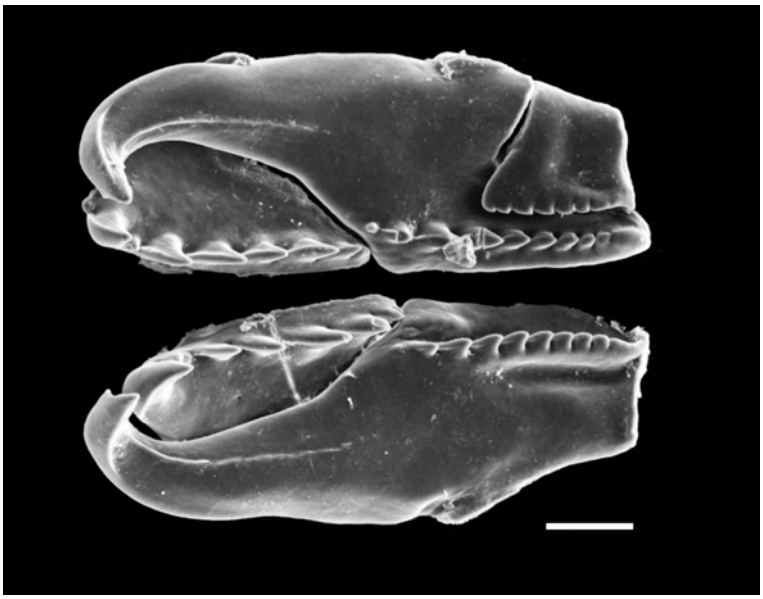
Newsletter March 2012 No. 79



A scolecodont apparatus from the Silurian of Waukesha, Wisconsin (photo: G. Mullins)

Commission Internationale de Microflore du Paléozoïque
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MESSAGE FROM THE PRESIDENT

Dear CIMP Members,
2011 has been a very busy year for all of us involved in Palaeozoic palynological research as it can be seen from the number of papers published on the subject (you will find the details in the Subcommission Newsletters), and from the contributions to several international conferences, including the AASP-TPS in Southampton, about which a report is included in this issue. Palaeozoic (and pre-Cambrian) palynology research seems to get more and more integrated in large multi-disciplinary projects, which is an excellent thing in order to keep pace with the rapid developments in many fields of science and more in particular in geology, biology, climate science, to which palynology is closely related. On the other hand, the demand for Palaeozoic palynology specialists in the industry has been growing in the last few years, so I think we can well say that our discipline is in good health despite the fact we still are a small community. The use of highly sophisticated analytical techniques such as FIB, microspectroscopy, precision mass-spectrometry are also more and more applied to palynomorphs, in the hope of elucidating the palaeobiology of our preferred microfossils. I would like to stress however, that we must not loose sight of what is at the base of all good research in and application of palynology (and palaeontology in general): knowledge of taxonomy. Becoming a specialist in one (or more) group of palynomorphs is the starting point from which one can move ahead in a direction which is meaningful. The big picture arises from a synthesis of data which must be meaningful from the bottom up.
I wish everybody another successful palynological year.

Marco Vecoli
marco.vecoli@aramco.com

MESSAGE FROM THE GENERAL SECRETARY

Firstly, many thanks to those of you who contributed material towards the current newsletter. I would also like to express our thanks to Petroleum Development Oman (PDO) for their very kind donation towards CIMP activities. You will find an advert for a Palaeozoic palynologist position at PDO on page 3. I would also like to apologise for the absence of a newsletter in the middle of 2011, but my call for news for that issue resulted in no feedback. However, I hope that you will continue to agree with me that all of the CIMP newsletters are still a very important means by which to communicate with each other. They still remain an excellent way through which to enhance our science. Nevertheless, the nesletters are not the only method. Hartmut Jaeger has instigated a CIMP Spores-Pollen Subcommission Facebook Group for those of you in the world of the social network. And we must not forget that there is a members messages facility on our own CIMP website – why not visit and see if this facility can be of use to you? (http://cimp.weebly.com/message-from-members.html). There is also a CIMP webpage dedicated to providing links to member's publications hosted on their own institutional website. Again, why not take a look and send Philippe Steemans a link to keep your colleagues informed? (http://cimp.weebly.com/members-libraries.html). The CIMP website also includes pages dedicated to future palynology meetings and educational courses. Please don't forget to make the best use of it!

Thank you,

Gary Mullins
gary.mullins@fugro-robertson.com

PALYNOLOGY POSITION PETROLEUM DEVELOPMENT OMAN (PDO)

Position:
Palaeozoic Palynologist

Location:
Muscat, Sultanate of Oman

Company:
Petroleum Development Oman (PDO) is the foremost exploration and production company in the Sultanate of Oman. It accounts for more than 70% of the country's crude-oil production and nearly all of its natural-gas supply. The Company is owned by the Government of Oman (which has a 60% interest), Royal Dutch Shell (34% interest), Total (4% interest) and Partex (2% interest). See www.pdo.co.om/pdoweb for more information
PDO's Stratigraphy team of 9 specialists operates within the Exploration Department but provides services and consultancy across the organisation (production, development, Government Gas and a study centre). Our emphasis for biostratigraphical input is on clastic Palaeozoic reservoirs and PDO operate their own palynology laboratory with a new 'state of the art' facility currently being built to become operational in 2012.

Synopsis of Role and Experience Required:
Experienced Palynologist providing stratigraphic consultancy services pan-PDO. Applicant should have a relevant MSc/PhD qualification and a minimum of 10 years experience. Preference will be given to applicants with Middle East / North African Early Palaeozoic and hands on laboratory preparation experience. Expertise in Acritarch stratigraphy and Cryptospore and Chitinozoa fossil groups would be a distinct advantage. Coaching and mentoring experience is desirable.

General Job Requirements and Responsibilities:
The work will include

- Routine monitoring of operational wells, post-drill assessments, well correlations, regional study input and the research and development of the existing palynozonal scheme.
- Focusing on the Early Palaeozoic, clastic sections of the Haima Supergroup but may require work in other stratigraphic sections.
- Familiarity and interest in the latest preparation procedures and an ability to advise and demonstrate the preparation of difficult material in the laboratory is preferred.
- Assisting in overseeing the academic and 'on the job' training of Omani staff in palynology and this will be a key component of the job.

PDO uses the StrataBugs and Oilfield Data Manager packages and knowledge of these software programmes would be an advantage. The applicant should be capable of well log interpretation and constructing stratigraphic correlations.

Benefits:
PDO offers a competitive expatriate salary package. Oman itself offers an unparalleled lifestyle in the Gulf Region. Contract will be fixed term for a 4 year period.

Contact:
Send an email with your CV attached to Khairan.KJH.Mauly@pdo.co.om

BERNARD OWENS HONOURED AT THE 44th ANNUAL AASP-TPS MEETING, SOUTHAMPTON, UNITED KINGDOM SEPTEMBER 3 - 7, 2011

The 2011 AASP/The Palynology Society meeting was held at the National Oceanographic Centre, Southampton (NOCS) in England, which provided an ideal opportunity for European palynologists to attend this excellent conference. In all about 80 people attended from across the globe, including North and South America, Africa, Oceania and Europe. The meeting also had a very strong Palaeozoic palynology theme, with a special CIMP session held on Monday 5th September in honour of Bernard Owens. We must congratulate Bernard, who receieved the Honorary Membership of the AASP-TPS at this meeting. This award was bestowed in recognition of his long commitment to the society and for his fostering of the science of palynology worldwide, including industry palynology acticities in the Middle East and North Africa.

Maurice Streel and Bernard Owens at the Saudi Aramco sponsored reception held in Bernard's honour (photo: G. Mullins)

A total of 14 talks were presented within the Bernard Owens CIMP session. Talks began with Brian Pedder's description of the palynology of the Cambrian Nolichucky Shale of Tennessee, USA, before moving on to a discussion on the biological affinities of the acritarchs presented by Paul Strother. North Africa and Middle Eastern chitinozoans from the early Silurian were the topic of Tony Butcher's presentation, while Wilson Taylor summarised the information gathered so far on the early crytospores. Talks on miospores were rightly prominent in a session to honour Bernard, with several presentations covering topics from the Ordovician to Carboniferous and from localities as diverse as Argentina, USA, Spitsbergen, UK, Portugal, Oman, Yemen and Pakistan (the abstracts appear below). The session was brought to a conclusion by Maurice Streel who in his personal and entertaining talk "Bernard Owens – an appreciation" reminded us all of the hard work and dedication that Bernard has put into palynology, including organisation such as the CIMP, during his career. Indeed, Bernard has been our CIMP President an impressive 7 times (the last time in 1998 as the General President) and has worked with a total of five different

Secretary-Generals. Bernard has also promoted the CIMP through organising international collaborative projects. Following the CIMP session, a buffet reception was held in Bernard's honour very kindly sponsored by Saudia Aramco. Further details of the AASP-TPS Honorary Membership award to Bernard can be found in the AASP newsletter volume 44, no. 3 (http://www.palynology.org/).

Bernard Owens (and pipe). Photo: Maurice Streel.

The AASP-TPS scientific programme on Monday also included talks on the Qauternary and on the Tuesday moved into the palynology of the Mesozoic and younger strata. Further information on these presentations can be found by following the link below. In addition to the scientific sessions, the conference organisers had arranged for two fieldtrips. The area around Southampton has a rich and varied geology, but Palaeozoic strata do not feature. However, the fieldtrip to the Cretaceous and Paleogene of the Isle of Wight showed that both the Palaeozoic and post-Palaeozoic palynologists shared a love of collecting the giant foraminifera *Nummulites*. The conference organisers John Marshall and Ian Harding must be congratualted for the overwhelming success of this meeting.

Gary Mullins

Conference talks:

https://www.ocs.soton.ac.uk/index.php/aasp2011/AASP2011/schedConf/presentations

PALAEOZOIC PALYNOLOGY ABSTRACTS FROM THE 44th AASP-TPS MEETING, SOUTHAMPTON

The abstracts appear with the kind permission of the organisers.

Ordovician-Lower Silurian Palynology of the Murzuq Basin, Southwest Libya

Faisal Hadi Abuhmida[1]

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A detailed palynological analysis has been undertaken on 200 core and cutting samples selected from seven wells recently drilled in the Murzuq Basin of southwest Libya. The boreholes penetrated Ordovician-Lower Silurian strata belonging to the As Shabiyat, Hawaz, Melez Shugran, Memouniat, Bir Tlakshin and Tanezzuft formations. The majority of the samples proved palyniferous, yielding abundant moderately to well preserved marine palynomophs (acritarchs, chitinozoans, scolecodonts) and non-marine palynomorphs (spores). The palynomorph assemblages enable biostratigraphical age dating and correlation of these strata, in addition to facilitating palaeoenvironmental interpretation. Particularly rich assemblages were recovered from the Melez Shugra Formation and shale intercalations in the Memouniat, Bir Tlakshin and Tanezzuft Formations. However, the As Shabiyat and Hawaz formations yields only rare, poorly preserved, low diversity assemblages characterized by a very low abundance of sphaeromorph acritarchs (*Leiosphaerida*). A total of 139 species of acritarch, 75 species of chitinozoan and 21 species of spore have been identified. Based on the presence of diagnostic species of acritarch and chitinozoan it is suggested that the Hawaz Formation is Dariwillian in age, the Melez Shugran Formation is late Katian to early Hirnantian in age, the Memouniat and Bir Tlakshin formations are late Hirnatian in age, and the youngest shale of Tanezzuft Formation ranges from Rhuddanian to Telychian in age. Regarding the variation in the proportion of different palynomorphs types, the depositional environment is interpreted as fluviatile to marginal marine in the Ash Shabiyat Formation, marginal marine to marine inner shelf in the Hawaz Formation, and marine inner shelf in the Melez Shugran Formation. Acritarchs are present in shale intercalations in the Memouniat Formation and are very similar to those of the silty shale of the overlying Bir Tlakshine Formation suggesting that the depositional environment is marine inner shelf. The hot shales of the Tanezzuft Formation were deposited in marine environments relating to maximum flooding events during the Rhuddanian. They pass up into marginal marine environments.
POSTER

Chitinozoans and early Silurian 'hot' shales − a case study from North Africa and the Middle East

Anthony Butcher[1]

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Early Silurian 'hot' shales, characterized by high gamma-ray readings from authigenic uranium, are important hydrocarbon source rocks in North Africa and the Middle East, with TOC values of up to 17% (Lüning *et al*. 2000).
Recent studies have highlighted the essential role of high-resolution biostratigraphy in identifying and dating such 'hot' shales (e.g. Loydell 2007), and have demonstrated that there are in fact several such 'hot' shales in the lower Silurian, rather than a single 'basal organic-rich ('hot') shale unit' (Lüning *et al.* 2000). Combined with carbon isotope and acritarch morphological data, studies on the BG-14 core of southern Jordan have shown that the 'hot' shale within it was deposited during a minor marine regression (Loydell *et al*. 2009), as opposed to the transgressive model of deposition proposed by previous authors.
Chitinozoan data from the E1-NC174 core of south-western Libya have dated the 'hot' shale as the same mid Rhuddanian age as that of the BG-14 core. The 'hot' shale intervals within each core also display a marked decrease in chitinozoan abundance, while TOC values increase overall. Such similarities between the two 'hot' shales suggest that they were deposited under similar environmental conditions.

References:

Loydell, D. K. (2007). Graptolites from the Upper Ordovician and lower Silurian of Jordan. *Special Papers in Palaeontology*, **78**, 1−66.
Loydell, D. K., Butcher, A., Frýda, J., Lüning, S. and Fowler, M. (2009). Lower Silurian 'hot shales' in Jordan: a new depositional model. *Journal of Petroleum Geology*, **32**, 261−270.
Lüning, S., Craig, J., Loydell, D. K., Štorch, P. and Fitches, B. (2000). Lower Silurian 'hot shales' in North Africa and Arabia: regional distribution and depositional model. *Earth-Science Reviews*, **49**, 121−200.

Palynological correlation of a Late Devonian dropstone in Kentucky with diamictite-bearing sections in the Appalachians and Bolivia

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A large granitic dropstone, the 'Robertson dropstone' was recently discovered embedded in the uppermost part of the Cleveland Shale Member of the Upper Devonian Ohio Shale in Logan Hollow Branch, approximately 8 km northwest of Morehead, Kentucky. Well-preserved miospore assemblages from grey mudrock samples immediately below, above and adjacent to the dropstone are assigned to the late Famennian *Retispora lepidophyta - Verrucosisporites nitidus* (LN) Miospore Biozone. LN Biozone assemblages have also been recovered from the overlying Bedford Shale at this locality.
Highly carbonized palynomorphs have been recovered from sections that include diamictites at three localities in the Appalachians, *ca*. 500 km to the east of Morehead, at Sideling Hill, Maryland, La Vale, Maryland, and Crystal Spring, Pennsylvania. Although these palynomorphs are highly carbonised and poorly preserved, stratigraphically important taxa can still be recognized, allowing the diamictite units in these sections to be assigned to the LN Biozone and the preceding *Retispora lepidophyta - Indotriradites explanatus* (LE) biozone. The palynological evidence supports previous lithostratigraphic and gamma-ray correlations between the Kentucky and Appalachian sections. It also provides firm evidence for the first

time of a late Famennian age for the alpine glaciation/deglaciation responsible for deposition of these diamictites and related glaciogenic sediments such as the laminites at Crystal Spring. The sections studied are correlated palynologically with Gondwanan, high-palaeolatitude, marine diamictites at Bermejo, Bolivia. Late Famennian miospore assemblages from Euramerica are similar to those from western Gondwana, though some distinctive taxa are restricted to the latter. However, some of the index species of the European-based miospore zonation including *Indotriradites explanatus* and *Verrucosisporites nitidus* are often relatively rare in both western Euramerica (USA) and western Gondwana (Bolivia) compared to eastern Euramerica (Europe).

Correlation of Spores, Acritarchs and U-Pb isochrons in the Lower Devonian of Cherry Valley, New York State, USA.

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The Lower Devonian section at Cherry Valley, New York State is of international geological importance as it contains two volcanic ash horizons that have been isotopically dated at 417.6 ± 1.0 Ma and 408.3 ± 1.9 Ma using the ID-MS U-Pb zircon method (Tucker *et al*.1998). Correlation of the ash beds with conodont biostratigraphy is poorly controlled in the section. A palynological study of the Lower Devonian marine sequence at Cherry Valley has revealed a succession of spore and acritarch assemblages. The new palynological data obtained from strata above and below the dated ash beds now provide a more precise biostatigraphic/chonostratigraphic calibration of Lower Devonian strata.The Kalkberg Formation containing the the Kalkberg Ash (dated at 417.6 ± 1.0 Ma) yielded poor to moderately preserved, low diversity spore assemblages that are assigned to the *breconensis-zallatus* BZ Biozone of Streel *et al*.1987. Acritarchs are abundant and well preserved and comprise the *Thysanoprobolus polykion - Duvernaysphaera actinota* Assemblage.The palynological data indictate a late Lochkovian age for the Kalkberg Formation and Kalkberg Ash.The overlying Esopus Formation containing the Esopus (or Sprout Brook) Ash dated at 408.3 ± 1.9 Ma yielded moderately preserved, low diversity spore assemblages. The spore assemblages associated with the ash horizon are assigned to the *polygonalis-wettedorfensis* PoW Biozone (*subgranifer* Su Subzone) of Streel *et al*.1987 and are of late Pragian to ? earliest Emsian age. Spore assemblages from the near the top of the Esopus Formation are assigned to the *annulatus-bellatulus* Biozone of Streel *et al*.1987 and the *annulatus-sextantii* Assemblage Zone of Richardson and McGregor 1986. Acritarchs are common throughout the Esopus Formation and are moderately to well preserved and comprise the *Polyedryxium carnatum – Fulgisphaeridium bristokii* Asemblage. The Schoharie Formation near the top of the Lower Devonian succession at Cherry Valley yielded low diversity spore assemblages assignable to the *apiculatus-proteus* Biozone of Streel *et al*. 1987 and the *douglastownense-eurypterota* Assemblage Zone of Richardson and McGregor 1986. Acritarchs are abundant and well preserved and comprise the *Navifusa bacilla-N.embudum* Assemblage. The palynological data indictate a late Emsian age for the upper part of the Schoharie Formation.

References:

Richardson, J. B. and McGregor, D. C., 1986. Silurian and Devonian spore zones of the Old Red Sandstone continent and adjacent regions. Geological Survey of Canada, Bulletin **364**, 1- 79.

Streel, M., Higgs, K., Loboziak, S., Riegel, W., Steemans, P., 1987. Spore stratigraphy and correlation with faunas and floras in the type marine Devonian of the Ardenne- Rhenish regions. *Review of Palaeobotany and Palynology*, **50**, 211- 229.
Tucker, R. D., Bradley, D. C., Ver Straeten, C. A., Harris, A. G., Ebert, J. R., McCutcheon, S. R., 1998. New U-Pb zircon ages and the duration and division of Devonian time. *Earth and Planetary Science Letters*, **158**, 175-186.

The geodynamic importance of the Late Cambrian to Late Devonian reworked palynomorphs from the borehole SDJ1, Santa Susana region, Ossa Morena Zone (OMZ), Portugal

Gilda Lopes[1,2], Zélia Pereira[2], Paulo Fernandes[1], João Matos[2], Diogo Rosa[2], Tomás Oliveira[2]

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The detail study of the borehole SDJ1 from the Santa Susana coal basin western border of the OMZ, Portugal, proved that most of the volcano sedimentary lithologic sequence yielded palynomorphs of mid late Viséan age (NM Biozone) i.e., they belong to the Toca da Moura Volcano Sedimentary Complex (TMC). The deepest few meters of the drill core have shales of mid Moscovian (Biozona SL) (see Pereira et al., in this volume).Together with the miospore assemblages that provide the age of the SDJ1 strata, mid late Visean and Moscovian age, associations of exceptional well preserved Lower Palaeozoic acritarchs and spores were identified and interpreted as reworked into the Carboniferous rocks. Four ages of reworked associations were identified: 1 - Late Cambrian acritarchs: *Acanthodiacrodium ?petrovii, Cristallinium randomense, Eliasum* sp*., Timofeevia phosphoritica*; 2 - Ordovician acritarchs: *Navifusa punctata, Stelliferidium striatulum, Striatotheca rarirrugulata*; 3 - Mid Late Silurian to Lower Devonian, spore taxa: *Ambitisporites* sp., *Archaeozonotriletes chulus*, *Brochotriletes* sp., *Dictyotriletes subgranifer; Emphanisporites* sp. and *Synorisporites labeonis*, cryptospores taxa *Laevolancis* sp., *Tetrahedraletes medinensis* and *Quadritisporites variabilis*, acritarch taxa such as *Duvernaysphaera aranaides*, *Micrhystridium stellatum*, *Multiplicisphaeridium ramusculosum*; 4 - Late Devonian miospore taxa: *Retispora lepidophyta* and *Rugospora flexuosa* and acritarch taxa *Craterosphaeridium ?sprucegrovense*, *Gorgonisphaeridium ohioense, Stellinium comptum, S. micropolygonale, Villosacapsula colemanii, Pterospermella* sp.. Detail examination of the reworked assemblages, still in progress, indicates that these are clearly dominated by Late Cambrian, Early Ordovician and Late Devonian acritarchs. In minor amount are Mid Silurian to Lower Devonian palynomorphs and the typical Middle Devonian species are very scarce. The TMC sediments are interpreted as had been deposited in an intra-arc basin in close association with the igneous rocks of the Beja Massif, a magmatic arc installed at the south border of the OMZ (Oliveira et al. 2006). The ages of the reworked palynomorphs suggest that considerable erosion of exposed Lower Palaeozoic OMZ basement occurred during Carboniferous times. The exposure of these rocks may have occurred during the first phases of the Variscan Orogeny in the OMZ. Within the OMZ the rock formations that may constitute the sources for the reworked palynomorphs are: the Early Ordovician *Phyllodocites Shales* (Piçarra et al., 2011); the *Raiados* and *Nódulos Shales* Fm. and the Terena Fm. of Mid Late Silurian to Early Devonian, age (Pereira et al., 1999; Lopes et al., 2009). The Late Devonian association could have come from the South Portuguese Zone, where late Famennian palynomorphs are very well documented. Lastly, there are no units of proven Late Cambrian age in the OMZ. The occurrence of reworked Late Cambrian palynomorphs in the Santa Susana region indicates that elsewhere in the OMZ, sedimentation of this age must have existed.

Oldest preserved cryptospore containing sporangia and mesofossils from the upper Silurian of Baltica (Gotland, Sweden)

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Early land plant remains in form of sporangia, with *in situ* cryptospores, spore masses, and an axis, were identified in the Burgsvik beds on Gotland, Sweden.
The sporangia are elongate in shape, with fragments of the sporangia wall preserved, and contain well preserved *in situ* cryptospores. No axes attached to the sporangia were detected. The single axis identified has a superficial longitudinal striation resembling that of epidermal cells and ends in a cup-shaped structure that probably represent the lower part of a sporangium. The spores found within the sporangia were identified as *Laevolancis divellomedia* and *Dyadospora murusdensa*.
In the same beds, naked spore masses, most probably representing coprolites of terrestrial arthropods, were found. The spore masses consist of cryptospore monads shrouded in amorphous organic material. These spores are poorly preserved compared to the well preserved dispersed- and sporangia-associated spores, possibly a result of their passage through the digestive system of the animal. The spores in the coprolites were identified as *Laevolancis divellomedia,* a common local constituent of the dispersed microflora, during this time.
This study represents the first report of the occurrence of definite Silurian land plants in Baltica and one of the earliest evidence for plant-animal interactions in the early terrestrial ecosystems.
POSTER

A unified Upper Carboniferous stratigraphy for the UK and Netherlands Sectors, southern North Sea

Duncan McLean[1], Tim Pearce[2], John Martin[2], Barry Lees[2] and David J. Bodman[1]

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Palaeogeographic reconstructions for the northern margin of the southern North Sea Carboniferous Basin indicate generally east-west trending, facies belts in a generally aggradational, alluvial depositional setting. This east-west orientation suggests that the Westphalian coal measures and alluvial red-bed successions in the UK and Netherlands sectors should be treated together and studied from a common stratigraphical viewpoint. Despite this there have been widely differing approaches to, and interpretations of, the Upper Carboniferous stratigraphy on either side of the UK-Netherlands median line.
A study of fifty key well sections from the Cleaver Bank High and areas to the south and west, has provided a detailed, integrated miospore biostratigraphy and chemostratigraphy, which, along with e-log, sedimentological and mineralogical data is used to produce a unified lithostratigraphy applicable to both sectors. This is based upon a synthetic, composite,

holostratigraphic reference section representing an idealised and complete sequence of the Upper Carboniferous strata preserved in the area. Key to understanding the stratigraphy of the laterally variable alluvial succession is the biostratigraphical and geochemical recognition of isochronous stratal surfaces (principally marine flooding horizons) which allow the subdivision of the sections into temporally and genetically related units.

The recognition of a significant and widespread, intra-Carboniferous unconformity, which in places removed several hundreds of meters of Duckmantian and Bolsovian strata, is of prime importance in understanding and correlating the geology of the area. In places the unconformity erodes down to strata of the earliest Duckmantian and is everywhere overlain by mid Bolsovian strata. Conformable or near-conformable section correlative to the unconformity is preserved in the south-eastern part of the study area. The areal development of the unconformity has significance for our ability to provide accurate original isopachs for the truncated sequences. The presence of the unconformity has significant implications for the tectonic development of the Upper Carboniferous of the area which has generally been considered as developing in a tectonically quiescent, thermal-sag basin. The newly established detailed stratigraphy allows mapping of the subcrop of this intra-Carboniferous unconformity which indicates significant uplift of the northern basin margin during the early Bolsovian with recycling of significant volumes of sediment into the basin centre. The mid Bolsovian timing of this tectonic movement is consistent with a major phase of nappe loading on the Variscan Front, and contemporary erosive unconformities elsewhere along the Variscan foreland.

Further, there is compelling evidence based upon differential subsidence patterns to indicate continuous tectonic influence upon sedimentation from as early as the late Langsettian. There appears to be strong syn-depositional structural compartmentalisation of the area with the major NW-SE trending structure of the Murdoch Ridge cut and offset by orthogonal NE-SW trending normal growth faults. Mapping of sandstone thicknesses, net-to-gross ratios and phytogeographic variations, help constrain the areal distribution of major braidplain facies belts and suggest that many of the major sandstone reservoir units are arrayed along the footwalls of syn-depositional half-graben.

The study demonstrates the similarity of Upper Carboniferous sequences preserved in the UK and Netherlands sectors of the North Sea. The consistent correlation of a series of formations allows inferences to be drawn regarding to the evolution of the northern margin of the southern North Sea Carboniferous basin. Most importantly, a significant tectonic influence on sedimentation is apparent.

Pennsylvanian (Namurian-Westphalian) miospore assemblages from the west coast of Scotland

Duncan McLean[1], Janine L. Pendleton[2], Bernard Owens[2], & David Bodman[1]

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Email: j.l.pendleton@sheffield.ac.uk

The Scottish Coal Measures Group of the Midland Valley was the proving ground for much of the pioneering palynological work that laid the foundations of European Carboniferous palynostratigraphy (e.g. Knox, 1945-1946, Smith and Butterworth, 1967). This study focuses on two small, relatively unstudied areas of the Midland Valley and western Scotland; the Machrihanish Coalfield on the Kintyre peninsula and Inninmore Bay on Movern. In addition to re-evaluating previously collected material (Love and Neves, 1964), new samples were acquired from two boreholes and newly discovered outcrop sections.

Previous palynological work suggested a Duckmantian to Bolsovian age for the Inninmore Bay sections, which is confirmed by this re-evaluation and by investigations of new sections. Re-evaluation of plant fossil registers from MacGregor and Mason (1934) implies a mid-Duckmantian to early Bolsovian age; in concordance with the palynological age range. Most of the Bolsovian miospore assemblages are dominated by diverse saccate pollen taxa and associations of *Auroraspora* spp., *Colatisporites* spp., *Knoxisporites* spp., *Verucosisporites* spp. and *Convolutispora* spp. These assemblages probably represent a "hinterland" vegetation reflecting relatively dry palaeoenvironemnts. Duckmantian assemblages are more typical of coal measures reflecting relatively wet palaeoenvironments.

Miospores from boreholes in the Machrihanish Coalfield prove Langsettian to early Bolsovian Scottish Coal Measures Group, overlying a probable Namurian aged sequence of interbedded basaltic lavas and sedimentary units likely representing the Passage Formation. The unconformable nature of the underlying late Viséan to early Namurian Limestone Coal and Upper Limestone formations is also demonstrated.

In addition to rich assemblages of western European taxa, the Machrihanish populations contain examples of miospore genera such *Paleospora* and *Columinisporites* that are characteristic of North America.

References:

Knox, E. M. (1945-1946). Microspores in the Productive Coal Measures of the Central coalfield of Scotland. *Transactions of the Institute of Mining Engineers London*, **105**, 137-142 and 268-270.

Smith, A.H.V. and Butterworth, M.A. (1967), Miospores in the coal seams of the Carboniferous of Great Britain. *Special Papers in Palaeontology*, **1**, 1-324.

Love, L.G. and Neves, R. (1964). Palynological evidence on the Age of the Carboniferous of Inninmore. *Transactions of the Geological Society of Glasgow*, **25**, 61-71.

MacGregor, M. and Manson, W. (1934). VII - The Carboniferous rocks of Inninmore, Morvern. *Summary of Progress of the Geological Survey of Great Britain 1933*, 74-84.

The Palynology of the Cambrian Nolichucky Shale at Thorn Hill, Tennessee, USA

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The Nolichucky Shale, as exposed at Thorn Hill in northeastern Tennessee, is a 179 m thick succession of predominantly shale, subtidal with occasional carbonate/shale peritidal deposits. It constitutes part of the Tennessee Conasauga Group and represents near-shore deposition within a shallow carbonate-rimmed, intracratonic basin that was subject to transgressive/regressive cycles (Glumac & Walker 2000), that formed part of a passive continental margin along the eastern side of Laurentia. Trilobites from Thorn Hill and the adjacent Lee Valley section indicate a Guzhangian to Paibian age for the Nolichucky Shale, encompassing the uppermost *Bolaspidella*, *Cedaria, Crepicaphalus* and lowermost *Aphelaspis* faunal zones (Sundberg 1989; Derby 1965).

Fifty samples from the Nolichucky Shale were collected for palynological examination. In all fifty five acritarch species and morphotypes were recovered including at least twelve new species and four new genera. Various filaments and invertebrate spines, cuticular fragments and sclerites (including *Wiwaxia* sclerites) were also recovered. Of the acritarchs two species, *Cerebrosphaera buickii* and *Apodastoides verobturatus* are known only from the Precambrian and might be reworked, though their small sizes suggest otherwise. The new acritarch species include a *Pirea*-like morphotype with horns, a polarised acritarch with a complex excystment

structure surrounded by processes and three anomalously large acanthomorphs measuring up to 155 µm. Two of the latter resemble the diapause egg cases of some extant crustacea; one resembles in both size and general morphology the egg case of the copepod *Pontella meadii,* whilst the other possesses a three-layered wall-ultrastructure similar to that observed in egg cases of extant Branchiopods. In fact, the size, surface ornament and wall ultrastructure, as well as the associated near-shore facies, together suggest they are more likely to be zooplankton egg cases than phytoplankton resting cysts.

References:
Derby, J.R. (1965). Paleontology and stratigraphy of the Nolichucky Formation in southwest Virginia and northeast Tennessee. Ph.D. dissertation. Virginia Polytechnic Institute and State University, Blacksburg.
Glumac, B., and Walker, K.R., (2000). Carbonate deposition and sequence stratigraphy of the terminal Cambrian grand cycle in the southern Appalachians. *Journal of Sedimentary Research,* **70**, 952-963.
Sundberg, F.A. (1989). Biostratigraphy of the lower Conasauga Group, a preliminary report. *Appalachian Basin Industrial Associates Spring Program,1989,* **15**, 166-176.

Carboniferous palynostratigraphy of the borehole SDJ1 from the Santa Susana region, Ossa Morena Zone, Portugal

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The borehole SDJ1, with a total depth of 404.5 meters, was drilled in 1991 by the Serviço de Fomento Mineiro to investigate an Electromagnetic TEM conductor (Oliveira & Matos 1991). This hole is located in the eastern sector of the Santa Susana/Moinho da Ordem coal mine (1927-1944), in the Jongeis mine sector. The borehole log indicates that it cuts lithologies of the Carboniferous Toca da Moura Complex (TMC) and the Santa Susana Formation (SSF). The TMC is a bimodal volcano-sedimentary sequence whose outcrops are dispersed along the southwestern border of the Portuguese part of the Ossa Morena Zone (OMZ). The TMC is dated of late Tournaisian to mid Late Viséan age based on miospores (Cunha in Andrade et al., 1991; Pereira et al., 2006). The TMC is followed by the continental coal-bearing detritic sediments of the late Moscovian SSF, based on macroflora (Wagner & Sousa, 1983) and miospores (Machado, 2010), by a probable fault contact. The SDJ1 borehole is one of the few in this region and offered the unique opportunity to recognize the TMC and SSF in depth.
Considering the current LNEG mapping surveying in the region (Escoural 1:50,000 scale map), the SDJ1 borehole was carefully sampled for palynostratigraphic studies and five lithological intervals were examined: (1) 3.5-57m, consists of black shales and basic volcanics of the TMC and yielded miospores assemblages assigned to the mid late Viséan (NM Biozone). (2) 58-230 m consists of volcanic rocks (mainly ryodacites), (3) The following interval, from 231.1-294.9m, consists of grey to black shales with microconglomerates and rare arenites. Assemblages recovered in this interval, yielded abundant and moderately preserved miospores of NM Biozone of mid late Viséan age. This age does not agree with the previous interpretation from this interval, based only on lithological grounds that correlated it to the continental coal-bearing sediments of SSF (Oliveira & Matos 1991). (4) The samples collected in the interval 305-377.8 m consist of volcanic rocks (possibly intrusives) and thin black shales beds; the last provided a moderately preserved association of miospores assigned, again, to the NM Biozone. (5) The last interval between 390.7-404.5m consists of black shales which were correlated to the SSF on lithological grounds. However, the sampled shales

between 390.7 and 397.7m yielded miospores assigned to the NM Biozone of mid Late Viséan. Whereas, the shales from the 400.6 and 404.5m interval provided an assemblage assigned to the SL Biozone of mid Moscovian age, suggesting a fault contact between the two shale units.

Thus, the borehole SDJ1 cuts mainly the TMC of mid Late Viséan age to the mid Moscovian age. For the first time TMC reaches the mid Moscovian age, meaning that this complex has a larger geographical expression, as shown during the current mapping survey. Further detailed research is being undertaken to investigate this question. Together with the Carboniferous miospores are reworked Lower Palaleozoic palynomorphs, a common signature throughout, that may represent an important tool for the interpretation of the tectonics of the Toca da Moura - Santa Susana basins (see Lopes et al. this volume).

A new *Grandispora cornuta* Interval Zone to specify the VCo Oppel Zone in the late Famennian of Western Europe

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The *Diducites versabilis-Grandispora cornuta* (VCo) Zone was defined by Streel *et al.* (1987) as an Oppel Zone i.e. a zone characterized by an association or aggregation of selected taxons of restricted and largely concurrent range chosen as indicative of approximate contemporaneity. Judgement may vary however as to how many and which of the selected diagnostic taxa need to be present to identify the zone (Hedberg 1976). The VCo Zone was defined by the first appearance of *Grandispora cornuta* and *Rugospora radiata* (then *flexuosa*). *Retusotriletes phillipsii* was added later as an additional zonal species, due to the importance given to this species in the Famennian of eastern North America (Clendening *et al.* 1980, Richardson & McGregor 1986). However, its range in the late Famennian of the Ourthe valley, where the zone was originally defined, has never been really established. A major problem has also arisen with regard to the use of *Rugospora radiata* as a zonal index species for the VCo Biozone, because of difficulties in discrimination between *R. radiata* and the morphologically similar late Frasnian-early Famennian taxon *Rugospora bricei* Loboziak & Streel (1989). These difficulties have resulted in the older stratigraphical extension of the VCo Zone range in some regions. Therefore, in this paper we propose to specify the VCo Oppel Zone with a new *Grandispora cornuta* (Gc) Interval Zone, with the base being defined by the first appearance of *Grandispora cornuta*. The top of the Gc Zone is marked by the first appearance of *Grandispora echinata* (Higgs *et al.* 2000), a morphologically related taxon, one of the characteristics of the base of the overlying *Apiculiretusispora verrucosa-Vallatisporites hystricosus* (VH) Oppel Zone as defined by Maziane *et al*. (1999). A detailed morphological analysis of *Grandispora cornuta* and other related *Grandispora* species has been undertaken involving the study of both new material obtained from the Namur and Dinant basins in Belgium and old published material. This review has allowed the authors to separate more clearly than before *Grandispora cornuta* from the frequent and often abundant *Grandispora tamarae.* The age of the base of this new *Grandispora cornuta* (Gc) Interval Zone is

correlated with the late *postera* or early *expansa* conodont zones. The correlations of the Gc interval Zone in W-Europe, E-America and W-Gondwanan regions are evaluated.

References:
Clendening, J.A., Eames, L.E., Wood, G.D. (1980). *Retusotriletes phillipsii* n.sp., a potential Upper Devonian guide palynomorph. Palynology **4**: 15-22.
Hedberg, H.D., Editor (1976). International Stratigraphic Guide. Wiley, N.Y., 200 p.
Higgs, K.T., Avkhimovitch, V.I., Loboziak, S., Maziane-Serraj, N., Stempien-Salek, M., Streel, M. (2000) Systematic study and stratigraphic correlation of the *Grandispora* complex in the Famennian of northwest and eastern Europe. Rev. Palaeobot. Palynol. **112**: 207-228.
Loboziak, S.& Streel, M.(1989). Middle-Upper Devonian Miospores from the Ghadamis Basin (Tunisia-Libya): systematics and stratigraphy. Rev. Palaeobot. Palynol., **58**: 173-196.
Maziane,N., Higgs, K.T., Streel, M. (1999). Revision of the late Famennian miospore zonation scheme in eastern Belgium. Journal of Micropalaeontology, **18**:17-25.
Richardson, J.B., McGregor, D.C. (1986). Silurian and Devonian spore zones of the Old Red Sandstone . Geol. Surv. Canada Bull. **364**: 1-79.
Streel, M., Higgs, K.T., Loboziak, S., Riegel, W., Steemans, P. (1987). Spore stratigraphy and correlation with faunas and floras in the type marine Devonian of the Ardenne-Rhenish regions. Rev. Palaebot. Palynol. **50**: 211-229.

Miospores from Ordovician-Silurian Argentinean basins: evolution and relationships with other South American basins

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The earliest evidence of land plants are cryptospores (*sensu* Steemans 2000) from the Middle Ordovician (Dapingian) of the Sierras Subandinas (NW Argentina). No uncontroversial data are available for the time period ranging from the Darriwilian to the Katian. In the latest Ordovician deposits from the northwestern geological provinces of the Central Andean Basin (Puna, Cordillera Oriental and Sierras Subandinas), there are few cryptospores in the palynological associations from the glacial-related strata (Caspalá and Zapla Formations). On the other hand, rich, diverse and well-preserved cryptospore assemblages are observed in the post Hirnantian glaciation levels (Salar del Rincón Formation). Lower Silurian cryptospores are known from the northwestern Argentina Basin and the Precordillera Basin, where they are preserved in marine sediments. The cryptospores are rare and no trilete spores have been observed. The low diversity of miospores is most probably due to the marine nature of the environment of deposition. Very few palynological data exists from Wenlockian layers. The palynological assemblages are exclusively marine, coming from the Chacoparanense Basin and probably from the northwestern Central Andean Basin. The FAD of trilete spores in Argentina occurs in Ludlovian sediments. The extensive outcrops of the Ludlovian-early Devonian (locally) Los Espejos Formation, in the Precordillera Basin, represent a muddy shelf to inner shelf exposed to storm activity, and storm-dominated shoreface towards the top. They yielded rich and diverse palynomorph assemblages assigned to the Ludlovian. The marine phytoplankton clearly dominates throughout the entire stratigraphic unit, except for the upper productive levels near the Siluro-Devonian boundary in the Río Jáchal locality. *Amicosporites* cf. *miserabilis*, *A.* cf. *streelii*, *Archaezonotriletes chulus* Morphon, *Chelinospora* cf. *hemisphaerica, Ch. poecilomorpha*, *Ch. sanpetrensis, Clivosispora verucata* var. *verrucata, Retusotriletes* cf. *amazonensis* and *Synorisporites verrucatus* are among the

most relevant trilete spores. Cryptospores such as *Artemopyra robusta*, *A. urubuense* and *Cymbohilates hystricosus* are the most informative taxa. Similarities and differences mainly with Brazilian and Paraguayan assemblages are noticed. The recorded miospore taxa of the Los Espejos Formation show differences with coeval assemblages, displaying evolutionary innovations that seem to appear firstly in the Precordillera Basin than in other regions.

References:
Steemans, P. (2000). Miospore evolution from the Ordovician to the Silurian. *Review of Palaeobotany and Palynology*, **113**, 189-196.

Comparison and palynological correlation of Pennsylvanian glacigene rocks in Oman, Yemen and Pakistan

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Similar glacigene rocks of Pennsylvanian age are present in basins in Yemen, Oman and Pakistan, now widely separated but originally close. Correlation using a palynological biozonation based in the Al Khlata Formation of interior Oman has indicated the widespread nature of glacial sediments of a relatively narrow biostratigraphic age range (the Oman P5 unit) across Oman, Yemen and Pakistan. Thirty nine samples from the upper 84 m of a 125 m thick section of the Tobra Formation at Zaluch Nala, western Salt Range, Pakistan yielded palynomorph taxa indicating the South Oman 2165B Biozone. Seven samples from the Yemen Kuhlan Formation, and 22 samples from the underlying Akbarah Formation from approximately 180m of a section near Kuhlan in northwest Yemen suggested a 2165A Biozone age. In neither the Pakistan nor the Yemen sections is there evidence of the younger 'deglacial' sediments of 2141B age which are present in Oman. This could be due to subsidence related to sub-Al Khlata Formation salt withdrawal which may have acted against isostatic uplift during the deglacial period, allowing the sediments to be preserved.

Expanding the Biological Affinities of the Acritarchs

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Paleopalynologists have long assumed that most acritarchs are the resistant remains of cyst-forming marine phytoplankton. As cysts, acritarch walls are thought to be composed of algaenan, or a functionally similar complex polymer analogous to sporopollenin or dinosporin. Of course there has always been an understanding that not all acritarchs fall into this category (as algal resting stages), and, in a few cases, the phylogenetic position of some exceptions have been well documented, such as the leeches fed by Sven Manum decades ago. In recent years, Precambrian palynology has become a source of doubt with regard to the assumption that all acritarchs are algal cysts, and there are now several lines of reasoning that

are eroding faith in the underlying assumptions of biological affinity of the acritarchs. Palynomorphs from non-marine earliest Neoproterozoic deposits possess vegetative walls, indicating that sporopollenin *sensu lato* is not a prerequisite for preservation. Others have used morphology to argue that the large acanthomorphic acritarchs characteristic of the Ediacaran System might be the resting cysts of animals, rather than algae, in part because they are outside the normal size range of Paleozoic acanthomorphs and the morphological analogs in the extant phytoplankton. This implies that the Cambro-Ordovician rise of the acritarchs as evidence of phytoplankton speciating into planktonic niches could have been a primary adaptive radiation and that the Ediacaran seas were depauperate in phytoplankton. Some large acanthomorphs found in the Cambrian Nolichucky Shale in Tennessee (USA) more resemble zooplankton egg cases or Ediacaran morphotypes than presumed marine phytoplankton cysts of the Cambrian. Ordovician acritarchs belonging to an "Opalla" complex are unlike any common phytoplankton found today, as are numerous asymmetric acritarch forms which imply a benthic, not planktonic existence. Eupoikilofusids are morphologically similar to euglenids, a group which may be basal to the chlorophytes. In combination, these morphological and organic geochemical considerations, along with new discoveries in Proterozoic and lower Palaeozoic sequences, are ushering in a new era of an expanded interpretative understanding of the biological affinities of the acritarchs that could lead to considerable revision of the early fossil record of the protoctists and subsequent understanding of the rise of ecological complexity during Neoproterozoic and Paleozoic time.

Interpreting the evidence for lower Paleozoic terrestrial (?) autotrophs: What do we think, and what do we know?

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Forty years ago, "primitive land plant spores" meant simple triletes. Happily, that was consistent with those spores produced by plants considered to be primitive based on other features. All was right with the world. Then, along came Jane Gray and Art Boucot, hoisting the banner for permanent tetrads (produced by few extant land plants) and dyads (produced by *no* extant land plants),and the era of the cryptospores was born. Comfort was banished, conformity upended, a flame of confusion ignited. In the ensuing forty years, we have learned a great deal about the types of plants that predated anything that is present in the extant flora. And we have done so based on the excellent labors of a number of scientists working with scant (but sometimes extraordinary) material and a rich but sometimes cryptic spore record. Simple trilete spores are now known to occur as early as the Late Ordovician, and geometrically regular cryptospores as early as the mid-Ordovician. But we are in the midst of another spasm of discovery. This one, too, is generating controversy about what kinds of organisms produced these spores (plants, algae, or something in between), and pulling us deeper and deeper into the Paleozoic and beyond. These "cryptospores" are less geometric, and we do not yet have any sporangial fragments to demonstrate their production by embryophytes. But, they occur with other types of tantalizing and enigmatic remains. Their walls are more robust than any extant alga, and the walls of some appear nearly indistinguishable from some extant liverworts. This talk will summarize the information gathered to date on these early cryptospores, present new evidence on attempts to identify modern analogues (e.g., desiccation resistant algal cells), and suggest a revised time line of the events that we believe may have occurred in terrestrial autotrophs as they colonized the land surface beginning in the late pre-Cambrian.

Spore assemblages from Lower Devonian 'Lower Old Red Sandstone' deposits of Spitsbergen

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The Lower Devonian deposits of Spitsbergen consists of typical terrestrial-fluviatile-lacustrine 'Lower Old Red Sandstone' facies. They accumulated within the Euramerica (Old Red Sandstone) continent, in a tectonically active region associated with the Caledonian Mountains. At the time of deposition Spitbergen is considered to have been located near the equator within the arid climate belt. Dispersed spore assemblages have been recovered from Lower Devonian deposits from Spitsbergen from two locations: (i) the Mimerdalen area of Dickson Land collected on a 2010 expedition; (ii) the Forkdalen area of Andrée Land resampled from historical collections of the Harland Svalbard Geological Collections (curated by CASP, Cambridge). Samples from both areas yield dispersed spore assemblages. The spore assemblages are variable in terms of abundance, preservation and thermal maturity. They vary from rich assemblages of well preserved spores of low thermal maturity (pale yellow) to low abundance assemblages of poorly preserved spores of high thermal maturity (black). Presumably this variability relates to the complex syn- and post-depositional tectonic activity characteristic of the area. Dispersed spore assemblages from the Lower Devonian of Spitsbergen are important because: (i) They are from near the palaeoequator and, along with co-occurring plant megafossils, provide a rare insight into Lower Devonian equatorial floras; (ii) They provide evidence (age dating and stratigraphical correlation) facilitating interpretation of the stratigraphy of these deposits, which is vital for understanding the complex tectonic history of this region; (iii) Spitsbergen spore assemblages were important in establishing taxonomy in the fledgling days of Devonian spore research (Allen 1965) and re-examination of this material is helping to resolve various taxonomic issues that have arisen during the subsequent half century.

References:

Allen, K. C. (1965). Lower and Middle Devonian spores from North and Central Vestspitsbergen. *Palaeontology* **8**, 687-748.

FUTURE MEETINGS AND CONFERENCES

IPC XIII/IOPC IX 2012
23 – 30 August 2012
Tokyo, Japan

The combined 13th International Palynological Congress and 9th International Organisation of Palaeobotany Conference will be held at Chuo University in central Tokyo, Japan. The call for abstracts for this meeting is now open.

There is a CIMP sponsored symposium at this meeting, with Marco Vecoli and Charles Wellman as the organisers. The symposium (SS39) is titled "Precambrian to Palaeozoic Palynology: the state of the art." Contributions are invited on cutting-edge Precambrian and Palaeozoic palynomorph research and its application to palaeoclimatic and palaeoenvironmental reconstructions, evolution of oceanic microphytoplankton, early terrestrial ecosystems, and high resolution palyno-stratigraphy in application to oil exploration.

More information can be obtained from the conference webpages at http://www.psj3.org/ipc-iopc2012/Welcome.html

4th INTERNATIONAL PALEONTOLOGICAL CONGRESS
The history of life: a view from the Southern Hemisphere
September 28 – October 3, 2014
Mendoza, Argentina

The 4th IPC will be held in Mendoza, Argentina and will be chaired by Claudia Rubinstein. Details of the conference can be found on the circular included within this newsletter. The 2014 annual meeting of the AASP-TPS will also occur in conjunction with the 4th IPC meeting.

9th European Palaeobotany Palynology Conference
26 – 31 August, 2014, Padova, Italy

Padua (Padova in Italian) is a picturesque, historic city in Northern Italy (about 40 km west of Venice), with a dense network of arcaded streets, large communal "piazza" (squares) and many bridges crossing the various branches of the Bacchiglione. It hosts the almost 800 years-old Università di Padova, which is famous for having had Galileo Galilei among its lecturers.

For more information visit: http://www.geoscienze.unipd.it/9th-european-palaeobotany-palynology-conference

2014 CIMP General Meeting
Ghent and Liège, Belgium
Date to be confirmed

Jacques Verniers and Philippe Steemans have proposed holding the 2014 CIMP General Meeting in Ghent and Liège, Belgium. The exact dates are to be confimed, but it is suggested that the meeting is held in late June or early July so as not to conflict with the 4th IPC in Mendoza, Argentina. A five day meeting including pre-conference workshops and field/museum visits as well as a three day scientific session is planned.

Second Announcement

Now a Joint Meeting:
45th Annual Meeting of AASP – The Palynological Society with the Acritarch, Chitinozoan, and Spore/Pollen Subcommissions of CIMP

University of Kentucky, Lexington, KY
July 21 – 25, 2012

Conference Co-Hosts
Cortland F. Eble, *Kentucky Geological Survey*
Jennifer M.K. O'Keefe, *Morehead State University*

Pre-Meeting Field Trip: Natural Bridge State Resort Park and the Red River Gorge National Geological Area (July 21)
Join us in our exploration, on well-maintained walking trails, of early Pennsylvanian sandstone cliffs, natural rock arches, and the unique microclimates and flora contained in this rugged terrain.
CIMP-Sponsored Devonian – Carboniferous Symposium in Honor of Geoff Clayton and Ken Higgs
Co-chaired by Zélia Pereira and Reed Wicander
Presentations in all aspects of Devonian-Carboniferous palynology and geology in honor of Geoff and Ken's tremendous contributions to our understanding of Late Paleozoic strata are welcome. Contact Zélia (zelia.pereira@lneg.pt) or Reed (reed.wicander@cmich.edu) for more information.
Presentations on a variety of palynological topics and interactions with colleagues from around the world.
We invite your submission of presentations in all aspects of palynology. Studies concentrating on any portion of the geologic column and modern settings are welcome.
Post-Meeting Field Trip: World-class outcrops of Devonian and Carboniferous Strata (July 25),
Focused on the Devonian "Black Shales" and associated sediments of eastern Kentucky. Both macro- and micro- fossils are common and collecting is encouraged.

Conference website, registration information, abstract submission coming in February 2012! See www.palynology.org or contact Jen O'Keefe (j.okeefe@moreheadstate.edu) or Cortland Eble (eble@uky.edu) for more details.

Darwin and the highest Andes

4th INTERNATIONAL PALEONTOLOGICAL CONGRESS

The history of life: a view from the Southern Hemisphere

Mendoza, Argentina, September 28th – October 3rd, 2014

The **4th IPC** will be an International Congress reflecting the directions of paleontology in the 21st century. The meeting will be held in Mendoza, Argentina, an attractive and easily accessible city, that offers a wide range of opportunities to participants of all backgrounds. Mendoza is renowned for its location, at the foot of the Andes with many tourist attractions to explore, and for being one of the most famous wine-producing regions in the world.

A Paleozoic journey through the Argentine Precordillera

A Cretaceous marine odyssey in the Neuquén Basin

A continental Triassic voyage

Dinosaurs of the Neuquén Group

Ichnology throughout the Paleozoic in the Atuel Canyon

Late Cretaceous dinosaur tracks and littoral biota

Local organizers are planning a comprehensive congress with an intellectually motivating scientific program. The congress will create opportunities for participants to present and share experiences, explore new directions and debate topics among specialists from across the globe. A varied array of meeting styles with a combination of keynote lectures, special symposia on leading issues, interactive workshops, technical sessions, and short courses promises to hold sessions of interest to all paleontologists.

Delegates will have the opportunity to enjoy a wide range of conference excursions to rich and well-known Argentinean paleontological sites involving a combination of scientific and touristic attractions. The schedule of field trips covers superbly exposed sedimentary successions, representing a great diversity of marine and continental palaeoenvironments, and encompasses near the whole stratigraphic record.

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AAS Asociación Argentina de Sedimentología

NEWS FROM THE MEMBERSHIP

KATHLEEN GREY

Chief Paleontologist
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The last twelve months have seen me concentrating on stromatolites rather than on acritarchs, as well as trying to expedite construction of a database of fossils in the Geological Survey of Western Australia collection. This database will eventually contain some 14 000 records, but progress is slow because of the need to track down co-ordinates for locations, including hundreds of drillholes across the State. Data capture also continues for a Precambrian microfossil and stromatolite database (now containing c.2000 records). The level of information and assistance provided to academics and industry remains high and covers a diversity of topics ranging from Archean stromatolites and microfossils, through Proterozoic biostratigraphy to modern microbialite environments. Collection management continues to occupy a large percentage of time. In particular, a large number of outstanding fossil loans have had to be called in to meet requirements under federal legislation on fossil exports, and to try to leave the collection in order when I retire.

Studies of Neoproterozoic stromatolites and microfossils continue. Correlations based on integrated results from stromatolite biostratigraphy, palynology, and stable isotope analysis are holding up. Further work in the western Amadeus Basin has confirmed stromatolite distributions recognized during preliminary studies last year. Results of earlier integrated Neoproterozoic correlation studies have finally been published in a book on glaciations. Work continues with Stan Awramik on a 'Microbialite Handbook'. Most of the illustrations have been compiled and the manuscript should be submitted in the next few months. Other manuscripts completed or nearing completion are mainly focussed on stromatolite research. Retirement looms after more than 40 years with GSWA. It is hoped that most of the above projects will have been completed by then, although I plan to continue work on scientific projects once she has left GSWA.

Publications

Grey, K., Roberts, F.I., Freeman, M.J., Hickman, A.H., Van Kranendonk, M.J. & Bevan, A.W.R. 2010. Management plan for State Geoheritage Reserves. Geological Survey of Western Australia, Record 2010/13, 23p.

Hickman, A.H., Van Kranendonk, M.J. & Grey, K. 2011. State Geoheritage Reserve R50149 (Trendall Reserve), North Pole, Pilbara Craton, Western Australia – geology and evidence for early Archean life. Geological Survey of Western Australia, Record 2011/10, 32p.

Hill, AC, Haines, PW, Grey, K 2011, Neoproterozoic glacial deposits of Central Australia: *in* The geologic record of Neoproterozoic glaciations *edited by* E Arnaud, GP Halverson and G Shields-Zhou Geological Society, London, Memoirs, 36, 677-691.

Grey, K and Hill, AC and Calver 2011, Biostratigraphy and stratigraphic subdivision of the Cryogenian successions of Australia in a global context**:** *in* The geologic record of Neoproterozoic glaciations *edited by* E Arnaud, GP Halverson and G Shields-Zhou Geological Society, London, Memoirs, 36, 113-134.

Note: Any papers published by the Geological Survey of Western Australia (GSWA) are available free if you go to: www.dmp.wa.gov.au/gswapublications
Use the DOWNLOAD button to obtain a .pdf file (download, print or both). All GSWA

publications (>100 years worth) are available – just type in appropriate search criteria. Now you can get a digital copy of that obscure monograph published in the 19th century!

In front of the Himalayas: new discoveries in the Salt Range of Pakistan

IRFAN U. JAN

University of Leicester and the National Centre of Excellence in Geology, University of Peshawar, Pakistan
Email: irfan_nceg@yahoo.com

The Salt Range of Pakistan, a celebrated geological site of the nineteenth and early twentieth centuries, has recently become increasingly inaccessible, because of growing political and security instability. A structurally complex, fossil-rich 150 km zone across it represents a many hundreds of metres thick Himalayan frontal thrust system (Fig. 1). The magnificent successions range in age from the Precambrian to Cambrian and Permian to Quaternary. The terrain is rugged and mountainous, located far from the federal capital, Islamabad, though connected to it by good roads. Once inside the range, though, the gorges and valley cuts that show that the geology can only be reached by driving jeeps along rough tracks. The weather is extreme, with great fluctuations between summer and winter temperatures. Summer temperature can rise to 45°C, while in winter they drop to well below zero. The best time to work is between November and March. Small road-side hotels around the Salt Range can be used for the overnight stays and they serve excellent traditional food.

I have recently been working on the Carboniferous-Permian successions of the area in PhD studies funded jointly by the Higher Education Commission of Pakistan (through the National Centre of Excellence in Geology, University of Peshawar), the University of Leicester and the British Geological Survey, UK. Significant funds were received from, the British Council, UK (via DelPHE grant, through Professor Michael Petterson), the Geological Society of London (Edmund Johnson Garwood Fund), UK, the International Federation of the Palynological Societies and the Commission Internationale Microflore Paléozoïque.

The Salt Range represents a crucial position in time and space. In time, because the late Palaeozoic stratigraphy of the area represents the end of the greatest glaciation of the Phanerozoic earth system, that of the Carboniferous-Permian; and in space, because during that time it lay next to the landmass now represented by Oman, Saudi Arabia and Australia. These Gondwana regions, especially the Arabian ones, have been well-studied, because the successions contain significant hydrocarbon-reserves and they also bear remarkable traces of the advance and retreat of the ice from around the South Polar regions. In this tectonic jigsaw puzzle, the Salt Range represents a place near the very margin of the vast glaciated region.

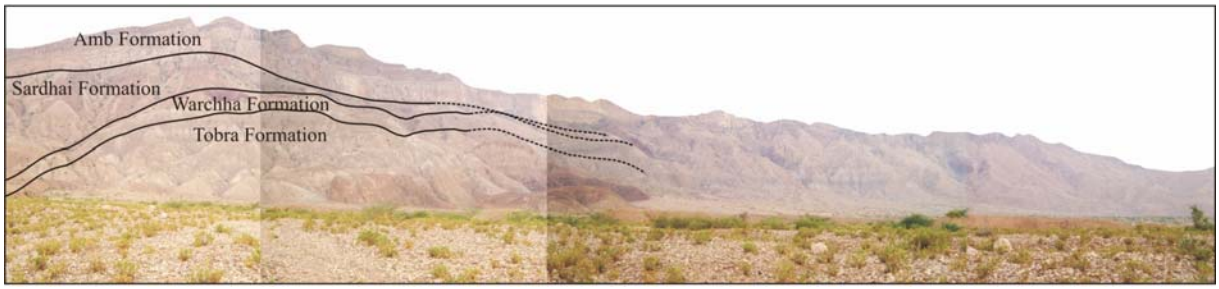

Fig. 1: Photomosaic of the Salt Range. The cliff is approximately 400 metres.

It is the lowermost of the Carboniferous-Permian units in the Salt Range that shows the imprint of ice. The Tobra Formation is Late Pennsylvanian in age and can be correlated by pollen and spores with glacigenic strata of Oman, Saudi Arabia and Australia. In the Salt Range, this unit seems ice-marginal, being deposited by glacio-fluvial processes associated with the final stages of the Gondwana glaciation. The overlying Dandot and Warchha formations show further retreat of the ice. The Dandot Formation is Late Pennsylvanian to Artinskian in age and represents deposition in a shallow marine setting that developed when sea level rose as glaciations waned. The Warchha Formation contains plant megafossils showing it to be Artinskian and was deposited in a river system. The topmost unit, the Sardhai Formation is dated as Middle Permian (Wordian) based on the presence of a distinctive, stratigraphically diagnostic monosaccate pollen *Florinites*? *balmei*. This useful fossil, only recently discovered in the Salt Range unit, has already been recovered from the Middle Permian strata of Oman and Saudi Arabia. The Sardhai Formation was deposited in a shallow marine setting, the incursion of the sea this time being associated with the opening of the neo-Tethys ocean and sea floor spreading.

The Carboniferous-Permian strata and fossils of the Salt Range, Pakistan thus appear very similar to the glacial and postglacial sequences in the Arabian Peninsula (Oman, Saudi Arabia and Yemen), which are the most productive Palaeozoic hydrocarbon provinces in the world. The Arabian sequences, though well studied at the subsurface, are poorly exposed, making the understanding of their 3D architecture difficult, limiting the ability to model reservoirs. However, the Pakistan successions are often spectacularly exposed. Thus, they provide an opportunity to understand the real geometry of these rocks and to take that knowledge from the Pakistan units to the units of Arabia. In return, understanding of the Arabia oil provinces will help in the understanding of potential hydrocarbon reserves in Pakistan.

Acknowledgments
The author of the article thanks Dr. Jan A. Zalasiewicz, (University of Leicester) for comments on this article.

Author's biography
Irfan U. Jan has BSc, and MSc geology from the Department of Geology, University of Peshawar, Pakistan. In 2007 Irfan Jan was awarded with the Higher Education Commission of Pakistan's scholarship and in 2011 he completed PhD in palynostratigraphy and sedimentology from the Department of Geology, University of Leicester, UK, jointly supervised by Prof. Michael Stephenson and Dr. Sarah Davies. Irfan Jan has been awarded with the BGS-BUFI students funds for analytical and field work during the PhD and he has gained professional society funds for his research from the Geological Society of London, the International Federation of Palynological Societies and the Commission Internationale Microflore Paléozoïque.

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I published one paper in RPP with Prof. Jacques Verniers and Dr Thijs Vandenbroucke in 2011. The title of paper is "First Ordovician chitinozoans from Indian Gondwana-New evidence from the Shiala formation". (RPP, 167, 117-122.).

The other paper recently accepted by Micropaleontology on melanosclerites. The title is "A new species *Melanosteus indica* sp. nov. from the Shiala Formation of the Garhwal Tethyan Himalaya, India". The authors are Claudia Trampich and H N Sinha.
A new project on the chitinozoans has been evaluated by DST (Ministry of Science and Technology, India) which I submitted few months back for funding.

THE MIOSPORE DATABASE
by Philippe Steemans

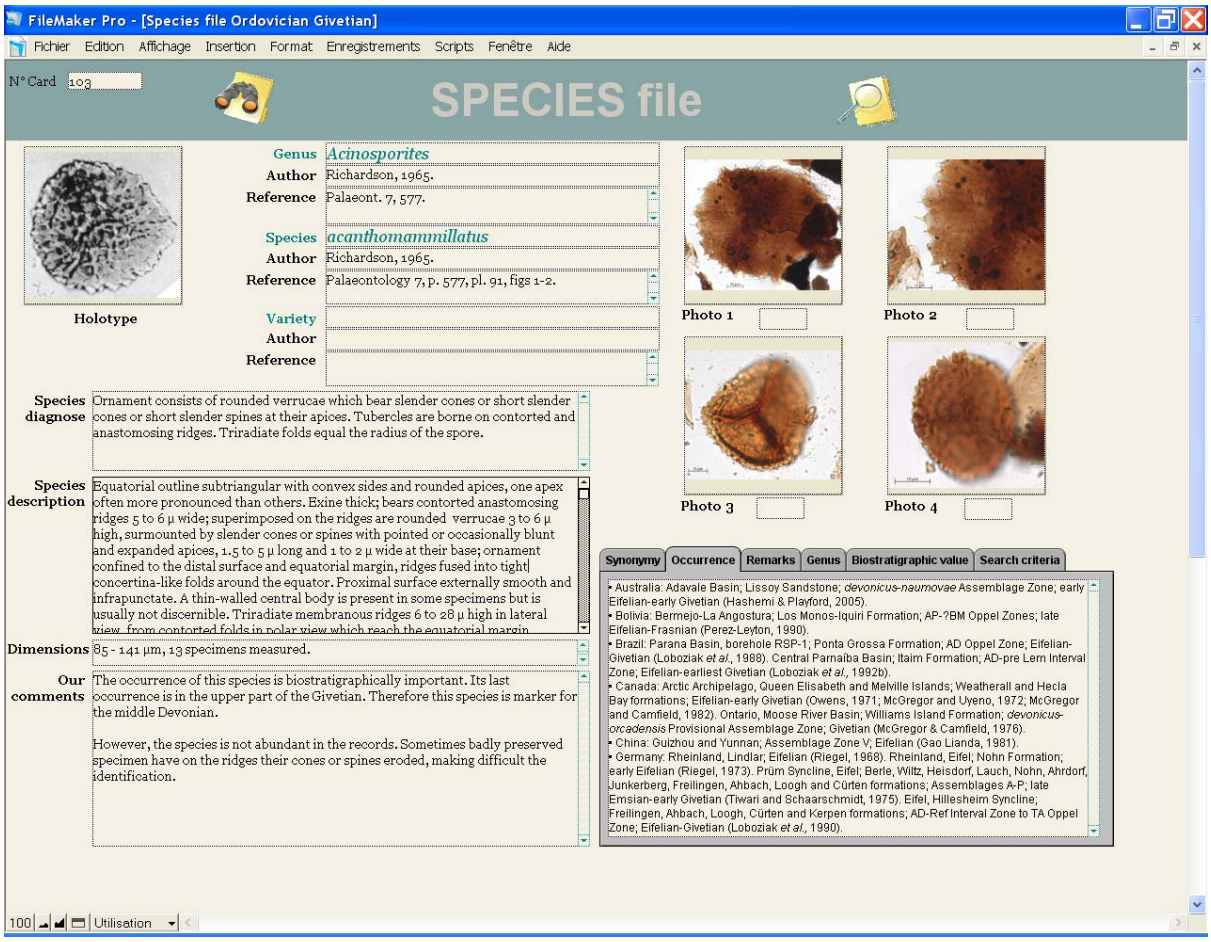
CONSULTING
PalynoStrata

A new database is born: MiosporeData. I have been employing Elodie Pétus as a research assistant for three years now. She is paid thanks to consulting works performed for private companies or institutes. As our activity is growing, we have created a small office of consulting in palynology called PalynoStrata. In the near future, we hope to have the opportunity to hire other people. We will extend our activities to other palynomorphs in collaboration with some "palyno-friends". We will also develop other solutions in using software such as StrataBugs, ODM etc. We will also organize web-consulting and web-courses. The ideas are numerous.
The complete database is composed of: the original description of the palynomorph genus and species; a list of synonyms; geographic and stratigraphic occurrences; remarks; an identification key. Up to four unpublished images are proposed to show the intra-specific variability. Moreover, and it is probably the most important, the palynological slides from which specimens have been photographed are provided with the database. The specimens are located thanks to the England Finder coordinates. Last but not least, you do not need any new software to work with the database since it has been built with a runtime solution. It works equally well with Windows NT up to 7 and on Mac. We have not tried it with Linux.
We already have provided the complete database to a petroleum society which seems to be very satisfied with our work. This version contained the ca. 300 most important Palaeozoic miospore taxa in biostratigraphy, selected from the two main palaeoplates: Gondwana and Euramerica. This version is of course the most expensive as we have to prepare new slides and to locate new specimens for photography. This work may take a lot of time according to the number of specimens included in the database. It is however possible to adapt the MiosporeData in respect of the budget. You will find here below the range of the possibilities. The price will change according to the number of genera/species included in the file. The database is copyrighted, "edit" and "copy" protected, and locked by a password. Prices are variable according to your type of activity (private societies or institutions). For more details, please feel free to contact us (p.steemans@ulg.ac.be).

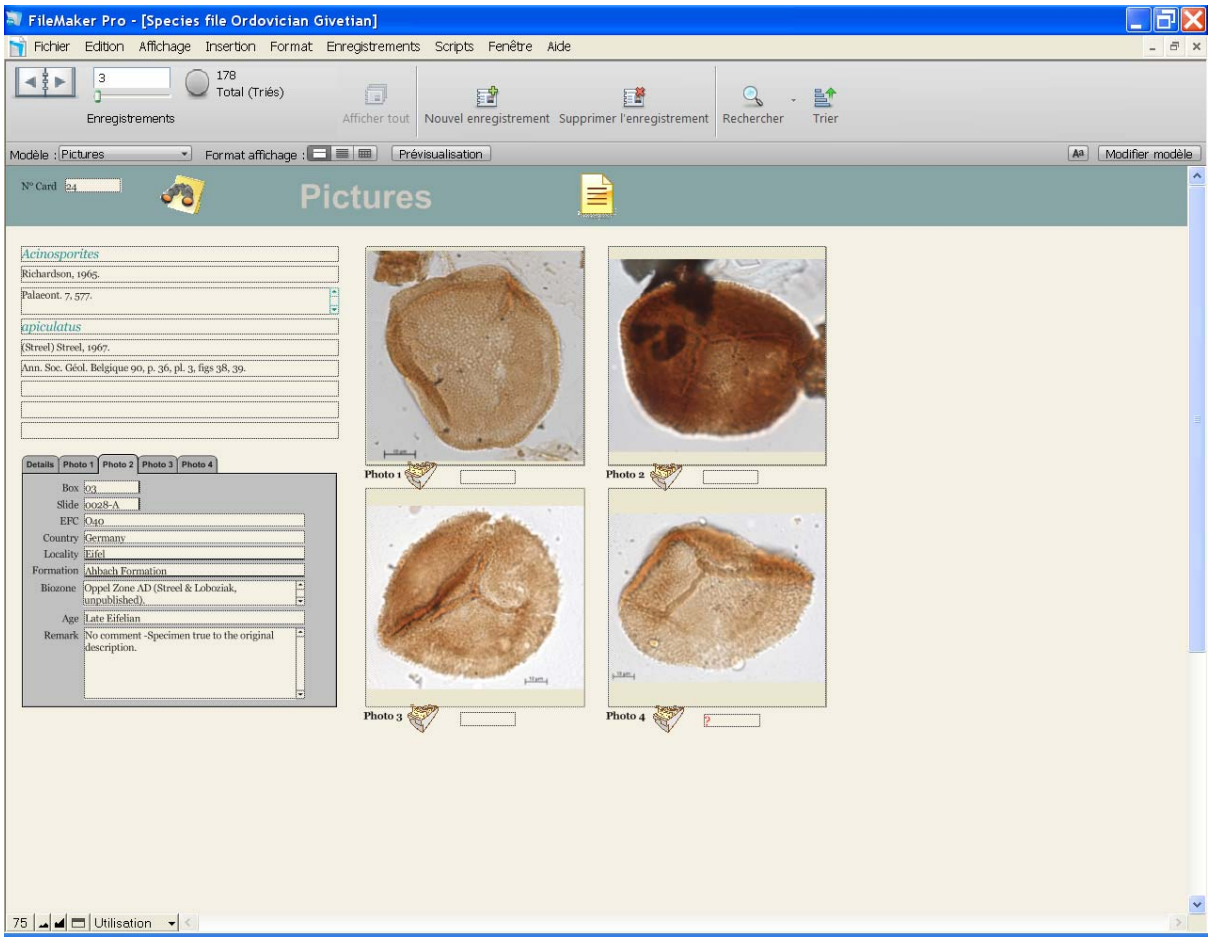
Versions	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Genus (ca. 150 files)	X	X	X	X	X	X	X
All references	X	X	X	X	X	X	X
Bibliography	X	X	X	X	X	X	X
Genus + species (ca. 300 species)		X	X	X	X	X	X
Holotype: description and remarks		X	X	X	X	X	X
Synonymies			X	X	X	X	X

Ranges			X	X	X	X	X
Biostratigraphic evaluation				X	X	X	X
Search criteria				X	X	X	X
From 1 to 4 pictures of specimens					X	X	X
Slides containing the specimens						X	X
Additional unpublished information*							X

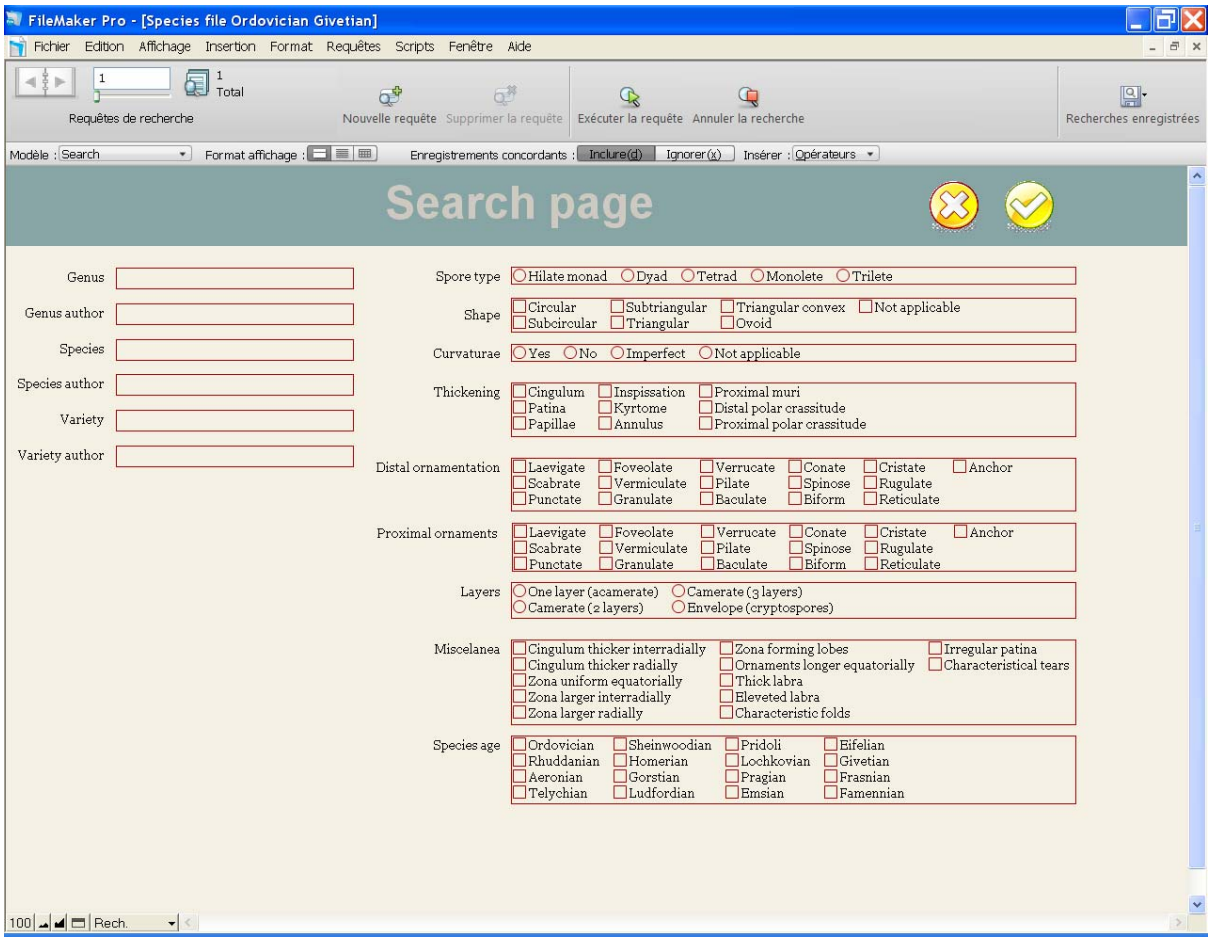
* The unpublished information stays our property and cannot be used for scientific publications without our authorization.



Page of the species description and other information.



Information on specimens located in the slides.



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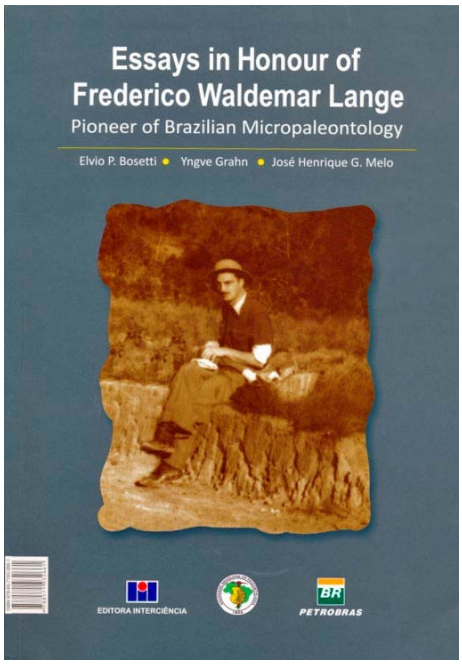
BOOK REVIEW
ESSAYS IN HONOUR OF FREDERICO WALDEMAR LANGE
PIONEER OF BRAZILIAN MICROPALAEONTOLOGY
By Elvio P. Bosetti, Yngve Grahn and José Henrique G. Melo



This volume, jointly from the Brazilian Palaeontological Society and Petrobras is dedicated to Dr Frederico Waldemar Lange on the occasion of the centenary of his birth in 1911. Yngve Grahn kindly provided a brief synopsis to inspiration behind this volume. As Yngve notes, "Lange was of paramount importance for the development of Brazilian palynology and he was also the first to work with palynomorphs in Brazil. We consider it appropriate therefore to celebrate the inspirational legacy of this distinguished Brazilian paleontologist with a commemorative volume. We wish to portray Lange as both a scientist and a human being to the wider international public, since he is indeed one of the founders of micropalaeontology."

Written in English and Portuguese, each chapter of the book is effectively duplicated in each language. The book begins with an introduction to the volume which briefly describes how Lange's geological and palaeontological passion developed from an early age. Initially working at the Museum of Paraná and subsequently Petrobras, his scientific drive was also sustained in the years following his retirement. This brief introduction to Lange's life is developed in much more detail in the first chapter, which begins with his birth in Ponta Grossa in the State of Paraná and describes his education, career and scientific development (including his membership of the CIMP and the positive collaborations that can come from attending our meetings). A second chapter provides some personal memories from Luiz Padilha de Quadros. I was impressed to read of Lange's dedication to his studies as well as his ability to selectively pick and mount chitinozoans, spores, acritarchs and other fossils on discrete areas of a microscope slide ready for analysis.

The remaining three chapters provide reviews and evaluations of Lange's scientific contributions pertaining to Palaeozoic palynomorphs. Chapeter 3 by Yngve Grahn describes a "Re-examination of Silurian and Devonian Chitinozoa described and illustrated by Lange between 1949 and 1967". This paper provides a brief overview of Lange's chitinozoan research and is based on a study of the approximately 800 photomicrographs taken by Lange, together with photomicrographs of type material from two of his papers. In total, 97 chitinozoan species could be identified. The paper illustrates the distribution of the Silurian and Devonian chitinozoan biozones in the Brazilian basins studied by Lange and provides a systematic section including helpful remarks and observations concerning the diagnostic features of species. The chitinozoans are illustrated over a total of 13 plates mainly using transmitted light photomicrography.

Chapter 4 by Mats Eriksson and others describes the "Malvinokaffric Realm polychaetes from the Devonian Ponta Grossa Formation, Paraná Basin (Southern Brazil), with a discussion and re-evaluation of the species described by Lange." The scolecodont fauna from this Emsian aged formation is relatively abundant, but of a low diversity, and the paper validates the meticulous work done by Lange on this topic. The paper also provides a review of Devonian scolecodonts from their first recognition in 1879 in assemblages from Canada and Scotland, as well as a discussion on the work of Lange.

Chapter 5 by Alain Le Hérissé provides "A reappraisal of F. W. Lange's 1967 algal microfossil studies". The two papers written by Lange in 1967 focused on acritarchs and microscopic algal remains (especially the netromorph acritarchs) and demonstrated their biostratigraphical potential. The review of the illustration of Lange's figured specimens has led to the recognition of 19 distinct taxa with the possibility that ecological factors may have influenced morphology leading to a taxonomic reappraisal of some morphotypes. As with chapter 3, a systematic section provides comments concerning their occurrence and morphology as well as describing a new species of the acritarch *Bimerga*.

In addition to the three technical articles included within the book, which will be of interest to people working in these areas, I do believe that this volume achieves its goal of portraying Lange as a scientist and human being. The book can be ordered from Editora Interciência, Rio de Janeiro with the contact details and pricing information as follows:

Editora Interciência, Rio de Janeiro (Email: vendas@editorainterciencia.com.br)
Price 92R$ + freight (within Brazil), 52 US$ + freight (outside Brazil)

Gary Mullins

THE CIMP WEBSITE

Philippe Steemans has been very ably fulfilling the role of both CIMP Treasurer and Webmaster for a number of years, but wants to stand aside as Webmaster. We are therefore looking for someone to take on the responsibility of managing our very professional looking (many thanks Philippe!) webpages (see http://cimp.weebly.com/index.html). Please submit your nominations or feel free just to volunteer. Contact me, Marco Vecoli or Philippe Steemans.
Thank you.
Gary Mullins
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Thank you!