Commission Internationale de Microflore du Paleozoique

NEWSLETTER 38

President: Dr. B. Owens, British Geological Survey, Keyworth, Nottingham NG12 5GG, England.

Secretary General: Dr. P. Brugman, Laboratory of Palaeobotany & Palynology, State University of Utrecht, Heidelberglaan 2, 3584 Utrecht, The Netherlands.

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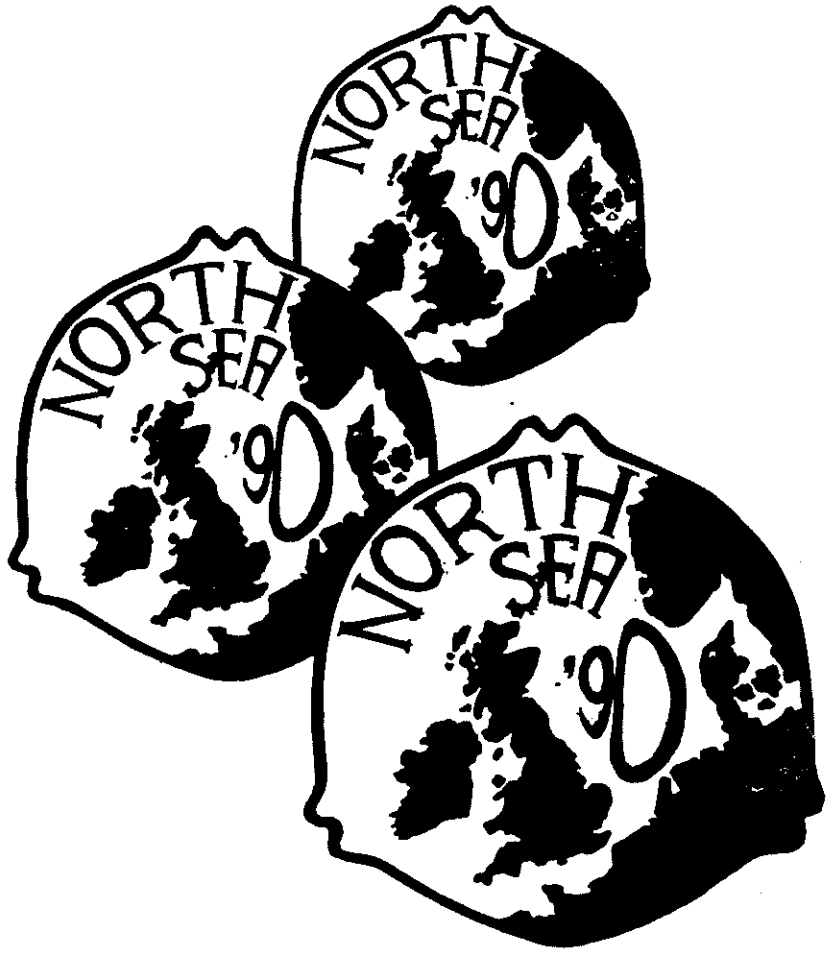

Editorial

It is a pleasure to start the new CIMP year with the good news that one of our long-standing members, Professor Henk Visscher, has been elected as the new president of the International Federation of Palynological Societies at the recent 7th IPC in Brisbane. We extend our warmest congratulations to Henk and wish him well during his four year term. His appointment will ensure that CIMP will continue to be able to play an important role in the global development of palynology at a time when our science is under a variety of threats in both the industrial and academic worlds. Not only is it important that IFPS is an effective global voice for palynology but also that it should foster a greater regional independence amongst palynological societies. As the number of active workers comes under threat, it is important that all palynological groups join together to produce an effective regional voice to ensure our contribution is made. Fortunately CIMP has a long history of such cooperation.

Not only is this issue of the Newsletter a large one, it is an opportunity for us to announce our next meeting, "North Sea '90", which will be held at BGS in Nottingham in 1990, and also the latest CIMP publication.

For eight years, about 15 of our members have been involved with palynologists and geologists from the Arabian Gulf Oil Company in Benghazi, Libya on a study of the Subsurface Palynostratigraphy of Northeast Libya. After some delays in the final stages of preparation this volume is now published. (See details on separate sheet on how to obtain a copy). I am pleased to have this opportunity to thank the management of Arabian Gulf Oil and in particular Dr A Asbali (Exploration Director) for the help and generous financial support to enable the results of this study to be published.

Finally the start of any new year is always a good time to remind you of the need to pay your 1989 subscription. Once again there will be no increase in the rates, which have now been frozen for almost 17 years. To maintain that record we depend on receiving your prompt payment which can for your convenience be sent to either Bob Turner in Calgary, Stan Loboziak in Lille, Michel Vanguestaine in Liege, Pim Brugman in Utrecht or Paul Hill in Derby. The rates for 1989 will be £3, 30 French Francs, 350 Belgian Francs, 10 Dutch Guilders, 10 German Marks or 6 Dollars (just in case you've forgotten from the last time you paid!).

67.15 6.26

B Owens

18.72 21,11 40,50.

ELECTION OF NEW CIMP PRESIDENT

In accordance with the informal rules of CIMP it is necessary in 1990 for the current President to retire and be replaced. The President serves for a period of four years with the option of an extension of a further two years.

In order that this change might take place smoothly at the CIMP meeting in Nottingham in April 1990, the long procedure must be started now. This procedure as laid down in our rules is set out below.

Nominations for any candidate must be signed by three members of CIMP, from at least two different laboratories.

The candidate must be approached and express his agreement prior to the nomination being submitted.

Notice of the election of a new President should be made in the Newsletter approximately 12 months before the change.

Nominations should be sent to the Secretary (Dr P Brugman, Laboratory of Palaeobotany & Palynology, State University of Utrecht, Utrecht, The Netherlands) before 31st July 1989.

The Secretary will organise a postal ballot for all CIMP members through the Newsletter in the Autumn of 1989.
In the event of only one nomination being received that candidate will be elected unopposed.

Please cooperate by making your nominations as soon as possible.

Thank you.

FUTURE MEETING

FIRST ANNOUNCEMENT AND CALL FOR PAPERS

XII
INTERNATIONAL CONGRESS OF CARBONIFEROUS-PERMIAN STRATIGRAPHY AND GEOLOGY (XII-ICCP)

September 22-27, 1991
Buenos Aires - Argentina

Invitation

The XII International Congress of Carboniferous-Permian Stratigraphy and Geology will be held September 22-27, 1991, in Buenos Aires, Argentina. The Permanent Committee and the Argentine Organizing Committee extend you a cordial invitation to attend this event.

Co-sponsors

1. National Research Council for Science and Technology, Argentina.
2. National Academy of Sciences, Córdoba, Argentina.
3. Argentine Geological Society.
4. Argentine Paleontological Society.
5. Latin America Association for Paleobotany and Palynology
6. Permanent Committee of the International Congress of Carboniferous Stratigraphy and Geology.

Topics

Paleontology, Paleoecology and Biostratigraphy.
Paleogeography and Paleoclimates.
Glacial deposits.
Sedimentology and Geochemistry.
Economic Geology (organogenic and other resources).
Coal Petrology.
Magmatism and Geotectonics
Paleomagnetism and Geochronology.

Special Symposia will be organized at the request of International Working Groups on Systemic Boundaries, subdivisions of the Carboniferous and Permian and the Evolution of the Gondwana during the Late Paleozoic.

Languages

English is the official language of the Congress. The Organizing Committee is considering the possibility of having simultaneous translation from Spanish into English during some of the technical sessions.

Pre-and Post-Congress Field Excursions

Several field excursions to visit important Carboniferous-Permian sections in Argentina Bolivia and Brasil will be arranged.

Other meetings

There will be time available for meetings during the Congress for International Organizations or Working Groups (IUGS Subcommissions on the Carboniferous and Permian, International Committee of Coal Petrology, Comission Internationale de la Microflore du Paléozoique, IGCP projects and others). Please contact the Organizing Committee with sufficient time for convenient scheduling.

Accompanying members

During the Congress, accompanying members will have the opportunity for short excursions, cultural events and tours.

Registration fee

U$S 250 (subject to change).

Correspondence

For further information please contact
Dr. Sergio Archangelsky, Convenor, XII-ICCP,
Museo Argentino de Ciencias Naturales,
Av. A. Gallardo 470, Buenos Aires (1405),
Argentina.

JARDIN BOTANICO
DE
CORDOBA

UPPER PALAEOZOIC PALAEOBOTANICAL MEETING

First Circular

(CORDOBA, September 1989)

Venue: Jardín Botánico de Córdoba

Dates: mid-September following upon the European Palaeobotanical meeting organised by C. Alvarez Ramis (University of Madrid)

ORGANISING COMMITTEE:

R.H. Wagner (Córdoba)

C. Alvarez Vázquez (Córdoba, Oviedo)

M.C. Diéguez (Mus. Nac. Ciencias Nat. Madrid)

M.J. Lemos de Sousa (Univ. Porto)

ACCOMMODATION:

University Hall of Residence within walking distance of the Botanical Garden. Price (subject to change until second and final circular): 3,500 pts for individual use of double bedroom with private bathroom (continental breakfast included; 4,500 pts with full board and washing included); 2,500 pts per person for shared use of bedroom as above (continental breakfast included; 3,500 pts with full board and washing included). Information about hotels in Córdoba will be given in the second (final) circular.

PROGRAMME:

Day 1 - Travel from Madrid to Córdoba which will include a visit to the Emma Opencast in Puertollano where Sporangiostrobus and other material can be collected from a tuff band. Age: Stephanian B/C.

Day 2 - Jardín Botánico de Córdoba: General lecture on the Distribution of Carboniferous and Permian Floras in the Iberian Peninsula. Presentation of Papers on Upper Palaeozoic Floras in different parts of the Iberian Peninsula. Poster Session.

Day 3 - Presentation of papers on Upper Palaeozoic Floras in different parts of Europe (and North America?). Poster Session.

Day 4 - Symposium on Floral Distribution in the Upper Palaeozoic (in the morning); Visit to the historical centre of Córdoba (in the afternoon). Official Dinner in the evening.

Day 5 - Field Trip to Sierra Morena: Peñarroya Coalfield (Westphalian B) and Valdeinfierno (Tournaisian). Dinner and Accommodation in Llerena.

Day 6 - Field Trip to Sierra Morena: Guadalcanal (Permian) and Berlanga (Viséan).
Dinner and Accommodation in Córdoba

AIM OF THE MEETING:

To acquaint palaeobotanists with the fossil floras recorded from the Carboniferous and Permian of the Iberian Peninsula. Apart from a general lecture setting the scene, posters will be prepared and material displayed of floras ranging in age from Tournaisian to early Permian (including fossil remains studied in Córdoba, Porto, Oviedo, Madrid, Lille and Paris). Palaeogeographical considerations will be emphasised in relation to the general topic of Floral Provinces and Palaeoecology.

FACILITIES:

The research building of the Botanical Garden offers facilities for lectures, displays and poster sessions. Its setting in the Botanical Garden provides for congenial surroundings and is of interest to Botanists wishing to see endemic species of the West Mediterranean area and the Canary Islands.

AREA AT LARGE:

Córdoba is a historical city founded by the Romans on the banks of the Quadalquivir River. For a long time the capital city of Moorish Spain (the Western Caliphate), its scientific and cultural traditions made it the funnel for Greco-Roman and Arab knowledge to reach Western Europe in the Dark Ages. The ancient Mosque (Mezquita) is one of the outstanding historical monuments in Spain and Europe in general. Roman mosaics may be seen in the Christian palace-fortress, Alcázar de los Reyes Cristianos. Other important buildings are the Palacio de Viana with its many patios and, outside the city, the partially restored ruins of Medinat Azahara, the summer residence of the Caliphs.

SECOND (Final) CIRCULAR:

People wishing to attend the Upper Palaeozoic Palaeobotanical Meeting in Córdoba are requested to fill in the provisional Registration Form which is to be sent to C. Alvarez Vázquez, Jardín Botánico de Córdoba, Apartado 3.048, 14071 Córdoba, Spain. The final circular will be sent out early in 1989.

REGISTRATION

Fee will include travel from Madrid to Córdoba with lunch at Puertollano, Abstracts of Papers, and the Official Dinner with Entertainment. This may come to 19.000 pts (c $150).

PUBLICATIONS:

Depending on the level of attendance, the possibility of printing selected papers will be looked into.

PALAEOZOIC ABSTRACTS OF PAPERS

PRESENTED AT THE AASP HOUSTON MEETING

NOVEMBER 1988

CAMEROSPORITES VERRUCOSUS MADLER - A ZONE FOSSIL FOR U.S. LATE TRIASSIC STRATA

Ronald J. Litwin[1]* and Judith E. Skog[2]
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[2] Biology Department, George Mason University, Fairfax, Virginia 22030

Light and electron microscope studies of specimens of Camerosporites verrucosus Madler 1964 from the Manassas Sandstone of Maryland and Camerosporites secatus Leschik emend. Scheuring 1980 from the lower part of the Chinle Formation of Arizona have confirmed that the two species are separate and distinct. Noteworthy morphological characters in C. verrucosus include the presence of a well-developed tetrad scar, fusion of the equatorial gemmae and verrucae to produce a nearly smooth, thickened equatorial ring, and uniform inflation of the distal surface. C. verrucosus had smaller sculptural elements and is larger (42 vs. 27 um mean equatorial and 33 vs. 21 um mean polar axis lengths) than C. secatus.

C. secatus has been recovered worldwide from Ladinian and Carnian strata. No definite post-Carnian occurances of C. secatus have been published, nor has C. verrucosus been isolated from any Carnian or Jurassic strata in this study. C. verrucosus has been reported from the Canadian Northwest Territories, the Newark Supergroup of the eastern U.S., and the Oberer Mittelkeuper of Germany. In the more complete stratigraphic sections examined from the conterminous U.S. to date (Chinle Fm., Arizona and Utah; Tecovas and Trujillo Fm., Texas), the palynomorphs recovered exhibit a consistent succession from monosaccate-dominated or nonstriate bisaccate-dominated assemblages containing C. secatus to nonstriate bisaccate-dominated assemblages containing C. verrucosus. The possibility of stratigraphic overlap of these species is still being investigated. The successor assemblage, although geographically widespread, has not been widely documented; it may represent an early Norian assemblage valuable for biostratigraphic correlation.

ULTRASTRUCTURE OF FOSSIL DISPERSED MONOSULCATE POLLEN FROM THE TRIASSIC CHINLE FORMATION OF SOUTHERN UTAH

Michael S. Zavada
Dept. Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70504

A diverse assemblage of monosulcate pollen was recovered from the Triassic Chinle Formation of Southern Utah. A variety of these pollen types have been studied with SEM and TEM. Many of these taxa exhibit features that are commonly associated with angiosperms, e.g., rugulate exine sculpturing and structured pollen walls. Some of these pollen types have a suite of features that converge on the pollen morphology of some dicots and monocots. The occurence of pre-Cretaceous dispersed pollen from the Chinle Formation and from various other localities with convergent angiosperm characters will be examined in the context of what is presently known about the origin of angiosperms as reflected in the dispersed pollen and megafossil record.

GLOEOCAPSOMORPA PRISCA ZALESSKY, GEN. ET SP. NOV.: A RESTUDY--TAXONOMY, GEOCHEMISTRY, AND PALEOECOLOGY

Clinton B. Foster[1], Jackie D. Reed[2], and Reed Wicander[3]*
[1] Western Mining Corporation, Ltd., 168 Greenhill Road, Parkside, South Australia, 5063

[2] Arco Exploration and Technology Company, 2300 West Plano Parkway, Plano, Texas 75075

[3] Department of Geology, Central Michigan University, Mt. Pleasant, Michigan 48859

Gloeocapsomorpha prisca Zalesky ex Foster, Reed & Wicander gen. et sp. nov. is validated and described from Middle Ordovician kukersites of the Baltic Shale Basin, Estonia. Gloeocapsomorpha gen. nov. was a colonial organism, and its fossil remains are represented by at least three morphotypes delineating various growth and life cycle stages. Gas chromatography of hydrocarbons from pyrolised kukersite yields a diagnostic low molecular weight, odd-dominated suite of n-alkanes, maximizing at C19. Recognition of the genus incorporates this biogeochemical criteria. Morphological and biogeochemical characters of Gloeocapsomorpha show strong similarities with certain species of the modern cyanobacteria Entophysalidaceae. Entophysalis major, a mat-forming, and sometimes stromatolite-forming, cyanobacterium is suggested as a modern analog of G. prisca.

PALEOECOLOGIC AND BIOSTRATIGRAPHIC SIGNIFICANCE OF CHITINOZOANS AND MICROPLANKTON FROM THE LOWER SILURIAN OSGOOD MEMBER OF THE SALAMONIE DOLOMITE, INDIANA AND KENTUCKY, U.S.A.

Gordon D. Wood
Amoco Production Co., P. O. Box 3092, Houston, Texas 77253

The Osgood Member of the Salamonie Dolomite contains the Pterospathodus amorphognathoides-Kockelella ranuloformis conodont zones, which spans the Llandovery-Wenlock boundry. In the study area this stratigraphic unit grades from an interbedded tan dolomite-greenish dolomitic shale in the north to a greenish-gray shale in the south. Samples from six exposures yielded a diverse and an essentially thermally unaltered palymorph assemblage. Palynomorph diversity increases from north to south within the study area and this is considered a reflection of the lithofacies.

Microplankton (acritarchs and prasinophytes) recovered include the genera Ammonidium, Baltisphaeridium, Cymatiosphaera, Deunffia, Domasia, Duvernaysphaera, Gracilisphaeridium, Hoqklintia (sic), Leiofusa, Multiplicisphaeridium, Onandagella, Oppilatala, Psenotopus, Pterospermella, Schismatosphaeridium, Tunisphaeridium, Tylotopalla and Visbysphaera. Chitinozoans are assigned to Ancyrochitina, Angochitina, Conochitina, Desmochitina and Margachitina. Gracilisphaeridium encantador, a form that is prevalent in the upper Llandovery of the United States, was recovered only in the middle and lower parts of the Osgood. Margachitina margaritana occurs in the upper portion of this stratigraphic unit. The base of M. margachitina has been reported at, or near, the Wenlock-Llandovery boundary in Scandinavia, Estonia, France and England. The presence of these two species in the Osgood corroborates the ages established by the conodonts.

CHITINOZOANS AND MICROPLANKTON FROM THE SILURIAN VARGAS PEÑA SHALE (ITACURUBI GROUP), CHACO BASIN, PARAGUAY

Gordon D. Wood[1], Merrell A. Miller[2], David A. Sawicki[1], Chris L. Shineldecker[1]
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[2] Amoco Production Co., P. O. Box 3385, Tulsa, Oklahoma 74102

This report is the first identifying Silurian palynomorph from Paraguay. A sample of the kaoliniteoe-rich, micaceous Vargas Peña Shale was collected at its type locality, the Vargas Peña Quarry, near Ypacaray. This unit is locally famous for its well-preserved megafossils. Vargas Peña invertebrates considered to have biostratigraphic significance include the graptolites Climacograptus innotatus var. brasiliensis and Diplograptus modestus and the trilobite Calymene boettneri, which together suggest this unit is Llandovery-Wenlock in age. The microplankton (acritarchs and prasinophytes) isolated from Vargas Peña Shale have been assigned to Ammonidium, Baltisphaeridium, Carminella, Cymatiosphaera, Cymbosphaeridium, Dactylofusa, Dictyotidium, Domasia, Duvernaysphaera, Elektoriskos, Geron, Leiofusa, Neoveryhachium, Onondagella, Oppilatala, Pterospermella, and Veryhachium. The chitinozoans include representatives of genera Angochitina, Ancyrochitina, Eisenackitina, Linochitina and Pterochitina. Forms similar to the ancyrochitinids and pterochitinids from the Vargas Peña Shale have been previously reported from the Lower Silurian from North Africa and Florida.

LUDLOW AGE ACRITARCHS AND SPORES FROM THE PITTSFORD SHALE, NEW YORK

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The greenish-black, eurypterid-bearing Pittsford Shale is now considered the lowest part of the Vernon Formation (Salina Group.) In Monroe County, New York, the Pittsford occurs discontinuously between the predominately red clastics of the Vernon Formation and the underlying dolomites of the Lockport Group. The presence of the conodont Polygnathoides siluricus (Pa element) limits the Pittsford to a late early to early late Ludlow age. Based on the range of Dilatisphaera willieraeae and Florisphaeridium cf. F. castellum in Ludlow type area, an age no younger than early Ludlow is suggested for the assemblages examined. Other acritarchs present include Cymatiosphaera spp., Dictyotidium sp., Diexallophasis remota, Duvernaysphaera aranaides, Elektoriskos sp., Helosphaeridium citrinipelatum, Leiofusa tumida, Leprotolypa sp., Lophodiacrodium pepino, Multiplicisphaeridium sp., Neoveryhachium sp., Polydeunffia cf. P. eisenackii, Pterospermella sp., Quadraditum fantasticum, and Schismatosphaeridium perforatum. Ambitisisporites avitus, A. dilutus, Brochotriletes sp., Synorisporites sp., and Tetraletes sp. comprise the terrestrial component of the assemblage. A comparable assemblage was identified from the McKenzie Formation, Central Applachians comprise the terrestrial component of the assemblage.

MICROPLANKTON AND SPORES FROM THE WOODFORD SHALE (DEVONIAN) OF THE TOBOSA BASIN, SOUTHEAST NEW MEXICO-SOUTHWESTERN TEXAS, U.S.A.

Gary W. Barker* and Gordon D. Wood
Amoco Production Co., P. O. Box 3092, Houston, Texas 77250

The Tobosa Basin, an early Paleozoic structural feature, is borderedto the northwest and east by the Pedernal Massif and the Texas Arch, respectively. To the south the Tobosa Basin opened into the Marathon-Ouachita mobile belt. During the Upper Devonian this basin was covered by an extensive sea in which the dominately brown-black, fissile shale of the Woodford was deposited. Core samples from the Texas subsurface yielded the following microplankton (acritarchs and prasinophytes) genera: Craterisphaeridium, Cymatosphaera, Dallydium, Dictyotidium, Duvernaysphaera, Gorgonisphaeridium, Lophosphaerdium, Maranhites, Micrhystridium, Multiplicisphaeridium, Navifusa, Oppilatala, Polyedryxium, Pterospermella, Quisquillites, Stellinium, Uncinisphaera, Unellium, and Veryhachium. Spores present are assigned to Ancyrospora, Auroraspora, Calamospora, Convolutispora, Geminospora, Laiphospora, Retusotriletes, Samarisporites, and cf. Vallatisporites. The presence of Geminospora lemurata, G. spinosa, Laiphospora membrana, Samarisporites triangulatus, Dallydium pentaster, Maranhites brasiliensis, M. stockmani, and Unellium winslowiae suggests a Frasnian age for the interval studied. This is corroborated by the presence of conodonts indicative of the lower Frasnian Polygnathus asymetricus zone. Although similar acritarch elements have been reported from several geographic areas the total palynomorph assemblage is most closely comparable to that of the Lime Creek Formation of Iowa.

PALEOGEOGRAPHY OF ORDOVICIAN CHITINOZOANS

Aicha Achab* and Rudolf Bertrand
INRS-Georessources, 2700 rue Einstein, Sainte-Foy, Quebec, Canada

Comparison of Ordovician chitinozoan microfauna from North Africa, southwestern Europe, Bohemia, Baltoscandia, eastern Canada, United States, Spitsbergen and Australia shows similarities between fauna described from regions located on the north Gondwana margin. These fauna are different from those encountered in regions occupying a low latitude position. These conclusions are based on the comparison of regional zonation, regional stratigraphic distributions and the entire microfauna described in a specific region. Similarities and dissimilarities are quantified by the evaluation of the number of species in common, calculation of similarity coefficients and multivariated data analysis (correspondence and hierarchical clustering analyses.)

MORPHOLOGICAL EVIDENCE IN EARLY PROTEROZOIC ROCKS FOR EUKARYOTIC LIFE

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Thin sections and acid residues of Early Proterozoic rocks expose morphological structures that suggest the early existence of eukaryotic algal and animal life. Thin sections of the Michigamme coal from the Iron River District, Michigan, contain black carbonized balls that are about 70 um in diameter. Under reflected light, the arrangement of numerous crystallites in the balls suggests a colonial algal origin. These features resemble those of Botryococcus, a green alga that is prevalent in the boghead coal of younger rock sequences. A thin section of a sample from the Gunflint Iron-Formation from Thunder Bay, Ontario, contains a worm-like striated microfossil that is 63 um in length. HCl-HF residues of black shale from Thunder Bay contain pellet shaped microfossils averaging 49 by 119 um in size from the Rove Formation and 42 by 98 um in size from the Gunflint Iron-Formation. The pellet-shaped microfossils resemble ciliate protozoans, such as Metacystis; however, the abundance of these microfossils indicates that they are more likely fecal pellets from metazoans such as Capitella-like benthic polychaetes or plankton polychaetes or planktonic microcrustaceans such as copepods.

This morphological evidence suggests the emergence by 1.9 Ga of eukaryotic algae and animals, a date earlier than the currently accepted 1.4 Ga for the first appearance of eukaryotes. Chemical evidence in the form of biomarkers, guided by such morphological data, is crucial for a better understanding of organic remains in Early Proterozoic rocks.

CHITINOZOANS FROM THE BEDINIAN FORMATION (UPPER ORDOVICIAN) SOUTH-EASTERN TURKEY

Merrell A. Miller[1] and Nihat Bozdogan[2]
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[2] Turkiye Petrolleri A. O., Arastirma Merkezi Gr. Bsk., Mudafaa Cad. No. 22, Bakanliklar, Ankara, Turkey

Chitinozoans, indicative of an upper Ordovician (Caradoc) age, were isolated from cores of the Bedinian Formation (Alcakale No. 1 well, southeastern Turkey). The Caradoc age is compatible with previous correlations using trilobites and other megafossils from the Bedinian Formation outcrop belt between Derik and Mardin. The composition of the Bedinian chitozoan fauna is similar to those from the Louredo Formation, Portugal, and the Pont-de-Caen Formation, Normandy. The abundant, compressed, but thermally unaltered chitinizoan fauna includes Angochitina n. sp., Acanthochitina barbata, Belonechitina n. spp., Calpichitina lenticularis, Conochitina homoclaviformis, Cyathochitina sp., C. kuckersiana, Desmochitina cocca, D. piriformis, Jenkinochitina tanvillensis, Rhabdochitina cf. R. magna, and Tanuchitina sp. The Bedinian chitinozoan fauna has provincial affinities with other upper Ordovician faunas in the circum Mediterranean region.

SELECTED EARLY ORDOVICIAN ACRITARCHS FROM THE BARBWIRE TERRACE, CANNING BASIN, WESTERN AUSTRALIA

Reed Wicander[1] and Clinton B. Foster[2]
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[2] Western Mining Corporation, Ltd., 168 Greenhill Road, Parkside, South Australia, 5063

A well-preserved acritarch assemblage was recovered from the subsurface Lower Ordovician Nambeet Formation, Canning Basin, Western Australia. While not particularly diverse, the acritarch assemblage comprises ten species, all but one of which are new. These species are distributed among five known genera; Aryballomorpha, Athabascaella, Gorgonisphaeridium, Lua, and Rhopaliophora, and one new genus. The new genus exhibits a new method of excystment.

This acritarch assemblage is similar in generic composition to an Early Ordovician assemblage described by Martin and Yin (1988) from north-eastern China. It is, however, much different in composition from the late Early or Middle Ordovician Canning Basin assemblage of Playford and Martin (1984) and the Early Ordovician Georgina Basin, Queensland assemblage of Playford and Wicander (1988).

Our acritarch assemblage is the first report of the distinctive acritarch genera Aryballomorpha, Athabascaella, and Lua from Australia.

EQUIVALENCES BETWEEN THE REFLECTANCE OF VITRINITE, ZOOCLASTS (CHITINOZOANS, GRAPTOLITES AND SCOLECODONTS) AND THE COLOR ALTERATION OF PALYNOMORPHS (SPORES AND ACRITARCHS)

Rudolf Bertrand* and Aicha Achab
INRS-Georessources, 2700 rue Einstein, Sainte-Foy, Quebec, Canada

Paleozic marine sequences studied in outcrop and wildcats of northeastern Gaspe Peninsula (Quebec Appalachians), Northwest Territories and Yukon (Canada) yield kerogen composed in part of vitrinite and palynomorphs (spores, acritarchs, chitizoans and scolecodonts), on both of which reflectance measurements were taken.

The comparisons between random measurements show that reflectance of chitinozoans is similar to that of telinite (vitrinite with a cellular texture) and that the reflectance of scolecodonts is significantly lower than that of telinite in the lower portion of the studied range, but seems closer in its upper portion. As shown by previous studies, reflectance of graptolites is slightly lower than that of telinite.

In the study area, thermal alteration index based on spore coloration (TAI) is, as suggested in literature, highly correlated with the reflectance of telinite. On the other hand, for equal rank, the acritarch alteration index (AAI) should have lower values than the thermal alteration index of spores. The acritarchs are also better preserved in sequences of higher maturation level (Ro > 2 %) than suggested by the literature (Ro < 1.4%).

THE APPLICATION OF PALYNOLOGY TO STRATIGRAPHIC INTERPRETATION IN THE MARATHON OROGENIC BELT, TEXAS

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The Marathon Orogenic Belt contains exploration targets which occur in Paleozoic rocks that were deposited as sediments in continental slope to ocean basin settings and subsequently deformed into complexly folded and imbricated thrust-dominated structures. Because seismic stratigraphy is not a totally successful tool in the region, palynology provides the method of correlation in subsurface mapping and possible reservoir occurrence prediction. Fossils utilized include acritarchs, chitinozoans, and spores. They occur throughout different lithologies which represent contrasting and changing depositional settings; from starved basin chert/clay-mudstone associations (Caballos Novaculite) to rapid fill siliciclastic flysch (Tesnus Formation).

Ordovician and Middle to Late Devonian acritarchs are common in well cuttings throughout the Marathon structural frontal zone. They help locate and substantiate repeated thrust packages of Devonian Caballos Novaculite and Ordovician Maravillas Chert, which together act as a structurally competent unit, and the subjacent, structurally incompetent Ordovician Woods Hollow Shale. These acritarch-bearing units are often structurally interleaved with the spore-bearing Mississippian-Pennsylvanian Tesnus Formation. The Tesnus, like the Woods Hollow Shale, is also a structurally incompetent unit and its subsurface presence and structural modification is substantiated by spore content, a task not always possible using log information alone.

It is suggested that further integration of palynological with other subsurface data will provide an accurate evaluation of the stratigraphic relationships in the Marathon Orogenic Belt and help identify boundaries between major structural packages.

PALYNOLOGY OF SOME UPPER PENNSYLVANIAN OUTCROPS FROM THE MIDCONTINENT REGION, U.S.A.

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Outcrop samples from approximately 50 localities in northcentral Texas, Oklahoma and Kansas have yielded diverse and well preserved pollen and spore assemblages. Outcrops collected range in age from Permo-Pennsylvanian (Harpersville Fm, northcentral Texas) to lowermost Missourian (Seminole Fm, Oklahoma).

The upper Virgilian (upper Cisco) in northcentral Texas (Harpersville Formation) and Kansas (Pillsbury Shale) can be recognized by the common occurence of Savitrisporites majus, Columinisporites cf. C. heyleri, C. peppersi and Lundbladispora cf. L. gigantea. Vittatina was notably absent.

Angulisporites, previously considered a reliable Missourian (Canyon) marker, is now known to occur sporadically throughout the Virgilian (Cisco) section (Harpersville Formation and Finis Shale in north-central Texas; Doniphan Shale, Scranton Shale, and Sibley Coal in Kansas; Vamoosa Formation in Oklahoma). This taxon should no longer be considered an indisputable Missourian marker.

The Placid Shale (upper Canyon; upper Missourian) in northcentral Texas is characterized by the common occurence of Angulisporites and Centonites symmetricus. The latter occurs as a very rare entity in the Finis Shale (lowermost Cisco). This horizon may represent the top of its range zone. However, the co-occurence of Angulisporites and Centonites symmetricus, in any significant abundance, is probably indicative of Missourian (Canyon) time.

Lower Missourian (Canyon) outcrop samples were examined from Kansas (Ladore Shale; Pleasanton Group Shale) and Oklahoma (Coffeyville Formation; middle and lower Seminole formations). Although Angulisporites ranges into the lower Missourian, Centonites symmetricus is notably absent. Lower Missourian strata are also characterized by the presence of Triquitrites spp., Vestispora fenestrata and Lycospora.

THE PERMIAN-TRIASSIC BOUNDARY OF ISRAEL: A STRATIGRAPHIC APPROACH

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The Permian-Triassic boundary in Israel represents a continuous sedimentary sequence in the subsurface of Israel. Most Permian palynomorphs, however, become extinct at this transitional zone, which indicates a hiatus whose significance is not yet understood. In the Triassic, an entirely new suite of palynomorphs of Scythian (Early Triassic) age occurs. The sequence of events at the Permian-Triassic boundary of Israel is reflected by palynology in the following successive order: (1) the extinction of most Late Permian palynomorphs, including well-established markers such as Klausipollenites schauberqeri and Lueckisporites virkkiae; (2) the occurence of a diverse assemblage of Protohaploxypinus at the top of the Late Permian interval; (3) the occurance of thin, but indicative horizons rich in fungal spores at the boundary itself or slightly above it; (4) the occurence of Early Triassic assemblages, dominated by lycopode spores such as Kraeuselisporites spp., and Endosporites pappillatus; (5) the first occurence of acritarchs (presumably marine phytoplankton), and this in large amounts. The sequence of events across the boundary seems to demonstrate a succession in which the vegetation responds to the strong ecologic stress at the transition from Permian to Triassic times; after the massive extinction of the Permian vegetation, ecologically-resistant fungi prevailed for a short time, followed by lower vascular plants. The sequence ends with the return to "normal" land vegetation and to marine phytoplankton in the oceans.

LYCOSPORA: INTRA- AND INTERSPECIFIC VARIABILITY AND ASSOCIATION OF SPECIES WITH DEPOSITIONAL ENVIRONMENT

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Lycospora microspores were isolated from Lepidostrobus and Flemingites cones of Namurian B-Westphalian D age from England, the Appalachian Basin, and the Western Interior. Study objectives include correlation of in situ Lycospora with species of dispersed spores, determination of intra- and interspecific variability of Lycospora and comparison of Lycospora species isolated from cones preserved in coal balls, ironstone nodules, and compressions. From coal balls, four Lycospora species were isolated: L. granulata, L. orbicula, and L. pusilla (Westphalian D), and L. pellucida (Westphalian A-B). These species differ primarily in relative cingulum breadth, cingulum structure, and size. Clastic lycopods produced Lycospora noctuina (Namurian B), L. rotunda (Westphalian A), L. torquifer (Westphalian A-D), and L. orbicula, L. punctata, and L. trigonoreticulata (Westphalian D.). Ornamentation, cingulum breadth, and cingulum structure are the most important characters in differentiation of clastic Lycospora species. L. orbicula, produced by free-sporing bisporangiate lycopods inhabiting unstable, disturbed habitats, is the only spore species common to both coal-swamp and clastic-dominated environments. Species of coal-swamp Lycospora represent a morphological continuum from small, narrow-flanged species to large, broad-flanged species. Spores from clastic-influenced lycopods exhibit more interspecific variation and, generally, are larger with more massive ornamentation than their coal-swamp counterparts. Such distinct differemces in microspore morphology emphasizes the divergence of coal-swamp and clastic-influenced lycopod lineages. Relative abundance of Lycospora species can be used to infer proximity of coal swamps to areas of higher influx and, for spores with known affinities, to infer relative abundance of source lycopods.

LATE PERMIAN PALYNOMORPHS FROM THE BUCKLEY FORMATION IN THE CENTRAL TRANSANTARCTIC MOUNTAINS

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The Permian age of rocks of the Buckley Formation in the Central Transantarctic Mountains has previously been based on the occurence of Glossopteris. Palynomorphs have been previously reported from purported Buckley age-equivalents, the Mount Glossopteris and Queen Maud Formations in the Central Transantarctic Mountains. Similar assemblages have been reported from the Avery Formation in the Prince Charles Mountains, Antarctica. A Late Permian age was thus proposed for the upper parts of the Buckley in the Beardmore Glacier area that lithostratigraphically correlated with the Mount Glossopteris and Queen Maud Formations. Palynomorphs were reported by others from the Buckley in 1978, however, a detailed listing of the palynoflora was not provided. Shales containing Glossopteris fragments, collected between two

diabase sills in the Buckley Formation on Mount Achernar, yielded over 30 species of spores, pollen and acritarchs. Although subjected to heating during Jurassic volcanism, palynomorphs nevertheless were cleared and identified. Based on recovered taxa, this section correlates with the aforementioned deposits, all of which have elements of Australian Stage 5 (Late Permian) assemblages, including Didecitriletes ericianus, Lophotriletes novicus, Lunatisporites sp., Marsupipollenites triradiatus, Praecolpatites sinuosus, Protohaploxypinus amplus, P. limpidus, P. microcorpus, Striatopodocarpites cancellatus, S. fusus, and S. gondwanensis.

CAMEROSPORITES VERRUCOSUS MADLER - A ZONE FOSSIL FOR U.S. LATE TRIASSIC STRATA

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Light and electron microscope studies of specimens of Camerosporites verrucosus Madler 1964 from the Manassas Sandstone of Maryland and Camerosporites secatus Leschik emend. Scheuring 1980 from the lower part of the Chinle Formation of Arizona have confirmed that the two species are separate and distinct. Noteworthy morphological characters in C. verrucosus include the presence of a well-developed tetrad scar, fusion of the equatorial gemmae and verrucae to produce a nearly smooth, thickened equatorial ring, and uniform inflation of the distal surface. C. verrucosus had smaller sculptural elements and is larger (42 vs. 27 um mean equatorial and 33 vs. 21 um mean polar axis lengths) than C. secatus.

C. secatus has been recovered worldwide from Ladinian and Carnian strata. No definite post-Carnian occurances of C. secatus have been published, nor has C. verrucosus been isolated from any Carnian or Jurassic strata in this study. C. verrucosus has been reported from the Canadian Northwest Territories, the Newark Supergroup of the eastern U.S., and the Oberer Mittelkeuper of Germany. In the more complete stratigraphic sections examined from the conterminous U.S. to date (Chinle Fm., Arizona and Utah; Tecovas and Trujillo Fm., Texas), the palynomorphs recovered exhibit a consistent succession from monosaccate-dominated or nonstriate bisaccate-dominated assemblages containing C. secatus to nonstriate bisaccate-dominated assemblages containing C. verrucosus. The possibility of stratigraphic overlap of these species is still being investigated. The successor assemblage, although geographically widespread, has not been widely documented; it may represent an early Norian assemblage valuable for biostratigraphic correlation.

POLLEN AND SPORES FROM THE LOWER PERMIAN (GEARYAN) OF KANSAS, U.S.A.

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Cyclothemic deposits from the Lower Permian Admire, Council Grove and Chase groups of eastern Kansas have yielded a diverse and well preserved pollen and spore assemblage. These palynomorphs were recovered from core and outcrop samples that have been correlated with the Wolfcampian of the Permian Basin based on fusulinids.

Pollen and spores recovered include Maculatasporites sp., Gillespieisporites cf. G. venustus, Indospora spp., Thymospora thiessenii, Nuskoisporites cf. N. crenulatus, Playfordiaspora spp., Potonieisporites spp., Crucisaccites spp., Columinisporites ovalis, Columinisporites cf. C. heyleri, Vittatina spp., Costapollenites ellipticus, Protohaploxypinus spp., Hamiapollenites cf. H. saccatus, H cf. H. tractiferinus and Striatites richteri.

The Kansas Wolfcampian assemblage is similar to assemblages reported from the Wolfcampian of eastern Canada, the Autunian of western Europe and the Lower Permian of the Donets River Basin, Russia.

Certain horizons in the Kansas Wolfcampian are dominated by "typical" Permian bisaccate gymnosperm pollen while other horizons are dominated by "typical" Pennsylvanian trilete spores. Implications are discussed.

PALYNOLOGICAL KEROGEN: CLASSIFICATION AND GEOLOGICAL APPLICATIONS

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A palynological kerogen classification is proposed which would facilitate comparative studies and also help integrate palynological kerogen reconnaissance data with geochemical kerogen typing. Many of the terms are familiar and are based primarily on coal maceral and ICCP terminology. The five major categories of dispersed organic matter recognized are vitrinite, inertinite, exinite, (i.e., alginite, sporinite, resinite and cutinite), other microfossils and amorphinite. Color photographs illustrate the optical properties and various physical states of the organic matter as viewed in transmitted, reflected and ultra-violet light.

A palynological analysis of kerogen provides an important first step toward source rock evaluation by depicting kerogen trends for an entire well. This reconaissance survey must be followed by a detailed geochemical characterization in order to assess the hydrocarbon potential of the organic matter in the most prospective intervals. Because palynomorphs and other kerogen elements are an integral part of the sedimentary environment and are subject to many of the same controls that govern clastic sedimentation, palynological kerogen analysis can also be useful in defining palynofacies and interpreting paleoenvironments. In addition, we have found in our studies of structurally complex terranes that kerogen assemblages can often be used in conjunction with microfossils to stratigraphically characterize and correlate rock units.

NEW PUBLICATION

STUDIES IN AUSTRALIAN MESOZOIC PALYNOLOGY: P.A. Jell, editor. Australian Association of Paleontologists Memoir 4.

Memoir 4 provides the most comprehensive study of Mesozoic palynology in the Australasian region. Integration of a spore-pollen zonation with a largely new and original dinoflagellate zonation in 95 pages, including 50 figures, is backed up by 13 taxonomic papers introducing many new genera and species. This 340 page work is principally derived from Northern and Western Australia. It appears as a commitment to further scientific knowledge through making public much commercially significant petroleum company information.

This memoir may be purchased from:

Dr. P.A. Jell
Queensland Museum,
P.O. Box 300,
South Brisbane,
Queensland 4101,
AUSTRALIA

REPORT OF THE SCCS WORKING GROUP ON THE DEVONIAN - CARBONIFEROUS BOUNDARY

Hasselbachtal section

M. STREEL

Critical advantages of the section are

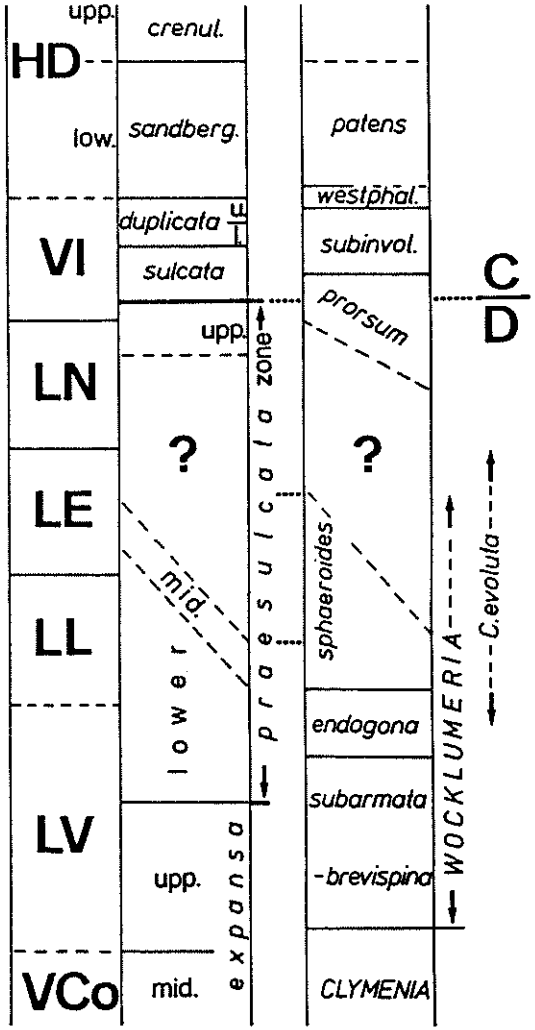
- a very easy accessibility,
- fossil content that allows detailed correlations with continental as well as marine environments,
- a reasonable representation of time by rock,
- the shallow diagenetic rank and quiet tectonic environment.

Since 1984 (Cour. Forsch.-Inst. Senckenberg, 67), the section has been supplemented by a borehole. Additional researches have provided more biostratigraphical data, the most important being the ammonoids of the Wocklumer Kalk which are now well correlated by Th. BECKER (Bochum) with the Schindewolf stratigraphy at Oberrödinghausen. Among other researches are the spectacular radiometric age determination of zircons from the tuff bed (79) by U. KRAMM (Munster) (The datation-340-350My- is now certainly the best available and closest to the D/C boundary) and also the geomagnetic investigation of H. UKAS (Köln) (10° lat. S., magnetism not altered with time).

Hasselbachtal section is one of the links in a 200 kms long chain of sections reaching as far east as the "Provinzialsteinbruch Drewer" the latter also recently proposed as stratotype (CLAUSEN et al. 1987, ZIEGLER et al. 1988). The relationships between most of these sections at the critical boundary levels have been discussed in detail by BLESS et al. 1988.

Compared with the other proposed boundary stratotypes elsewhere in the world, the major characteristic of the area which now forms the northern border of the Rheinisches Schiefergebirge is the display of siliciclastic material immediately below the boundary beds. These beds form a morphologically shallow hinterland in the south, and the siliciclastic detritus was derived from the rising Variscides and delivered into a shallow sea. Siliciclastics are absent in places e.g. on the flanks or tops of shoals (dead Givetian-Frasnian reef complexes) where a rather condensed sediment of carbonate limestone formed and where gaps and non-sequences are common. The siliciclastic discharges are well dated (fig. 1) by their miospore content : they reach a maximum thickness in the Seiler locality and they have interrupted the limestone deposition eastwards, in the Oese, Apricke and Oberrödinghausen localities, at LL time. During LE time, the discharge went to a minimum in this area but was still spectacular in the Riescheid locality to the west. The siliciclastic influx started again in LN time, now on both sides of the Seiler locality, interrupting the limestone deposition in Hasselbachtal where the top of the Wocklumer limestone might be younger than elsewhere in the basin. One should remember that LL to LN times are represented by several hundreds of meters of sediment in the Irish Munster basin and might represent therefore some significant timespan.

Unfortunately, no specific faunas are known (fig. 1) in this interval (See evoluta-prorsum interregnum in BECKER, 1988). Consequently, this timespan cannot be proved to be represented by rocks in any of the other proposed boundary stratotypes elsewhere in the world.



After learning the new comments by BECKER and KORN on the discovery of C. evoluta in the basal Hangenberg Shales, in Hasselbachtal, well above the base of the LE zone, the question is risen if C. evoluta can have a much longer range than formerly accepted. This suggestion is also strengthened by the fact that C. evoluta has been previously found in the Etroeungt Quarry (Northern France) at a level near the base of the LL zone.

PLANTS AT THE DEVONIAN/CARBONIFEROUS BOUNDARY, A SHORT REVIEW

K. HIGGS, M. FAIRON-DEMARET & M. STREEL.

Miospores

Plant miospores are very useful and important fossils for the recognition of the Devonian/Carboniferous boundary. Miospores at this stratigraphic level have a global distribution being found on all the continents, with the exception of Antarctica. They are also significantly preserved in both non-marine (continental) and marine rocks. They occur abundantly, and the presence of distinctive and rapidly evolving forms has resulted in the establishment of a detailed miospore succession at this interval.

The most complete and continuous miospore record at the Devonian-Carboniferous boundary has been found in the enormously thick marine clastic sequences in southern Ireland. HIGGS *et al* (1988) have described a miospore zonation scheme comprising eight biozones (fig.1) which are defined essentially on the first appearances of selected and distinctive taxa. The only exception to this is at the LN/VI Biozone boundary where the base of the VI Biozone is defined at the disappearance of the well known and highly distinctive *Retispora lepidophyta* complex and associated species (fig.1). This extinction event has been recorded worldwide and is considered to be an isochronous event, resulting from a major change in climatic conditions at this time. However, no significant time gap is envisaged at the LN/VI boundary because many other species survive this event and continue through into the succeeding VI Biozone including members of a number of morphological and possible phylogenetic lineages eg. *Vallatisporites* complex (see STREEL and TRAVERSE, 1978) also the *Umbonatisporites* and *Spelaeotriletes* complexes.

CLAYTON and HIGGS (1979) have demonstrated both the stratigraphical application of this miospore zonation scheme and its independence of sedimentary facies. They have conclusively shown that the marine and non-marine rocks at this stratigraphic interval can be successively correlated using miospores and that the top of the continental facies in southern Ireland is strongly diachronous. The lack of diagnostic conodont and ammonoid faunas in the Irish sequences has ruled them out as possible boundary stratotypes.

The miospore zonation scheme described from Ireland has been successively correlated with the well dated marine sequence in the classic area of the North Rhenish Slate Mountains of Germany (HIGGS and STREEL, 1984).

The most continuous spore succession here is found in the Hasselbachtal Section, where the LN/VI Biozone boundary occurs near the top of the Hangenberg Shales only 14 cms below the bed containing *Siphonodella sulcata*.
A palynological study of the more recent Hasselbachtal Borehole has confirmed the presence of the LN/VI boundary just below the *sulcata* level equivalent bed and it has also extended the LN Biozone well down into the Hangenberg Shales. Also the base of the Hangenberg Shales in this section is much younger than those at Oberrödinghausen where they are of LL Biozone age.

Recent collaborative work between Soviet and western palynologists, has allowed detailed palynological correlation between the respective miospore schemes in Russia and western Europe, (AVCHIMOVITCH *et al*, 1988) - see fig.2 - where the LN/VI boundary correlates with the base of the PMI in the central and eastern parts of the Russian Platform and the base of the M Zone in the Pripjat Depression and Mugodzhary. Palynological correlation of the Devonian-Carboniferous boundary beds in China is much more difficult due to absence of suitable clastic lithologies at this interval.

The rather poorly preserved and limited assemblagle recorded from the Gedongguan Bed shale between limestone beds 21 and 22 (JI QIANG, 1987) in the Muhua section in Guizhou Province in southern China is tentatively correlated with the VI Biozone.

This illustrates one of the unfortunate problems in palynology, that is the absence of well preserved and identifiable spores in carbonate lithologies. Hence, no miospores have yet been recovered from the carbonate sequences of the Devonian-Carboniferous boundary beds at Nanbiancun in China, from Grune Schneid in Austria, and from La Serre in the Montagne Noire, France. In conclusion, it is considered that the LN/VI miospore biozone boundary is a very distinctive, widespread and readily recognisable biohorizon. It occurs very close to the base of the *Siphonodella sulcata* conodont zone and so is an excellent biostratigraphical marker for the recognition of the Devonian-Carboniferous boundary. This is particularly important due to the fact that miospores have the unique attribute of allowing correlations to be made between marine and continental rocks at the Devonian-Carboniferous boundary.

Megaflora

The stratigraphic distribution of plants at the Devonian-Carboniferous boundary has recently been reviewed by FAIRON-DEMARET (1986). Figure 3 illustrates the ranges of the more important genera, and a few general comments are given here. The most important elements of the late Devonian flora belong to the genera *Archaeopteris*, *Rhacophyton* and *Cyclostigma* only *Rhacophyton* sp. (not yet studied specimens fully).) is known to range into rocks of proved early Carboniferous age (Avon Gorge). *Archaeopteris* is characteristic of the Upper Devonian (although first appearing in the late Givetian), this genus ranges into the Strunian then disappears close to the Devonian/Carboniferous boundary. *Cyclostigma* has been much less extensively recorded but the few records indicate it may be restricted to the Strunian interval.

There is no continuous and uninterrupted plant record through the Devonian-Carboniferous boundary. However, it appears that a different plant flora comprising forms such as *Adiantites* and *Aneimites* appears in the early Carboniferous rocks.
The biostratigraphical value of plant fossils in the recognition of the Devonian-Carboniferous boundary is obviously limited, due to their restriction to mainly continental facies and to their general lack of abundance. Nevertheless, in broad terms two separate macrofloras are clearly recognisable either side of the systemic boundary.

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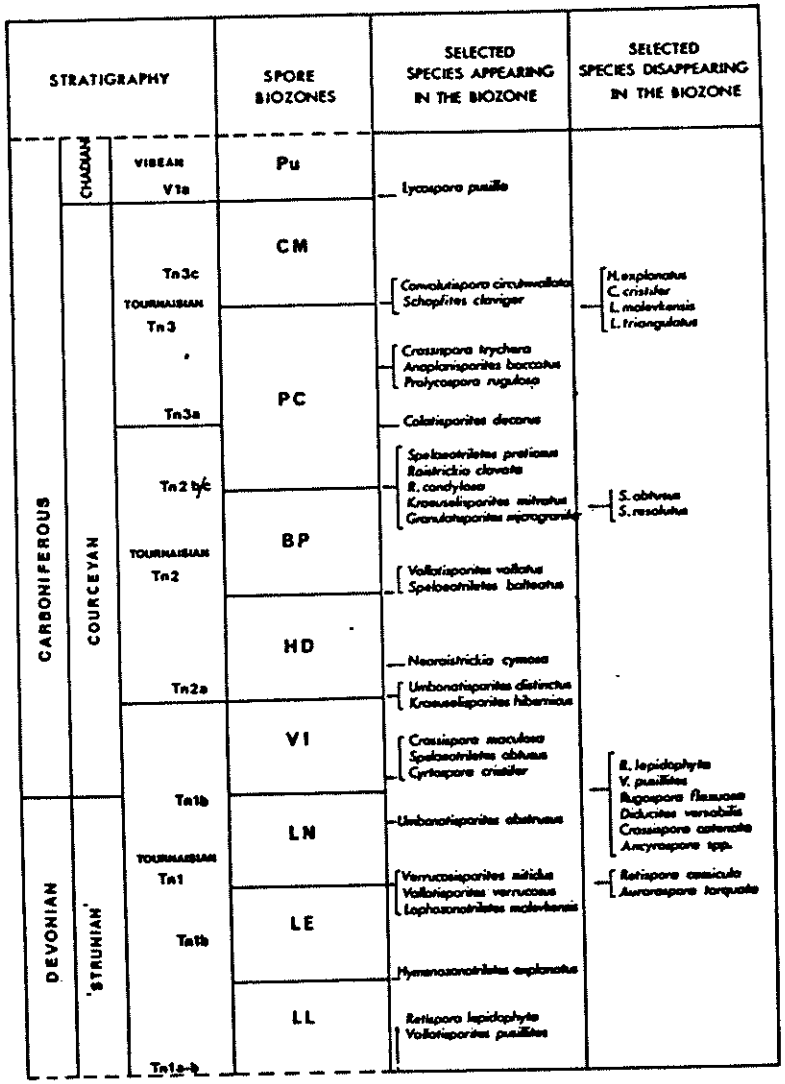

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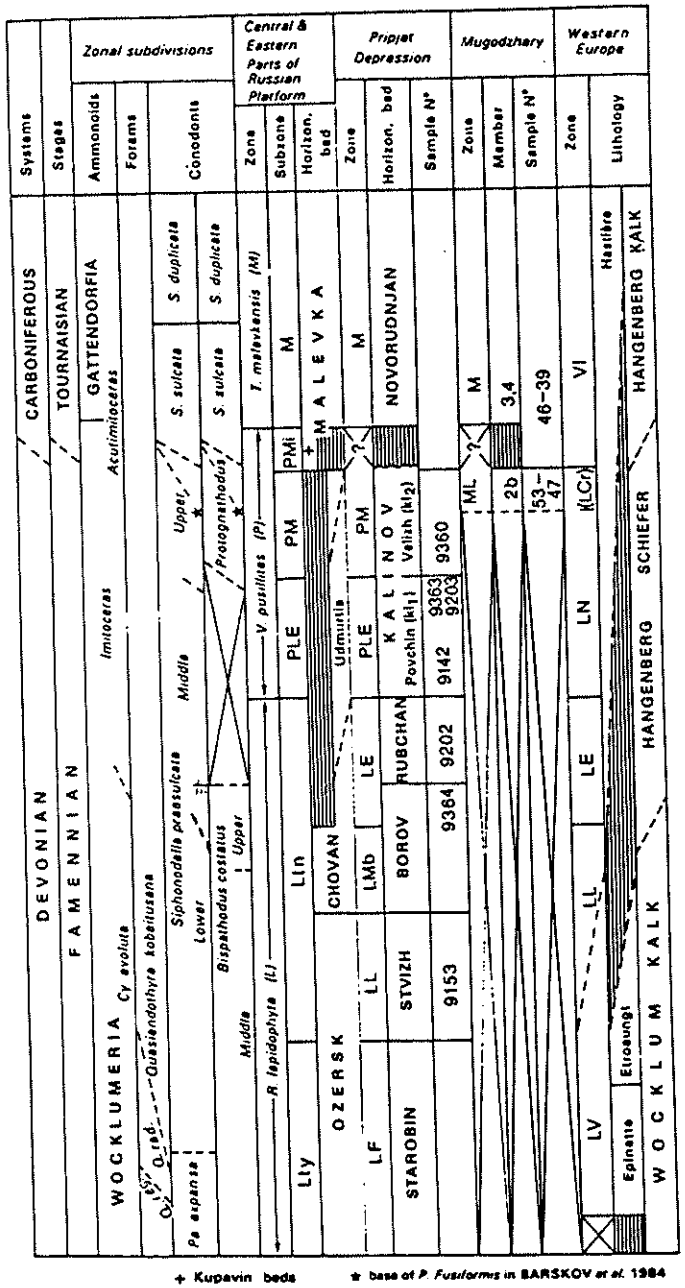

Fig.2

Moreover, the recognition of reproductive organs assignable to two species of *Callipteris* enabled the interpretation of these assembled plants in terms of a natural classification. Because the generic name *Callipteris* Brongniart was a later homonym of *Callipteris* Bory and arguments previously given for the conservation of the generic name *Callipteris* Brongniart were no longer valuable, *Callipteris* Brongniart had to be rejected.
The genus *Autunia* Krasser was emended to include both vegetative and reproductive organs, thus gaining a natural status. *Autunia* could be assigned to the family Peltate. A selection of valuable West- and Central European species formerly assigned to *Callipteris* were transferred to five different form-genera, defined to include the wide diversity of callipterid foliage types: viz., *Rhachiphyllum* Kerp, *Lodevia* Haubold et Kerp, *Arnhardtia Haubold et Kerp*, *Sphenocallipteris* Haubold et Kerp and *Dichophyllum*. These form-genera were (re)defined on the basis of pinnule morphology.
The most common types of callipterid foliage are to be classified in the natural genus *Autunia* and in the form-genus *Rhachiphyllum*. West- and Central European species assignable to these genera have been studied in detail. The material investigated mainly originates from the Rotliegend (Upper Carboniferous - Lower Permian) of the Saar-Nahe Basin (F.R.G.). Some of the localities have yielded abundant, apparently more or less autochthonously deposited material. In addition specimens from France, the German Democratic Republic, Poland and Czechoslovakia have been studied.
Within the natural genus *Autunia* two species were recognized: *A. conferta* (Sternberg) Kerp and *Autunia naumannii* (Gutbier) Kerp. The genus is characterized by bilaterally symmetrical megasporophylls with adaxially attached ovules. The polliniferous organs consist of small elongate sporangia attached to peltate megasporophylls. The foliage of *Autunia* consists of bipinnate to tripinnate fronds with alethopteroid pinnules and equally shaped intercalate pinnules. *Autunia* is thus far the oldest known peltasperm.
The form-genus *Rhachiphyllum* is characterized by its bipinnate to tripinnate fronds with entire-margined to pinnately lobed alethopteroid normal and rachial pinnules. Six species are assigned to *Rhachiphyllum*.
The foliage of *Autunia conferta* and some species of *Rhachiphyllum*, e.g., *R. schenkii* (Heyer) Kerp appears to be very variable. The intraspecific variability of these species could be determined. Variations in foliar morphology partly appear depend on the stage of development of the plant and the frond. Also ecological factors may have influenced the development of the frond.
In the literature there exists a considerable confusion about the specific delimitation of the species treated. A number of the callipterid species previously introduced in the palaeobotanical literature appear to be synonymous with the here accepted taxa.
The traditional concept of the importance of callipterids in chronostratigraphy and biostratigraphy cannot be maintained. The group has a potential in ecostratigraphical considerations.

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Laboratory of Palaeobotany and Palynology, University of Utrecht, Utrecht, The Netherlands.

The affinity of the conifer *Taxodium scoticum* and its male cone *Masculostrobus zeilleri* from the Upper Jurassic of Scotland.

In 1984 the conifer *Taxodium scoticum* has been described from Upper Jurassic beds in Sutherland, Scotland. Its affinities were thought to be taxodiaceous, mainly on the basis of the leaf structure and its cuticles. Recently it was discovered that the type-species of *Masculostrobus zeilleri* from these beds very probably belongs to the same plant. It is a compound male inflorescence with a possibly branched axis covered with bracts and in the axils of the bracts male fructifications. The cuticle of the bract is exactly that of *T. scoticum*. The cuticular structure and the morphology of the in situ pollen has been studied in detail. All these data suggest a taxodiaceous affinity.

Leisman, Gilbert A, Gillespie, W.H. and Mapes, G. Division of Biology, Emporia State University, Emporia, Kansas 66801, USA; West Virginia Department of Agriculture, Charleston, West Virginia 25314, USA; Department of Botany, Ohio University, Athens, Ohio 45701, USA.

Plant megafossils from the Virgilian (Upper Pennsylvanian) near Hamilton, Kansas, USA.

The Late Pennsylvanian (Virgilian) megafossil flora from the Hartford Limestone, collected about two miles east of Hamilton, KS, contains at least 20 species. The presence of *Walchia*, *Cordaites* and *Callipteris* and the absence of psaroniaceous tree ferns, the major components of Late Pennsylvanian coal swamps, strongly suggest an upland habitat. The fragmentary and twisted nature of the remains, as well as being in a limestone matrix, suggests transport, which is consistent with this interpretation. Lycopod remains are scarce. The calamites are represented by *Annularia*, *Asterophyllites* and *Palaeostachya*. Pteridosperms include three species of *Callipteris* and *Sphenopteris*, *Neuropteris* and *Trigonocarpus*. The most numerous components of the flora belong to the gymnospermous Voltziales and Cordaitales. Vegetative branches of *Walchia piniformis* and *W. schneideri* are especially common. The reproductive cones *Walchiostrobus*, along with isolated *Gomphostrobus*, are not rare and are occasionally permineralized which allows for histologic study. Cordaitalean remains are most often fragments of the leaf *Cordaites principalis*. Others include *Cordaianthus* and *Samaropsis*. The occurrence of *Callipteris* at the Hamilton location, as well as the Garnett location, casts considerable doubt on the reliability of using this genus as an index fossil for the base of the Permian.

Poort, R.
Laboratory of Palaeobotany and Palynology, University of Utrecht, Utrecht, The Netherlands.

The pollination mechanism of the Late Palaeozoic conifer *Walchia hypnoides* with special reference to the morphology of the prepollen genus *Potonieisporites*.

Studies on the pollination mechanism of recent conifers have demonstrated a high degree of efficiency in wind pollination, especially with regard to the morphology and position of the ovuliferous cones. It is long since known that modern conifers are characterized by a siphonogameous nature. Late Palaeozoic conifers, having prepollen, appear to be zoogameous.
The present material originates from the Rotliegend (?Upper Carboniferous - Lower Permian) of West- and Central Europe. It includes classical specimens described and figured by Florin and recently collected material from the Saar-Nahe Basin (F.R.G.).
Walchia hypnoides is the most abundant conifer present in the material from the Saar-Nahe Basin. Sterile twigs are found in organic connection with polliniferous cones. The material from Florin, stored in the Museum fÜr Naturkunde in Berlin (G.D.R.), contains ovuliferous cones of *Walchia hypnoides* which display various stages of maturity. From the rigid habitus of the sterile twig to which the ovuliferous cones are attached and the constant angle between twig and cone, an upright position of the cone is concluded. In the mature cones the morphology of the ovuliferous dwarf shoots can be observed. Ovuliferous dwarf-shoots having an identical morphology are found dispersed in the Saar-Nahe material. The presence of two ovules per dwarf shoot makes it appropriate to establish a new, natural genus, assignable to the family Walchiaceae.
The ovules, attached to the dwarf-shoots in an inverted position, are also found dispersed. By means of fluorescence microscopy the morphological details of the ovules could be studied. Clusters of (pre)pollen on top of the salpinx as well as (pre)pollen in a pollen chamber could be observed. These (pre)pollen are of the *Potonieisporites-type but rather badly preserved. Better preserved material from the Weiden locality was used to study the morphological characteristics of the (pre)pollen.*
SEM and TEM studies were carried out. The prepollen nature of Potonieisporites could be demonstrated undoubtedly. The monosaccus is filled with sexinal elements and no distal sexinal thinning or sexinal free area, indicative for distal germination of the grain, could be observed.
Altogether this resulted in a reconstruction of the reproductive biology of *Otovicia hypnoides*. Airborne prepollen are caught by the ovuliferous cones and directed towards the axils of the dwarf-shoots. There the prepollen are drawn into the pollen chamber by means of a pollination droplet. Here the grain germinates proximally and free antherozoids are shedded and fertilization of the ovuliferous nucleus took place.
Because of resemblances in the structure of ovuliferous cones a similar pollination and fertilization strategy for various other Late Palaeozoic conifers is suggested.

7-IPC 1988

SYMPOSIUM BRISBANE REPORTS

Symposium 3: In situ palynology.

One of the smaller symposia held during the 7th IPC dealt with investigations on *in situ* pollen and spores. The symposium included a number of high quality lectures.
The contribution by prof. Taylor could be regarded as a key-note lecture for this symposium. In his lecture he pointed out the specific importance of ultrastructural studies of *in situ* spores and pollen with respect to the understanding of the evolution of reproductive systems. Dr Taylor furthermore summarized the information on *in situ* spores and pollen known from various groups of fossil plants through geological history.
A lecture given by dr Richardson from the British Museum dealt with morphological trends observed in dispersed spores as well as in *in situ* spores from *Cooksonia pertoni*. A general trend in spores from Ordovician - Devonian ages can be observed ranging from laevigate through murinate/verrucate to apiculate ornamentations. This trend can also be found in spores from *Cooksonia pertoni* from different ages. In his view this morphotrend has to be interpreted in terms of an adaptation to a changing germination strategy from plants in increasingly seasonally arid environments. In a second lecture dr Richardson discussed evolutionary trends within Devonian *Acinosporites lindlarensis* derived from *Leclercqia complexa* sporangia.
Diane Edwards discussed the morphological variation in Silurian/Devonian *in situ* spores from *Cooksonia* and *Salopella*. Permian *in situ* spores belonging to *Arberiella*-type sporangia were presented by dr Rigby.
Three lectures were given on Mesozoic *in situ* material. Dr Manum talked about morphological variation in pollen belonging to the conifer *Sciadopytis*. Chris Hill introduced us to a new species of *Androstrobus* from the Middle Jurassic of Yorkshire. The material is hardly compressed permitting an accurate assessment of the shape and disposition of the spores. Dr Raunsgaard Pedersen discovered *Eucommiidites* pollen in the micropyle of dispersed Cretaceous seeds. (Ultra)structural studies revealed the clear gymnospermous nature of the pollen.
All lectures presented were accompanied by excellent slides. Nice pictures of SEM and TEM studies displayed the high standard of research that is currently achieved in this linking discipline between palaeobotany and palynology.

Organic petrology at the 7th IPC

Contributions to the field of organic petrology (in the broadest sense) were presented in four symposia: '12 - Palynologic/Lithologic Relationships', '22 - Coal Palynology', '25 - Maturation and Source Rock Analysis' and '26 - Methods of Kerogen Analyses for Hydrocarbon Exploration'. Although this subdivision suggests a clear distinction according to different approaches and aims, contributions having more or less the same scope were presented in the different sessions. Each of these symposia included papers on palynofacies analysis, whereas other contributions on the same or closely related topics were included in the session on Methodological Advances in Palynology. Moreover, a number of contributions devoted to the various aspects of palynofacies analyses were presented at the same time. Therefore it might have been better to devote a special symposium to palynofacies analyses. Especially the papers of Symposium 12 were perhaps a little bit too strongly diversified for including them in a single session.

Symposium 12 - Palynologic/Lithologic Relationships - included a large number of papers on pollen dispersal, hydrodynamic properties of pollen and spores, preservation of pollen and spores, the distribution and concentration of pollen and spores in recent and fossil sediments and palynofacies analyses. During this session case histories from Devonian to modern sediments were presented. In some cases discrepancies between theoretical and practical appproaches were remarkably clear. Sometimes the papers were too strongly focussed on the results, while only little attention was given to the methods. As a result discussions were almost impossible.

Symposium 22 - Coal Palynology - included only three papers, the other two were cancelled. Subjects covered in this session included palynofacies analysis of cretaceous coals and palynology of the West-European Upper Carboniferous.

Symposium 25 - Maturation and Source Rock Analyses - also included a very limited number of papers, essentially dealing on the same topics which were treated in the sessions 22 and 26.

Symposium 26 - Methods of kerogen analysis for hydrocarbon exploration - consisted of eight contributions. Two fundamentally different approaches in the study of kerogen in relation to hydrocarbon exploration were included in this session, viz. the geochemical approach and the use microscopical techniques. Contributions dealing on microscopical analyses included a study on the palynofacies of modern sedimentary environments and a paper on the degradation of dispersed sedimentary organic matter.
Within the geochemical approach special attention was paid to the rapid characterization of source rock qualities, oil-source rocks correlation, the mechanisms of kerogen formation and the molecular characterization of kerogens with applications to primary and secondary migration studies.
Unfortunately approaches were not clearly linked to each other.

It was evident that palynofacies studies are still in an early stage of development. Almost everyone used his or her classification of sedimentary organic matter. A number of authors had even adopted the maceral classification system used in coal petrography for the study of organic matter in transmitted light. However, the palynological and the coal petrographical approach are fundamentally different an the application of the coal petrographical nomenclature for palynofacies studies is not realistic. At the 41st meeting of the Committee for Coal Petrology, early September 1988, it was decided that two separate nomenclatures are necessary; it was not considered possible to combine them into a single system. It is evident that a uniform nomenclature for palynofacies analyses is needed. The institution of a workshop for nomenclature for sedimentary organic matter should be a goal for the next IPC.

E. Tegelaar & H. Kerp

Symposium 31: Acritarch Morphology and Stratigraphy.

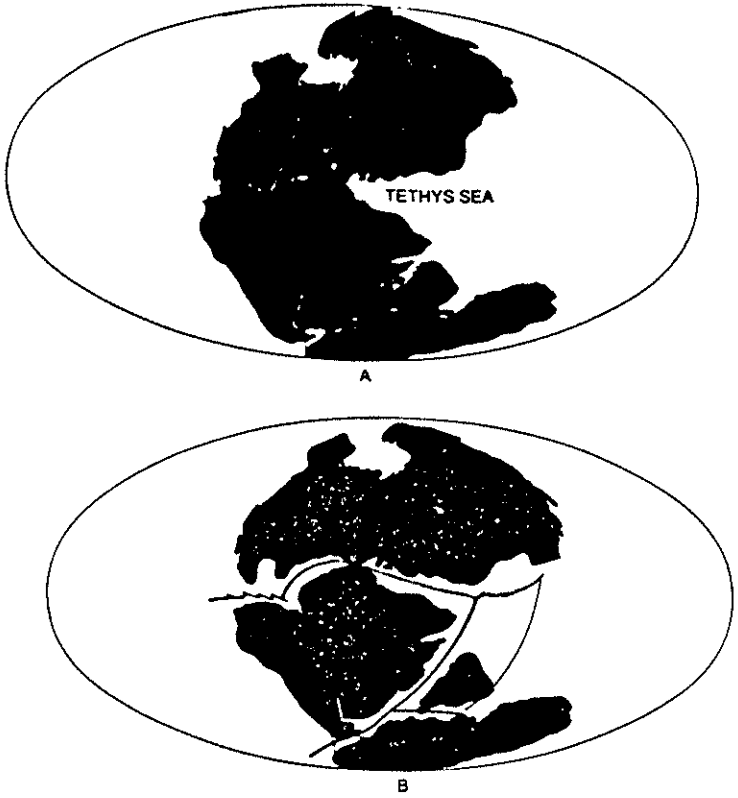
In order to understand what is going on within the somewhat unknown world of morphology and stratigraphy of Palaeozoic acritarchs, a visit was made to symposium 31. Of additional importance for this visit was the preparation of a future course for the students of the Laboratory of Palaeobotany and Palynology and to see who is who in this part of palynology. First of all it may be remarked that acritarchs are actually quite beautiful if seen only as objects, even if one does not have a palynological backround. The symposium did not only present the usefullness of acritarchs as a palynostratigraphical tool, but it was also made clear that these palynomorphs have an extremely wide formvariation, as was shown by most of the speakers present.Although it may be premature it does seem, however, that a better understanding is needed with regard to the palaeoclimatological and palaeoecological parameters controlling the composition of the observed assemblages. A number of papers did actually deal with this aspect, but as also may be concluded from the literature, it appears that additional studies are needed. All in all the symposium was very interesting and as an additional positive aspect, many of the speakers have agreed to send samples to the Laboratory of Palaeobotany and Palynology, so that it may be possible to present a course in acritarch palynology.

P. Brugman

Symposium 34: Late Palaeozoic and Early Mesozoic palynomorphs: support for concepts of Gondwana and Laurasia.

Most people will be familiar with the concepts of Gondwana and Laurasia. In general terms, discussing these concepts is discussing plate tectonics, palaeogeography, biogeography, etc.
Currently, the Palaeozoic history of continental movements is quite uncertain. What is clear is that, in the late Palaeozoic, a huge super-continent called

Pangea was a conglomeration of all the separate continents in existence today. The continent seems first to have split parallel to the equator, but we remain unsure of the degree of division that had occurred by the end of the Permian. One interpretation of the breakup of Pangea into Gondwana and Laurasia is given in the figure.



The breakup of Pangea and Gondwanaland A: Reconstruction of the supercontinent Pangea at the end of the Permian. B: Fragmentation of land masses at the end of the Triassic (Dietz & Holden, 1970).

The most striking stratigraphic evidence for continental movement is found in the so-called Gondwana strata of India, South America, Southern Africa, Antarctica and Australia. These strata, ranging in age from Carboniferous to Triassic, are to varying degrees arranged in similar sequences on the various continents and contain many similar fossils. There is evidence of glaciation in the Permo-Carboniferous strata on all five land masses. What is remarkable is that there is such strong resemblance of fossil floras among the now widely separated areas. Two genera of seed ferns, *Glossopteris* and *Gangamopteris*, are particularly well represented. As an example of the similarity of the floras, India and Antarctica have in common about 20 species of *Glossopteris*.

As for palynology, most of the contributions at Symposium 34 were dealing with palynofloras from the southern hemisphere. Comparisons between the five landmasses revealed only minor differences in the palynological assemblages, thus supporting the concept of Gondwanaland. Unfortunately, little comparisons were made with palynofloras from Laurasia. A selection of the lectures presented at the symposium is given below.

Backhouse, J.
Geological Survey of Western Australia, Perth, Western Australia

Palynostratigraphy and geological history of Permian strata in south-western Australia.

Thick Permian sedimentary sequences are preserved in south-western Australia, in the Perth Basin and in small intracratonic basins on the Yilgarn Block.

The Collie Basin is the largest intracratonic basin and has at the base the glacigene Stockton Formation of Stage 2 age which is succeeded by the Collie Coal Measures which range from Stage 2 to Stage 5b/c. The successive first appearances of 8 index species have been used as correlation points in the Collie Coal Measures. Correlation between sub-basins within the Collie Basin shows that sedimentary thicknesses are similar throughout the depositional area. This supports palaeocurrent evidence that suggests that the basin is a down-faulted remnant of a more extensive pre-existing sheet of Permian sediments.
The Lower Permian sequence in the southern Perth Basin is palynologically and lithologically analogous to the sequence in the intracratonic basins and formed part of the Permian cover, that extended over much of the Yilgarn Block and adjacent areas. Extensive sheets of Permian coal-bearing sediments, such as this, are characteristic of the Lower Permian of Gondwana.

Grenfell, H.R.
Department of Biogeography & Geomorphology, Australian National University, Canberra, A.C.T.

The correlation of Middle to Late Permian north-western Australian, Salt Range and Chinese palynofloras - biostratigraphic and palaeogeographic implications.

Fourteen species first appearing in the Chhidru and basal Mianwali Formations, Salt Range, allow good correlations with the uppermost Hyland Bay and basal Mount Goodwin Formations, Bonaparte Basin, and the uppermost Hardman Formation, Millyit Sandstone and basal Blina Shale, Canning Basin, north-western Australia. Two taxa allow tentative correlation with Chinese Middle to Late Permian palynofloras. Very rare specimens of *Kaipingispora ornata* were recovered from the Hyland Bay Formation, and numerous examples of the monolete spore *Yunnanospora radiata* were seen in material from the upper Hyland Bay and Hardman Formations and also significantly, the upper Chhidru Formation. The presence of these species in the Middle to Late Permian of north-western Australia and of one of them in the Salt Range, could have a bearing on expanding earth or plate tectonic reconstructions of Gondwana and Laurasia. However, palynofloral evidence to date suggests that if links existed they were tenuous and a plate tectonic reconstruction is supported.

The abscense of the distinctive spore taxon *Dulhuntyispora* from Indian and Salt Range palynofloras, and its presence in Australian and southern African palynofloras of Middle to Late Permian age, is difficult to reconcile with many reconstructions of Permian Gondwana.

Millsteed, B.D.
Department of Geology and Mineralogy, University of Queensland, St. Lucia, Queensland, Australia.

Stratigraphically significant miospores in the Late Carboniferous of the Galilee Basin, Australia.

Results from a continuing study of the Joe Joe Group and its partial lateral equivalent, the Boonderoo beds, are presented. These glacigene sediments are the oldest occurring in the intracratonic Galilee Basin of north-eastern Australia; being underlain by Early Carboniferous (Visean) sediments of the Drummond Basin and overlain by Middle Permian (Stage 5) coal measures. The Joe Joe Group ranges from probable Westphalian to earliest Permian in age and is the most continuous palynomorph-bearing section of this age in eastern Australia. The study is based on core samples. Within a diverse miospore assemblage, that includes mono- and bisaccate pollen, are several widely dispersed species of trilete spores (some new) that appear to be biostratigraphically useful. While some of these species appear to be endemic to Australia, others are also known from South America. Their distribution is therefore not only important in strata as young as Stage 2/3a in Australia, but also for correlation on a Gondwana scale.

Visscher, H.
Laboratory of Palaeobotany and Palynology, University of Utrecht, Utrecht, The Netherlands

A dramatic floral event at the Permian-Triassic junction.

Transitional sequences across the Permian-Triassic boundary in the Southern Alps preserve a remarkable palynomorph record that is indicative of dramatic ecological changes on land at the very end of the Palaeozoic.
The collapse of a mature ecosystem is reflected by the abrupt disappearance of characteristic latest Permian gymnospermous pollen, in combination with mass-occurrences of fungal remains.
This prominent floral event may have world-wide extent. It may indicate a significant disturbance of the balance between autotrophic and heterotrophic organisms. This view is supported by the anomalies in carbon-isotope ratios measured in marine carbonates from Permian-Triassic transition sequences.

USSHER SOCIETY, BIDEFORD, DEVON.

JANUARY 1989

Abstracts of contributions presented at the 28th Annual Conference of the Ussher Society, Bideford, Devon, 3-5 January 1989, and submitted for publication in the Proceedings of the Ussher Society (ISSN 0566-3954; details available from Mr M C George, Department of Geology, University of Exeter, North Park Road, Exeter, Devon EX4 4QE, U.K.).

A NEW PALYNOMORPH ASSEMBLAGE FROM THE BOVISAND AND STADDON GRIT FORMATIONS OF SOUTH DEVON

Andrew Dean
Department of Geology, University of Exeter

The resolution of many problems in the low grade metamorphic rocks of South Devon has been inhibited by the lack of site-specific biostratigraphic control. However, the recent application of routine SEM techniques has shown that many rocks, previously considered barren, reveal abundant palynomorphs. This technique is outlined and the character of the material examined with reference to the Lower Devonian Meadfoot group of South Devon. Further work continues in association with the British Geological Survey's Cornwall and South Devon Project.

The study is funded by a postgraduate scholarship from the University of Exeter and a field grant from N.E.R.C.

DEVONIAN PALYNOMORPHS RECOVERED FROM THE SEDIMENTS OF S.E. OF LOE BAR, SOUTH CORNWALL - PRELIMINARY RESULTS AND IMPLICATIONS

Richard Knight and Jamie Wilkinson
Dept. of Geology, University of Southampton.

Diverse, prolific palynomorph assemblages have been recovered from "Mylor-type" horizons S.E. of Loe Bar. Miospores form the predominant component and acritarchs comprise less than 3% of the total microflora. Rare fragmented chitinozoa have been recorded. The assemblages are Late Devonian (Famennian) in character, and contain no exclusively Carboniferous taxa. Any assignment to the miospore biozonation scheme of Street et al., (1987) is contentious. The absence of Retispora lepidophyta and its' associates, coupled with the occurrence of Rugospora flexuosa and Retusotriletes phillipsii, intimates a Mid Famennian (pre-lepidophyta) age for the "anomalous" occurrence of the taxon Grandispora echinata challenges this interpretation, suggesting a Latest Famennian age.

Taxa indicative of the Lower/Middle Devonian were recorded and are considered reworked. Reworking may account for this confusing mixture of Famennian/Strunian index miospores.

Previous structural models for this section are considered questionable.

THE PERMO-TRIASSIC IN DEVON

G. Warrington
British Geological Survey, Keyworth, Nottingham NG12 5GG

The south Devon coast, from Torbay eastwards to Pinhay Bay near Lyme Regis, provides the most continuously exposed and accessible section of a Permo-Triassic succession in Britain. The sequence preserved there formed between c. 260 and 205 Ma. Continental environments characterised the region during most of that time but were replaced by marine conditions before the end of the Triassic period. Late Permian pollen from the lowest beds at Exeter are the oldest indigenous fossils known from the succession and form the first clear biostratigraphic evidence for the presence of Permian deposits in the region.

These beds rest unconformably upon rocks affected by the Variscan orogeny or, locally, upon weathered rocks of the Exeter Volcanic Series. An interval of up to 40 Ma separates the late Permian deposits at Exeter from the youngest sediments (Westphalian C: Carboniferous) affected by Variscan folding in Devon. This interval forms a geochronological envelope that accommodates the intrusion of the Cornubian granite batholith and related events, including extrusion of the Exeter Volcanics.

The position of the Permian-Triassic boundary in Devon is constrained within the sequence between the Dawlish Sandstone and the vertebrate-bearing middle Triassic Otter Sandstone. Late Triassic pollen occur in the Mercia Mudstone Group and, with macrofossils, in the Penarth Group and lowest beds of the Lias. The boundary with Jurassic deposits, within the Lias at the appearance of Psiloceras, is conformable. The Devon coast section is at the western side of the Wessex Basin in which an analogous sequence is known, from borehole and geophysical evidence, to be present beneath younger deposits: the section is, therefore, the "tip of the iceberg" that provides an insight into the nature of the largely concealed development of Permo-Triassic rocks in southern England.

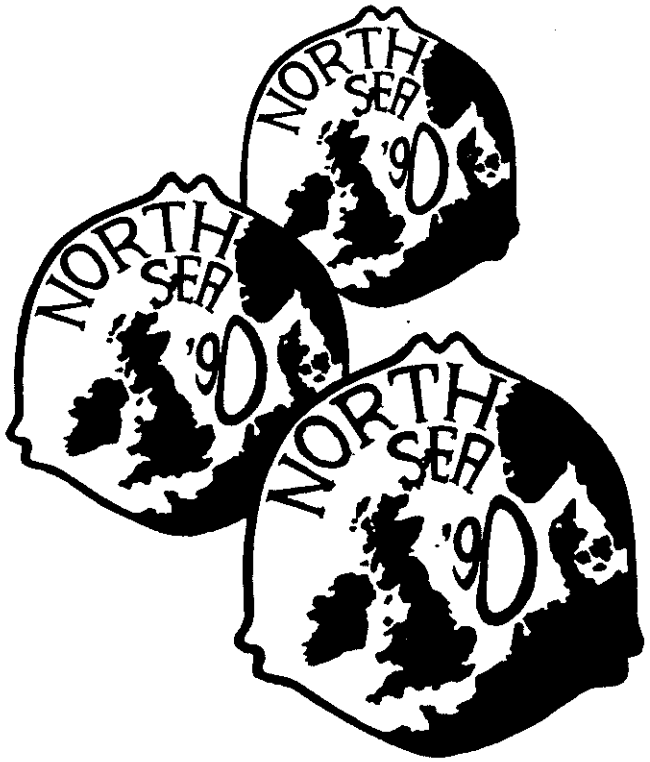
LATE TRIASSIC AND EARLY JURASSIC BIOSTRATIGRAPHY OF STRATOTYPE SECTIONS IN SOUTHERN BRITAIN

G. Warrington and H.C. Ivimey-Cook
British Geological Survey, Keyworth, Nottingham NG12 5GG

Late Triassic and early Jurassic outcrops on the coasts of the Bristol Channel in South Glamorgan and West Somerset include, respectively, the type sections of the Penarth Group and the Blue Anchor Formation (both late Triassic). Those in Somerset also include the type locality of Psiloceras planorbis, the index fossil of the basal Jurassic planorbis Zone, and a proposed stratotype for the base of the Hettangian Stage and, therefore, the Jurassic System. The base of the Jurassic, at the lowest occurrence of Psiloceras, is typically a few metres above the base of the Lias, the lowest beds of which are therefore placed in the Triassic. Palynological and faunal studies of these sections accompanied mapping of the Cardiff, Weston-super-Mare and Taunton districts by the British Geological Survey. During the late Triassic a continental environment was replaced by marine conditions following a transgression, the inception of

which is reflected in the biota from the topmost beds of the Blue Anchor Formation. Faunas and microfloras from the succeeding Penarth Group record the progressive colonisation of a widespread marine environment during the latest Triassic. After minor fluctuations during Penarth Group deposition this environment and the associated biota stabilised during deposition of the Lias. The appearance of Psiloceras in the Lias is an event that occurred in an established marine regime rather than one associated with the preceding transgression.

The poster illustrates the distribution of palynomorphs and other fossils, mainly macrofaunal, in the Triassic-Jurassic boundary sequence at outcrop and in boreholes in South Glamorgan and West Somerset, and the use of fossils as indicators of the environments represented by the late Triassic sequence at Lavernock, South Glamorgan.



NEWS ITEMS

1. The proceedings of the workshop on "Concepts, limits and extension of the Indian Gondwana" have been published as a book in THE PALAEOBOTANIST, Volume 36. A summary of the proceedings appeared in AASP Newsletter January 1988 Vol.21(1):4-6/ IOP Newsletter 35:2-4 April,1988. The volume comprises 42 articles covering the whole gamut of the Indian Gondwana in 377 pages. Priced at US$ 150.00 (US$ 160.00 Hard bound) or £ 85.00 (airmail delivery),it is available from Registrar, Birbal Sahni Institute of Palaeobotany, P.O. Box 160, Lucknow GPO 226 001,India.

2. A symposium "Vistas in Indian Palaeobotany" was held at Birbal Sahni Institute of Palaeobotany, Lucknow during November 14 - 16,1988. The seventy-three papers that were presented covered a wide spectrum, such as origin and antiquity of life, palaeobotany of fossil fuels, evolutionary trends, palaeoclimates, palaeoenvironments and taxonomy through artificial intelligence. Palaeobotanists from 17 Indian Universities and all the research organizations persuing palaeobotanical research in India participated. Besides 2 delegates from France and 1 delegate from West Germany also contributed. Most of the papers are expected to be published in Volum 38 of THE PALAEOBOTANIST.

   One of the main activity of the symposium was a panel discussion to work out modalities and to frame an action plan for promotion of palaeobotany and palynology at the Graduate level. It was decided that the Birbal Sahni Institute with the help of the Universities will revise and update the curriculum and develop excellent teaching material.

EXTRACTS FROM THE SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

NOTICE OF FUTURE MEETINGS

1.5.1 BIENNIAL FIELD AND GENERAL MEETING - UTAH/NEVADA, 1989

Business Meeting

The next Business Meeting of SCCS will be held in Provo, Utah, USA during the combined Field and General Meeting which is presently scheduled for September 24-30, 1989.

Conveners:

Dr. Morris S. Petersen, Brigham Young University
Dr. H. Richard Lane, Amoco Production Company
Dr. Walter L. Manger, University of Arkansas

The Business Meeting will focus on potential horizons for the further subdivision of the Carboniferous. Following decisions reached at Beijing, ad-hoc Working Groups on "lower" and "upper" Carboniferous subdivision are chaired by Dr. Paul Brenckle (USA) and Dr. Cor Winkler Prins (Netherlands) respectively. These groups are to present an evaluation of biostratigraphic horizons that may be of value for series and stage level subdivisions of the Carboniferous on an intercontinental basis. Identification of these potential horizons will direct SCCS research efforts towards its IUGS mandate to develop an intercontinental classification of the Carboniferous.

Field Trip

Leader:

Dr. Gary D. Webster, Washington State University

The field trip, planned in conjunction with the mid-Carboniferous Boundary Working Group, is to be led by Gary Webster, Washington State University, Pullman, Washington. Details of the proposed itinerary are given below:

- **September 24** - Arrive in Provo, Utah; Hosts - Department of Geology, Brigham Young University
- **September 25-26** - Technical sessions - Reports of ad-hoc Working Groups; SCCS Business Meetings.
- **September 27** - Depart on field trip - Lake Point Section, Oquirrh Mountains - overnight Delta, Utah
- **September 28** - Granite Mountain Section - overnight Ely, Nevada
- **September 29** - Frenchman Mountain - overnight Las Vegas, Nevada
- **September 30** - Arrow Canyon and Dry Lake Sections - overnight Las Vegas, Nevada
- **October 1** - Grand Canyon Section (optional, only run if there is enough interest); departure

Publication

Proceedings of this field and general meeting will be published in either the *Courier Forschungsinstitut Senckenberg* or the *BYU Geology Study Series.*

Details of the meeting are in the late planning stages. If you expect to be able to attend and wish to be kept informed about the arrangements then **PLEASE TICK THE APPROPRIATE BOX ON THE MAILING LIST UPDATE FORM.** A circular will be distributed with the final plans to those who reply. Direct requests for additional information should be sent to Walter L. Manger, Department of Geology, University of Arkansas, Fayetteville Arkansas 72701, USA.

XIIth I.C.C. ARGENTINA, 1991

The Permanent Committee of the International Congress of Carboniferous Stratigraphy and Geology met on September 3, 1987 during the XIth I.C.C. in Beijing. It had before it letters of invitation to stage the XIIth I.C.C. in either Poland or Argentina. The Committee elected to accept the invitation from Argentina which will host the XIIth Congress in Buenos Aires in 1991. The Chairman of the new Organizing Committee, Dr. Sergio Archangelsky, has supplied copies of the first circular for inclusion with this Newsletter. Further distribution will also be made at the Sao Paulo Gondwana Symposium, the Palaeobotanical and Palynological Meetings in Australia (1988), the SCCS Biennial Meeting in Utah/Nevada (1989) and the International Geological Congress in Washington DC (1989). Arrangements are well under way in Buenos Aires and we can look forward to this first occasion on which a Carboniferous Congress has been convened in the Southern Hemisphere.

PUBLICATIONS

1.8.1 CARBONIFEROUS OF THE WORLD, Volumes 1 and 2.

Volume 2 of the "Carboniferous of the World", edited by R.H.Wagner, C.F.Winkler Prins and L.F.Granados has now been published and was presented at the Opening Session of the Beijing Congress. Volume 2 covers Australia, India, South Africa, South America and North Africa and contains some 450 pages and 37 plates. Volume 3 on the USSR and Middle East is in the final editing stages and should go to the printer by the end of the year. Volume 4 on North America is progressing and the series will be completed by a fifth volume summarizing paleomagnetic data, biostratigraphy and stratigraphic classification.

Volumes 1 and 2 have been published on behalf of the IUGS Subcommission on Carboniferous Stratigraphy by the Geological and Mining Institute of Spain (IMGE) in cooperation with the National Company for Mining Investigation "ADARO" (ENADIMSA), Madrid. Both can be purchased from EPISODES SECRETARIAT, 601 Booth St., Room 177, Ottawa, Ontario K1A OE8, Canada. Individual requests may also be directed to Mr. L. F. Granados, ENADIMSA, Doctor Esquerdo 138, 28007 Madrid, Spain. The volumes have been moderately priced so that no Carboniferous research workers can afford to be without their personal copies.

- Volume 1 (China, Korea, Japan, SE Asia) costs US$30 (including postage)
- Volume 2 (Gondwana countries and North Africa) costs US$50 (including postage).

SELECTED STUDIES IN CARBONIFEROUS PALEONTOLOGY AND BIOSTRATIGRAPHY

Edited by P.L. Brenckel, H.R. Lane, and W.L. Manger, *Courier Forschungsinstitut Senckenberg*, vol.98, 1-206, 1987.

This volume contains 12 papers on paleoecology, taxonomy and biostratigraphy of the Early and Mid Carboniferous of North America, Great Britain, Ireland, Central Europe and Southeast Asia.

In detail the collection of papers deals with: taxonomy, classification and life cycle of foraminifers; ammonoids from the mid-Carboniferous boundary; coral and conodont zonation of Ireland and Britain; conodonts from the Kinderhookian - Osagean in New Mexico and from the Devonian-Carboniferous boundary in Moravia; conodont zonation of Carboniferous and Permian of North and Northwest China; palynostratigraphy and palynofacies of Devonian and Mississippian of Eastern Kentucky as a basis for correlation with Western Europe; stratigraphy of Mississippian of Idaho and Northeastern Utah; stratigraphy of Carboniferous bryozoans; stratigraphic distribution of camerate crinoids.

The interest of this and future volumes is to share with the reader the diversity and vitality of that research. Copies can be purchased by mail order from Forschungsinstitut Senckenberg, Senckenberganlage 25, D-6000 Frankfurt/Main 1, Federal Republic of Germany, for the price of DM 48 per copy plus handling and postage.

EL SISTEMA CARBONIFERO EN LA REPUBLICA ARGENTINA (The Carboniferous System in the Argentine Republic),1987

Edited by S. Archangelsky and A.J.Amos, R.R. Andreis, C.L. Azcuy, C.R. Gonzalez, O. Lopez Gamundi & N. Sabatini, 430 pp., 34 authors. US$30 plus postage.

A pre-print of this book, *"The Carboniferous System in Argentina - A Synthesis"* was presented to the participants of the scientific sessions held in association with the mid-Congress Field Meeting in Cordoba, Argentina in March 1986. After discussion and revision, the Cordoba Academy of Sciences published the final version in 1987. It was first presented during the XIth International Congress on Carboniferous Stratigraphy and Geology in Beijing, Peoples Republic of China in August-September 1987. It is written in Spanish, with extended English summaries for each chapter and Spanish-English legends for all figures and plates.

The following chapters are included in the volume - 1. Introduction; 2. Tarija Basin; 3. Paganzo Basin; 4. Rio Blanco & Calingasta-Uspallata Basins; 5. Paleontology, biostratigraphy & paleoecology of the Paganzo, Rio Blanco & Calingasta - Uspallata Basins; 6. San Rafael Basin; 7. Tepuel Genoa Basin; 8. Chaco Paranense Basin; 9. Sauce Grande & Colorado Basins; 10. Malvinas Area; 11. Diastrophism; 12. Late Paleozoic magmatism in Argentina; 13. General correlation of biozones; 14 Ages of biozones; 15; Economic resources; 16. Bibliography; 17. Index.

Orders for **'THE CARBONIFEROUS SYSTEM IN THE ARGENTINE REPUBLIC'** should be sent direct to **ACADEMIA NACIONAL DE CIENCIAS, Casilla de Correo No.36, 5000 Cordoba, Republic of Argentina.** The price is US$30 plus surface postage of US$3. (please enquire re airmail rates). Names and addresses should be typed or printed clearly and all cheques made payable to Academia Nacional de Ciencias.

FIELD GUIDE FOR THE CORDOBA MEETING, ARGENTINA, 1986

Dr. Archangelsky advises that there are a few copies of the field guide, issued to participants of the 1986 excursion, which he is willing to supply to SCCS members. The guide contains 54 pages (in English) and includes road logs, maps, sections and references. Anyone interested should forward their request to Dr. S. Archangelsky, URQUIZA 1132, Vincente Lopez (1638), Buenos Aires, Argentina, together with a cheque to cover the postage (US$1 surface mail or US$3 airmail).

REPORT OF THE SCCS FIELD AND GENERAL MEETING, ARGENTINA, 1986

by S. Archangelsky, URQUIZA 1132, Vincente Lopez 1638, Buenos Aires, ARGENTINA, M. Hünicken & T. Dutro.

The SCCS held its field and general meeting in Cordoba, Argentina from March 26-April 8, 1986 in conjunction with the participants of IGCP Project 211 (Late Paleozoic of South America) and with sponsorship from the National Academy of Sciences, Cordoba and the National Research Council of Argentina (CONICET). This was the first meeting which SCCS has held in the Southern Hemisphere. The focus of the meeting involved the analysis and correlation of the Late Paleozoic biota, particularly the floras of the Gondwana Realm.

Academic sessions (March 26-30) were attended by 46 delegates from Argentina, six Titular/Bureau Members of SCCS (J.T.Dutro, P.K.Sutherland, J.Roberts, C.F.Winkler Prins, W.L.Manger and S.Archangelsky) and 19 foreign delegates (USA, Australia, Brazil, Uruguay, Chile, Bolivia, Ecuador and Colombia).

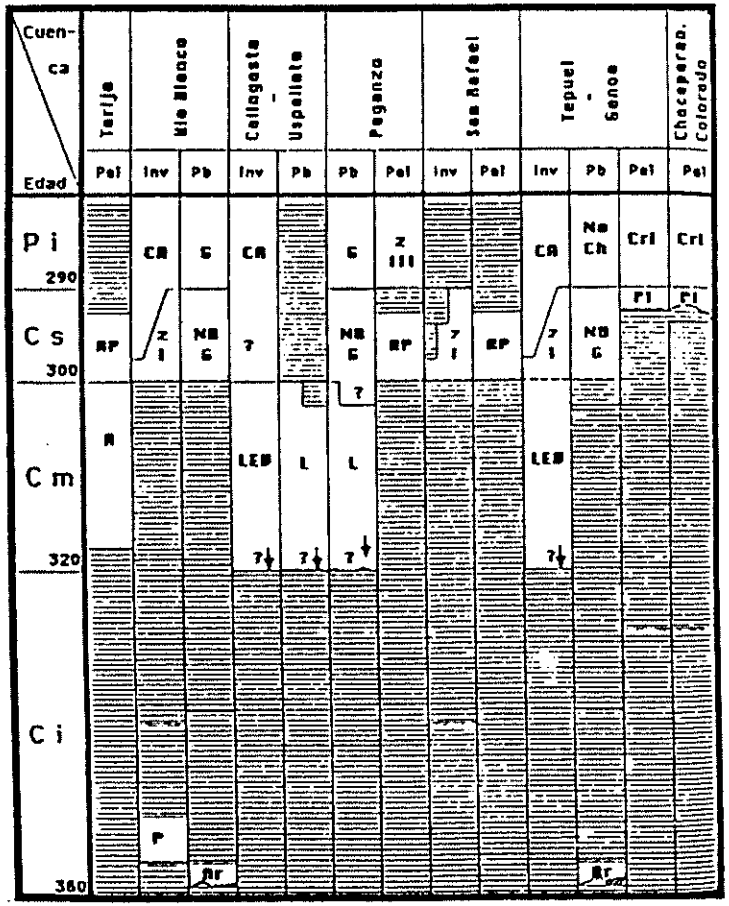
On the first day, a detailed survey of Argentinian Carboniferous Basins was presented by different authors; Permian strata were also included for some continental sections. The second day's program was devoted to biostratigraphy, magmatism and diastrophism, paleomagmatism and natural resources in these basins. A lecture by V.Ramos on "Patagonia: new evidence for its allochthony" was followed by a round table session on "Problems in Carboniferous chronology and the Carboniferous-Permian boundary in Argentina". This discussion carried over on to the third day, the remainder of which was taken up with reports by national delegates of the IGCP 211 Project. Similarities between Brazil, Paraguay, Uruguay and Argentina were stressed, particularly in respect of their terrestrial strata. The Andean sector (Argentina, Chile, Bolivia, Peru, Colombia and Equador) has different problems, mostly related to marine environments and the combination of sedimentary, igneous and metamorphic rocks. On the last day, the Closing Ceremony was followed by a display of Carboniferous fossils from collections lodged in Cordoba University, La Plata Natural History Museum, Buenos Aires University, Lillo Institute (Tucuman) and the CIRGEO (Buenos Aires).

A 400 page book, *The Carboniferous System in Argentina: A Synthesis*, was prepared for the meeting. The volume was edited by Dr. Sergio Archangelsky and it contains contributions by more than 30 specialists on the Late Paleozoic Basins of Tarija, Chacoparana, Sierra Australes-Colorado, Malvinas, Paganzo, Rio Blanco, Calingasta-Uspallata, San Rafael, and Tepuel-Genoa. A chapter was devoted to the Carboniferous biostratigraphy, including a general correlation chart, which generated considerable discussion among SCCS members. Non-Gondwana specialists gained appreciation for the difficulties in working with the southern, terrestrial-dominated sections with a cold climatic influence. The magnitude of the unconformities involving the Carboniferous was also forcefully demonstrated. A copy of the chart is included with this report. All participants received a copy of

Cordillera, and the San Juan Valley with spectacular gorges and thick early Paleozoic sequences. Social activity during the excursion included a reception in Merlo village (San Luis Province) and in San Juan City. The Leoncito Astronomical Observatory was visited during the night when the Halley's Comet was in its nearest position (the visit included taped films of the comet's route). In San Juan, the Natural History Museum was also visited. Logistic support was available during the excursion with vehicles from the governments of Cordoba and La Rioja provinces, YPF (Argentine National Oil Company) and San Juan University. A 54 page Field Guide (in English) was distributed among the participants. It included the complete road log, maps, sections and the main references.

The Organizing Committee for this SCCS meeting were pleased that they were given the opportunity to stage this excursion which made it possible for Argentinian and South American specialists to have discussions with visiting SCCS members on the many problems associated with the very different, Southern Hemisphere, geological setting. The meeting provided a valuable opportunity for "northern" specialists to become aware of the geological, stratigraphic, and paleontological problems in one region of the vast Gondwana supercontinent. They also gained appreciation for the problems involved in correlations using standard sections in the paleoequatorial belts.

The Subcommission is most grateful to Professor Archangelsky and his colleagues who organized this meeting.



GENERAL CORRELATION OF BIOZONES IN ARGENTINA

Pi = Pérmico inferior
Cs = Carbonifero superior
Cm = Carbonifero medio
Ci = Carbonifero inferior
Pal = Palinologia
Inv = Paleontologia Invertebrados
Pb = Paleobotánica
Edades: según Odin 1983

ZONAS

Palinológicas
AP = *Ancistrospora - Potonieisporites*
PL = *Potonieisporites - Lundbladispora*
Cri = *Cristatisporites*

Paleontologia de Invertebrados
P = Fauna de *Protocanites*
ZI = Intervalo
CA = *Cancrinella*
L = *Levipustula*

Paleobotánicas
Ar = *Archaeosigillaria*
L = Flora de *Lepidodendropsis*
NBG = *Nothorhacopteris argentinica*
- Botrychiopsis weissana
- Ginkophyllum diazii
G = *Gangamopteris*
NoCh= *Nothorhacopteris chubutiana*

the volume, in the form of a pre-print, with the final volume to be distributed later.

The field trip began on March 31. The first part included sections in Paganzo continental strata, including coal mine visits. Among classical localities, Bajo de Veliz, Tupe, Sierra de los Llanos (Anzulon and Malanzan), Amana and Los Colorados were visited. Carboniferous and early Permian floras were seen at these stratotypes, including those referred to the biozones *Nothorhacopteris-Botrychiopsis* (Carboniferous) and *Glossopteris* (Permian). The second part was spent in the western area of Paganzo Basin and the mostly marine Calingasta-Uspallata Basin, where different stratotypes were also visited (La Capilla, Barreal, Uspallata, Huaco, San Juan River section), including the biozones *Levipustula levis* and *Cancrinella*. Glacial evidence was also shown in some areas (glacial blocks, dropstones, striated pavements). Associated Late Paleozoic magmatism was seen on the last day in the Aconcagua region and strong diastrophism in the Barreal-Uspallata area.

The excursion covered a distance of 2500 Km, through the provinces of Cordoba, San Luis, La Rioja, San Juan and Mendoza. The trip ended in Mendoza City from where the participants returned home via Chile or Buenos Aires. Some colleagues stayed for a few days to visit institutions and museums in Buenos Aires and La Plata.

Other interesting sites were visited during the excursion: the Ischigualasto Triassic basin, known for its spectacular scenery as well as for its vertebrate fauna and fossil flora, the Rio Mendoza Valley with the "Inca's Bridge" and a close view of the Aconcagua, the highest mountain of the Andes