in pollen and spore morphology, entomopalynology, melissopalynology, forensic palynology, aerobiology and allergy. Perhaps things in palynology are not that bad!

As usual if you have views on the topics covered in this newsletter, perhaps in violent disagreement, or in a spirit of practical advice, please send them to me (mhste@bgs.ac.uk). Let’s get a discussion going….

Forthcoming conferences

32ND SESSION OF THE INTERNATIONAL GEOLOGICAL CONGRESS. AUGUST 20-28, 2004

‘From the Mediterranean Area Toward a Global Geological Renaissance’ Geology, Natural Hazards and Cultural Heritage, in Florence, Italy. See http://www.32igc.org or contact Chiara Manetti, Dipartimento di Scienze della Terra, Via La Pira, 4 - 50121 Firenze - ITALY, Phone/Fax: +39-055-2382146, E-mail: casaitalia@geo.unifi.it

Avalonia – Moesia Symposium
Ghent, 9th October 2004

Avalonia – Moesia Workshop
Ronse, 10-11th October 2004

This is the second and final announcement of a one day symposium and a two day workshop on the Early Palaeozoic orogens of the Trans-European Suture Zone (TESZ), organised three years after the EUROPROBE project and the PACE network project. The workshop will be followed by a fieldtrip in the Brabant Massif and Condroz Inlier. At the symposium, key-note addresses are invited from the U.K. and Romania. We also welcome talks and posters showing the recent progress in research, concentrating on the extremities of the TESZ:

? the Anglo-Brabant Deformation Zone and the history of Avalonia
? the Romanian Dobrogea belt, the Moesian Platform, the Palaeozoic in the southern Carpathians and their history

The preliminary list of speakers includes, amongst others, C. Corteel, T. Debacker, S. Dewaele, M. Oczlon, T. Pharaoh, K. Piessens, T. Servais, M. Sintubin, P. Steemans, M. Vanguestaine, S. Veliciu, J. Verniers, P. Williamson, J. Winchester and S. Yanev, giving talks spread over four thematic sessions, concentrating on different topics such as structural geology, applied palaeontology,
terrane evolution, palaeogeography, basin evolution, metallogenesis, palaeomagnetic data, etc... A poster session will be organised during the symposium and a selection of presented talks or posters will be published in a special volume of Geologica Belgica.

During the workshop all persons active in Early Palaeozoic research are invited to participate in the debate. The first day, we will concentrate on different aspects of the Palaeozoic history of the Anglo-Brabant Deformation Zone and NW Europe; the second day the Moesian Platform and Dobrogea region in Romania will be addressed. Posters can be shown again and authors of recent studies (e.g. PhD’s) and/or authors who presented their results at the symposium will have ample time to elaborate in detail on their results, followed by discussion.

We warmly invite all interested geoscientists to participate in this meeting!

Under the auspices of Geologica Belgica and with the support of Ministerie van de Vlaamse Gemeenschap (Bilaterale wetenschappelijke en technologische samenwerking Vlaanderen-Roemenië) and Fonds Voor Wetenschappelijk Onderzoek - Vlaanderen.

**Ordovician Palaeogeography and Palaeoclimate**

September 2004, official opening meeting at Erlangen, Germany: ocean and climate modelling, and the development of stable C- and O-isotopes; field meeting S-Sweden (Fågelsång, Öland, Gotland); second (final) circular available from http://www.pal.uni-erlangen.de/IGCP503/

AASP 38th Annual Meeting, St Louis September 18-21, 2005.

For details see
http://campus.umr.edu/dce/conferences/aasp.htm
and
http://www.palynology.org/meetings.html

**XI Reunião de Paleobotânicos e Palinólogos, Rio Grande do Sul State, Brazil, November 7-10, 2004**

The "XI Reunião de Paleobotânicos e Palinólogos" (XI Meeting of Paleobotanics and Palynologists) is to be held in Gramado, Rio Grande do Sul State, Brazil, from November 7-10, 2004, hosted by the Universidade do Vale do Rio dos Sinos (UNISINOS, by Tânia Lindner Dutra) and the Universidade Federal do Rio Grande
do Sul (UFRGS, by Roberto Iannuzzi and Paulo Alves de Souza).

More information:
http://www.exatec.unisinos.br/_rpp2004/english

The scientific program:
1. Gondwana alive
2. Hots spots and Biodiversity
3. Palynology and Palynofacies
4. Quaternary floras and climates
5. Mesozoic and Tertiary floras and paleoclimates
6. Extinctions
7. Organic Geochemistry
8. Remote Sensing and Landscape Ecology
9. Phytogeography
10. Molecular studies and taxonomy
11. Ethnobotany and human history
12. Reproductive biology, conservation procedures and reforestation
13. Taphonomy and Paleoecology
14. Biostratigraphy
15. Southern Hemisphere modern biomes

XI Russian Palynological Conference
The XI Russian palynological conference will be held on September, 2005 at the Paleontological Institute of the Russian Academy of Sciences (Moscow) by the Russian Palynological Commission. Presentations on all branches of modern palynology are welcome. The working language is Russian, but English presentations are acceptable. The preliminary scientific program includes the following topics:

History of palynology
Pollen and spore morphology and ultrastructure
Palynology and ecology
Pre-Paleozoic and Lower Paleozoic palynology
Devonian and Carboniferous palynology
Permian and Triassic palynology
Jurassic and Cretaceous palynology
Neogene and Pleistocene palynology
Holocene and modern sediments
Microalgoflora and dinocysts biostratigraphy
Diatoms
Palynological databases
Paleophytogeography

Contact address: e-mail vkras@paleo.ru, phone (7095) 3396022, fax (7095) 3391266.

More information will be available at www.paleo.ru at the end of this year.

Spores and Pollen Subcommission
Chairman
Following Ken Higgs accession to the post of IFPS councillor, we now need a new Chairman for the Spores and Pollen Subcommission. If you are interested please contact Ken (k.higgs@ucc.ie) or Mike Stephenson (mhste@bgs.ac.uk).

Prague CIMP meeting
CIMP GENERAL MEETING
SEPTEMBER 4-6, 2006
Prague, Czech Republic
Institute of Geology, Academy of Sciences of the Czech Republic, Prague & Charles University Prague, Institute of Geology and Palaeontology
ORGANIZING COMMITTEE
Jirí Bek, Oldrich Fatka, Jirina Dasková and Rainer Brocke

GENERAL INFORMATION
The CIMP General Meeting will convene in Prague, the capital of Czech Republic, from 4-6 September 2006.

Czech palynology has a long research tradition of Palaeozoic palynomorphs, including acritarchs, spores and pollen. The meeting is open to all palynologists interested in any aspects of Palaeozoic palynology. The scientific program will include symposia, contributed talks, posters, poster sessions, and meetings of working groups, associated with workshops.

Pre-conference and post-conference field trips are planned to the Barrandian Early Palaeozoic.

Prague, the capital of Czech Republic, is one of the most beautifuf cities in Europe with attractive sites of medieval architecture. The landscape and art have created a manifold collection of monuments from the tenth Century – starting with Romanesque churches up to modern buildings – making thus a unique open-air gallery on a relatively small area lying on Ordovician to Devonian rocks.

LANGUAGE
The official language of the meeting is English

Further information abouth costs, accommodation, field trips etc., will be available during the early spring 2005 (2nd Circular).

The deadline to respond to the pre-registration for the meeting is December 31, 2004

SCIENTIFIC PROGRAMME:
The scientific program will consists of invited papers, contributed talks and papers and poster sessions. Each participant is invited to present results of original research or reviews of particular subjects.

CONFERENCE FIELDTRIPS
September 3. – pre-conference trip: Proterozoic to Ordovician of the Barrandian area
September 6. – post-conference trip: Silurian and Devonian GSSPs of the Barrandian area

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IPC 2004

The IPC 2004, XI INTERNATIONAL PALYNOLOGICAL CONGRESS took place in Granada, Spain at the superb Granada Conference and Exhibition Centre, between 4th and the 9th July 2004.

There were several themes: Pollen Biology, Pollen and Spore Morphology, Entomopalynology and Melissopalynology, Forensic Palynology, Aerobiology, Pollen and Allergy, Palaeopalynology and Evolution, Quaternary Palynology and World Pollen Databases. As well a number of plenary lectures including Professor Eugenio Domínguez (University of Córdoba, Spain) who spoke on ‘The use of aerial platforms in aerobiological studies’ and Professor Henry Hooghiemstra (University of Amsterdam, Netherlands) who spoke on ‘Ice-ages in the tropics: new records and improved understanding of long Colombian pollen records’.

I would like to thank, on behalf of CIMP, the institutions that supported the conference: The Spanish Palynological Association (APLE), The International Federation of Palynological Societies (IFPS), The University of Granada and The Zaidín Experimental Research Station (CSIC), Granada. Of course the organising committee should not go without mention:

Ana Teresa Romero (Chairwoman)
Francisca Alba, Juan de Dios Alché, Consuelo Díaz de la Guardia, María
CIMP Newsletter Summer 2004

Carmen Fernández, Adela Olmedilla, María Isabel Rodríguez-García, María Jacoba Salinas and Jose Luis Ubera.

Excellent presentation facilities
This year CIMP was extremely well represented at the IPC 2004 and to mark this great contribution, this Newsletter will cover some of the abstracts submitted within the CIMP sessions to the conference. The rest will follow in the CIMP Winter 2004 Newsletter. I would like to thank Thomas Servais, Charles Wellman and Bernard Owens for coordinating, organising and chairing the CIMP sessions with great efficiency, and representing CIMP so well.

Discussions over posters

IPC 2004 Abstracts, Part 1
The majority of abstracts from the g4 Upper Palaeozoic Palynology/CIMP Symposium will be presented in this issue of the Newsletter. The rest of the g4 abstracts and abstracts from the g3 Lower Palaeozoic Palynology/CIMP Symposium, as well as those from the g5 CIMP/Saudi Aramco Symposium will be presented in the Winter 2004 Newsletter.
TAXONOMY ONLINE*: INTERNET PALYNOCOLOGICAL DATABASE THAT IS LINKED TO CURATED SPECIMENS

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In an article in Nature last year (v. 417, p. 17-19), H. Charles Godfray of Britain’s NERC Centre for Population Biology, noted how descriptive biological taxonomy suffers from a lack of prestige and resources when compared with the newer disciplines of genome databasing and phylogenetic taxonomy. He described the problematic legacy of 200 years of traditional biological systematics, whereby modern taxonomists attempt to interpret the work of their nineteenth century counterparts by trying to understand inadequate (by today’s standards) published descriptions, or looking for poorly curated or even lost type material. Godfray proposed a web-based unitary ‘taxonomic process’, rather like a bulletin board, to make taxonomy more productive, efficient and worthy of funding.

Palaeozoic palynological taxonomy faces similar problems, particularly over the condition and curatorial status of topotype and holotype specimens. In order to remedy these, the British Geological Survey (BGS) is funding the ‘Taxonomy Online’ Project, which will use the internet as a forum to illustrate and describe specimens curated in its collections. The initial report and palynological database, which will represent the first 68 taxa of the ‘Bernard Owens Single Mount Palynology Collection’, will shortly be published and released on the web. This single grain mount collection is one of the most important palynological collections in the world with over 145 taxa represented by up to 25 specimens per taxon, showing a wide range of preservation states and natural variation. Many of the specimens are holotypes or topotypes, while other determinations have been validated by leading taxonomists. The taxa are most closely associated with Britain and NW Europe and are integral to the palynozonation of the Carboniferous of NW Europe published by Clayton et al. (1977), and to earlier regional palynozonations (e.g. Owens et al. 1977, Neves et al (1972).

The main value of the new database is the link between description/illustration and specimen. Each specimen (contained within a unique single grain mount slide) has a unique BGS collections number, and may be borrowed for examination and photography. We anticipate that the database will grow organically with contributions by workers in the field; but all added taxa will be represented by specimens housed in single grain mounts. In this way the collection will embody the online database, and will become an invaluable resource for future students and researchers.

EARLY DEVONIAN PALYNOFLORAS OF THE ADAVALE BASIN, QUEENSLAND, AUSTRALIA

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Diverse, moderately well preserved, and miospore-dominated palynofloras have been obtained from marginal marine to continental Devonian strata of the subsurface Adavale Basin, south-central Queensland. The miospores are mainly radiosymmetrical and trilete; monolete and hilate forms are infrequent. Acritarchs, prasinophyte phycocysts, and scolecodons occur in minor proportions. Based on the vertical distribution of certain miospore species and on the introduction of particular sporomorphological traits, three successive miospore floras, informally termed “assemblages”, are identified within the Adavale succession lying between essentially non-palyniferous, continental volcanic and redbed units (Gumbardo Formation, below; and Buckabie Formation, above).

Assemblage I, the oldest recorded from the Adavale Basin, occurs exclusively in the Eastwood Formation and is characterized particularly by tricrassate miospores, together with apiculate and cingulate forms. The lower stratigraphic limit of this assemblage is unknown, as it occurs at the deepest borehole-depths sampled. Assemblage I is distinguished from the two succeeding assemblages by the complete absence of ancyrate forms, viz., species of Ancyrospora and Hystricosporites. In a positive sense, this assemblage can be recognized by the consistent co-occurrence of certain species of Brochotritiles, Retusotritiles, Rotaspora, and Verrucosiporites, and by some distinctive new taxa. Most of these forms are restricted to Assemblage I, but several species persist into the succeeding Assemblage II and a few into Assemblage III.
Of the three Adavale spore assemblages, II and III can confidently be correlated with the devonicus-
naumovae and optivus-triangulatus Assemblage Zones, respectively, of the northern hemisphere. Assemblage I, however, appears to be the least affilable with the Euramerican spore assemblages. Despite sharing a few key elements or form features with some of the Euramerican Lower and Middle Devonian assemblage zones, the Eastwood suite is significantly different in specific composition. Moreover, some “morphological events” appear to be diachronous, evidently occurring earlier in the northern hemisphere and are thus either inappropriate or equivocal for long-distance correlation; e.g., introduction of monolete miospores and bizonate forms. A particularly distinctive feature of Assemblage I is the abundance of tricrassate/apiculate miospores (i.e., Rotaspora, Tricidarisporites).

The presence of Verrucosisporites polygonalis, Brochotriletes foveolatus (cf.), and a bizonate form (Breconisporites sp. A), all known from Euramerican rocks as old as the Early Devonian, could indicate an extension of the Eastwood Formation’s Assemblage I into the late Early Devonian. In the northern hemisphere, V. polygonalis and B. foveolatus appear initially in the Siegenian-?earliest Emsian polygonalis-ensis Emsian Assemblage Zone; bizonate miospores with distal annulate thickening (i.e., Breconisporites breconensis) were introduced in the late Gedinian, extending into the Siegenian or early Emsian. Further supporting evidence as to the age of Assemblage I comes from the introduction of monolete miospores in the Eastwood Formation; in the northern hemisphere, this was an Emsian event. Possible attribution of the Eastwood Formation to the early Eifelian velata-langii Assemblage Zone, based on the presence of V. dubia, appears unjustified as that species is known to be relatively long ranging (annulatus-sextanti through lemurata-
magnificus Assemblage Zones). Thus, on present evidence, the age of Assemblage I could possibly be Emsian; somewhat older than previous estimates. Accordingly, Assemblage I appears to represent the oldest known Australian Devonian spore assemblage.

Detailed comparison of Assemblage I with “palynological unit I”, previously reported from the Eastwood Formation, is possible only in general terms, i.e., absence of ancyrate forms, abundance of retusoid taxa, and rarity of cavate forms. In fact, no ancyrate form has been recorded from samples of the Eastwood Formation. The presence of Calamospora atava and abundance of Retusotriletes, particularly in Assemblages I and II, could imply miospore contributions from Phaeophyta, Rhynoipsida, Zosterophyllopsida, Barinophytopsida, and/or Lycopsida (Drepanophycales) during late Early-Middle Devonian sedimentation in the Adavale Basin.

**PALYNOLOGY AND BIOSTRATIGRAPHY OF THE LOWER-UPPER EMSIAN BOUNDARY (LOWER DEVONIAN) IN THE RHEINISCHES SCHIEFERGEBIRGE (GERMANY) AND IN THE BARRANDIAN AREA (CZECH REPUBLIC)**

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Emsian – the third stage of the Devonian encompasses about 15 Ma representing one of the longest stages in the Palaeozoic. Therefore, the Emsian has been subdivided into lower and upper parts. An interfacial correlation of the Lower/Upper Emsian boundary interval is under discussion. For this purpose different groups of macroscopic and microscopic fossils from Lower Devonian sections in the Rheinisches Schiefergebirge (Germany) and similar sections in the Barrandian area (Czech Republic) are studied in detail.

Rheinisches Schiefergebirge.

The characteristic development of the Emsian in its type area (Rheinisches Schiefergebirge, Germany) refers to sequences generally deposited in neritic facies (= Rheinisch Facies type) where benthic fauna, namely brachiopods are well represented. But other stratigraphically important fossil groups (e.g., conodonts, dacyrocanid tentaculites, trilobites, goniatites) are rare or even absent. Traditionally, the base of the Upper Emsian corresponds to the base of the Ems-Quartzite. Recently, spores have been determined at the type locality of the Ems-Quartzite in the vicinity of Koblenz, Mosel Syncline (locality Friedrichsseggen). However, in several other sections covering the critical interval in the Rheinisches Schiefergebirge (localities in the Eifel-Kalkmulden), spores are associated with sporadic acritarchs and chitinozoans.

Barrandian.

In the Barrandian, another classical area for the Lower Devonian, sequences are deposited in open marine facies (= Bohemian Facies type) where pelagic fossils are more abundant (e.g. dacyrocanids, goniatites, conodonts, trilobites) and benthic fossils (mainly brachiopods) may be also present.

In this area the Emsian is subdivided into the Zilchovian and Dalejen regional stages. The base of the shaley Daleje Formation reflects the onset of the transgressive Daleje Event. Its basal part is may be co-eval to the Ems Quartzitze in the German sections. Diversified and well preserved OWM (acritarchs, prasinophytes, chitinozoans, scolecodonts and spores) have been discovered in the critical interval in a continuous section at the Cisarska rokle locality near Srbisko. The comparison of OWM in the two facies types, representing shallow and deeper water environments, enables to understand changes in diversity and bioproductivity, and provides a new tool for interregional biostratigraphical correlation.
EARLY DEVONIAN (LOCHKOVIAN) CHITINOZOANS FROM THE MOESIAN TERRANE, SE ROMANIA

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The SE part of Romania is mostly occupied by Moesian Terrane. In this area the Palaeozoic sediments cover the Precambrian-Early Cambrian basement. Since the sedimentary deposits do not outcrop, many boreholes were drilled over their entire subsurface in order to study them. They have yielded palynomorphs (acritarchs, chitinozoans, spores and pollen) as well as macrofaunal data. Based on them it was possible to establish a biostratigraphy of these sediments.

The main goal of this study is a systematic revision of the palynological data, necessary to refine the Palaeozoic biostratigraphy of Moesian Terrane. The necessity of revision derives at least from two reasons: a large amount of existing data is unpublished over the last 17 years and the palynomorphs were determined according to the systematics available at or before that time.

The new study in the argillitic formation of the Calarasi 2881 borehole, located close to the Romanian - Bulgarian border, is based on SEM photography, and shows a rich assemblage of chitinozoans, most of them in a correct state of preservation. It documents a Lochkovian age for the sediments.

Two standard Devonian biozones defined by Paris et al. (2000) were identified in the borehole: the Eisenackithina bohemica and the Urochitina simplex biozones. The chitinozoan assemblage also contains the accompanying species Cingulochitina ervensis, Cingulochitina plusquelleci as well as other chitinozoans with biostratigraphical value.


DEVONIAN MOISPORE MAIN DEVELOPMENT RANGES AND STAGES IN THE RUSSIAN PLATFORM

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The following investigations have been performed to determine Devonian plants’ development ranges and stages: analysis of regional succession of typical and representative miospore taxons’ associations and their quantitative interrelations; determine ranges of their occurrence and change due to microfossils’ main morphological properties change; determine a succession of biostratigraphic subdivisions characterized by microfossils’ of definite structure and dimensions. Comparison of such biostratigraphic subdivisions with corresponding stratigraphic units determined by microfossils in sections of the near-by territories allows for correlation of sediments in remote regions. Associations are characterizing series, stages and more rare substages; zones are usually characterizing substages and horizons; subzones are usually characterizing horizons. Five main ranges of miospore associations change have been determined by spore occurrence in the Devonian: early in the Late Emsian-Eifelian stage; early in the Frasnian stage; early in the Late Frasnian stage and early in the Famennian age, that is corresponding to considerable changes in the structure of the Devonian flora complex (Yurina, 1985).

The first range in the Devonian flora development is seen early in the Late Emsian. The initial stage of Late Emsian-Eifelian stage is corresponding to the Retusotriletes clandestinus zone basement. R.clandestinus zone is occurring locally in fragmentary sediments of the Ryazhsky horizon lower part corresponding to Takatinnian and Vyazovian horizons on the Uniefied Stratigraphic Scale. Late Emsian-Eifelian age is characterized by mass development of pore with vivid arâà of Retusotriletes, Apiculiretusispora, Dibolisporites. Wide development of plants producing large amounts of spores with various and complex perispore is characteristic of this stage (Diplanospora inassueta, Periplecotritistes tortus, Rhadosphores langii zones). Great variety of Late Emsian-Eifelian miospores is probably explained by the development of main groups of Devonian surface plants at that time. Zones succession in the Russian platform has been determined and traced (Akvimovich et al., 1993) but in some cases their correspondence to regional stratsions requires further investigation.

The second range lies on the borderline between the Eifelian and Givetian stages. The Givetian stage is characterized by the association of Geminospora extensa zone with a wide variety of Geminospora appearing on the background of more ancient "surviving" species of the previous stage. The lower borderline of the G.extensa zone is seen vividly even in case of an incomplete spore complex. At this range spores with vividly determined âôà are changing by Geminospora that are mainly characterized by spiny-tuberculcar exine structure: G.decora, G.vulgata, G.meonacantha, G.micromanifesta, G.rugosa, G.tuberculata; representatives of Cymbosporites are also characteristic of this zone. Species G. extensa, Archaeozonotriletes timanicus, etc. are seen in less quantities.
The third range coincides with the time of the Frasnian stage Pashian sediments’ formation. The upper borderline of G.extensa zone is less distinct than the lower one. Change of spore complex dominants at this range is mainly taking places at the species’ level with many species characteristic of the Frasnian stage appearing in the upper part of the Givetian stage. The Early-Middle Frasnian stage is characterized by mass development of Geminospora and Archaeozonotriletes with small tubercular, shagreen and large net-like sculpture. The beginning of the stage is corresponding to the foundation of Nontagisporites optivias-Spelaeotrites krestovnikovii zone.

The forth range is corresponding to the beginning of the Late Frasnian stage concerning the development of palynoflora that is characterized with the abundance of Archaeoperisaccus (50-80 %) in A.ovalis-V.grumosus zone as well as spores with filmy perispore: Nristatisporites deliquesrens, Auroraspora speciosa, Spelaeotrites hopericus, Membraculispores radiatus, Grandispora subsuta (N.deliquescentes-V.evlanensis zone) that are almost disappearing in the Frasnian-Famennian stages. The Late Frasnian stage in Devonian palynoflora development is vividly traced in the central regions of the Russian platform (Rodionova et al., 1995). The abundance of Archaeoperisaccus is fixed in Frasnian of Canada (McGregor, 1964, 1969; Owens, 1971, etc.).

The fifth range in Devonian palynoflora development is seen at the beginning of Famennian age with the appearance of new taxon types. The Famennian stage is characterized by considerable renovation of complex structure connected with the appearance of new genus Nytothpora and Cornispora, so new species Corbulispora vininea and Geminospora vianaica. On the whole, spore types and quantities are decreasing during the Famennian. To conclude with we may say that main ranges in the development of spores are coinciding with borderlines of stages and horizons on the Unified Stratigraphic Scale of the Devonian in the Russian platform.

This work was supported by the Russian Foundation for the Basic Research.
differentiation on microsporangia and megasporangia, and formed the equatorial protosaccus disposed around the spores. The spores of Archaeopteris fimbriata Nath. are particularly close to those of Ludovavia. More advanced spores of the genus Telangiopsis (division Lyginopteridophyta) from the Upper Viscan deposits of Central Russia are similar to the spores of Archaeopteris. The similarity is presented both in the outer morphology (circular or triangular-circular outlines of the spores; fissura dehiscentis) and in the inner structure of the exine as well (circular- alveolate ectexine, lamellate endexine).

Specialization of the spores of Telangiopsis is prominent in the considerable thinning of the layer of the ectexine down to a single row of the alveoli and in the presence of the large air cavities within the alveoli. In addition the most of the alveoli are confluent, they increase air cavities and create supplemented possibility of stretching of the ectexine. The endexine consists of few lamellae, which are united between each other, and can easily slide in respect to each other. So, the entire exine was capable to stretch easily, permitting the contents of the spore to change its capacity without a disruption of the sporoderm. This is the second prerequisite (after the heterospory) for germination of the male gametophyte within a microspore wall without its disruption, in other words, for appearance of the pollen. Each transitional form of the evolution from the microspores to the actual pollen greatly differs in the morphological structure and physiology and represents the prepollen grains, typical for the pteridosperms. Obviously, that some of them are still the spores, while others are rather similar to pollen. Judging from the outer morphology and ultrastructure of the exine, the pollen of the most groups of gymnospermous plants can originate from the spores of Archaeopteridophyta and Lyginopteridophyta.

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MIDDLE DEVONIAN PALYNOMORPHS FROM JUNGGAR, NORTH XINJIANG, CHINA AND THEIR BIOSTRATIGRAPHIC AND PALAEOGEOGRAPHIC IMPLICATIONS

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Abundant palynomorphs, including 53 spore species assigned to 26 genera, 20 acritarch species assigned to 19 genera and scolecodonts are reported from the Middle Devonian Ulusubasite Formation of east Junggar Basin, North Xinjiang, China. The biostratigraphic ranges of the miospores and acritarchs indicates a Middle Devonian, with the spore assemblage considered comparable with the devonian-naumovae spore zone of the Old Red Sandstone continent. The close similarity of the present assemblage to Euramerican miospore assemblages other than those of South China and Gondwana supports the paleogeographic reconstructions which indicate that the eastern Junggar was part of the Kazakhstan plate during Middle Devonian and thus situated closer to the Euramerica landmass than to South China and Gondwana.

At least 20 miospore species from the Canadian Middle Devonian also occur in the Ulusubasite Formation, indicating a Middle Devonian age for the Ulusubasite Formation miospore assemblage. Faunal evidence from the Ulusubasite Formation also corroborates a Middle Devonian age assignment. In particular, corals and brachiopods recovered mainly from the lower and middle parts of the formation indicate an Eifelian age. Because the palynologic assemblage comes from the uppermost part of the Ulusubasite Formation and is roughly equivalent to the mid-Eifelian-early Givetian devonicus-naumovae spore zone of Euramerica, we consider the upper part of the Ulusubasite Formation to be Late Eifelian in age.

It is clear from the paleogeographic reconstructions that during the Middle Devonian the Kazakhstan plate was close to the Old Red Sandstone continent (Euramerica), thus helping to explain the many similarities between the miospore assemblages from the Junggar terrane and the Old Red Sandstone continent. In addition, the South China plate during the Middle Devonian was much closer to the Gondwanan landmass and separated from the Junggar terrane by the Prototethys ocean.


THE TAGHANIC EVENT: A LATE MID DEVONIAN ARIDITY CRISIS


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LATE DEVONIAN PHYTOPLANKTONIC ASSOCIATIONS AND ORGANIC RICH SEDIMENTS FROM THE AMAZON AND PARNABIA BASINS, BRAZIL


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The latest Givetian (late Mid Devonian) Taghanic Event is the first of a series of extinctions events that characterize the Late Devonian to Early Carboniferous interval. The marine Taghanic Event in Scotland has its expression as a limestone found in a few offshore oil exploration wells and represents an extreme sea-level highstand. In terrestrial sections the equivalent level is the Eday Marl Formation that is well known from Orkney. Spore assemblages show that the base of the Eday Marl can be attributed to the Ex3 zone and its top to the OK spore zone. The very significant reduction in spore diversity encountered at the base of the OK zone was the result of an extinction event within the land plants echoing that found in the marine invertebrates. The terrestrial flora became dominated by araucaroid-like progymnosperms, hence the ubiquitous occurrence of Contagisporites optivus. Offshore the Eday Marl is found in many wells drilled north of the Highland Boundary Fault.

These have generally been mis-identified as a Permian siltstone. Marine palynmorphs from onshore sections show that subtle marine transgressions occur at the top and base of the Eday Marl. The Eday Marl was formed within a sandy sabkha environment with the sediments showing a clear internal climatic cyclicity indicating a duration of perhaps some 400 ky. The Eday Marl represents an aridity episode within a long sequence of fluvial sandstone. The association of low latitude aridity and high sea levels is in the case of the Taghanic believed to result largely from thermal expansion of sea water. The aridity driven reduction in the terrestrial hydrological cycle and linked changes in the shelf sea circulation and water temperature

The global distribution, diversity patterns, composition and bio-horizons of late Devonian phytoplanktonic associations were analyzed based on fine sampling subsurface material from the South American Amazon and Parnaiba Basins in northern Brazil. The biostratigraphy of acritarch and associated microalgae in the Upper Ererê Formation and Curua Group (Barreirinha and Lower Curiri Formations) of the Amazon Basin, is calibrated with the miospore and chitinozoan successions from similar samples, also correlated with other western Gondwana and Euramerican-defined zonal schemes. Marine phytoplankton (acritarchs and other microalgae) are well represented, with more than 200 species recorded in the continuous cored borehole of Caima PH2 (375 core samples studied in 137m). The characteristics of these associations are important regarding the phytoplankton development during the late Paleozoic and its evolution later.

The assemblages of acritarchs and associated microalgae are compared to the assemblages described in other basins, such as the Parana Basin in Brazil, the Devonian Bolivian succession and from various areas of North Africa. In the Amazon basin a subdivision in nine successive biozones is proposed, for an interval comprising possibly the entire Frasnian and much of the Famennian. The material from the Parnaiba basin, from the successive Pimenteira and Cabeças Formations is mainly used to compare the palynological and geochemical characterization of the organic-rich sediment of the Frasnian anoxic event, in a basin less subsident than the Amazon Basin.

UPPER FAMENNIAN PALYNOMORPHS OF THE IBERIAN PYRITE BELT, SW SPAIN

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Diverse and moderately well preserved Upper Devonian (upper Famennian) miospores and organic-walled microphytoplankton have been recovered from 42 surface samples of the Phyllite-Quartzite Group (PQ) of the Iberian Pyrite Belt (IPB), southwest Spain. This region is characterized by “giant” and “supergiant” sulphide ores as well-known, for instance as the Riotinto, Tharsis, Aznalcolar, Neves-Corvo, and Aljustrel deposits. The PQ represents the oldest stratigraphic unit of the IPB. It comprises a monotonous Middle to Upper Devonian succession of shales and sandstones that grades rapidly at the top into an intricate sequence of sandstones, conglomerates, and carbonate lenses. The overlying Volcano-Sedimentary Complex (VSC), which hosts the sulphide deposits, consists of a heterogeneity of Upper Devonian-Lower Carboniferous volcanic, sedimentary, and volcaniclastic rocks, displaying rapid lateral and vertical facies changes and thickness variations. The uppermost unit, the Culm Group, is a Lower Carboniferous turbiditic succession of shales, litharenites, and rare conglomerates.

The study area is located south of the Riotinto Mine, where the old Rriotinto mining railway crosses (perpendicular to the tectonic structures) the largest PQ outcrop in the region. The 30 sampling stations
are distributed along the 22 km-long PQ exposure, and an average of six samples were collected from each station. Shales from the middle and upper parts of the sequence, excluding those from the PQ-VSC contact, have proven productive palynologically and have accordingly been analyzed in detail.

The palynoflora is relatively uniform in all the samples analyzed. The terrestrial (miospore) component is characterized by such species as Retusotriletes rotundus, Anaeusporopsis greggsii, Auroraspora macra, Diductites mucronatus, D. polyjessicus, D. versabilis, Grandispora cornuta, G. echinate, and Rugospora flexuosa; this miospore association clearly establishes correlation with the upper Famennian flexuosa-cornuta miospore Biozone. The marine palynoflora is generally less diverse and is represented by long-ranging taxa, such as the prasinophyte phycomata Maranibites mosesii, M. brasiliensis, Tasmanites spp., and Leoisphaeridia spp. together with the acritarchs Veryhyachium trispinosum and Micrhystridium stellatum, among others. These palynological data support the shallow marine platform environment inferred from sedimentological analyses.

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PETROLEUM SYSTEMS, PALAEOCLIMATE AND SEA LEVEL CHANGE IN THE DEVONIAN OF BOLIVIA

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The Devonian System of Bolivia is important for hydrocarbon exploration because the major gas reservoir (Huamampampa Formation) and source rock (Los Monos Formation) in the region are found within it. Recently, intensive hydrocarbon exploration has been undertaken in the central and southern areas of the country with the Huamampampa Formation the main subsurface target. The main Devonian outcrop is in the Sub-Andean trend, an active thrust belt, where thrusting and folding over the last 10Ma have complicated the subsurface stratigraphy. Seismic surveying has been unsuccessful in resolving subsurface architecture and the application a standard lithostratigraphic division of the Devonian to the subsurface has produced ambiguous results. Success has been achieved using biostratigraphy, particularly microfossils, since in the Bolivian Devonian there is a succession of distinctive marine microphytoplankton ‘events’. These are short-lived monospecific pulses of certain acritarchs and green algae. Four such events are recognised in Bolivia involving the acritarchs Evittia sommeri, Bineruga bensonii, Crucidia camireuse and the alga Petrovina connata. The aim of this study is to undertake a high resolution palynological study of surface Devonian exposures and characterise the microphytoplankton events in terms of precise stratigraphic position, stratigraphic extent, geochemistry and global context. Initially work has concentrated on the *E.sommeri* event, associated with a major marine transgression thought to be the Eifelian ‘Chotec’ Event.

LATEST DEVONIAN AND EARLIEST CARBONIFEROUS MICROFLORA, BRACHIOPODS AND CONODONTS OF THE SAIMBEYLI (ADANA) REGION, EASTERN TAURIDES, TURKEY

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In the Eastern Taurides a thick pile of sedimentary rocks ranging in age from the Cambrian to Tertiary is widely exposed. This autochthonous succession which is called Geyikdarı Unit is composed of platform carbonates intercalated with siliciclastics. The Ziyarettepe formation placed in this autochthonous unit consists of shallow-water, marine sequence mainly an alternation of sandy-clayey limestone, marls and shale. It conformably overlies the Upper Devonian Gümüşsali formation and is unconformably overlain by the Upper Permian Yigiltepe Formation. This formation is very rich in macrofossils such as brachiopods, corals, trilobites and in microfossils such as miospores and conodonts. The latest Famennian brachiopod assemblage comprises mainly Prospira struniana, Prospira lapparenti, Centrorychynchus turanica, Megalopterorhynchus chanackiensis, Cleiothyridina coloradensis, Aulacella interlineata, Whidbornella pauli, Dichospirifer anatolicus while the Tournasian assemblage includes Marginatia bourligtotonensis, Rhipidomella michelini, Unispirifer tornacensis, Antinoconchus lamellosus. Conodont assemblage comprising Bispachodus jugosus, Bispachodus ultimus, Bispachodus spinulicostatus, Polygnathus parus subplanus, Polygnathus radina, Siphonodella quadruplicata, Siphonodella cooperi indicates latest Devonian and earliest Carboniferous age. One distinct miospore assemblage is characterized Verrucosisporites nutidus, Convulatispora mellita, Dictyotrites spp. and Punctatisporites spp. It is dateable on palynological grounds as latest Devonian (latest Famennian) and earliest Carboniferous (earliest Tournasian). Conodont and brachiopod data from the same subsurface section corroborate the miospore age determination as well as the positioning of the Devonian-Carboniferous boundary.
PALYNOSTRATIGRAPHY OF THE TOCA DA MOURA VOLCANO-SEDIMENTARY COMPLEX, BEJA MASSIF, OSSA MORENA ZONE, PORTUGAL

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The Beja Massif, located at the southwestern border of the Portuguese part of the Ossa Morena Zone (OMZ) is a large chalc-alcaline suite composed of basic to felsic intrusions and a main volcano-sedimentary complex, the Toca da Moura Complex (TMC). The age of this suite is still poorly constrained being currently assumed that it ranges from the Tournaisian to late Bashkirian. As a whole this plutono-volcanic chalc-alkaline suite has been interpreted as corresponding to volcanic arc(s) associated to a north dipping subduction zone situated at the southwestern edge of the Ossa Morena Zone (Munhá et al, 1986; Santos et al., 1987; Santos et al., 1990)

The TMC, exposed in scattered outcrops in the north-western part of the Beja Massif, comprises basalts, andesites, riolites and reworked tuffs, withmetric thick intercalations of shales. A recent palynological research in shales of several sections of this complex provided new palynostratigraphic data.

The Corte Pereiro section exposed in a quarry 5 kms NE of Santa Susana, provided spores assigned to the Biozone of the late Tournaisian to early Bashkirian age and reworked lower and middle Paleozoic acritarchs. Two well-exposed sections in the “Ribeira dos Marmelos” stream, west of “Vila Nova da Baronia”, yielded well preserved spores assigned to the Biozone of early Visean age and again some reworked acritarchs.

This research indicates that the age of the TMC ranges from the late Tournaisian to the late Visean. It should be noted that, about 20 kms north of Santa Susana shales of the Cabrera Volcano-Sedimentary Complex provided spores whose age ranges from the Biozone of the late Tournaisian to the Biozone of Visean age. The TMC and the Cabrera Complex appear so to be coeval.

The constant presence reworked early and mid Paleozoic palynomorphs indicates uplift and erosion of crustal blocks of the Ossa Morena Zone during the volcanic activity, but the source area is still a matter of conjecture.


PALYNOFLORISTIC CHANGES USED TO RECONSTRUCT PALEOECOLOGICAL CONDITIONS OF THE MAIN GROUPS OF MEGAFLORAS ALONG THE MALIMÁN FORMATION (LOWER CARBONIFEROUS) AT THE CORTADERAS CREEK, SAN JUAN PROVINCE, ARGENTINA

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Malimán Formation outcrops at the northwestern of the Precordillera in San Juan province, around 30° S and 69° W, Argentina. This unit belongs to the Río Blanco Basin, which is characterized by Upper Paleozoic rocks with glacially-influenced continental, transitional and marine deposits. Erosional unconformities separate the Malimán Formation (probably Viséan) from the underlying Chiguá Formation (Middle Devonian) and the overlying Cortaderas Formation (late Lower Carboniferous) (RODRÍGUEZ AMENÁBAR et al., 2003). The present contribution focuses on the analysis of the palynofloristic changes obtained from 10 samples of this unit collected at Cortaderas creek. Additionally, previous paleontological and sedimentological data were considered. This unit, with a thickness of 1300 m, is made up of shales and fine-grained sandstones intercalated with subordinated thick conglomerates that are referred to fluvial, deltaic and coastal plain palaeoenvironments; minor marine mudstones mainly with brachiopods are registered in the lower section. Quantitative variations of each
palynological association allow recognizing different habitats for the major palaeobotanic groups of taxa (considered at generic level), such as lycopods, sphenopods, ferns and pteridosperms, which are developed around depocenters containing mostly transported microspores. Three groups of assemblages are identified: one recovered from shales where lycopods and ferns spores show quite similar percentages (type I); a second group also obtained from shales is characterized by the dominance of herbaceous lycopods spores (45%-60%) such as Cristatiporites and Densospirites (type II), and a third one yielded by a very fine-grained sandstone level, is a monospecific assemblage dominated almost exclusively by only one species of fern spore (56% of Anapiculatisporites hystricosus; type III). Sphenopods (Calamospora) and pteridosperms (Cyclogranisporites) spores are rare (less than 2.5%). A significant percentage of incertae sedis spores have been registered, too (5-17%). All the levels yielded reworked material comprising Siluro-Devonian taxa ranging between 12% and 55%. Type I assemblages are representative for a wide range of wetter lowland as well as dryer more upland environments (wetlands and small lakes and related better drained areas on the alluvial plain). In contrast, type II assemblages represent local vegetation of swamps and ponds while the type III level could have preserved a quite in situ deposit of the dryer floodplain under an abiotic stress. The almost complete absence of the sphenopods both in the micro- and the megaflora along the outcrop points out to unfavorable conditions for its development or perhaps to a taphonomic bias, since this flora is characteristic of the margins of rivers where relative high energy conditions added to long transport, could have prevented its preservation. Plant fossil remains include herbaceous lycopods and small pteridosperms and other plants with uncertain taxonomic position (CARRIZO, 1998). Differences in composition between macro- and microfloras reflect a subrepresentation of pteridosperms of the local flora in the microfloras due to its miospores are typically trilete spores similar to other fern spores while the megascopic ferns remain are not registered even though they are apparently overrepresented in the microfloristic associations. The presence of reworked Silurian and Devonian palynomorphs into Carboniferous strata is consistent with a mountain range uplifted occurred during the Late Devonian orogenic movements (Chanic phase). Therefore, during the Early Carboniferous, this region placed at a high palaeolatitude of around 60° S, would have had a temperate-cool and humid palaeoclimatic. The relative wetness would have been maintained at least more or less stable along the Malimán Formation.


LOWE CARBONIFEROUS PALYNOSTRATIGRAPHY OF NE-GERMANY (RÜGEN) – A REVISION
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Only few palynostratigraphic investigations have been completed in the Lower Carboniferous of Germany. The most data are available from the carbonate shelf sequences in NE-Germany, especially Rügen. The first study by BURMANN (1975) was based on samples from one borehole leading to a spore zonal scheme for the Tournaissian of Rügen. It is closely linked to the scheme from the Pripyat Depression (Russia) with spore zones defined by a combination of first occurrence and frequency of key species. Therefore detailed correlation with schemes from W-Europe and E-Europe (Poland) are difficult.

A second study was done by CARSON & CLAYTON (1997) based on two other boreholes from Rügen Island. The Lower Carboniferous strata were studied completely, but because of a hiatus at the bottom and on the top of both sections the published spore zonal scheme ranges from the Middle Tournaissian to Upper Visean. It showed, that spore assemblages from Rügen are good to compare to those from W-Europe. Nevertheless differences are seen in the uppermost Tournaissian and in the Upper Visean leading to different spore zones for these intervals.

Palynological investigations of all boreholes from Rügen Island bearing Lower Carboniferous strata done by the author during the last few years, led to a revision of the spore zonal schemes mentioned above. There is no complete section throughout the Lower Carboniferous in any borehole. But by combination of boreholes a continuous section can be put together, reaching from Mid-Tournaisian BP-Zone to Upper Visean VF-Zone. Spore assemblages showing a mix of in-situ and redeposited older taxa are very common in Visean strata, which are dominated in most sections by redeposited sediments. Redeposition seems to effect both, spore assemblage diversity and preservation (JÄGER in press).

Beside partially poor preservation spore assemblages from Rügen are less diverse than those from the British Isles, especially from the Mid-Visean TS/TC-Zone onwards. Clearly triangular taxa like Tripartites, Triquitrites, Waltziispora, Ahrensisporites etc. - common and stratigraphical important in Upper Visean assemblages from W-Europe - are rare and partially absent in Rügen. Also middle Visean key species like Knossisporites stephanophorus, K. triradiatus and Schulzospora campylopera can be quite rare or - in case of Perotriletes tesselatus - mostly absent. Furthermore,
the first appearances and stratigraphical ranges of some Visean taxa such as Densosporites and Leiotriites tamiudus differ between these regions. Similarities are observed also between spore assemblages from Rügen and Poland, e.g. rare appearance of Lycospora pusilla in the Lower to Middle Visean and the presence of Triparites incisotrilobus in the Lower Visean of both regions.

Despite the differences described above the spore assemblages from Rügen are even more comparable to those from W-Europe as shown by Carson & Clayton (1997). The differences in the zonal schemes can not be confirmed by the present investigations. The upper Tournaisian TC-Zone (Carson & Clayton 1997) can be identified in one more borehole from Rügen only. Therefore it is not useful even for local correlations. Also upper Visean palynostratigraphy shows no major differences between Rügen and the British Isles. Mid-Visean spore assemblages from Rügen are followed by assemblages typical for the NM-Zone in Western Europe. The diverging VP-Zone introduced by Carson & Clayton (1997) for the upper Visean from Rügen is produced by a hiatus in the studied borehole. In this section the NM-Zone is missing. So the Mid-Visean TC-Zone is overlain by strata from the Upper Visean VF-Zone, creating an unusual ‘first appearance’ of NM and VF key species at the same level. Based on the data presented here the standard spore zonal scheme for the Lower Carboniferous of W-Europe is adapted for NE-Germany too. To avoid problems caused by rare and sometimes absent key species, additional key species are proposed for the biostatigraphical definition of Visean spore zones of NE-Germany.


MID-CARBONIFEROUS BOUNDARY IN THE ANGARALAND (MINUSA BASIN) BAY PALYNOLOGICAL DATA

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The Carboniferous of Angarida differs by two peculiarities. First is the type of structure sections. There is special type of «basin» environments, where coal-accumulation originated not in the sea coastal, but in «basin» alluvial-delta plains. It is the second peculiarity of the especially Angara type flora of the temperate climate.

These peculiarities are the reasons of essential difficulties in the correlation of the continental deposits with Euramerian stratotypes, which include marine other groups of fauna. The most complete section of the continental Carboniferous Angarida is represented by Sayno-Altai folded region, where the stratotypical sequences of Angara (Tunguska) paleofloristic area are defined. These are Kuznetsk stratotype and its analogues of Minusa basin (South Minusa intermountain sag). Here, in South Minusa intermountain sag, at present the best investigated by different groups of organic remains is the Isyk bank exposure, which is continuous from Devonian to Upper Permian. The Lower Carboniferous part is characterized by lepidodendry flora, but its Upper Carboniferous part with transit beds is characterized not only by terrestrial flora and freshwater fauna remains, but also polyonimorfan. In the Middle–Upper Carboniferous part palynological zones are established correlating with complexes of leaf flora and abiotic occurrences.

The most ancient lower part of Carboniferous section is represented by Tournaisian-Lower Visean deposits volcano-sediment genesis and terrigenous carbonate sediments. The formation is characterized by: 1) aridic climate; 2) ash composit dominating over terrigenous; 3) absence of alluvial facies; 4) dominating lepidodendry flora; 5) absence of gnynosperm pollen. Flora and spores in the complexes of Lower Carboniferous part corresponds with flora and spores of Euramerian paleofloristic area. Since the Upper Visean (Baynovskaya, Podsinskaya suites) in the Lower Carboniferous section has the characteristics of transition formations: 1) domination of terrigenous composit; 2) texturas of dynamic enviroment (it is evidence of precipitations rise); 3) endemism appearing in the flora; 4) lepidodendry spores are still dominating in the palynological complexes; 5) it occurs the first appearence of gnynosperm pollen, ancient morphological aspect Florinites grandis. The upper beds of Lower Carboniferous part, conditionally correlating with Serpukhov stage (Solyonoozerskaya suite of the South Minusa sag), demonstrate clear characteristics of coal-bearing formation, for example alluvial and coal-bearing facies. There are lepidodendry flora in coast-marine settings (in Kuznetsk basin); palynological complexes are represented by pteridosperm spores, by archrist pollen of ancient gnynosperm Florinites, partially with lepidodendry spores. The Middle Carboniferous (Sarskaya suite of Bashkrian stage) is characterized by abrupt humidisation of climate, bareness of taxonomy composite, abrupt reduction of macroremains and lepidodendry spores, in the palynological complexes it occurs the first appearance of Cordaitina pollen. The coal-bearing, quantity and variety of Cordaitina pollen increase up to the sequence.

The palynological complex is established in the unique geological exposure of the South Minusa sag. It is a palynological complex of the Solyonoozerskaya suite, which lower boundary can
be suggested as the Mid-Carboniferous boundary. The lithological and taxonomy composite renovates here. It corresponds a boundary of remarkable reconstruction in the floras of the Carboniferous Angarida, boundary of Pennsylvanian and Mississippian of America, of Dinantia and Silesia of West Europe.

**PALAEOENVIRONMENTAL EVOLUTION OF THE ITARARÉ SUBGROUP AT ITAPORANGA (UPPER CARBONIFEROUS, PARANÁ BASIN), SÃO PAULO STATE, BRAZIL, BASED ON PALEONTOLOGICAL AND PALYNOFACIES DATA**

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New palynological data are presented from the Itararé Subgroup, which is related to the Permocarboniferous Gondwana glacial event in the Brazilian Paraná Basin and includes marine and continental strata. This study is based on four fertile core levels from the IG-01 borehole at Itaporanga, São Paulo State, northeastern basin. The section analysed corresponds to the middle-upper part of the Itararé Subgroup and revealed rich palynological assemblages. Thirty species of spores, seventeen monosaccate pollen grains (one species striate), six bisaccate pollen grains (two species striated), one praeclipe pollen grain species and other, colpate were identified from a total of fifty-eight miospore species. Paleophytolankton species like *Deutsilites tenatisriatus* Gutiérrez, Césari and Archangelsky, *Botryococcus braunii* Kützing and *Brazilia scissa* (Balme and Henneley) Foster have also been recognised. Seven species of spores and one of pollen grain are recorded for the first time in the Brazilian Paraná Basin: *Retusotriletes anfractus* Menéndez and Azcuy, *Cyclogranisporites firmus* Jones and Truswell, *Apicalutisporites parviapiculatus* Azcuy, *Dibolisporites disfacies* Jones and Truswell, *Convolutispora muriornata* Menéndez, *Cristatisporites stellatus* (Azcuy) Gutiérrez and Limarino, *Kraeuselisporites volkheimerii* Azcuy and *Circumplicatipollis plicatus* Ottone and Azcuy. Taxonomic results, including a new species of spore and a new genus combination were presented by Di Pasquo et al. (2003a; 2003b).

Taking into account previous paleontological information from this well related to marine bivalves and brachiopods, palynological composition, botanical affinities, palynofacies characters, and lithology, an evolution of the palaeoenvironment / paleoclimatic conditions of depocentre is proposed. A first stage reflecting estuarine conditions is registered at the 76 m level. A second one linked with restricted coastal lagoon and dry-wet temperate seasonally climate features, corresponds to the 54 m level. The last episode interpreted as a low energy and normal salinity shelf setting is recognized at the 37 m and 36,5 m levels. Therefore, a relative sea-level rise upward the upper section of the Itararé Subgroup is recognised. This transgressive event may correlate with the retreat of glaciers during an interglacial period.

Marine invertebrates comprise species distributed from the Late Carboniferous to the Early Permian in Brazil and correlated Gondwana basins, preventing their use in correlation and as biostratigraphical markers. Besides, they have been found in low diversity. The palynological assemblages are attributed to the Late Carboniferous *Cricusacites monoletus* Interval Zone (Souza, 2000; Souza & Marques-Toigo, 2001), in which spores and monosaccate pollen grains are dominant.


**UPPER CARBONIFEROUS PALYNOMORPHS FROM THE EASTERN MARGIN OF THE PARANA BASIN, SOUTHERN BRAZIL**

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and the overlying Khuff formations has also been a within its reservoirs. Correlation within the Gharif heterogeneity and consequent difficulties in understanding hydrocarbon fluid flow and yield is complex with great lateral and vertical facies of much of the continental Gharif Formation. However, the non-marine hydrocarbon reserves.  However, parts of the Middle Permian, particularly the Middle and Upper Gharif members and the Gharif - Khuff transition, could hitherto only be correlated rather imprecisely. This is because the standard biozones relating to that part of the sequence (OSPZ4, 5 and 6) are rather broad, and their bases not formally defined.

Recent intensive work on several cores from the Barik Field in central Oman has allowed the erection of a standard palynological section for the hydrocarbon reservoirs of the Middle and Upper Gharif members and lower Khuff Formation. This enables high-resolution correlation to the surface Huqf Outcrop area, 100 km to the east, in which these reservoir rocks outcrop; and may allow subdivisions of the OSPZ regional biozonation scheme of Stephenson et al. (2003).

A valuable consequence of the close correlation between surface and subsurface in this interval is that sedimentological-palynological models of reservoir heterogeneity developed in the Huqf Outcrop area can be extended into the subsurface oil bearing strata. For example Unit B of the Upper Gharif member, defined at the surface by Bureau de Recherches Géologiques et Minières (BRGM), is interpreted as a floodplain complex of point bar sands and clay plugs probably formed in oxbows and crevasse spays. Although the sands are good reservoirs, the clays are baffles to hydrocarbon fluid flow, and strongly affect yield and flow directions. Very detailed surface palynological work has shown that the plugs are distinguished by their autochthonous algal spore content. This may be due to local water chemistry variation between floodplain waterbodies. These autochthonous algal ‘fingerprints’ will enable thin mudstone bodies to be distinguished in field scale subsurface borehole studies. Mudstone units in adjacent boreholes with radically different autochthonous algal spore content. This may be due to laterally continuous baffles to fluid flow, while those at similar levels with similar algal ‘fingerprints’ are more likely to be laterally continuous field wide barriers.


THE SPORES OF UPPER DEVONIAN PLANTS AND THE DISPERSED SPORE MORPHONES

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This investigation is based on the studying of in situ mega- and microspores extracted from Tanaitis furcihasta Krassilov, Rask.et Istch. Sporangium which is intermediate between the progymnospermous order of Aneurophytales and Archaeopteridales, spores from dispersed sporangia of the Late Devonian pteridophytes with an emphasis on their variation and dispersal miospores picked out during bulk maceration of the rock matrix around Tanaitis from the Lower Frasnian deposits (Lower Upper Devonian) of Pavlovsk in the upper reaches of the Don River (Russia).

In modern palynology, classification of dispersed sporomorphs is based on the formal system of Naumova (1953), as well as on the congregational system of Potonie and Kremp (1954; Potonie, 1956, 1958). Both these systems deal with single organ parataxa unrelated to whole plant taxa (eutaxa). However, classification of dispersed sporomorphs takes into account the variability in similar morphotypes in the eutaxa, as well as preservation and morphological variation in each sample. By this criteria parataxa are made comparable with respective eutaxa. However, only in situ records of spores, classified as parataxa, give evidence of their taxonomic affinities in the system of eutaxa.

The importance of this and similar studies of in situ spores cannot be over-emphasized.

This paper describes the wide variety of spores present in numerous sporangia of Tanaitis and in situ spores from dispersed sporangia of the Late Devonian pteridophytes with an emphasis on their variation. The spores are easily identifiable in dispersed spore assemblages because of their distinctive sculpture. Dispersed spores, many identical to those found in situ, were investigated from Lower Frasnian strata and are considered to belong to one morphospecies. Within this species we describe several informal variants referred to numbered types and subtypes. This sequence of assemblages of types we regard as a single species morphon. A morphon has been defined as a group of palynological united by continuous variation of morphological characteristics. As from taxa and taxonomic levels are subjective, we are extending the morphon concept to include groups of informal taxa and correlated with short-term regressive pulse, corresponding to the Upper Kellwasser Crisis level in the linguiformis conodont Zone. This very rich abundance of the chitinozoans has been correlated with the fluctuation of the other palynomorphs (Filipiak 2002), conodonts (Dzik 2002, Racki et al. 2002), ostracods (Casier et al. 2002; Olempska 2002), and brachiopods (Balinski 2002) present in the same beds of investigated sections, as well as with sedimentological and environmental factors. The upper part of the Frasnian beds in both sections, comprising rhythmic calcareous-marly sequences at the Kielce (Malopolska Massif) in southern Poland (Racki et al. 2002).

CHITINOZOAN RESPONSE TO THE FRASNIAN/FAMENNIAN BIOTIC CRISIS IN THE HOLY CROSS MOUNTAINS (KIELCE REGION), POLAND

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Organic-walled microfossils (chitinozoans, tasmanaceans and scolecodonts) were investigated in the Frasnian/Famennian boundary interval comprising rhythmic calcareous-marly sequences at the Plucki and Kowala sections located in the Kielce region of the Holy Cross Mountains (HCM; Malopolska Massif) in southern Poland (Racki et al. 2002).

The abundant Chitinozoan occurrence in the basal bed of the Kellwasser interval coincides with a short-term transgressive pulse in the linguiformis conodont Zone. This very rich abundance of the chitinozoans has been correlated with the fluctuation of the other palynomorphs (Filipiak 2002), conodonts (Dzik 2002, Racki et al. 2002), ostracods (Casier et al. 2002; Olempska 2002), and brachiopods (Balinski 2002) present in the same beds of investigated sections, as well as with sedimentological and environmental factors. The upper part of the Frasnian beds in both sections, corresponding to the Upper Kellwasser Crisis level and correlated with short-term regressive pulse, contains only few chitinozoans (Angochitina, Cingulochitina, Fungochitina and Sphaerochitina), but other palynomorphs, particularly spherical prasinophycean green algae and scolecodonts are common in the same beds.
Palynological results from HCM sections are similar to those of previous records of the F-F boundary beds at La Serre, Montagne Noire, Southern France (Paris et al. 1996), but the chitinozoan response to the Kellwasser bio-event in Poland appears earlier than in France. The frequency distribution of chitinozoans recovered from Frasnian/Famennian sediments in the Holy Cross Mountains is discussed with a particular attention to the consequence of the Frasnian-Famennian extinction events (e.g., Schindler 1993, McGhee 1996, Walliser 1996).


DEVONIAN-CARBONIFEROUS ACRIPTARCHS FROM CENTRAL PART OF BADAJOZ PROVINCE (OSSA-MORENA ZONE, SW SPAIN)

Delgado Iglesias, D. & Palacios, T.

The palynological content of the Robledillo section in the area of Los Santos de Maimona (Ossa-Morena Zone, SW Spain) has been analyzed in order to obtain new biostatigraphic data. A detailed stratigraphical analysis of this section allows us to differentiate four lithostratigraphic units in the rank of formations:

Lower detritic unit: The lower part consists of alternations of fine sandstones, calcareous siltstones and limestones. The upper part is characterized by a higher proportion of sandstone levels, the absence of limestones and, towards the top, the appearance of pyroclastic levels with abundant plant remains (Lepidodendron and Stigmaria).

Volcanosedimentary unit: This unit consists mainly of volcanosedimentary material, including pyroclastic levels, dacitic and andesitic rocks, volcanic breccias, mudstones, sandstones, marls and limestones. It contains abundant macrofossils, which include colonial corals, brachiopods, gastropods and trilobites.

Carbonate unit: This unit consists of rhythmic alternations of limestones and calcareous mudstones.

Upper detritic unit: This unit consists mainly of mudstones.

The lower detritic unit shows high diversity and abundance of acritarchs in the lower part, some of which are characteristic of the middle and upper Devonian. The following genera have been recognized: Baltisphaeridium, Comaspheeridium, Cymatosphaera, Duvernaysphaera?, Elektoris?, Gorgonisphaeridium, Leiofusa?, Leiosphaeridia, Lophosphaeridium, Michrystridium, Multiplicisphaeridium, Pterospermella, Solisphaeridium, Stellinium, Unelium?, Veryhachium. Acritarch diversity drops drastically with the appearance of first pyroclastic levels.

The upper three units show a continuous acritarch record of low species diversity. The recovered acritarchs species are not age diagnostic, but previously reported fossils, including foraminiferans and corals (RODRÍGUEZ et al. 1992), indicate a Visean age for these sediments.

The high acritarch diversity and the presence of species characteristic of the Devonian (Michrystridium stellatum, Multiplicisphaeridium ramispinosum, Pterospermella capitana, Uncinisphaera lappa, Veryhachium donnei, Veryhachium roscidum) in the lower detritic unit contradict the current stratigraphical and depositional model, which invokes emergence (or non-deposition) of the study area during the Devonian (COLMENERO et al., 2002). The new data presented here indicate that the sediments of
the lower part of the section were deposited during the Devonian, and suggest that the Devonian-Carboniferous boundary in the Ossa-Morena Zone coincides with the first appearance of volcanoclastic rocks, as previously suggested by VALENZUELA et al. (1990). This data is in accordance with recent palynological data in the Iberian Pyrite Belt (MORENO et al., 2003).


PALYNOSTRATIGRAPHY OF THE PHYLLITE-QUARTZITE GROUP IN THE EASTERNMOST SECTOR OF THE IBERIAN PYRITE BELT, SW SPAIN.

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This work summarises the palynological analysis carried out in the lower part of the Phyllite-Quartzite Group of the Iberian Pyrite Belt (IPB). The IPB, located in the south-western corner of the Iberian Peninsula, represents one of the world’s major metallogenetic provinces, including sulphide deposits as well-known as Riotinto, Tharsis, Aljustrel or Neves-Corvo. Its stratigraphic sequence is constituted by both volcanic and sedimentary rocks of Devonian and Carboniferous age, which traditionally have been subdivided into three main stratigraphical units: the Devonian pre-volcanic sedimentary rocks (PQ Group); a complex sequence of volcanic, sedimentary and volcanoclastic rocks, where the ore bodies cited above are emplaced (Volcano-Sedimentary Complex); and the post-volcanic upper Visean to Westphalian Culm facies deposits (Culm Group).

The palaeontological record of the IPB is poor. Most of the age data are provided by goniatites, generally associated with diagenetic concretions included into shaly levels, and by the sparse amount of conodonts included into the equally sparse carbonate lenses scattered throughout the region. During the last time, Palynology has turned into one of the most efficient biostratigraphic tool in the region.

The studied unit, PQ Group, represents the base of the outcropping series of the IPB. Most of stratigraphical record of the PQ is constituted by a monotonous detrital sequence of shales with quartzites and quartzwackes as subordinated lithologies. At the top, this unit contains a complex mixture of conglomerates, sandstones, carbonate lenses and shale levels.

Samples were taken from the easternmost area of the IPB, where the oldest rocks of the PQ Group outcrop due to the combined effect of 1) Variscan tectonic, 2) post-Tertiary Iberian Plateau tilt and, 3) erosive processes—denudation-. Twenty three shaly samples were collected, of which 11 yielded well preserved to moderately well preserved palynomorphs. Most of the samples contain mainly trilete miospores and, in a second order, organic-walled microphytoplankton (both acritarchs and prasinophyte phycoconta). The miospore assemblage contains taxa representative of the Middle to Upper Devonian. The species biostratigraphically most relevant are Chelinospora concinna, Cristatisporites triangulatus, Geminospora lemurata, Retusotriletes rugulatus, Ancepsora leberioides and Verrucosporis scurrus. These taxa define a stratigraphical range comprising the Biozones optivus-triangulatus and ovalis-bulliferus, which implies an upper Givetian-lower Famennian age, the oldest age established in the IPB.

Concerning the marine microflora, the most noticeable feature is the record of different taxa of prasinophyte phycoconta assignable to the genus Maranhites such M. mosesii, M. brasilienensis and M. britoi, indicative of a higher vertical stratigraphic range comprising Middle and Upper Devonian age. The acritarch content includes sparse specimens of Gorgonosphaeridium spp. erratically recorded.

Evidence from the palynological assemblage suggests a shallow marine environment close to mainland consistent with the interpretation provided by previous sedimentological studies.

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NEW DATA ON THE PALYNOSTRATIGRAPHY OF THE CARBONIFEROUS SUCCESSION OF VARISCAN EXTERNIDES (SW POLAND)

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The monotonous Carboniferous turbidite succession of Variscan externes, occurring under the Foresudetic Monocline, was studied palynologically. These studies provided new and interesting palynostratigraphical data. Miospores were obtained from rock samples from 10 boreholes. Majority of the studied rocks haven’t had a palaeanontological documentation until now. Thermal maturity of the organic matter was various and represented all stages - from mature to metamorphosed. The precision of the stratigraphical conclusions was limited by the general poor preservation of miospores.

Results of the palynostratigraphical studies indicate that two rock successions of different age occur in the studied profiles. The older one is of Viséan? and/or Early Namurian age and was recorded in all of the boreholes. Age of the rock samples with poor preserved miospore assemblages was interpreted as Viséan-Namurian. Rich and well preserved miospore associations with Kraeuselisporites ornatus, K. echinatus, Cressispora kosaneki, C. maculosa, Rotaspora spp., Savitrisporites nux, Grandispora spinosa, Schulzospora spp., Secarispores remotus, Spinozonotriletes uncatus and Bellisporites nitidus from three boreholes allowed to limit their age to Namurian A. In profiles Sicieny IG 1 and Marcinki IG 1 the younger rock succession was recorded. Presence of taxa Torispora secutis, Microreticulatisporites nobilis, Triquatrites sculptilis, Vestispora laevigata and V. costata indicate on its Westphalian C age. In the latter rocks reworked miospores of Viséan-Namurian age were recorded. The duplication of stratigraphic intervals in these two profiles and no evidence of the Upper Namurian and Lower Westphalian rocks in the studied boreholes indicates an important role of thrust tectonics in that area.

**LATE CARBONIFEROUS PALYNOSTRATIGRAPHY OF THE BRAZILIAN PARANÁ BASIN**

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The Paraná Basin comprises a thick, widespread sedimentary-magmatic sequence, located in central-eastern South America, covering about 7,000,000 km² in area in Brazil, Uruguay, Argentina and Paraguay and reaching thicknesses of ca. 5,000 m, including Ordovician to Cretaceous deposits. The biostratigraphy of its Upper Palaeozoic strata has been studied by several authors, who proposed different zonations based on plants, invertebrates and palynomorphs. However, palynology seems to be the most efficient tool in providing biostratigraphic data for the Paraná Basin, because of the abundance, diversity and widespread distribution of spore-pollen assemblages.

Four interval zones characterize the palynological succession of the Upper Palaeozoic strata of the Paraná Basin: Ahrensisporites cristatus, Crucisaccites monoletus, Vittatina costabilis and Lueckieporites virkiiae Interval Zones, in ascending stratigraphical order (Souza & Marques-Toigo, 2001; 2003). These take into account spore-pollen distribution and horizons of appearance and disappearance of selected species. This contribution deals exclusively with the Late Carboniferous zones recovered from the northeastern Brazilian Paraná Basin (Ahrensisporites cristatus and Crucisaccites monoletus Interval Zones), which remain unpublished (Souza, 2000).

The Ahrensisporites cristatus Interval Zone is characterized by eleven stratigraphically restricted spores species: Anapliculatisporites argentenensis Azcuy, Raistrickia pinguis Playford, Foveospores hortenensis (Playford) Azcuy, Grandisporites varigranifer Menéndez and Azcuy, Ahrensisporites cristatus Playford and Powis, Cristatisporites menendezii (Menéndez and Azcuy) Playford emend. Césari, Cristatisporites inordinatus (Menéndez & Azcuy) Playford, Cristatisporites spinosus (Menéndez and Azcuy) Playford emend. Césari, Cristatisporites indignabundus (Potonie & Krem) Staplin and Jansonius, Cirratriradites veeveri Playford, and Psomospora detecta Playford and Helby. It has been recognised in the lowermost Itararé Subgroup, from the northeastern portion of the basin (São Paulo and Paraná States).

The Crucisaccites monoletus Interval Zone is characterized by the disappearance of restricted species of the former unit and by the appearance of Scheeringipollenites maximus (Hart) Tiwari and Crucisaccites monoletus Matiły. The latter species is stratigraphically restricted to this unit. The upper limit of the palynozone is marked by disappearance of several species of spores and pollen grains, such as Cyclogranisporites firmus Jones and Truswell, Dibolisporites disfacies Jones and Truswell and Potomiesporites triangulatus Tiwari, and by the appearance of characteristic species of the subsequent unit. This interval zone occurs in the northeastern portion of the basin and has been recognized from the lower to middle portion of the Itararé Subgroup.

In these two palynozones, smooth and cingulizate spores as well as monosaccate pollen grains are dominant, disaccate and monosaccate/disaccate taeniate pollen grains are rare. Within the Paraná Basin, correlation can be established with the informal G, H1 and H2 intervals of Daemon and Quadros (1970). Out of the basin, best correlations are indicated with Argentinean palynozones, i.e. Ancistrispora and Potomiesporites Palynozones, or Raistrickia densa-Convolutispora muriornata Assemblage Biozone. Similarities are also evident with material from Tarija Basin belonging to the Kraeuselisporites volkhehmerit-Circumplecatisporis plicatus Superzone.
ON THE FINE MORPHOLOGY OF
PLICATIPOLLENITES MALABARENSIS
(POTONIÉ & SAH) FOSTER 1975

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The trilete monosaccate pollen taxon, Plicatipollenites malabarensis is characterized by radial symmetry, a prominent trilete mark and a continuous endexinal fold encircling the pollen corpus. Pollen grains of the taxon from the Early Permian of the Arabian Peninsula were studied using light microscopy (LM, Fig. 1), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). A “crochet-like” sculpture is visible on the both sides of the corpus in SEM (Fig. 2, 3). On TEM ultrastructural scenes the sculpture is distinguishable as a thin undulated ectexinal layer. The dark area around the proximal trilete mark (LM) is caused by a slight thickening of the endexine in that area, though the ectexine does not change in thickness or morphology in this region. The reticulate ornament of the saccus, as shown in LM, is formed by superficial folds visible with SEM (Fig. 2) and inner ectexinal partitions (TEM).

TEM demonstrates that the saccus is hollow with ectexinal partitions, many of which are radially oriented. This taxon was previously described as protosaccate (Foster, 1979); although most of these partitions reach the underlying layer, the protosaccate appearance might be due to compression. The endexine is prominent and homogeneous; at the region of the fold (where there is less compression) several lamellae are visible.

Of great interest is comparison between this material and the ultrastructure of monosaccate pollen grains of Cordaitina Samoilovich from the Permian of Angaraland (Zavialova et al., 2002). Both taxa show a very similar sculpture of the corpus surface. They are also similar in the thick, apparently homogeneous but ontogenetically lamellate endexine, and in the thickening of the endexine which is present around the proximal trilete mark. This similarity is important since the genera Plicatipollenites Lele 1964 and Cannanoropollis Poitonié & Sah 1960 are generally used by taxonomists in the Gondwana palaeophytogeographic province, while in Angaraland and the Euramerican province Cordaitina is used. Attempts have been made to compare the ultrastructure of Cordaitina and taxa such as Plicatipollenites and Cannanoropollis using SEM, TEM and LM (e.g. Powis 1979) but we consider that these comparisons were inconclusive. This preliminary report, which is part of a larger project, will attempt a more detailed comparison.
Vorobievian horizon is determined by the change of Chernoyarian horizon argillites with sandstones and aleurites containing Vorobievian complex of miospores, brachyopods and ostracods. Spore complex of this subzone is represented by the following species: Cymbosporites magnificus, Geminospora micromanifesta, G. extensa, G. tuberculata, Archaeozonotriletes tithonovitschi, Geminospora micromanifesta, G. extensa, G. tuberculata, Archaeozonotriletes tithonovitschi, G. magnifica, Lamatisporites bislimbatus, Camarozonotriletes minutus, etc. H tichenovitschi species-index is vanishing in this zone. Except for species listed before, there are traced spores passing from the Eifelian deposits: Rhabdosporites langii, Grandispora velata, Densosporites devonicus, Cirratriradites monogrammos, and also forms of wider vertical expansion: Stenozonotriletes formosus, Lophozonotriletes scurrus, L. grandis, etc.

The spore complex of this subzone is almost similar to spore complexes from Vorobievian deposits of the central and east regions in Russian platform (Raskatova, 1969; Tchibrikova, 1977; Arkhangelskaya, 1985; Avkhimovich et al., 1993; Rodionova et al., 1995).

The middle subzone Vallatisporites celeber-Grandispora violabila corresponds to the Ardatovian horizon. Species passing from the underlying subzone are mainly distributed in this subzone with Vallatisporites celeber, Cirratriradites monogrammos, C. punctomonogrammos vanishing here. The quantity and the variety of Geminospora genus are still increasing. Prevailing are: Geminospora vulgaris, G. tuberculata, G. decorata, G. micromanifesta, Chelinospora concinna. Constantly are present Geminospora extensa, Lophozonotriletes scurrus, L. grandis, V. celeber-G. violabila spore complex is almost similar to palynocomplexes determined in the Ardatovian horizon of Russian platform (Raskatova, 1969; Tchibrikova, 1977; Arkhangelskaya, 1985; M.Raskatova, 1990; Avkhimovich et al., 1993; Rodionova et al., 1995). Besides, two lower subzones of the Givetian stage may be compared to Geminospora extensa zone in the Volgograd Povolzhie is to a definite degree similar to the upper part of the triangulatus-angucyrea (TA) zone and the lower part of a triangulatus-concinna (TC) zone in the Western Europe (Loboziak, Streel, 1981; Loboziak, 1983; Streel et al., 1987).

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The occurrence of Lower Gondwana Palynofossils assemblage has been recorded from the sediments of Singrimari area of Meghalaya and Dhubri district of Assam. The recorded palyno assemblage includes genera like verticipollenites, gnetaceaepollenites, dentatipollen, alisporites, divarisaccites, parasaccites clyclogranisporites, etc. The Palynofossils assemblage shows similarity with the palynological assemblages of Lower Gondwana Formations of other parts of Asia. This assemblage mostly represents the Karharbari and Barakar Formations of Upper Carboniferous to Lower Permian age. The palynofacies is found to be humic and terrestrial under braided nature of environmental set-up.

DEVONIAN IN SITU SPORES: MORPHOLOGY, EVOLUTION AND STRATIGRAPHY.
The finds of Devonian spores in situ are very rare but they give the very essential information for early history plants reconstruction. Spores of Early Devonian plants are studied most well. They are known at small number in Middle and Late Devonian deposits. Of about 200 Devonian plants have a descriptions of the spores from sporangia now.

The analysis spores in situ has allowed to single out their basic morphological types corresponding to various phylogenetic lines of plants (Telnova, Meyer-Melikyan, 2002). At allocation of these types of spores both morphological features of a sporoderm surface and its ultra thin structure in section were used.

The spores from sporangia of most typical and important species of Devonian plants from Timan are studied. The representatives of ferns and progymnospermes dominate in Late Devonian flora. The presence of endemic forms gives significant originality to Late Devonian phytocomplexes of Northern Timan. There is licopsids plant Kossoviella timanica Petrosyan among them. As a result of detailed studies of its spores it is established that ultra structural peculiarities of megaspores sporoderm of dyed and modern plants is in general similar.

Their sporoderm can consist of one or several layers, more often they have spongy ectexine and lamellar endexine and the degree of condensation of layers is various.

The microspores ultra structure is original in different phylogenetic lines of plants. The most simple in the structure is homogeneous exine found out both at Devonian and at modern plants. The widely spread type of exine is the cellular structure, which, apparently, represents an initial type of ectexine. The internal sporoderm structure of each specie differs by a smaller rank of ultra structural attributes (density and sizes of cells etc.).

The study of a sporoderm internal structure of dispersed spores, most important for the purposes of stratigraphy, has allowed to establish their systematic connections and to make the conduction biostratigraphic partition of Upper Devonian deposits in the Timan-Pechora province more ground.

The analytical comparison of spores in situ speaks about that some species of spores can be indicators for concrete groups of Devonian plants. It allows (in view of given study ultra thin structure of sporoderm) to correlate dispersed spores with their producers. The new methodological approach in the decision stratigraphic questions was used in substantiation of phostatigraphic boundaries in Devonian (appropriate to the border of middle and top departments of Devonian in the Timan-Pechora province).
preserved acritarchs, prasinophytes, chitinozoans, scolecodonts, spores, and cryptospores. A few layers are enriched in cuticles and tissue fragments which are clearly derived from landplants. The ongoing studies are concentrated on core material from the Middle and Upper Dadas Formation and the lower Hazro Formation. Parts of the Dadas Formation yield highly diverse assemblages of acritarchs and chitinozoans which are used for palynofacies and biostratigraphy. Due to the lack of other stratigraphical index fossils like graptolites or conodonts, acritarchs and chitinozoans may serve to define the Silurian/Devonian boundary in this area. However, diagnostic chitinozoans which occur at the GSSP (e.g., Urnochitina urna, Linochitina klonakensis, Angochitina chilupaci, Eisenackitina bohemica) have not yet been found and the acritarchs still need to be studied in more detail. Additional information is expected from spores and cryptospores, especially for higher parts of the Dadas Fm. and the overlying Hazro Fm. Spore morphotypes resemble species of e.g. Ambitissporites and cf. Archaeozonotriletes but index taxa for the Lower Devonian like Strelispora newportensis or Emphanisporites and Retusotriletes are missing so far. Cryptospores are mainly represented by Dyadispora, Tetraletes and cf. Cymbosporites. In general, the Dadas assemblages are very rich in prasinophytes like Dictyotidium, Cymatosphaera and cf. Pterosphaeridia (Orygmapsis sensu Colbath 1987). Some horizons predominantly consist of huge prasinophycean phycomata (> 200 µm) which are assigned to Tasmanitaceae (e.g., Tasmanites). They can easily be detected by magnification glasses on bedding planes. Such mass occurrences (“blooms”) could reflect specific facies conditions (e.g. low salinity) in a shallow water environment, probably controlled by sea level fluctuations. Usually, prasinophytes are considered to be of restricted stratigraphical value, but detailed taxonomical and systematic studies of their representatives in the Fetlika material may provide supplementary data at least for the regional S/D boundary correlation. Interestingly, mass occurrences of specific prasinophytes from the Upper Silurian-Lower Devonian interval have also been described from other places, e.g. in North America and Europe (Colbath, 1987). Spores and cryptospores are present throughout the sequence, but more frequent at the base of the core (lower Middle Dadas Fm.). The same is particularly true for the uppermost Dadas Fm. to lower Hazro Fm where marine elements are restricted to specific acritarchs and prasinophytes. Chitinozoans and scolecodonts are rare or absent where spores and cryptospores are common. In each of these two intervals cuticles/tissues of landplants and spores are accumulated in a specific layer which is otherwise characterised by a lack of any marine palynomorphs. These layers may be interpreted as representing short-term terrestrially derived pulses in a generally coastal/near shore environment. This is supported by specific biomarkers of supposed landplant origin.

CIMP General Meeting at Granada 2004

Time: 7/7/2004, 1930-2100

Mike Stephenson

Around 40 CIMP members attended this CIMP General Meeting held in a room kindly provided by the organisers of the IPC 2004. No formal notes were taken of the meeting (my omission), however the following were discussed.

Forthcoming CIMP meeting Prague, 2006

Jiri Bek and Oldrich Fatka gave a short presentation on the meeting (see also this Newsletter). Jiri and Oldrich discussed ways in which money from the meeting might be used to help CIMP members with limited funds to attend.

Postage costs and email/web delivery of newsletters

Mike Stephenson referred to the costs of hardcopy postal distribution to a small number of members who do not receive email copies of the newsletters. This is often greater than a member’s annual membership fee. Rather than continue to supply newsletters in this way, it was decided to switch entirely to email and web delivery, except in special circumstances.

Treasurer

Jacques Verniers, outgoing CIMP Treasurer gave a short presentation of the provisional (at 3 July 2004) Accounts for 2003 and 2004; see back page of this Newsletter.

Phillipe Steemans has agreed, with immediate effect, to take over the job of CIMP Treasurer from Jacques Verniers.

Use of CIMP funds

Arising from the previous item, a discussion on how CIMP funds might be used ensued. CIMP outgoings are very small, amounting mainly to IFPS membership fees and bank charges. If costs of Newsletter hardcopy postage are kept minimal, some funds could be made available to students or other researchers in the form of grants or prizes. Commercial sponsorship might also be sought to support grants or prizes.

IFPS representative

Charles Wellman has taken up the job of IFPS Palynos Newsletter Editor, hence Ken Higgs has agreed to take up his place as our second CIMP IFPS representative.

Publications from the IPC 2004

Thomas Servais indicated that discussions were underway with Elsevier over publications from the CIMP sessions of IPC 2004.

Subcommission reports
Brief reports were given by the subcommission representatives. For details contact, Ken Higgs (Spores and Pollen Subcommission), Gary Mullins (Chitinozoan Subcommission) and Reed Wicander (Acritarch Subcommission).

50 years of CIMP
The President, Florentin Paris, mentioned that CIMP will be 50 years old in 2008. He asked for suggestions as to how this anniversary might be celebrated.

New directions
The President, Florentin Paris, congratulated CIMP members present on their strong representation at the IPC 2004, but continued to repeat his message of previous meetings…that CIMP will only survive if members continue to collaborate and discuss with scientists outside palynology, in the fields of palaeobiology, geology, organic geochemistry and radioisotopes.

Brachiopod Sr dates to calibrate Permian palynology biozones in Arabia
Lucia Angiolini (lucia.angiolini@unimi.it) and Mike Stephenson (mhste@bgs.ac.uk)

The palynological succession in the siliciclastic sequence of the Permian of Oman and Saudi Arabia has been refined and integrated by Stephenson et al. (2003) and subdivided into six palynological biozones. The ages of some of the biozones are poorly constrained either because they lack age diagnostic taxa, or are defined by taxa that are as yet undescribed and hence cannot be related to international stratigraphical standards. Dating of the biozones has been considerably helped by new macrofaunal information from carbonate units in the Early and Middle Permian of Oman (Angiolini et al. 2003a,b; 2004), but this is unlikely to allow precise dating of the intervening palynological biozones. Nor can absolute radioisotopic dates be applied, through lack of dateable tuffs or other volcanic rocks. These problems have meant that a number of perennial questions relating to the stratigraphy of the Arabian Permian still resist solution. One such question concerns the age of the base of the Mid Permian Khuff Formation in Oman and Saudi Arabia, and the degree of diachroneity of the Khuff transgression; another is over the age of the Early Permian Haushi Limestone in Oman which has been dated by brachiopods and other fauna as Sakmarian and by palynology as Artinskian.

Sr isotope ratios in the shells of brachiopods studied by a team from the University of Milan, the British Geological Survey and the NERC Isotope Geoscience Laboratory

To solve some of these problems and to obtain independent ages for the Haushi Limestone and the Khuff Formation, Strontium (Sr) isotope ratios in the shells of brachiopods are being studied by a team from the University of Milan, the British Geological Survey and the NERC Isotope Geoscience Laboratory, UK. The technique measures the ratio of one isotope of Sr to another in the originally preserved secondary layer of the brachiopod shell. Ratios are then compared to a standard curve of ratios for Permian seawater established through previous work on sequences elsewhere. This allows determination of the age of the brachiopod and the sediment than encloses it. A recent pilot study of five brachiopods from the surface Saiwan Formation in Oman (substantially equivalent to the subsurface Haushi Limestone) has produced some extremely promising results. However the team intends to extend the technique to younger Khuff
brachiopods and have obtained limited sponsorship from an oil company and service company operating in the Middle Eastern area to finance a larger study.


Request for Samples
Catherine Duggan, Department of Geology, Trinity College Dublin, Dublin 2, Ireland, duggancm@tcd.ie

Acritarch Colour and Thermal Maturity – Request for Samples to assist a PhD project

Measurement of changes in the reflectivity of vitrinite, fossil woody material, in incident light is the standard technique for assessing the organic maturity of sedimentary rocks. However, plants producing substantial woody tissues did not evolve until Devonian times so thermal histories of older rock successions cannot be investigated by this method. Also, marine hydrocarbon source rocks of Devonian and younger age often contain little or no vitrinite. The aim of this project is to develop an inexpensive alternative method for the assessment of organic maturity of vitrinite-deficient marine hydrocarbon source rocks, based on colour change in acritarchs.

Acritarchs are abundant in marine rocks of the late Precambrian to Devonian age, rare in the Carboniferous and Permian, but are then common throughout the Mesozoic and early Tertiary. Like spores and conodonts, they gradually change colour with increasing temperature, from yellow, through to amber and brown, and eventually to black. Acritarchs, specifically *Veryhachium* and *‘Tasmanites’*, are being studied in this project because of their frequent occurrence in vitrinite deficient source rocks, and their long fossil record. Acritarchs are more suitable for quantitative colour determination than dinoflagellate cysts, since they generally have a simpler wall structure. This project involves correlating the colour changes undergone by acritarchs with the standard vitrinite reflectance maturity scale. Visual estimation of palynomorph colour has been used to assess maturity but in this study, quantitative RGB (Red, Green, Blue) colour analysis is used to provide a more precise and objective method of characterising colour. This scale describes colour in terms of three variables, Red, Green and Blue and assigns an intensity value between 0 and 255 for each channel. RGB
intensities are relatively simple to measure using equipment readily available in most laboratories. Vitrinite reflectance is reported as a percentage and is measured using standard techniques. A schematic of the relationship being described is shown below.

The success of this project depends on the number of samples available to be measured. So far, pale low rank samples have been studied from Upper Devonian sections in North America. In terms of vitrinite reflectance, these samples range from $R_t$ 0.8 – 1.3%. A further set of samples, collected with the help of Thomas Servais from an Upper Devonian section in Belgium have provided a higher rank set of sample, with reflectance values between 2.0 – 2.2\% $R_t$.

Samples are needed that contain vitrinite, fossil woody material, as well as *Veryhachium* and/or ‘Tasmanites’. Unoxidised samples containing a majority of pale yellow to dark orange *Veryhachium* or mid brown to black *Veryhachium* are a priority to collect. However, samples within the range already measured would still be useful for purposes of comparison.

Rock samples or unoxidised residues would be suitable. Contributions of samples would be acknowledged in any further publication of this project and would be gratefully received by the author. Suggestions for possible areas that could be sampled are also welcome.

**Leslie Rowsell Moore (1912-2003): A footnote**

Duncan McLean, D.Mclean@sheffield.ac.uk

In the previous CIMP Newsletter Spinner et al. (2003) described the contribution made to Palaeozoic palynology by the late Professor L.R. Moore. Although they described the importance of his role in the development of C.I.M.P, they overlooked a particularly important fact of which Commission members may like to be reminded.

Prof. Moore was present at both of the inaugural meetings of the C.I.M.P. held during the 4th Congress on Carboniferous Geology and Stratigraphy in Heerlen in 1958. At the time the instigation of the C.I.M.P. was in response to the growth in the study of Carboniferous spores and pollen, particularly from coal seams. In the minutes of the first of these meetings, Alpern (1960) records a debate concerning the naming of the new organisation. Robert Potonié (who became the president of the C.I.M.P. at its first meeting in Paris in 1959) proposed to name it the Commission Internationale de Sporologie du Paléozoïque. Moore maintained that this would limit its scope in a potentially unfavourable way. He knew the value of the work of his research student Charles Downie (also present at the first meeting) and considered that, as future work on the algae and fungal spores may yet prove useful in stratigraphy, the Commission should have a wider remit and be named the Commission Internationale de Microflore du Paléozoïque, and so it became known. This proved to be a pivotal decision in the history of the C.I.M.P. Without the argument of
Leslie Moore we would have a Commission devoted solely to the study of spores and pollen (though not only in coals). There would be no subcommissions on acritarchs nor chitinozoans and the C.I.M.P. would be much the weaker for it.

We should remember Leslie Moore not only as a founder member of the C.I.M.P., but also as the person who, at the outset, defined its scope and allowed it to develop into an organisation devoted to Palaeozoic palynology in its widest sense. This is the C.I.M.P. that we have today.


**PhytoPal**

Gary Mullins Mullins, glm2@leicester.ac.uk

PhytoPal is a three year project, funded by an award from the Leverhulme Trust to Dick Aldridge (University of Leicester), that aims to document the stratigraphical and palaeogeographical distribution of phytoplankton from the late Precambrian to the Permo-Triassic. The principal scientific aim of the project is to construct a Sepkoski-type curve of phytoplankton diversity and to compare this with patterns of radiation and extinction in other micro and macrofossil groups and with changes in global climate.

Cymbosphaeridium bikidium, Lower Bringewood Formation, Ludlow Series, Silurian from Downton Gorge, near Ludlow, UK

To achieve this goal an international group of phytoplankton workers has been gathered (Ken Dorninig, Alain Le Hérissé, Malgorzata Moczydlowska-Vidal, Gary Mullins, Stewart Molyneux, Thomas Servais, and Reed Wicander). These researchers will be able to provide the most up to date data and knowledge in their respective areas of expertise. Collaboration will take place via exchange visits and regular workshops. The first workshop was held at the University of Leicester in December 2003 and a further meeting to discuss the progress of the project was held at the IPC meeting in Granada (July 2004). The next workshop will take place in conjunction with the Palaeontological Association meeting at the University of Lille, France, on December 15th-16th, 2004, and a further meeting with the ASAP in St. Louis 2005 has been confirmed. The free exchange of ideas and knowledge lies at the heart of phytoPal and we welcome the participation in these workshops of people not directly involved in the project. Currently, a taxonomic database of phytoplankton is being constructed and this database will form
the backbone of the phytoPal project on to which all the necessary occurrence data can be added. We hope to make this taxonomic database available to all via the WWW shortly. In addition, an email discussion group for the project has been initiated and this is open to all interested people. Further information on the project and details of how to subscribe to the discussion group can be found at www.le.ac.uk/geology/glm2/phytopal.html.

Screen shot of the genus database as currently is...for Ammonidium.

The phytoPal Group will be holding a workshop at the University of Lille 15th-16th December 2004, which will coincide with the 48th Annual Meeting of the Palaeontological Association (17th-20th December 2004). Contact info...Gary Mullins.

PhD theses

Lower Palaeozoic acritarchs as proxies for the reconstruction of palaeoenvironments

L. Stricanne, Institut für Geowissenschaften, Sigwartstrasse 10, D - 72076 Tübingen (Germany). Tel: 49 (0)7071 / 29-74339, Email: ludovic.stricanne@uni-tuebingen.de

Thesis supervised by Dr T. Servais (Villeneuve d’Ascq, France), Pr Dr A. Freiwald (Erlangen, Germany) and Dr J. Pross (Tübingen, Germany). Presented on June 28th 2004.

Abstract

The Lower Palaeozoic is characterised by a major phytoplankton diversification. Organic-walled organisms (acritarchs) played an essential role in primary production. This group is very useful for biostratigraphy, but has also a high potential for palaeobiogeographical and palaeoecological reconstructions.

Late Cambrian, Ordovician and Late Silurian material was studied in order to analyse taxonomy, to review published data and to reconstruct palaeoenvironmental conditions and palaeoclimate. This research led to the publications of six articles attached to the present thesis.

Multivariate statistics on Cambro-Ordovician galeate acritarchs from the Algerian Sahara allow an alternative classification. The revision of the genus Nellia from the same succession is based on the combination of traditional taxonomy and statistical approach to demonstrate the high intraspecific variation.

For the evaluation of Ordovician acritarch biodiversity, a complete review of the literature has been carried out. The results reflect more regional trends and do not display global diversity patterns.

The relation between the morphology of the Cambro-Ordovician galeate acritarchs and environmental parameters (such as salinity) is analysed in comparison with modern dinoflagellate cysts. The acritarch distribution across certain facies boundaries has been investigated on a Late Silurian carbonate platform (Gotland, Sweden). Some acritarch taxa characterise specific palaeoenvironments. The detailed record of climatic changes in the Late Silurian is reflected by changes in the composition of acritarch assemblages from the Gotland succession. The
sensitivity of acritarchs to environmental changes may represent an important tool for the reconstruction of the Lower Palaeozoic climate.

Upper Ordovician chitinozoan biostratigraphy and palaeobiogeography on the Avalonia and Laurentia palaeocontinents

T. Vandenbroucke, Research Unit Palaeontology, Ghent University, Belgium. Research Assistant of the Fund for Scientific Research – Flanders. Thijs.vandenbroucke@UGent.be

The following gives a small overview of my PhD project, which should reach completion sometime next year. The project focuses on the Ordovician System, as it is at present subject to major stratigraphical revisions. The main objective was (and still is) the study of the chitinozoan assemblages of the newly proposed, or already ratified Global Stratotype Sections and Points (GSSPs) for the different stages of the Upper Ordovician Series. Secondly, I aim to correlate these new GSSPs with the historical type areas of the British Caradoc and Ashgill Series and their subdivisions in the U.K., and to establish concomitantly an Upper Ordovician chitinozoan biozonation for British Avalonia. The latter might then be used to work towards an Upper Ordovician chitinozoan biozonation for the entire Avalonia palaeocontinent, which does not yet exist, but is well established on all other big palaeocontinents for that period in time. As a third objective, Avalonian faunas will be compared with Baltic and Gondwana assemblages and the why, when and how of the differences found will be scrutinised.

As decided at the ninth ISOS meeting in Argentina (2003), the Upper Ordovician Series will consist of three stages. The new GSSP for the base of the Upper Ordovician, or the base of the at present unnamed “fifth stage”, has been ratified by the ICS/IUGS; it is localized along Sularp Brook, nearby Fågelsång in Southern Sweden. The section yielded a quite well preserved chitinozoan assemblage with a typical Baltoscandic signature. This assemblage has been fully studied and was published last month (Vandenbroucke, 2004). A GSSP for the base of the middle stage (“stage six”) has not yet been proposed, but awaiting formal proposals, the Hartfell Score Section (near Moffat, Southern Uplands, Scotland) has been examined. Results were rather poor, but the yielding samples are situated near the discussed boundary, allowing correlation with middle Caradoc sections on both Baltica and Northern Gondwana. The Chinese Wangjiawan section is the GSSP candidate for the base of the Upper stage of the Upper Ordovician Series, which has been named Hirnantian at the already mentioned ISOS meeting. A batch of samples from the Wangjiawan section unfortunately yielded few chitinozoans, and allows only correlation of the pre-Hirnantian beds with comparable Laurentian sections (Vandenbroucke, Chen & Verniers, submitted). These first findings do not exclude further studies and more accurate biostratigraphical results.

As for the British part of the study, several classical key sections in British stratigraphy, as well as a few fairly new ones have been investigated during the last three years. Amongst these the Shelve Inlier sections (good correlation with Baltica and North Gondwana using chitinozoans) and the Onny Valley section (revision of previous chitinozoan studies with spectacularly good material from the type Caradoc area is in progress) are stratigraphically the lowest. Some of the most important sections are found within the type Ashgill area in the
Cautley district, Northern England. These sections yield diverse assemblages of chitinozoans from at least seven chitinozoan biozones cited from bottom to top, and containing Baltoscandic, endemic Avalonian as well as Gondwanan faunas: the *F. fungiformis*, *T. ?bergstroemi*, *C. rugata*, *S. fossensis*, *B. umbilicata* sp. n., *A. merga* and *B. postrobusta* biozones (Vandenbroucke et al. 2003). In addition to these data, the type Pusgillian section (Cross Fell Inlier, Northern England) yielded important additional information, among others confirming the presence of the *F. fungiformis* zone and allowing correlation with the Welsh Borderland sections (Vandenbroucke, Rickards & Verniers, in prep.).

A recently remapped Caradoc succession between Fishgard and Cardigan, southwest Wales, has potential to correlate well with some of the above sections, on the basis of chitinozoans tentatively assigned to the *C. reticulifera* subzone, *F. fungiformis* and *T. ?bergstroemi* zones. The same correlation potential with the type Ashgill area exists for the Greenscoe section in the Lake District (Northern England).

All biozones are well correlated with the existing biozonal schemes based on other fossil groups present. When possible, samples, taken from recent graptolite collections (Bettley et al., 2000; Rickards, 2002; Williams et al., 2003) have been used, in order to obtain a perfect calibration between both groups.

Future work (in 2005) will focus mainly on refining the biostratigraphical frame and the systematic comparison of problematic specimens with existing collections. The study of additional sections such as the Whitland road cutting, Meidrim village section and Rhayadar area, will probably allow to fill gaps in the biozonation.

As more data become available from the Caradoc and Ashgill sections, the establishment of a biozonation with chitinozoans for the British part of Avalonia becomes feasible; it will contribute to the final Upper Ordovician chitinozoan biozonation of Avalonia.

References


*Palynology of the Devonian and Carboniferous rocks of Uspallata-Iglesia and Paganzo basins, northwestern Argentina*

Cecilia Rodríguez Amenábar, Buenos Aires, Argentina. amenabar@gl.fcen.uba.ar

The main objectives are the establishment of biostratigraphic units for the Devonian and Early Carboniferous and, based on new fossiliferous localities, to continue the analysis and improvement of the biostratigraphic schemes previously proposed for the Carboniferous of Argentina. The detailed study of these microfloras bearing spores and microplankton of the Early Carboniferous will allow correlations with other contemporaneous microfloras of South America and other regions in Gondwana (like Australia).

One of the first topics was the study of the Devonian/Carboniferous boundary to characterize the magnitude of the hiatus based on the analysis of the reworked palynomorphs from the Silurian and Devonian deposits into the Carboniferous sections. This issue contributes to the knowledge of the diastrophic and palaeoclimatic events that originated unconformities in the west of Gondwana.

This study also includes palaeoenvironmental aspects, considering among other data, palynofacies analysis for this purpose.

**New books**

*New Directions in Palaeozoic Palynology*

Special Issue in the Journal Review of Palaeobotany and Palynology, serving as proceedings volume for the Lille CIMP Meeting (2002) is now published.

Volume 130, Issues 1-4, Pages 1-299 (July 2004)

Edited by T. Servais, C. Wellman.

Contact T. Servais
(Thomas.Servais@univ-lille1.fr)

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**Morphology, classification and description of form-genera of Late Paleozoic miospores**

Oshurkova M.V.


Illustration from Oshurkova (2003)

The morphology of fossilized spores and pollen grains is discussed, notions and terms used in miospore description by means of light microscope are also specified, and a glossary is given. Rules of creating morphological miospore classification are discussed. It is suggested that morphological classification of dispersed miospores of R. Potonie and G. Kremp should be used with more precise definitions in accordance with strict rules of classification construction – distinguishing taxa of one hierarchical level using one morphological feature. Morphological features necessary and sufficient for distinguishing all taxa of the supergeneric level should be mentioned in their characterization. Unified descriptions of diagnoses of Devonian, Carboniferous, and Permian miospore form-genera are published. Basic species composition of a genus...
is given with works containing first description of the species as well as information on geographical and stratigraphic position and dimensions of miospores described in this work. As a result of the revision of species descriptions published earlier, many of them have been newly grouped into form-genera in accord with the current understanding of morphological features. Lists of basionym species are compiled with corresponding species in modern nomenclature. Lists of species most frequently used in the modern nomenclature are given. Index of genera-synonyms is compiled with the indication of a corresponding genus where to they are assigned.

Descriptions of 11 new taxa of suprageneric level are resulted, as well of 345 form-genera of miospores of Devonian, Carboniferous and Permian; 17 form-genera are emended and 12 are new. Information on 2364 species is given and for 628 the new combinations are given.

The book can be used by palynologists and geologists in biostratigraphic studies of Late Paleozoic deposits, and as a textbook.

Atlas of the miospores from diamondiferous deposits of Upper Paleozoic of Western Yakutian

M.V. Oshurkova, T.A. Chernaya.

The work includes descriptions of dispersed miospores from diamondiferous deposits of the Upper Palaeozoic of Western Yakutian. It contains a section auditing the nomenclature of Carboniferous and Permian miospores of Angaraland. The descriptions of three new form-genera and 24 new species are given. The descriptions of 171 other species, are also given.

The book is intended for geologists and palynologists who study Carboniferous and Permian deposits.

To order the books, or for further information contact M.V. Oshurkova: Maya.Oshurkova@vsegei.ru

More contributions
Mike Stephenson

Please contribute articles to the Newsletter. Items on new techniques, research, book reviews and ideas are all welcome.
Accounts presented at IPC 2004

2003 AND 2004

PROVISIONAL (3 JULY 2004)

Previous accounts CIMP newsletter Winter 2002

Accounts closed 13 Dec 2002  Euros……………………..+1676.07

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PLEASE PAY YOUR MEMBERSHIP FOR NEXT YEAR(S) TO THE TREASURER
8 EUROS PER YEAR