



# Commission Internationale de Microflore du Paleozoique

## NEWSLETTER 41

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PERMO-CARBONIFEROUS (GONDWANAN) PALYNOMORPHS FROM THE CHACO BASIN, ARGENTINA

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Permian and Upper Carboniferous palynomorphs were recovered from conventional cores and cuttings samples in 15 wells in the Chaco Basin, Argentina. Pollen and spores characteristic of the three Permo-Carboniferous palynozones defined by Archangel'sky et al. (1980) for the Chaco Basin have been identified. Assignment of the Cristatisporites Zone to the Lower Permian has not been corroborated by faunal evidence. However, Granulatisporites confluens Archangel'sky and Gamero 1979, a key component of this zone, is the basis of the Granulatisporites confluens Oppel-zone established by Foster and Waterhouse (1988) from the Canning Basin, Western Australia. The G. confluens Oppel-zone is associated with an Early Permian (Asselian) marine fauna and correlates with the Cristatisporites Zone in the Chaco-Parana, Paganzo, Central Patagonian, Colorado and Parana basins, of South America.

*Moyeria cabottii* FROM THE ORDOVICIAN OF WALES, UK.

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Recent work by Gray and Boucot suggests that *Moyeria* occurs abundantly only in the non-marine and nearshore environments. Further supportive evidence has been found in North Wales where *Moyeria cabottii* has been found in abundance in the late Ordovician (Caradoc) Capel Curig Volcanic Formation at Capel Curig. Two samples collected from mudstones above and between thick beds of welded tuff yield acritarchs of marine origin including *Arkonina*, *Baltisphaerosum*, *Dicrodiacrodium*, *Orthosphaeridium*, *Peteinosphaeridium*, *Stelliferidium*, *Striatotheca*, and *Veryhachium*, in addition to abundant *M. cabottii* specimens. Caradoc (Soudleyan Stage) brachiopods indicating open marine conditions have been found close to the acritarch localities. Faunal, sedimentological and volcanological evidence from the surrounding area indicates that during emplacement of the tuffs, a complex interplay between subaerial, alluvial, lacustrine, and marine shelf environments existed.

Dating of sediments for recent BGS mapping in Central Wales has revealed abundant *M. cabottii* in mudstones within the Dol-y-fan Conglomerate Member of the Yr Allt Formation of the Llandrindod Wells area. Also present are acritarchs of marine origin including *Actinotodissus*, *Baltisphaerosum*, *Cymatiogalea*, *Diexallophasis*, *Eupoikilofusa*, *Goniosphaeridium*, *Multiplicisphaeridium*, *Peteinosphaeridium*, *Stellechinatum*, *Stelliferidium*, *Striatotheca*, *Veryhachium*, and *Vulcanisphaera*; together this assemblage suggests an Ashgill age, except *Cymatiogalea* and *Vulcanisphaera* which are probably recycled from the Tremadoc. Sedimentological evidence suggests the conglomerate is of latest Ashgill (?Hirnantian) age. The abundant *M. cabottii* thus suggests a non-marine to marginal marine environment, perhaps related to regressive events during the Hirnantian glaciation.

CLIMATIC CHANGE DURING THE LATE HOLOCENE FROM A SOUTH-CENTRAL COLORADO LAKE

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A detailed paleoenvironmental study was based on pollen preserved in a two-inch diameter, two-meter core taken from San Luis Lake in San Luis Valley, Colorado. An approximate age of 1,600 yrs. B.P. at a depth of 150 cm was determined using <sup>14</sup>C of 10 cm bulk sediment samples. Pollen was sampled at 7 cm intervals through this depth; concentration was too low for statistically significant counts below this level. Preliminary analyses indicate dry periods 1,600-1,400 yrs. B.P. and 800-300 yrs. B.P. Between 1,600 and 1,400 yrs. B.P. *Artemisia* and *Chenopodiaceae-Amaranthus* pollen-type percentages are highest (50% total) in the core, with low *Pinus* percentages. This is followed by the interval of 1,400 to 800 yrs. B.P., with decreasing *Artemisia* and *Chenopodiaceae-Amaranthus* percentages and an increase in *Quercus*. The interval from 800 to 300 yrs. B.P. shows a return to higher *Artemisia* and *Chenopodiaceae-Amaranthus* (30% total). The final interval of 300 yrs. B.P. through the present is characterized by decreased *Artemisia* and *Chenopodiaceae-Amaranthus* percentages.

PALYNOLOGICAL EVIDENCE OF THE DEVELOPMENT OF LAND VEGETATION THROUGH THE ORDOVICIAN, SILURIAN, DEVONIAN AND CARBONIFEROUS AND IMPLICATIONS FOR THE ENVIRONMENTAL INTERPRETATION OF TERRESTRIAL, LACUSTRINE, FLUVIAL AND MARINE SEQUENCES

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Spores of land plants are regularly recorded in the late Ordovician. Well preserved spores are present in the type section of the Caradoc Series, Shropshire, England. The spore walls are dark and thickened, presumably in response to the effects of ultraviolet radiation. During the Ashgill, Llandovery, Wenlock, Ludlow and Pridoli, fragmentary sheets of thickened cellular material are frequently recorded in marginal marine sediments. During the Devonian and Carboniferous, increasing amounts of fragmentary vascular tissue is recorded in palynological assemblages, reflecting the increase in vascular land plant vegetation cover. The increase in vegetation cover will have encouraged the formation of soil profiles and reduced rates of sediment erosion. Nutrient levels returned to the oceans by runoff apparently decreased significantly during the Devonian and early Carboniferous, leading to major changes in the marine microflora.

A PALYNOLOGICAL STREW MOUNT SPECIMEN EXAMINATION SYSTEM  
FOR PALYNOMORPHS STUDIED WITH THE OPTICAL MICROSCOPE AND  
SCANNING ELECTRON MICROSCOPE

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A reliable, rapid specimen location procedure for permanent strew mounts is required for routine recording and examination of palynomorphs in biostratigraphy and palynofacies analysis. The location system is based on a square grid, with Rivelin Finder coordinates attached to the axes of the mechanical stage giving a specimen relocation to an accuracy of 1000 microns. The coordinates may be read directly from the mechanical stage without the need to move the microslide. The Rivelin Finder coordinates are compatible with the first three characters of an England Finder reference.

For scanning electron microscope specimen examination, strew dry mounts on a glass coverslip may be examined on the optical microscope prior to coating using a special microslide template. Specimens of particular interest may be photographed as required and relocated rapidly. The coverslip is attached with high vacuum wax to a stub with a Rivelin Finder grid prior to coating. After full examination on the scanning electron microscope, the coverslip may be inverted and, using a template location guide, cemented onto a glass microslide with Petropoxy 154 to provide a permanent reference microslide.

LITHOSTRATIGRAPHY, BIOSTRATIGRAPHY AND RADIOMETRIC DATING OF THE UPPER  
JUDITH RIVER FORMATION AT MUDDY LAKE, SASKATCHEWAN AND DINOSAUR PROVINCIAL  
PARK, ALBERTA.

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Aspects of lithostratigraphy, palynology and radioisotopic dating with regards to correlation of the Campanian in the Alberta Basin will be discussed with examples drawn from localities in Saskatchewan and Alberta. A 55m thick composite section of the Judith River Formation at Muddy Lake, west-central Saskatchewan, represents the northeasternmost surface expression of the formation in the Western Interior. It is a new source of stratigraphic and sedimentologic data applicable to Campanian sequences and has yielded the first nonmarine Campanian vertebrate fossil assemblage from Saskatchewan. Palynologic correlation of the Muddy Lake section with portions of the formation in southern Alberta and north-central Montana is consistent with marine biozone correlations that show a diachronous Judith River/Bearpaw Formation contact from western Saskatchewan (older) to southern Alberta (younger). This correlation suggests that exposures of the Judith River Formation in Dinosaur Provincial Park are correlative with a marine biostratigraphic interval ranging from the Baculites gregoryensis ammonite zone upwards to the Baculites compressus ammonite zone. Palynologic correlation further suggests that a regional disconformity, extending from Dinosaur Provincial Park in southern Alberta to the Muddy Lake area in western Saskatchewan, is a useful chronostratigraphic datum (within one ammonite zone) across this region. Radiometric dating of bentonites from Dinosaur Provincial Park indicate that the Muddy Lake section comprises one million years of geologic time ranging from approximately 76 to 77 Ma.

Biostratigraphy of Late Cretaceous and Paleocene mammals in western Canada. Richard C. Fox, Departments of Geology and Zoology, University of Alberta, Edmonton, Alberta, Canada T6G 2E9.

Mammalian biostratigraphy in North America is based on the concept of North American Provincial Land Mammal Ages (LMA's), biochronological units defined by biological, not lithological criteria. Originally formulated for the Cenozoic, LMA's have been extended into the Cretaceous, and are units of time defined by the stage of evolution of characteristic groups of mammals. Aspects of the succession of Upper Cretaceous and Paleocene mammals in western Canada are reviewed, on the basis of recent work, and the strengths and limitations of the discipline discussed.

Acritarchs of the Ordovician Simcoe Group, Southern  
Ontario

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A well preserved and very diverse acritarch assemblage is described from the Middle-Late Ordovician (Llandeilo-Caradoc) Simcoe Group in southern Ontario. The Simcoe Group comprises 180 m of limestone; the stratigraphic section was sampled at thirty-one localities and fifty species of acritarchs from twenty-three genera were identified.

The lowermost unit in the section, which was deposited in a high energy, nearshore environment was barren of acritarchs. Diversity and overall abundance increased upward in the section in response to a marine transgression which produced, lower energy conditions.

Various acritarch assemblages were recognized based on diversity and dominance and were used as paleoenvironmental indicators. General trends in acritarch distribution appear to correlate quite closely with those of the chitinozoans within the study section.

# MIOSPORES FROM THE CEDAR VALLEY GROUP (MIDDLE - UPPER DEVONIAN) OF IOWA.

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Samples from the carbonate dominated strata of the Cedar Valley Group of Iowa were processed simultaneously for miospores and conodonts. The samples from the open marine strata of the Little Cedar Formation generally produced abundant, diverse, well-preserved miospore floras, as well as conodonts. Samples from the restricted marine to supratidal strata of the Coralville, Lithograph City and Shell Rock Formations also produced miospores and conodonts, but less consistently, and usually in lower abundance and diversity. Over one hundred species and varieties of spores were recognized, most of which are undescribed. The previously described taxa, however, suggest assignment of the lower part of the section to the *lemurata* - *magnificus* and/or *optivus* - *triangulatus* Zones or, alternatively, the *Samarisporites triangulatus* - *Chelinospora concinna* Zone. Conodont faunas suggest assignment of the strata to the following: Middle and ?Upper *varcus* Subzones, *hermanni* - *cristatus* Zone or Lower *disparilis* Subzone, *subterminus* Fauna, and *insita* Fauna. The co-occurrence of miospores and conodonts allows the calibration of the miospore ranges with the established conodont zonation. The miospores will aid in biostratigraphic correlation, including strata lacking the more frequently employed marine invertebrate fossils, such as conodonts.

## MULTIVARIATE ANALYSIS OF PALYNOFACIES DATA

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There is currently considerable interest in the way in which the composition of the acid resistant organic content of sedimentary rocks can be used to aid the interpretation of depositional environments. However, few studies have used multivariate methods in analysing and interpreting the data. Such methods, which reduce the dimensionality of the data, emphasize the most important trends and provide a quantitative basis for assessing these in the light of lithology and depositional environment. They also provide a graphical means of clearly presenting the results much more effectively than is possible through descriptions alone.

Two techniques have been used to analyse published data from the Jurassic and Cretaceous of South-east England (in Sladen & Batten, 1984, and Jarvis *et al.*, 1988). These are stratigraphically-constrained cluster analysis, and principal components analysis in which the scores were plotted stratigraphically as "palynomorph logs". In analyses of data from the Purbeck and Ashdown Beds, these techniques clearly show a dominant trend from *Classopollis* dominated assemblages, indicating arid climates, to those more characterized by fern and lycopod spores, implying increasing humidity. Data from the Cenomanian-Turonian boundary near Dover were also analysed. These results show the differing species responses to the Oceanic Anoxic Event that occurred across this boundary. These results will be discussed in detail to demonstrate the value of these techniques.

# MIOSPORE ASSEMBLAGES FROM THE *Gastrioceras listeri* MARINE BAND AND ASSOCIATED COAL MEASURES, SHEFFIELD, ENGLAND.

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Comparisons of Westphalian A (= Morrowan, Lower Pennsylvanian,) palynological assemblages from Western Europe with those from North America at first sight seem to indicate that many taxa are restricted to North America. Recent studies of British Westphalian A sequences, however, have revealed the presence of several "American" miospore species previously unrecorded from Europe. These include: *Adelisporites multiplicatus* and *Tantillus triquetus* from Northumberland (Butterworth & Mahdi, 1982); *Anafoveosporites avcinii*, *Diaphanospora parvigracila*, *Paleospora fragilis*, *Rugospora gracilirugosa* and *Tinnulisporites microsaccus* from the southern North Sea (Mahdi in Butterworth, Mahdi & Nader, 1988); *Trinidulus diamphidios* from Shropshire (Turner & Spinner, 1990) and *Costatascyclus crenatus*, *Pteroretis primum* and *Trinidulus diamphidios* from South Yorkshire (McLean, in prep.)

Samples from the Lower Westphalian A *Gastrioceras listeri* Marine Band and the associated Ganister Coal and non-marine mudstones from the Sheffield region have been prepared for palynological analysis. Samples provided well preserved, highly abundant and very diverse assemblages. Most, particularly those of non-marine mudstones above the Marine Band, contain many "American" taxa. These include: *Adelisporites multiplicatus*, *Anafoveosporites avcinii*, *Cordaitina coalensis*, *Costatascyclus crenatus*, *Diaphanospora parvigracila*, *Illinites unicus*, *Peppersites cf. ellipticus*, ?*Pteroretis* sp., *Quasillinites diversiformis*, *Raistrickia brevenensis*, *Rugospora gracilirugosa*, *R. radiata*, *Spackmanites* spp., *Tinnulisporites microsaccus*, and *Trinidulus diamphidios*.

The assemblages also contain specimens of certain distinctive taxa originally described from the Westphalian of Turkey. Occurrences of *Reticulatisporites karadenizensis* (recombinable with the genus *Cordylisporites* Playford & Satterthwaite 1985), *Fragilipollenites radiatus* and *Fragilipollenites* aff. *radiatus* from western Europe have never been published.

Also of note is the presence of disaccate taxa (*Illinites unicus*, *Parasporites macanensis* and *Pityosporites westphalensis*), the occurrence of which corresponds with assemblages obtained from horizons of similar age in northern Spain (Neves, 1964) and southern Scotland (Sabry & Neves, 1971).

Most of the taxa mentioned above are highly distinctive, although usually rare, and are potentially of biostratigraphic value. Re-examination of the published material of Sabry & Neves (1971) housed in the palynology collection at Sheffield University indicates that many of these taxa are present (e.g. *Reticulatisporites karadenizensis*, *Rugospora gracilirugosa*, *Tinnulisporites microsaccus*) but have gone unrecorded. Re-study of unpublished data and published material from the Westphalian A of Britain provides an indication of the biostratigraphic value of these forms.

## PALYNOLOGICAL EVENT HORIZONS AND THEIR USE IN REGIONAL CORRELATION, UPPER CRETACEOUS, WESTERN NORTH AMERICA

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Broad-scale regional correlations of nonmarine strata can be effected by utilization of palynological event horizons. These biostratigraphic datums are based on major evolutionary changes in terrestrial vegetation reflected in the appearance or disappearance of distinctive higher level palynological taxa. Five such event horizons are present in Upper Cretaceous rocks of western North America; these horizons provide a framework of correlations from northern Canada to the southwestern United States. Palynological event horizons can be calibrated using vertebrate biostratigraphy and, through terrestrial palynomorphs recovered from nearshore marine intervals, using the Western Interior ammonite zonation. Finer scale correlations are possible within broadly correlated intervals, but they may be complicated by latitudinal variation in composition of contemporaneous palynomorph assemblages and by diachroneity in first appearances of certain species-level taxa. Problems induced by latitudinal variation and diachroneity can be mitigated by recognition of event horizons involving more than one taxonomic group. The palynological event horizons recognized to date and the corresponding stage boundaries they mark are: (1) appearance of tricolporate pollen and obligate pollen tetrads, Albian-Cenomanian; (2) appearance of triporate and oculate pollen, Turonian-Coniacian; (3) appearance of triprojectate pollen, Santonian-Campanian; (4) appearance of pollen of the genera *Wodehouseia* and *Kurtzipites*, Campanian-Maastrichtian; and (5) disappearance of numerous taxa at the Maastrichtian-Danian (K-T) boundary—the K-T mass extinction. The K-T event horizon is calibrated using geochemistry and mineralogy as well as vertebrates and is the most precise and reliable event horizon in western North America.

PALYNOMORPHS FROM CENOMANIAN, TURONIAN, AND CONIACIAN MARINE STRATA IN THE POWDER RIVER BASIN, WYOMING

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Palynomorphs were extracted from the cores of two stratigraphic test wells drilled on the east and west flanks of the Powder River basin in Wyoming. The eastern well, at Beaver Creek near the town of Osage, penetrated rocks deposited in a deep shelf environment during the early Late Cretaceous. These strata are assigned to, in ascending order, the Belle Fourche Shale, the Greenhorn Formation, and the Pool Creek, Turner Sandy, and Sage Breaks Members of the Carlile Shale. The western well, at Bailey Flats near the town of Kaycee, includes strata deposited in a shallow shelf environment during the same time interval. These rocks are assigned to the Frontier Formation and the overlying Cody Shale. Ages of the rock units are based on fossil mollusks from nearby outcrops and from the cores.

Approximately 275 m of core was recovered from the eastern well and over 305 m from the western well. Samples were taken only from dark silty shales, which resulted in a variable sample interval from 3 to 9 m. Preliminary examination of the material has revealed diverse and abundant palynomorph assemblages throughout the study interval strongly dominated by dinoflagellate cysts; pollen, spores, and acritarchs are less common. Topics to be investigated include morphology and taxonomy of the dinocysts and development of a palynological biostratigraphy by comparison with the standard zonation based on mollusks. Changes in dinocyst assemblages can then be compared with parasequence events as well as the Cenomanian-Turonian and Turonian-Coniacian stage boundaries.

THE BIOSTRATIGRAPHIC POTENTIAL OF MIDDLE CAMBRIAN TO TREMADOCIAN ACRITARCHS: MODIFICATION OF EXISTING ZONAL SCHEMES BASED ON MATERIAL FROM CONCEPTION AND TRINITY BAYS, NEWFOUNDLAND, AND ST. JOHN, NEW BRUNSWICK

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Acritarch assemblages from the early Middle Cambrian to Early Ordovician (Tremadoc) of southeastern Newfoundland and from New Brunswick can be correlated in part with assemblages from Spain, Belgium, Britain, North Africa, northern Norway, and the Russian Platform. The section at the NW part of Random Island, Trinity Bay, is almost complete and can be used as a reference section for acritarchs of this time interval. Martin and Dean (1981; 1983; 1984; 1988) defined nine acritarch zones based on material from Random Island and from Manuels River, Conception Bay. Examination by the authors of samples from these two localities, and from St. John, New Brunswick, supports much of this zonation, but some modification is required in light of new finds from Random Island.

Three assemblages not previously reported from this area have been recovered from the Random Island section - one from the *Peltura* Zone, and two from probable *Acerocare* strata. The oldest assemblage is characterized by the presence of a new species of *Acanthodiacrodium*, the second, by new species of *Ooidium* and *Acanthodiacrodium*, and the youngest, by the common occurrence of *Ooidium rossicum*, originally described from the *Obolus* Beds of the Russian Platform. Two of the assemblages appear to be totally new, and the third, the *O. rossicum* assemblage, has not previously been described from Random Island.

Additional taxa recovered from the A5 and A6 assemblages of Martin and Dean (1981) have been used to refine the definition of these assemblages.

LONG-DISTANCE DEVONIAN SPORE CORRELATIONS: AUSTRALIAN AND CANADIAN PALYNOFLORAS COMPARED

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Spore floras of the Devonian system in Australia are known principally, albeit intermittently, from subsurface, Middle to Upper Devonian, marine to continental sequences in the Carnarvon, Canning, and Bonaparte basins of northwestern Australia, and in the Adavale Basin in Queensland. Sufficient data are now available to permit comparison of the Australian spore assemblages with those reported from the much more intensively studied sequences in Euramerica (and in Canada in particular); and, thereby, to facilitate qualified recognition in Australia of the palynozonation established (by J.B. Richardson and D.C. McGregor in 1986) for the Old Red Sandstone region. The comparison is feasible at various levels - i.e., form-taxonomic, morphons, and gross morphological characteristics - and provides not only a means for long-distance biostratigraphic correlation, but also some insights into Devonian global phytogeography.

THE SPORE AND POLLEN SUCCESSION OF THE TYPE DAKOTA FORMATION (?LATE ALBIAN-CENOMANIAN) OF THE NORTH CENTRAL UNITED STATES: COMPARISONS AND LITHOSTRATIGRAPHIC IMPLICATIONS

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The Dakota Formation of Nebraska, South Dakota and Iowa is a dominantly non-marine siliciclastic unit of mid-Cretaceous age. Various units designated as "Dakota" throughout a dozen central and western states are based on this type area. Arguments about the precise age and relationships of the type Dakota to "Dakota" strata in the Rocky Mountain area have continued for many years, hampered by the lack of biostratigraphic data. A rich and diverse succession of non-marine palynomorphs occurs in the upper part of the type Dakota, and compares favorably with successions from other areas in North America. Key comparative species are *Cicatricosisporites crassiterminus*, *Impardecispora purverulenta*, *Microfoveolatosporis pseudoreticulatus*, *Polypodiisporites cenomanianus*, *Artiopollis indivisus*, *Equisetosporites ambiguus*, *Plicatella fucosa*, *Neorastriackia robusta*, *Impardecispora marylandensis* and *Plicatella jansonii*. These comparisons indicate that the upper part of the type Dakota ranges in age from latest Albian to late Cenomanian, and imply that the lower part of the unit, from which no palynomorphs have yet been recovered, is potentially Albian.

Albian and Cenomanian strata are widely exposed in North America. Virtually everywhere, strata of Albian and Cenomanian ages are separated by a distinct unconformity representing the withdrawal of marine waters from the Western Interior Seaway during late Albian time. A contradiction appears to exist, however, in the placement of the Albian-Cenomanian boundary in western Canada and in many areas of the United States. In western Canada, this boundary is conventionally placed at the well-known "Fish-scale Bed" separating the Lower and Upper Shaftesbury Formation, which has been correlated into the western United States to units such as the Aspen Shale. Rather than being an unconformable surface developed at maximum regression of the sea, however, these units represent starved-basin deposits developed during a marine high stand. Objective correlation of these sections with type European Albian and Cenomanian sections is also largely lacking. No evidence for a mid-Cretaceous unconformity has been observed in the type Dakota area, but the lower part of the formation is dominantly sandy and poorly exposed; the presence of an unconformable surface may simply remain undetected. Clarification of the age of the type Dakota should promote reevaluation of largely conjectural lithostratigraphic relationships with "Dakota" strata in areas to the west.

# WHATEVER REMAINS, HOWEVER IMPROBABLE . . . A REVIEW OF DATA PRESENTATION IN PALYNOLOGY.

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The proper identification of fossils and their location in time and space is always central to palynological data. This basic information need not occupy much room in a publication; articles often are better when it doesn't. Examples from recent palynological literature suggest that an astonishing amount of effort is being expended in the concealment of such information in creative ways that both increase verbiage and decrease effective communication. For the readers' benefit, authors, editors and reviewers need to apply more rigorously certain standard principles in the presentation of palynological information.

What, Where and When should be given unambiguously in the title of any article. Titles are important; often we find out about an article only by noticing its title in a list of references, with no other information about it available. A title such as "The age and significance of XYZ" is insufficiently informative. What is the age? What is the significance? Stratigraphic and geographic terminology used should be common knowledge to the intended audience; an author can reasonably expect a reader of palynological literature to know what is meant by the "late Toarcian of Bolivia", but not what is meant by the "L. sinuatus Zone of the Cucaracha Formation near Santa Angelina del Oso de Oro." Locations should be shown on a meaningful map; no one should be expected to consult an atlas to find a locality listed only by latitude and longitude. Detailed stratigraphic information should be summarized in one place and in a unified manner, preferably by graphic means (a simple *pro forma* chart provides an example), which often can eliminate large amounts of prose, making articles both shorter and clearer. Readers should not be required to flip back and forth among several pages to determine that the observed range of *Aggravatodinium infurcatum* is Cenomanian to Campanian, when such information can be presented on a single chart. Illustrations ought to show something, especially if the caption says so.

In presentation of taxonomic information using standard Linnéan names, there is no excuse for not following rules and procedures of the International Code of Botanical Nomenclature. Good reasons exist for these, developed over decades for the sole purpose of clarity of communication. Taxa lists should include both names and authorship; proposed reassignments require citation of basionyms. To do less invites ambiguity and error and saves little, if any, space in a publication.

The most important question to be asked by an author about any aspect of an article is What is the point? If it doesn't have one, leave it out. Life is short. Authors, reviewers and editors should not expect the reader to spend large portions of it being Sherlock Holmes, straining to ferret out the truth from hidden and scattered clues.

## LATE QUATERNARY PALAEOENVIRONMENTS OF THE LAKE O'HARA REGION, YHO NATIONAL PARK, BRITISH COLUMBIA, CANADA.

Reasoner, Mel A. (1), Hickman, M. (2), (1) Dept. of Geology, (2) Dept. of Botany, Univ. of Alberta, Edmonton, Alberta, Canada, T6G 2E3.

Lake O'hara (subalpine) and Opabin Lake (alpine) are situated immediately adjacent to a high section of the Continental Divide in the central Canadian Rocky Mountains. Core samples recovered from the lakes show a consistent stratigraphy comprising gyttja and underlying inorganic clastic sediments. The gyttja contains Bridge River (2350 yr BP) and Mazama (6800 yr BP) tephras and is separated from the lower clastic sediments by a sharp, conformable contact. Radiocarbon dates obtained from conifer needles immediately above the contact indicate that deglaciation had proceeded upvalley from the O'Hara basin prior to ca. 10,100 yr BP and that moraine systems situated downvalley are Late Wisconsinan.

Pollen zone LOH25-1 (> 10,100 yr BP) is dominated by *Pinus* (ca. 80%) with *Artemisia* and *Gramineae* pollen well represented. Also present are "exotic" taxa (*Quercus*, *Sarcobatus* and *Ephedra*). Pollen zone LOH25-2 is characterised by decreasing *Pinus* (ca. 70 to 50%) and increasing *Picea* (ca. 5 to 20%) pollen with *Abies* and *Alnus* pollen as important contributors. Pollen zone LOH25-3 is dominated by *Pinus* (ca. 55%) with *Picea*, *Alnus*, *Abies*, and *Tsuga* other important pollen types. Pollen and macrofossil data suggest that a *Pinus-Abies* forest was established in the vicinity of Lake O'Hara by ca. 10,100 yr BP. Vegetation resembling modern subalpine *Picea-Abies* forest was established by ca. 3000 yr BP. By ca. 8530 yr BP timberlines were at least 70 m higher than present (at or above the elevation of Opabin Lake) and had declined to near modern elevations by ca. 2350 yr BP. Glacigenic sediments are absent from the Opabin record for this period. Warmer than present climatic conditions are inferred for the period ca. 8530-3000 yr BP.

## CHITINOZOAN REFLECTIVITY : AN INNOVATIVE LOWER PALAEOZOIC THERMAL MATURITY INDEX. A CASE STUDY FROM THE WELSH BASIN, GREAT BRITAIN.

Paul M. Tricker

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

The paucity of the maceral vitrinite in the Lower Palaeozoic sediments means alternative methods of thermal ranks assessment must be employed in pre-Devonian sediments.

Chitinozoan reflectivity (Chit  $R_0$ ) is an innovative method of maturity determination suitable for the Lower Palaeozoic. Chitinozoa are common marine microfossils which are relatively facies independent, have thick apparently homogeneous walls, and are easily identified making them ideal for use in organic petrology. Analysis of samples which contain both chitinozoa and vitrinite (Late Silurian-Devonian) permits direct calibration between Chit  $R_0$  and vitrinite reflectance (Vit  $R_0$ ), proves a similar regular progression of Chit  $R_0$  through increasing maturities and enables Lower Palaeozoic sediments to be compared directly against the established maturation scale. Chit  $R_0$  is being utilised to maturity map the pre-Devonian rocks of the Welsh Basin.

Limited occurrences of hydrocarbons are known in the Welsh Basin but the source is unidentified. The two plausible sources are either (i) migration from the hydrocarbon bearing Carboniferous, or (ii) the Lower Palaeozoic itself. A satisfactory hydrocarbon source potential assessment is now possible with the resolution and widespread maturity data afforded by Chit  $R_0$ . In this study the maturity, type and amount of Lower Palaeozoic organic matter in the Welsh Basin is evaluated.

A source evaluation for the Lower Palaeozoic Welsh Basin is concluded on the basis of the findings; shelf areas possess thermal maturities which are favourable but low quantity and poor quality of available kerogen mean the source rock potential is poor. Basinal kerogen is now overmature but occurs in higher quantity and quality.

## PALYNOLOGY AND THERMAL MATURITY OF LOWER CARBONIFEROUS OIL SHALES OF NOVA SCOTIA AND NEW BRUNSWICK

John Utting,

Institute of Sedimentary and Petroleum Geology, 3303-33rd St. N.W., Calgary, Alberta, T2L 2A7.

The Lower Carboniferous (Tournaisian) Horton Group, Nova Scotia and New Brunswick, contains oil shales of economic interest. Complex lithostratigraphy, resulting from rapid lateral facies changes, and the lack of complete sections, has hindered petroleum and mineral exploration. Palynological investigation of the type sections and coeval beds of the Horton Group indicates that there are four assemblage zones and two subzones. These zones are independent of facies changes, and permit relatively detailed biostratigraphic correlations to be made. The oil shales in the Antigonish and Moncton basins can be assigned to the same subzone, which contains spore assemblages characterised by abundant *Spelaotriletes cabotii* Utting and *Vallatisporites vallatus* Hacquebard, and the presence of *Umbonatisporites abstrusus* (Playford) Clayton and *U. distinctus* Clayton. The alga *Botryococcus* sp. is common to abundant. The similarity of Lower Carboniferous spore assemblages from Atlantic Canada and Western Europe enable precise correlations to be made with parts of the Dinantian. These comparisons indicate that the Horton Group, and coeval beds, are of Tournaisian age (early to mid Tn2 to late Tn3), and the oil shales are late Tn2 to early Tn3.

The thermal maturity of the group varies throughout Atlantic Canada, on a five point scale, from low to high. For example, the oil shales of Antigonish, Nova Scotia, and Albert Mines, New Brunswick, generally have a low Thermal Alteration Index (TAI 2- to 2+). An example of high thermal maturity (TAI 5) occurs in the Horton Group of the L' Ardoise area of southeastern Cape Breton. These differences may reflect variations in depth of burial, but other factors might include heating adjacent to plutons, faulting and tectonic loading.

# XII ICC - P

INTERNATIONAL CONGRESS ON  
CARBONIFEROUS - PERMIAN



## XII ICC - P

### INTERNATIONAL CONGRESS ON CARBONIFEROUS - PERMIAN

BUENOS AIRES SEPTEMBER 1991

Plans are moving ahead smoothly regarding the XII ICC - P International Congress on Carboniferous - Permian that will be held in Buenos Aires, Argentina, September 22-27, 1991.

In order to accommodate as many persons as possible at the Congress the organizing committee has moved the date for the receipt of registration materials, excursion fees, housing bookings and abstracts back to 15 April 1991.

In order to eliminate potential problems with the mail abstracts and all registration materials and fees for the Congress can be sent to either:

Dr. Thomas N. Taylor  
Dept. Plant Biology  
Ohio State University  
1735 Neil Ave.  
Columbus, Ohio 43210 USA

(614) 292-3564  
FAX (614) 292-2180

Dr. W.C.H. Ramsbottom  
Brow Cottage  
Kirkby Malzeard  
Ripon  
N. Yorks  
HG4 3RY  
England

Please note that there are no special forms for abstracts and that they will be retyped by the Congress staff. Abstracts are limited to 250 words.

Excursions are rapidly filling up so please book these as soon as possible.

A receipt will be sent for all fees received.

No refunds will be granted after 1 July 1991.

## XII - ICCP Palynological Symposium, Buenos Aires, September 1991

The XII International Congress of Carboniferous-Permian Stratigraphy and Geology (XII - ICCP) is to be held during 22-27 September 1991 in Buenos Aires, Argentina. The scientific programme planned for the Congress is a diverse one embracing many aspects of Upper Palaeozoic stratigraphy, biostratigraphy, palaeontology, palaeobotany, sedimentology, coal geology, geochemistry, geotectonics, geochronology, and economic geology. If you have not already received a copy of the First Circular, copies are available from the Congress Convener, Dr Sergio Archangelsky, Museo Argentino de Ciencias Naturales, Av. A. Gallardo 470, Buenos Aires 1405, Argentina.

The XII - ICCP Palynological Symposium will cover a diversity of palynological topics within that age-range, including: miospores, megaspores, organic-walled microphytoplankton, natural affinities of palynomorphs, palynomorph/lithotype relationships; and applications of palynomorphs in such fields as biostratigraphy (including Devonian - Carboniferous and Permian - Triassic boundary criteria), phytogeography, palaeoecology, and maturation assessments. Your participation in the Symposium is most warmly sought.

Details concerning the time allocations for oral presentations and concerning poster specifications will be announced in the next Congress Circular. Also, contributors will be invited to prepare their contributions for publication in the Congress Proceedings (Compte Rendu) as per previous congresses. In the meantime, it would be very helpful if you could advise one of us, as Symposium co-conveners, whether you think there is a reasonable chance of your being able to participate in the Symposium and, if so, provide a tentative title for your contribution.

Geoffrey Playford

Dept of Geology  
University of Queensland  
St Lucia, Brisbane  
Australia 4067

Carlos Azcuy

Dept Ciencias Geologicas  
Univ. de Buenos Aires  
Fabellon 2 - 1428 Nunez  
Buenos Aires, Argentina

Bernard Owens

British Geol Survey  
Keyworth  
Nottingham NG12 5GG  
England

## Conveners, XII - ICCP Palynological Symposium



**Commission Internationale de Microflore du Paleozoïque:  
Acritarch and Chitinozoa Subcommissions**



**Symposium on Acritarchs and Chitinozoa  
British Geological Survey, Keyworth, Nottingham, U.K.**

**3 - 6 September 1991**

**Second Circular**

**C.I.M.P. SYMPOSIUM ON ACRITARCHS AND CHITINOZOA,  
BRITISH GEOLOGICAL SURVEY, KEYWORTH, NOTTINGHAM, U.K.  
3-6 SEPTEMBER, 1991.**

**INVITATION:**

You are cordially invited to attend a C.I.M.P. Symposium on Acritarchs and Chitinozoa at the headquarters of the British Geological Survey, Keyworth, Nottingham, U.K., between 3rd and 6th September 1991. The First Circular generated offers of more than 30 contributions concerning acritarch and chitinozoan biostratigraphy and palaeoecology, acritarch taxonomy, classification and evolution, evolutionary lineages in chitinozoa, chitinozoan provincialism, and phytoplankton productivity.

**VENUES:**

Registration will commence on Tuesday 3rd September at the University of Nottingham. Technical sessions on Wednesday 4th September and Friday 6th September will be held in the De la Beche Lecture Theatre at the headquarters of the British Geological Survey, Keyworth. On Thursday 5th September, a workshop session will be held in the Department of Geology, University of Leicester, approximately 30km south of Keyworth. Transport will be provided between the University of Nottingham, Keyworth and Leicester.

**REGISTRATION:**

Pre-registration for the Symposium should be made on the enclosed Registration Form, which should be returned with payment of £40 (students £20) by 30th APRIL 1991. Cheques and money orders in £ sterling should be made payable to "C.I.M.P. Acritarch Symposium".

**ACCOMMODATION:**

A provisional booking has been made for accommodation in a student hall of residence at the University of Nottingham. The University occupies an attractive parkland campus about 3km WSW of Nottingham city centre and 12km NW of Keyworth. Most of the accommodation is in single study-bedrooms, though a few double rooms may be available on request. The cost of university accommodation is £32 per person per night, and includes dinner, bed and breakfast, the cost of transport from the University to Keyworth and Leicester, and the cost of the Symposium Dinner. University accommodation should be reserved on the enclosed Registration Form, and may be paid for in advance or at registration.

Alternative accommodation will be available in hotels and guest houses in Nottingham city centre and the city's southern suburbs. The symposium organisers will supply details on request, but responsibility for booking alternative accommodation rests with individual participants.

The cost of morning coffee and afternoon tea is included in the Registration Fee. Participants should note, however, that they will have to purchase their own mid-day meals. Canteen facilities are available at



Keyworth and Leicester; in addition, the University of Leicester is within easy reach of Leicester city centre where meals may be purchased in restaurants and public houses.

#### TECHNICAL PROGRAMME:

1. Oral Presentations. These are scheduled for the two full days of the symposium to be held at Keyworth, on Wednesday 4th and Friday 6th September. All speakers will be allocated 20 minutes for their presentation, including time for discussion. Twin 35mm projectors and an overhead projector will be available.

2. Posters. Wherever possible, posters should be designed to fit a standard 1m x 1m area. Anybody requiring a larger area on which to display their poster should indicate this on the returned Abstract Form. At present there are no plans to include a poster session in the proceedings; it is probable that posters will be displayed for the duration of the symposium.

3. Workshop. The workshop session on Thursday 5th September will be held in the Department of Geology, University of Leicester. The Department of Geology at Leicester is a major centre of Lower Palaeozoic micropalaeontology in Britain, with staff and research students currently studying ostracodes, conodonts, acritarchs and chitinozoa. Our decision to hold the workshop session at Leicester is based partly on this, and partly on the fact that the university has the laboratory bench space and microscopes necessary to hold such a session.

We have included a workshop in the symposium in order to allow participants to bring material that they are working on, that they may have discussed in oral presentations or illustrated in posters, and to allow free and informal discussions between colleagues. Its success depends on the willingness of symposium delegates to participate, so please do not let this opportunity pass - bring along some of your material.

#### INSTRUCTIONS FOR THE SUBMISSION OF ABSTRACTS:

Abstracts are required for oral contributions and posters, and should be submitted on the enclosed Abstract Form by 30th APRIL 1991. They should follow the format shown below.

LATEST TREMADOC - EARLIEST ARENIG SEDIMENTS IN ENGLAND AND WALES: THEIR BEARING ON THE DEFINITION AND CORRELATION OF THE BASE OF THE ARENIG SERIES.

MOLYNEUX, S.G. and RUSHTON, A.W.A., British Geological Survey, Keyworth, Nottingham NG12 5GG, U.K.

The definition and correlation of the base of the Arenig Series presents particular problems. In its type area, the Arenig Series has yielded shelly and graptolitic faunas. The former.....(etc.)

Work in the English Lake District has revealed the presence of a distinctive acritarch assemblage, characterized by .....(etc.)

#### PUBLICATION:

Negotiations are continuing to find a suitable journal in which to publish the proceedings of the Symposium. One possibility is that the Palaeontological Association may be willing to accept papers for a publication in the series Special Papers in Palaeontology. Intending contributors to a Symposium Volume should indicate their interest on the returned Abstract Form. They will be provided with a guide for authors once a decision has been made about publication.

#### FIELD EXCURSION:

The symposium will be followed by an excursion of 3 days duration to internationally important Lower Palaeozoic sections in Wales and the Welsh Borderland. The excursion will be based in bed and breakfast accommodation in Ludlow, at a cost of approximately £17 per person per night. Transport will be by mini-bus to allow ease of access to forestry sections, but this means that numbers will necessarily be limited to 24 participants (excluding leaders). Places will be allocated on payment of an Excursion Registration Fee of £15, to cover transport costs and the cost of producing a field excursion guide. Please indicate your interest on the enclosed Registration Form.

A provisional itinerary for the excursion is as follows:

Friday 6th September 1991 (p.m.). Depart from Keyworth for Ludlow.

Saturday 7th September. Precambrian-lower Ordovician.  
(Longmynd, Wrekin, Shinetun, Shelve).

Sunday 8th September. Upper Ordovician, Onny Valley.  
Lower-Middle Silurian  
(Llandovery-Wenlock), Wenlock Edge.

Monday 9th September. Upper Silurian (Ludlow) Mortimer Forest. Return to Nottingham by late afternoon/early evening, in time to allow participants to travel on to other destinations. Participants requiring overnight accommodation in Nottingham should indicate this on the enclosed Registration Form.

Intending participants should note that mid-day and evening meals are not included in the estimated costs, and should budget accordingly.

#### REFUNDS:

In the event of cancellation before 30th June 1991, 90% of all fees paid will be refunded. After that date, refunds will be limited to 75%.

C.I.M.P. SYMPOSIUM ON ACROTARCS AND CHITINOZOA

REGISTRATION FORM

Please complete and return with payment in £ sterling by 30th APRIL 1991.

Name and address:

Tel. \_\_\_\_\_ FAX \_\_\_\_\_  
Accompanied by: \_\_\_\_\_

1. REGISTRATION. Please complete either Section A or Section B.

Section A ☐ (please tick if applicable).

I will be attending the symposium and enclose payment of the registration fee (pre-registration £40 per person attending the symposium; students £20 per person).

Section B ☐ (please tick if applicable).

I hope to attend the symposium but I am unable to make a firm commitment.

2. ACCOMMODATION.

Please reserve accommodation for ..... person(s) in student residence at the University of Nottingham for the following nights, at a cost of £32 per person per night (includes dinner, bed and breakfast and the cost of transport to Keyworth and Leicester).

Tuesday 3rd September .... Wednesday 4th September ....  
Thursday 5th September ....

I enclose payment/will pay at registration for the accommodation (please delete whichever is not applicable).

Approximate time of arrival on first day .....

Special dietary requirements .....

Other special requirements .....

(continued over page)

3. FIELD EXCURSION.

I wish to book a place on the post-symposium excursion for ..... person(s), and enclose payment of the excursion registration fee(s) of £15 per person.

I am willing to share a room YES/NO. I am a smoker/non-smoker.

I wish to share a room with .....

I/we will require overnight accommodation in Nottingham on Monday 9th September YES/NO.

4. PAYMENT.

I enclose payment of the following:

- |  |        |
|--|--------|
| 1. Pre-registration Fee (£40; students £20)            | £..... |
| 2. University accommodation (£32 per person per night) |        |
| for the nights of:                                     |        |
| Tuesday 3rd September                                  | £..... |
| Wednesday 4th September                                | £..... |
| Thursday 5th September                                 | £..... |
| 3. Excursion Registration Fee (£15 per person)         | £..... |

Total enclosed £.....

Please note: all cheques and money orders must be in £ sterling and made payable to "C.I.M.P. Acrotarch Symposium".

Please return this form to:

Dr S.G. Molyneux  
British Geological Survey  
Keyworth  
NOTTINGHAM NG12 5GG  
U.K.

8th International Palynological Conference

Aix en Provence, France

September 6-12 1992

Extra C.I.M.P. Organised Symposium

PALAEOZOIC PALYNOMORPHS OF THE GONDWANA - EURAMERICAN INTERFACE

Organisers:

Dr A Le Herisse, Université de Bretagne Occidentale, Brest, France

Dr F Paris, Université de Rennes, Rennes, France

Dr S Loboziak, Université de Sciences et Techniques de Lille,  
Villeneuve d'Ascq, France

Dr Y Grahn, Petrobras, Rio de Janeiro, Brazil.

Aim of Symposium

The principal objectives of the proposed Symposium are to examine the general trends of palynomorph assemblages of the Gondwanan and Euramerican landmasses during the different systems of the Palaeozoic. All relevant papers with new data and original interpretations are welcome. These contributions should be targeted at refining existing Biostratigraphy and Biochronology and developing more precise concepts on biogeographic distribution patterns of palynomorph assemblages in response to palaeo-ecological and palaeoclimatological circumstances.

WHY NOT JOIN US?

Your name and title: .....

Your address: .....

.....

.....

Title of proposed Symposium contribution: .....

.....

.....

To be returned to:

A Le Herisse, Lab. de Paléontologie,  
Université de Bretagne Occidentale, U.E.R. Sciences,  
Avenue Le Gorgeu, 29287 Brest Cedex, France.

# C.I.M.P. SYMPOSIUM ON ACRITARCHS AND CHITINOZOA

## ABSTRACT FORM

For instructions regarding format, please refer to the Second Circular

I intend giving this paper as an oral presentation ☐ ; as a poster\* ☐

I intend to submit a manuscript for inclusion in the Symposium Proceedings ☐

\* Contributors offering posters will be allocated board space of approximately 1m x 1m.

Any additional requirements should be indicated here: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FIFTH INTERNATIONAL CONFERENCE  
ON MODERN AND FOSSIL DINOFLAGELLATES

ZEIST, THE NETHERLANDS  
APRIL 19 - 25, 1993



FIRST ANNOUNCEMENT

Dino5 will focus on all aspects of modern and fossil dinoflagellates, including, but not limited to, life cycles, ecology, morphology, biology, chemistry, stratigraphy and the significance of dinoflagellates in Recent and ancient environments. The conference will be held April 19-25 1993 in Zeist, at the premises of the Royal Dutch Soccer Association, near Utrecht. The meeting is being organized under the auspices of the Laboratory of Palaeobotany and Palynology of the University of Utrecht. The third symposium on Neogene - Quaternary Dinoflagellates will be organized in conjunction with Dino5.

ORGANIZING COMMITTEE

Raimond Below (Utrecht NL)  
Henk Brinkhuis (Conference Manager, Utrecht NL)  
Barrie Dale (Oslo N)  
John Dodge (Egham UK)  
Han Leereveld (Utrecht NL)  
Jan Willem Weegink (Secretary, Utrecht NL)  
Henk Visscher (Chairman, Utrecht NL)

THIRD SYMPOSIUM ON NEOGENE - QUATERNARY DINOFLAGELLATES

Co-Convenors:

Martin J. Head (Toronto CANADA) & John H. Wrenn (Tulsa USA)

Please take notice of this announcement and mark your agenda's in red. Fill in the form below to secure your participation and (preliminary) registration.

FIFTH INTERNATIONAL CONFERENCE  
ON MODERN AND FOSSIL DINOFLAGELLATES

ZEIST, THE NETHERLANDS  
APRIL 19 - 25, 1993

Preliminary Registration Form

Name: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

☐ Yes, I plan to attend Dino5

☐ I also plan to present an ☐ oral presentation and/or ☐ poster

a probable topic will be \_\_\_\_\_  
\_\_\_\_\_

Please send this form to:

Symposium Secretariat  
Jan Willem Weegink  
Lab. Palaeobot. Palynol.  
University of Utrecht  
Heidelberglaan 2  
3584CS Utrecht The Netherlands

Tel. xx31-30-532799  
Fax. xx31-30-531357

## ELECTION OF NEW CIMP PRESIDENT

Nominations are now required to elect a new CIMP President to replace Bernard Owens, whose term of office must come to an end this year.

In accordance with the CIMP Constitution, nominations for a candidate must be received from three separate laboratories to be confirmed as a viable contestant in the election. Nominations can be received in writing from any CIMP member but must have the agreement of the nominee.

In the event of more than one valid nomination being received, a postal ballot will be organised during the late Summer of 1991.

Nominations should be sent to the Secretary General, Dr Jacques Vernier, VUB-KWAR, Pleinlaan 2, B1050 Brussels, Belgium. All nominations must be received by May 24 1991.

---

Offer of jobs (received 25 nov. 1990)

The Saudi Arabian Oil Company (SAUDI ARAMCO) the free world's largest producer and exporter of oil and gas, has the following opportunities available in Saudi Arabia:

### PALYNOLOGIST

Master's degree in Geology and ten years' experience in the petroleum industry or related fields required. Candidates must have experience in palynostratigraphy and palynofacies analysis. Knowledge of S.E.M. operations helpful and a background in the Paleozoic section an asset.

### MICROPALAEONTOLOGIST

Master's degree in Geology and ten years' experience in the petroleum industry or related fields required. Candidates must have experience in Mesozoic and Cenozoic microfaunal age and environmental interpretation with, foraminifers and ostracods, nannofossil, macrofossils and microfossils experience an asset.

Employment with Saudi Aramco will provide you with an interesting lifestyle in a multicultural environment, including comfortable family living arrangements, free medical care while in Saudi Arabia, fine schools and a broad spectrum of recreational opportunities, plus 36 calendar days of vacation annually, allowing for extensive travel. We provide an attractive compensation package which includes an expatriate premium.

For immediate consideration, please send your resume/salary history in confidence to: ASC, Employment Dept. 06S-006-0, P.O. Box 4530, Houston, Texas 77210-4530

## CIMP ANNUAL SUBSCRIPTIONS 1991

In order to maintain our aim of issuing at least two Newsletters each year (march and september), it is vital that we receive your subscriptions on a regular basis. In 1989 we have received payments from less than 10% of our members.

Please arrange to make your payments as soon as possible. We would particularly appreciate payments for any years outstanding.

For your convenience payments can be made to any of the following regional collectors:

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France/Spain: Dr. S. LOBOZIAK, Lab. de Paleobotanique, Sciences de la Terre, Université des Sciences et Techniques de Lille, F-59650, Villeneuve d'Ascq Cedex, France.

U.K./Ireland: Dr. P.J. HILL, Dept. of Geology, Derbyshire College of Higher Education, Kedleston Road, Derby, England, U.K.

Belgium: Dr. M. VANGUESTAINE, Lab. ass. Palaeontologie, Université de Liège, 7 Place du Vingt Aout, B-4000 Liège, Belgium.

Others: President or Secretary

Rates: 3£, 30FF, 175BF, 10DM, 10Dfl, 6 US\$.

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Algemene Spaar- en Lijfrentekas (ASLK)  
Wolvengracht  
1000 Brussel Belgium  
Account N° 001-2193763-87  
on the name CIMP, Pleinlaan 2, 1050 BRUSSEL.