

# PALYNOS

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## NEWS AND VIEWS

### The importance of being an ultrastructurally experienced palynologist

With great interest we have read the stimulating and groundbreaking article by Annick Le Thomas in PALYNOS 25/2, and her invitation to other working groups to present their actual research priorities. She proposed an interdisciplinary discussion about topics and new directions during the next IPC 2004 in Granada, Spain. After focussing on the fact that, "Palynology has become a well-established research tool .... integrating perfectly into .... multidisciplinary programmes", she then goes straight to the point: "Because of this it seemed, of itself, to disappear". Palynologists as evolutionarily oriented botanists working ultrastructurally, especially those routinely using Transmission Electron Microscopy (TEM) are perfectly trained, highly experienced scientists. However, unfortunately, nowadays they appear to be an endangered species, and their field of work should be put on a Red Data List. This is a big reason for writing the present article.

#### Where we are and what we do?

To follow up on Annick's comments and suggestions we would like to present our own palynology research group in Vienna, and discuss our interests and priorities. In Vienna, the study of pollen and pollen/pollination biology, currently housed within two University Departments,

namely the Institute of Botany and the Institute of Palaeontology, has been a tradition for many decades, in fact more than hundred years: Fritz Knoll, Elise Hofmann, Wilhelm Klaus, not to forget Anton Kerner v. Marilaun in the 19<sup>th</sup> century! For more than fifty years (Lothar Geitler, Karl Carniel) there has also been a tradition of cytological and ultrastructural studies. In the Sixties W. Klaus was the first Chair of Palaeobotany, with a focus on palynology, while K. Carniel founded the Electron Microscopy Unit at the Institute of Botany in 1966, installing one of the first Transmission Electron Microscopes at the University of Vienna. In the meantime, both departments, in trying to combine their strengths in palynological investigations, acquired a considerable range of technical equipment necessary for their research.

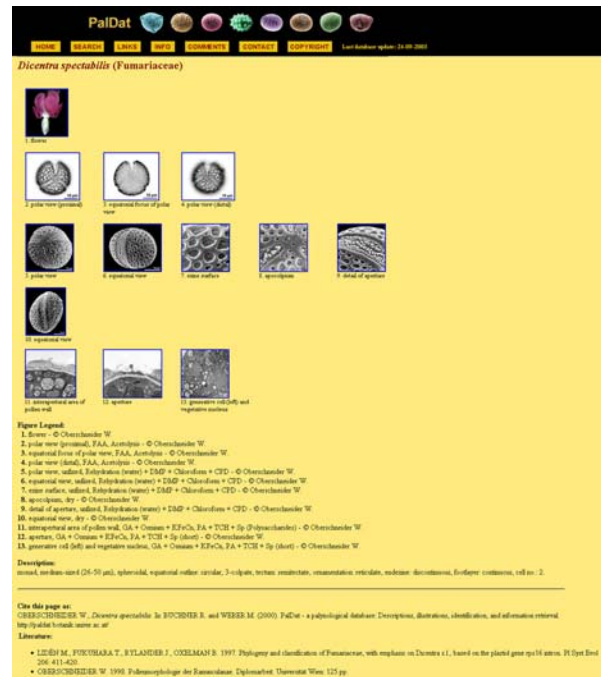
#### Two fields of interest are shared by both departments:

One of these fields is to obtain 'life-like' structures by optimizing conventional and advanced preparation techniques in TEM and SEM, not only to avoid 'artifacts' but also to improve structural preservation. Optimal preservation of structure is especially important for adequate representation of organelles/structures in metabolically highly active cells observed with TEM, and for plant material with fragile, collapsible cell walls (seen in SEM). This goal fits within the context of the second and dominant field of members of the combined working group, pollen and spore morphology, i.e. the knowledge and understanding of spores and pollen grains from recent and fossil pteridophytes, gymnosperms,

and angiosperms in basic and applied sciences. However, we see pollen and spore studies in a broader context, not only of mature spores/pollen grains, but more particularly developmental aspects of sporogenesis and gametogenesis. Sexual reproduction in Spermatophyta requires the coordinated development of both the male and female reproductive organs (anther and pistil), both of which show highly distinct structures and developmental pathways. For a better understanding of the specialised structures of spores and pollen grains long-term research into both pollen and spore development (sporogenesis), and ovule development (gametogenesis), as well as pollination ecology are indispensable.

Within our department one of the main topics is ultrastructural research in order to understand relationships between form and function. A crucial tool in our research has been the development of a comprehensive pictorial (LM, SEM and TEM) and terminological database, *PalDat*, for the extensive, but usually species-specific, range of morphological pollen and spore characteristics.

The main purpose for the establishment of this database was to get an overview of the large amount of palynological data from a variety of plant families accumulated in the department through many years. The database includes a detailed description of the pollen grain (size, shape in dry and hydrated state, apertural details, wall-stratification and ornamentation, pollen coatings and cellular condition), images of each pollen grain (LM, SEM and TEM), an image of the plant (flower), and basic literature for each genus. Search forms allow to the database to be queried for any combination of pollen grain characters, including images and literature. Moreover, a number of print-outs are available, for example, a standardized pollen grain description of each taxon, literature and/or images for each genus, a key to a selected family, herbarium labels. Presently *PalDat* includes c. 5500 pictures (representing 783 species from 492 genera). The database will soon be extended to include an illustrated terminology. Free access to most of *PalDat*-data is available via the internet (<http://paldat.botanik.univie.ac.at/>). To view the database a free registration is necessary (registration requires that your system will accept 'cookies'!).



In the next part of our article we would like to discuss two aspects of palynology which were, in the past, are in the present, and will be, in future, central to our studies. These two aspects, or more precisely axioms, may be seen as related: firstly the pollen grain or spore as an individual generation, or even as an individual plant (spores), with few but, for actuo- and palaeopalynological application, highly important diagnostic features and secondly the reasons why we consider pollen as morphologically conservative. This is exemplified by fossil pollen which can often be related to pollen of a recent taxon because of closely shared characteristics.

### 1) Quality rating of pollen features as a consequence of being a separate (haploid) plant generation, i.e., alternating at regular intervals with the diploid generation

Alternation of generations is a unique feature of plants, not only in the green algae, but also in mosses, ferns, gymnosperms and angiosperms. It is without parallel in the animal kingdom. Pollen grains develop in anthers as the result of meiosis and very few mitoses (two in angiosperms, three to five in gymnosperms), and represent an extra generation, the highly reduced male gametophyte. Pollen grains are not simply small parts of a plant as, for example, leaves or seeds, but are the complete (hidden) haploid counterpart to the more dominating plant, the

diploid generation, so much more readily observed in nature.

The haploid generation does not usually suffer from the various selective pressures to which the diploid plant is subjected. If selective pressures upon pollen characters are absent, the pollen features may remain constant for millions of years. Evolutionary trends in pollen morphology within a taxon are scarce, when viewed only as reflecting phylogenetic developments (Nowicke & Skvarla 1980). Selective forces play a major role only in pollination ecology, but the matter is not so simple as it looks (for examples and review see Hesse 2000). The correlations sometimes mentioned between spiny pollen and flies as flower visitors, and smooth pollen with visiting beetles in Araceae are an overrated simplification (J. Bogner, pers. comm.). One should expect a clear separation concerning pollinators (flies versus beetles), but far from it! Beetles visit taxa with both smooth and spiny pollen, and this is also true of flies (Mayo et al. 1997). A recent example is shown by the precise distribution of pollen ornamentation along a straight line within the Aroideae. In the basal ('lower') clades of Aroideae (sensu Cabrera et al. 2003) with psilate pollen highly dominant, while in the more derived ('higher') clades of Aroideae (*Arum* etc.) spiny pollen is found almost exclusively. The more subtle pollen ornamentation probably arose near the beginning of Aroideae expansion, stabilised and has enjoyed a prolonged existence for millions of years, right up to the present (Hesse et al., in prep.).

Adaptations of pollen characters mainly concern the transition from entomophily to anemophily. Pollen grain volume may decrease, and ornamentation be much less elaborate, or even smooth. There is a loss of typically entomophilous pollen ectexine features such as a reticulate tectum, distinctive spines, or other prominent ornamentation. A rarer transition may concern adaptation to differing environments, for example, from dry to moist or wet, and this may have consequences for pollen morphology, too. A striking example of an ecologically based adaptive force occurs in some angiosperms adapted to wet environments, notably monocots, where there are many taxa with inaperturate pollen that remains viable without a protective exine. This is because in wet or moist environments where pollen is not subjected to desiccation, and consequently to harmomegathic

stresses, it does not collapse into a dry state because of a thick stabilizing intine (Furness & Rudall 1999). Similarly, especially in Aroideae (Weber et al. 1999) the pollen grains are protected by a thick and spongy stabilizing endexine. In contrast, pollen of Poaceae, which is adapted to dry environments, is mono-aperturate (porate or, more precisely, ulcerate) and subject to desiccation and harmomegathic stress. The exine undergoes considerable and irregular infolding despite its typically stable exine structure.

These tiny (male haploid) plants have only a very limited number of variable parameters, in fact only one, the pollen wall with its structural and ornamental features but, nevertheless, show an astonishing diversity of pollen wall characteristics. Hence, their characters are, if used for systematic and taxonomic purposes, at least as important or even more important than, any other (micro-) morphological character of the diploid generation. For this reason pollen morphology claims an important place in plant systematics.

## 2) Pollen characters are conservative

Evolutionary trends, for example, from echinate to echinolophate ornamentation in pollen morphology of Lactuceae, are well established (Blackmore 2000). These trends refer to relationships between genera or even species as, for example, in *Scorzonera*. However, this works only if we assume that pollen characters remain constant at genus/species level, at least for the life-time of the genus/species. Let us take a closer look at this assessment in relation to the fossil record. We feel that exceptionally similar or even practically identical, and simultaneously rare conditions very probably belong to the same genus/species, or at least family, and cannot have been invented twice independently in distant groups. If the view is accepted that pollen and spore features are (highly) conservative (Hao et al. 2000), because the haploid generation is not usually subjected to various selective forces (see above), then the specific combination of typical pollen characters is a worthy, often indispensable systematic feature, acting like a compass needle in critical situations. Blackmore (2000, p. 162ff.) brought out the point that Erdtman used the metaphor of a compass needle, ".... effectively treating morphology as an autapomorphy." "The unique pollen construction in *Nypa* .... in a separate family the Nypoideae". This intuitive approach involved judgements based on extensive

knowledge of the pattern of pollen-morphological variation. For example, detailed research by Le Thomas et al. (2001) on pollen aperture characters in Nivenioideae - Iridaceae revealed that the subfamily is paraphyletic, which is strongly supported by molecular analyses (Reeves et al. 2001). A further, recent example from our group (Halbritter & Hesse in press) may be mentioned. Lamiaceae pollen, with a morphological series from hexa- to tricolpate has, in dry condition, a characteristic shape, prolate and flattened, with the apertures arranged in a very distinct manner. So we would claim that a dispersed quite similar featured pollen grain must have a Lamiaceae origin. Of course we do not ignore an inherent danger: uncritically evaluated pollen characters may be misleading, compared to molecular data. An excellent example was shown by Doyle et al. (2000) concerning the so-called 'xylopoid conflict' in the Annonaceae: this conflict looks to be due at least in part to avoidable misinterpretations of stamen and pollen morphology.

Alfred Traverse in his thoughtful textbook (1988) and others say that pollen determination is usually only possible to the genus level. This statement is valid at best at the (lower) LM-level! However, with high resolution SEM and TEM much more detail is apparent which allows detailed comparison at the genus and sometimes even at the species level (for example, *Rubus chamaemorus* and *R. saxatilis*: Parger 1998, several *Camellia* species: Fendt 1996, *Quercus robur*, *Q. cerris*, *Q. coccifera*: Zetter unpubl., also for *Stachys* species, Halbritter 2000a, b). Recently, some authors (Joosten & DeClerk 2002) addressed the nomenclatural question, going even further with a general claim that, in principal, it is impossible to ascribe fossil pollen to recent and native taxa that produce the same kind of pollen (inferring they are seen only at LM level). They ignore the fact that more and more Lower Cretaceous to Cretaceous pollen grains that are found both *in situ*, and also dispersed (sporadic dispersals), are being investigated at high resolution with SEM and/or TEM, as well as at LM level. The results of such studies do allow attribution to extant taxa at least to family, and often to genus level. The same authors, in this well-intended paper, claim that *Quercus* is palynologically similar to Ranunculaceae, which is comprehensible only at low LM level. However, Quaternary pollen studies are almost exclusively focussed at LM-level. This limits the

degree of accuracy attainable in assigning affinities. Without combined SEM, TEM and LM pollen studies we might even claim that 'Nothofagus pollen in Europe' is distinctly like Euphorbiaceous pollen, if identified only at high SEM magnifications.

To say that in principal it is impossible to relate fossil pollen to similar pollen of living taxa (not necessarily as far as species level) is a clear drawback, and overlooks our insights into what pollen is and what it represents, the independent haploid generation of an individual plant. Inclusive comparisons between fossil pollen grains and possible living counterparts demand specialised and highly experienced pollen morphologists, working in suitably-equipped laboratories. It is not rare for a pollen morphological type to remain stable through long periods of geological time. One of the best known examples is the pollen of the extant species, *Nypa fruticans* Wurmb, which, in all features, is practically identical with the fossil genus *Spinizonocolpites* (Muller 1981, Harley et al. 1991). Furthermore, more and more accounts of Early Cretaceous pollen and floral structures are being published (for examples and review see Friis & Pedersen 1996). There are a number of examples of fossil flower structures where the *in situ* pollen appears to be quite similar to the pollen of an extant flower that shares structural similarity to the fossil flower. Both flower remnants and pollen have retained important diagnostic characters, for instance the case of the Lauraceae megafossils, with pollen sacs and *in situ* pollen, typical of the Lauraceae (Herendeen et al. 1994). The zona-aperturate *Proxapertites operculatus*, which has a world-wide Cretaceous to Eocene distribution, is exceedingly similar to recent zona-aperturate Araceae pollen (Zetter et al. 2001). Another recently published example is that of an Oligocene fossil with an affinity to Casuarinaceae, *in situ* pollen shows all the features typical of extant pollen in this family (Guerin & Hill 2003).

A morphological series from *Normapolles* s. str. to modern Juglandaceae, Myricaceae, Betulaceae and Casuarinaceae etc. demonstrates the slow, but steady rate of evolutionary modification for pollen features, which are the results perhaps of adaptations to, rather than from, selective pressure. We do not, however, claim that pollen is exclusively conservative irrespective of the direction in which the parent plant is evolving.

We are quite aware that other taxa may show a 'character mosaic', meaning that the 'evolutionary speed' or 'evolutionary direction' of different characters within a plant might be variable, and that species/genera with evolutionarily advanced characteristics may have pollen with more basal or 'retarded' characters, or *vice versa*. For example, Zhou et al. (2001) state "... the fossil [a Turonian Hamamelidaceae] exhibits a mosaic of characters found within modern Hamamelidaceae, it ... lacks the derived pollen found in extant Altingioideae and retains the more plesiomorphic tricolpate pollen found in the rest of Hamamelidaceae". Another fine example of a mosaic of characters is the diversity and varying complexity of the triaperturate configuration within the monocotyledons (Harley in press), where advanced or 'innovative', features may occur in more basal or in more advanced groups. Last but not least we draw attention to important characters which have evolved several times independently. Examples include microsporogenesis type and pollen aperture type in the monocots, reviewed by Furness & Rudall (1999), and the various tapetum types in the basal angiosperms (Furness & Rudall 2001).

Remarkable diversity of form may occur, followed by stability in form (and in function?) over millions of years. Is it not amazing that a ring-like aperture occurs in at least ten angiosperm families, more precisely in basal dicots and monocots? This apparently naive statement poses several questions, for instance: Why in so many families? Why does it occur in isolation within a family where most pollen are sulcate or inaperturate, as in Annonaceae? Why not in the eudicots? Perhaps they are a relict of early angiosperms, before the arrival ('invention') of the tricolp(or)ate-condition. Before the advent of eudicot- tricolp(or)ates an aperture ring was perhaps the best way for a target-oriented harmomegathic movement, i.e., to expand or to close a large area adapted for possible pollen tube formation/pollen germination. Furthermore, why does, for example, the spectacular zona-aperturate condition occur alongside other apertural conditions within the same genus? And why is the aperture condition sometimes not stable within a species, or even within a single pollen sac? Look at the case of *Rhaphidophora africana* where most of the pollen grains are extended sulcate to bisulcate (in SEM), but fully zonate pollen also occur (Grayum 1992: "separating into halves").

The percentage of fully zonate/bisulcate pollen may vary between individual plants. In general, within large monocot families, the aperture condition is often diverse, for instance in Araceae (Grayum 1992) or in Arecaceae (Harley & Baker 2001): inaperturate, sulcate, trichotomosulcate, bi-aperturate, and zona-aperturate pollen even within genera may have been 'an experiment by the playing/ /gambling/ /toying of nature'.

We have put forward the idea of plasticity in character formation within recent basal angiosperms including the monocots. This hypothesis is supported by pollen characters dating back to the Late Cretaceous, found in manifold combinations only in the basal angiosperm groups. The inconstancy, or the principle of trial and error, and/or 'imaginativeness' of apertures in basal angiosperms is valid even for the Ranunculales, the most basal group of the Eudicots (APG 2003), which are also diverse in floral morphology and pollination biology! In contrast, 'advanced' eudicot families (Apiaceae, Asteraceae, Brassicaceae, Fabaceae, etc.) are stenopalynous, and often very 'constant', 'uninspired', with a few exceptions such as Acanthaceae, which have stunningly eurypalynous pollen, with many aesthetically exquisite pollen forms. Some families of the otherwise rather stenopalynous core Eudicots are palynologically diverse. For instance, Polygonaceae within the Caryophyllales, formerly seen as an advanced taxon, are now placed together with Gunnerales near the base of core Eudicots (APG 2003). Although this is exceptional it does, at the same time, point in the direction that, the more derived a taxon is, and the 'higher' its placing in the phylogenetic angiosperm tree (APG 2003), so the richness of pollen character variation lessens. Interestingly, Furness & Rudall (1999) have pointed to a similar direction concerning microsporogenesis types in 'primitive' dicots and monocots, compared to eudicots.

In our opinion, if ultrastructural characters of fossil pollen (SEM, TEM) are also examined, the fossil pollen can be more accurately compared with pollen of living taxa producing similar pollen. Subsequently, from the assumption of highly constant (conservative) pollen features at the generic level over millions of years, proposing a relationship between the fossil pollen and a living counterpart might be justified.

In summary, we emphasize that further studies should and will not only be diverting and exciting, but are very much needed for a better understanding of what has been going on in pollen and spore evolution. Our future research must not only reflect the conservatism of pollen grains!

## References

- APG. 2003. <http://www.mobot.org/MOBOT/Research/APweb/welcome.html>.
- Blackmore, S. 2000. The palynological compass: the contribution of palynology to systematics. In: Plant Systematics for the 21<sup>st</sup> Century. (eds. Nordenstam, B., El-Ghazaly, G. & Kassas, M.), 161-192. Portland Press Ltd, London.
- Buchner, R. & Weber, M. 2000. PalDat - a palynological database: Descriptions, illustrations, identification, and information retrieval. <http://paldat.botanik.univie.ac.at/>.
- Cabrera, L.I., Salazar, G.A., Chase, M.W. & Mayo, S.J. 2003. Phylogenetics of Araceae and Lemnaceae: Evidence from multiple plastid DNA data sets. In: Monocots III, 31 March - 4 April 2003, Rancho Santa Ana Botanic Garden, Claremont, California. Abstracts. p. 11.
- Doyle, J.A., Bygrave, P. & LeThomas, A. 2000. Implications of molecular data for pollen evolution in Annonaceae. In: Pollen and Spores: Morphology and Biology (eds. Harley, M.M., Morton, C.A. & Blackmore, S.), 259-284. Royal Botanic Gardens, Kew.
- Fendt, A. 1996. Beiträge zur Palynologie rezenter und fossiler Theaceae. Diplomarbeit, Formal- und Naturwissenschaftliche Fakultät der Universität Wien.
- Friis, E.M. & Pedersen, K.R. 1996. Angiosperm pollen *in situ* in Cretaceous reproductive organs. In: Palynology: principles and applications. Vol. 1. (eds. Jansonius, J. & McGregor, D.C.), 409-426. AASP Foundation.
- Furness, C.A. & Rudall, P.J. 1999. Microsporogenesis in Monocotyledons. *Ann. Botany* 84: 475-499.
- Furness, C.A. & Rudall, P.J. 2001. The Tapetum in basal angiosperms: early diversity. *Int. J. Plant Sci.* 162: 375-392.
- Grayum, M. 1992. Comparative external pollen ultrastructure of the Araceae and putatively related taxa. *Monographs in Systematic Botany from Missouri Botanical Garden* 43: 1-167.
- Guerin, G. & Hill, R.S. 2003. *Gymnostoma tasmanianum* sp. nov., a fossil Casuarinaceae from the early Oligocene of Little Rapid River, Tasmania, Australia. *Int. J. Plant Sci.* 164: 629-634.
- Halbritter, H. 2000a. *Stachys annua*. In: PalDat - a palynological database: Descriptions, illustrations, identification, and information retrieval. <http://paldat.botanik.univie.ac.at/> (Buchner, R. & Weber, M.)
- Halbritter, H. 2000b. *Stachys recta*. In: PalDat - a palynological database: Descriptions, illustrations, identification, and information retrieval. <http://paldat.botanik.univie.ac.at/> (Buchner, R. & Weber, M.)
- Halbritter, H. & Hesse, M. Principal modes of infoldings in tricolp(or)ate Angiosperm pollen. Grana: in press.
- Hao, G., Saunders, R.M.K. & Chye, M.-L. 2000. A phylogenetic analysis of the Illiciaceae based on sequences of internal transcribed spacers (ITS) of nuclear ribosomal DNA. *Plant Syst. Evol.* 223: 81-90.
- Harley, M.M. Triaperturate pollen in the monocotyledons: configurations and conjectures. *Plant Syst. Evol.*: in press.
- Harley, M.M. & Baker, W. J. 2001. Pollen aperture morphology in Arecaceae: application within phylogenetic analyses, and a summary of the fossil record of palm-like pollen. *Grana* 40: 45-77.
- Harley, M.M., Kurmann, M.H. & Ferguson, I.K. 1991. Systematic implications of comparative morphology and in selected Tertiary and extant pollen from the Palmae and the Sapotaceae. In: Pollen and Spores. Pattern of Diversification (eds. Blackmore, S. & Barnes, S.H.), 225-238. The Systematics Association Special Volume 44. Clarendon Press. Oxford.
- Herendeen, P.S., Crepet, W.L. & Nixon, K.C. 1994. Fossil flowers and pollen of Lauraceae from the Upper Cretaceous of New Jersey. *Plant Syst. Evol.* 189: 29-40.
- Hesse, M., 2000: Pollen wall stratification and pollination. *Plant Syst. Evol.* 222: 1-17.
- Hesse, M., Weber, M. & Halbritter, H. Pollen wall ultrastructure gives support to the morphological and molecular classifications of Araceae. in prep.
- Joosten, H. & DeClerk, P. 2002. What's in a name? Some thoughts on pollen

classification, identification, and nomenclature in Quaternary palynology. *Rev. Palaeobot. Palynol.* 122: 29-45.

- Le Thomas, A. 2002. Is there a decline in Palynology? *Palynos* 25/2: 1-2.
- Le Thomas, A., Suarez-Cervera, M. & Goldblatt, P. 2001. Pollen of Nivenioideae and its phylogenetic implications. *Annali di Botanica, Nuova Serie I*, n. 2: 67-72.
- Mayo, S.J., Bogner, J. & Boyce, P.C. 1997. *The Genera of Araceae*. The Royal Botanic Gardens, Kew.
- Muller, J. 1981. Fossil pollen records of extant Angiosperms. *Bot. Rev.* 47: 1-142.
- Nowicke, J.W. & Skvarla, J.J. 1980. Pollen morphology: the potential influence in higher order systematics. *Ann. Mo. Bot. Garden* 66: 633-700.
- Parger, M. 1998. Zur Pollenmorphologie ausgewählter rezenter und fossiler Vertreter der Rosaceae. Diplomarbeit, Formal- und Naturwissenschaftliche Fakultät der Universität Wien.
- Reeves, G., Goldblatt, P., Rudall, P.J. & Chase, M.W. 2001. Molecular systematics of Iridaceae: a combined analysis of four plastid DNA sequence matrices. *Annali di Botanica, Nuova Serie I*, n. 2: 29-42.
- Traverse, A. 1988. *Palaeopalynology*. Unwin Hyman, Boston.
- Weber, M., Halbritter, H. & Hesse, M. 1999. The basic pollen wall types in Araceae. *Int. J. Plant Sci.* 160: 415-423.
- Zhou, Z.-K., Crepet, W.L. & Nixon, K.C. 2001. The earliest fossil evidence of the Hamamelidaceae: Late Cretaceous (Turonian) inflorescences and fruits of Altingioideae. *Amer. J. Bot.* 88: 753-766.
- Zetter, R., Hesse, M. & Frosch-Radivo, A. 2001. Early Eocene zona-aperturate pollen grains of the *Proxapertites* type with affinity to Araceae. *Rev. Paleobot. Palynol.* 117: 267-279.

Michael Hesse (michael.hesse@univie.ac.at)  
Martina Weber (martina.weber@univie.ac.at)  
Reinhard Zetter (reinhard.zetter@univie.ac.at)

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**The second and revised edition of the Glossary of Pollen and Spore Terminology is available at the following address:**

<http://www.bio.uu.nl/~palaeo/glossary/glos-int.htm>

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**The Pollen Monitoring Programme (PMP)**

#### **What is the PMP?**

The Pollen Monitoring programme was initiated in 1996 as the European Pollen Monitoring Programme (EPMP), a Work Group within the INQUA Holocene Commission. In 1999 the epithet European was dropped so that the programme now welcomes participants who are monitoring pollen deposition anywhere in the world. Moreover, since July 2003, PMP is functioning as a Work Group within the newly established INQUA Commission on Palaeoecology and Human Evolution. Full details can be seen on the Programme's web page <http://www.ngdc.noaa.gov/paleo/pmp/pmp.html> which is mirrored in Europe <http://wdc.obs-mip.fr/paleo/pmp/pmp.html> (and in several other sites throughout the world). The programme is administered by a 5-person Advisory Council, members of which are elected during the international meetings. At present pollen monitoring is in progress in a wide range of vegetation situations (Fig. 1.).

#### **Aims**

The aims of the PMP are twofold: 1. To produce a standardized data set of modern pollen deposition (grains cm<sup>-2</sup> year<sup>-1</sup>, often referred to as pollen influx) for transects across latitudinal and altitudinal treelines, and 2. To produce pollen deposition (influx) values primarily for major tree species but also for ecologically significant or dominant herb species. These standardly collected and, therefore, comparable and contrastable data will be archived in a fully relational database so as to be available as a reference tool for palaeoecological research.

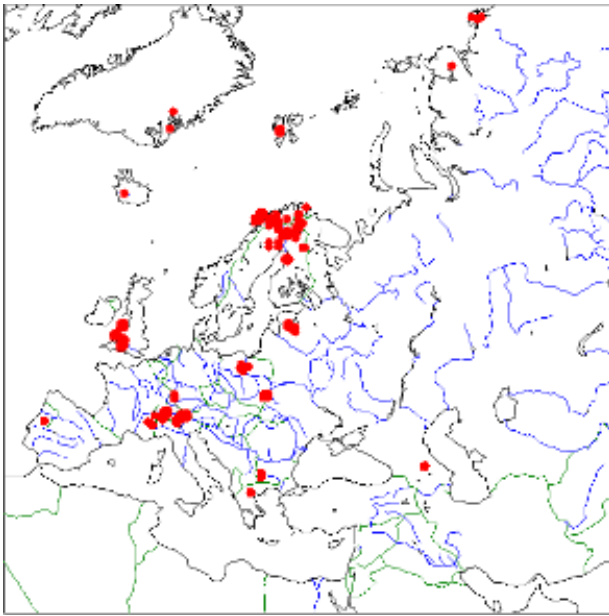


Figure 1. MP monitoring sites

### Applications and uses

The PMP was initiated by members of the Quaternary community who felt the need to have quantified modern analogues (i.e. knowledge of the actual quantity of pollen being deposited, rather than the relative representation between species) which would enable a more objective interpretation of fossil pollen sequences. The results of the pollen monitoring provide 1. Empirical data of pollen-vegetation relationships and enable 2. The quantitative delimitation of tree-lines (which often have a climatic control), 3. The calibration of annual variations in pollen deposition (which closely follows pollen production) with climate parameters and 4. The evaluation of models of pollen dispersal.

### Methods

Pollen deposition is monitored with a modified 'Tauber' trap which is located in the centre of a mire (or comparable open area within the vegetation community to be monitored) and is sunk into the ground so that its opening is at ground level (to simulate the surface of the mire) (Fig. 2). In this way the monitoring situation is as close as possible to the situation preserved in fossil sediments. The trap is collecting pollen for a full calendar year and is emptied once a year at the end of the flowering season. This gives a temporal resolution which is comparable to the 'best possible obtainable' from fossil sediments.

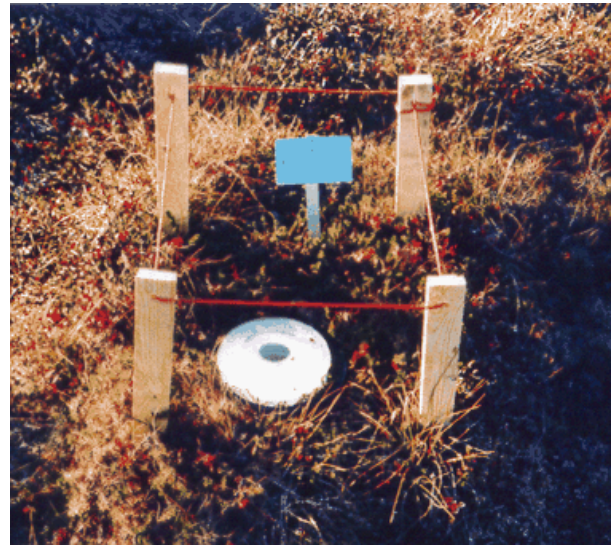


Figure 2. A modified 'Tauber' pollen trap in place in the centre of a mire

### Facilities and infrastructure

The PMP offers a number of facilities. The web page contains complete details of how to proceed with monitoring (including the associated vegetation mapping), how to treat the samples in the laboratory and how to prepare results for submission to the database (see below). On-line forms are available for submitting both metadata and pollen counts. On the web page the protocols and working principle of the PMP can also be consulted, and existing monitoring sites reviewed. Metadata about each trap and annual pollen counts are archived in **PMP data** which is managed in the University of Oulu, Finland. This database is completely compatible with the fossil pollen databases in GPD (Global Pollen Database). Access to these data is restricted initially to enable contributors to publish their results but PMP protocol allows for data becoming public 5 years after their year of submission. It should be remembered that for each pollen monitoring site data are collected year by year and so they are often not representative until monitoring has continued for several years, hence the initial restriction.

The programme is also developing **PMP tracker**, a tool for questioning the database and visualizing the results on maps. This enables spatial overviews of pollen deposition of specified taxa in a specified year or over a number of years.

### Activities to date and planned for the future



PMP has had four international meetings so far and also participated in two of the INQUA Congresses as follows:

- 1st Meeting: 4-8.7.1996 - Oulanka and Hailuoto, Finland.

- 2nd Meeting: 7-11.5.1998 - Roosta, Estonia Symposium and Poster Session: '**Modern pollen deposition, tree-lines and climate**'.

- XV INQUA Congress 1999, Durban, South Africa.

- 3rd Meeting: 12-17.4.2000 - Cardiff, UK.

- 4th Meeting: 25-30.9.2002 - Lublin, Poland, Poster session joint with the POLLANDCAL network '**Developments in pollen calibration and quantitative reconstruction of past vegetation cover**'.

- XVI INQUA Congress 2003, Reno, USA

The 5<sup>th</sup> PMP meeting will be held in Varna, Bulgaria in May 2005. One focus of this meeting will be pollen monitoring in problematical or ecologically extreme situations. It is hoped that anyone who has even one year of results from monitoring in steppe, desert, tropical, Arctic/Antarctic or any other non temperate or boreal situations will present their results and comments for discussion and comparison.

The programme has also produced a symposium volume which contains several articles covering preliminary pollen monitoring results and their application. HICKS, S. & TINSLEY, H. (Eds.) 2001. **Modern pollen deposition, tree-lines and climate**. *Rev. Palaeobot. Palynol* 117

Further information can be obtained from the PMP President Sheila Hicks (sheila.hicks@oulu.fi)

## ANNOUNCEMENTS

### APIMONDIA International Federation of Beekeepers' Association

Dear ICPBR member,

Thanks for your interest to attend the Apimondia conference on Tropical Beekeeping: Research and Development for Pollination and Conservation,

which will be held in Costa Rica in 2004.

You can find complete information about the conference in this site:

<http://www.apiservices.com/apimondia/manifestations.htm>

Download our PDF file

Also you can find there the Registration Form. Please complete and return it to the Following address:

Apimondia Pollination 2004

Conference Secretary

L.A. Sánchez

P.O. Box 475-3000, Heredia, Costa Rica

Fax: ++(506) 237-7043

e-mail: [lsanchez@una.ac.cr](mailto:lsanchez@una.ac.cr)

Thank you very much for your attention and we hope see you in Costa Rica next February 2004.

Dr. Marinus J. Sommeijer

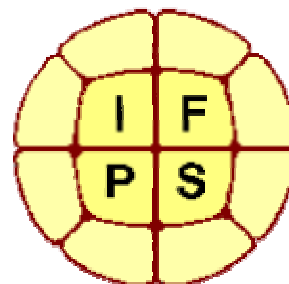
APIMONDIA, Standing Commission for Pollination and Bee Fora

M.Sc. Luis Sanchez Chaves

CINAT, Universidad Nacional de Costa Rica



### IFPS Financial awards for 11 IPC



This year, the International Union of Geological Societies (IUGS) has awarded \$US1000.00 to IFPS. This is in recognition of our work within the international community of geological scientists.

Furthermore, as Councillors must be aware, the move to electronic publication of PALYNOS has led to savings in expenditure relating to printing and distribution.

Therefore, our current financial position enables us to set aside \$US10,000 as an award fund to assist a selected number of doctoral students and established, but financially disadvantaged researchers, to attend 11 IPC July 2004, and present an aspect of their recent research. The award could, for example, be used to help fund accommodation, travel, registration etc.

A Committee headed by the IFPS President, Annick Le Thomas, and including Anne Marie Lezine, Madeline Harley and Owen Davis will consider applications for funding.

Applicants will not be eligible for an award, if they have applied, and been accepted, for an award from either of the other two award funds (see below\*).

This information about the award, and an application form, can be found on the IFPS and 11 IPC websites. Symposium organisers will also be advised of the IFPS award fund.

\*\*\*\*\*

**\*Please note:** The IFPS Award Fund should not be confused with either of the other two awards which have been announced in the second 11 IPC circular:

#### **The AASP award scheme**

#### **The 11 IPC Organising Committee Award scheme**

## **Countdown to the XI International Palynological Congress Granada, Spain, from 4 to 9 July 2004**

Dear Colleagues,

With just over six months to go to the 11 IPC we are making good progress here in Granada with the organisation of the conference. We are very pleased with the level of response we are getting from all over the world and feel confident that the quality of the contributions will assure the success of the conference. May I remind you that the deadline for receiving abstracts is only a few weeks away on the 15 January 2004 and the deadline for registration without surcharge is 15 April 2004.

In September we sent out the second circular outlining the scientific programme so far. If any of you have not received this information you can find it all on our website at [www.11ipc.org](http://www.11ipc.org)

The IFPS executive committee has undertaken to publish the new edition of the World Directory under the careful supervision of Professor Owen Davis, who is currently preparing all the relevant information. You will all receive a copy of this publication, which is being printed in Granada, with your conference documentation.

There are three different options for conference funding from the limited resources available:

1) from the 11 IPC organisation itself and is open to anyone with financial difficulties, but only covering university accommodation and registration fees (to apply for one of these grants please follow the instructions which appear in the second circular and on the conference web page).

2) from the AASP, which is restricted to students but covers travel expenses and/or accommodation, instructions for this grant appear on the AASP website.

3) from the IFPS, which is also for anyone with financial difficulties and would be a refund to cover part of accommodation and/or travel expenses, instructions for this grant appear on the IFPS website and in this issue of Palynos.

The registration fee includes the full social programme as well as a guided tour of the Alhambra and Generalife. There are two

attractive options available for accompanying persons. We have organised special discounts at hotels within easy walking distance of the conference centre, but if you want other accommodation or cheaper prices you may contact the Technical Secretary at [eurocongres@eurocongres.es](mailto:eurocongres@eurocongres.es)

On the evening of Monday 5 July we are planning to hold a special celebration in honour of retired palynologists and past presidents of I.F.P.S. On Wednesday 7 July several associations plan to have their own dinners. Further information can be found on our website.

The conference centre is a very modern building with every imaginable facility for important conferences.. The days are quite hot in June but the conference centre is fully air-conditioned. Due to Granada's altitude, the evenings are pleasantly cool and the dinners we have organised will be held outside in lovely gardens. Summer evenings are part of Granada's magic and eternal attraction to visitors. If you wish to extend your stay in Spain I highly recommend the pre- and post-conference tours we are offering to participants and their companions. Prices and itineraries will be included on our web page shortly (we are waiting for better offers nearer to July). The technical secretary will contact personally all participants who express an interest.

encourage you to send us the latest results of your research and to join us here in Granada next summer to meet colleagues old and new and to enjoy our Andalucian hospitality.

Ana T. Romero.  
11 IPC Chairwoman

## European Palaeobotanical-Palynological Conference

The next general EPP Conference (European Palaeobotany-Palynology) will be in Prague, Czech Republic. from 7<sup>th</sup> to 12<sup>th</sup> September, 2006.

Sept. 7-9<sup>th</sup> - registration, pre-congress field trip to the Barandien area, and Icebreaker party.

Sept. 8-9<sup>th</sup> - Opening ceremony, and scientific sessions.

Sept. 9<sup>th</sup> - Session and programme in Prague.

Sept. 10-11<sup>th</sup> - Session, and closing ceremony.

Sept. 12<sup>th</sup> - three post-congress field trips. One of these trips, 'Pennsylvanian plants and spores of the Czech Republic', will be common to both the EPP and CIMP (Commission Internationale des Microflore du Paleozoique) conferences.

People who would like to participate in both conferences can continue from EPP to CIMP. The CIMP conference commences on September 12<sup>th</sup> with a shared pre-congress field trip (with EPP), 'Pennsylvanian plants and spores of the Czech Republic', followed by:  
Sept. 13-15<sup>th</sup> – Scientific sessions.  
Sept. 16<sup>th</sup> - Post congress field trip to Barrandien (Cambrian, Ordovician and Silurian palynomorphs).

**Please note the current information is preliminary and subject to slight changes. The First Circulars for both conferences will be sent during the first half of the next year.**

Jiri Bek  
[bek@gli.cas.cz](mailto:bek@gli.cas.cz)

## THESES

### A multiproxy PhD study on diatoms, pollen and sediments:

Maria Isabel Vélez-Caicedo was awarded her PhD on 9 October 2003, At Amsterdam University, for her thesis, '**The contribution of diatom analysis to Late glacial and Holocene environmental reconstruction of Colombian lowland and montane ecosystems**'. Henry Hooghiemstra (Amsterdam), Sarah Metcalfe (Edinburgh; now at Nottingham), Jef Vandenberghe (Amsterdam) and Ignacio Martinez (Medellin) directed the study.

The main aim of this study was to reconstruct environmental dynamics in various Colombian ecosystems, located along a longitudinal and altitudinal gradient. Five sites were studied located in four different ecosystems: lowland rainforest (Chocó; the last 3850 cal BP), savanna (Llanos Orientales; the last 11,000 BP), dry interAndean forest (Patia Valley; the last 7830

BP), and upper montane forest (Lake Fuquene area; the last 19,000 BP). For all these sites pollen records were available and we explored how information from diatoms was able to improve reconstructions that had left several questions. Politically unstable conditions in many parts of Colombia prevented us from completing a robust calibration dataset of modern diatoms. Here the cosmopolitan character of diatoms was helpful: apart from our initial collections in Colombian lakes, information from African diatom studies was very helpful.

For example the rainforest site, now some 30 km from the Pacific coast, changing dominance of mangrove vegetation suggested tectonic movements of this unstable coastal area and/or changes in coastal morphology. Benthic and littoral-benthic diatom species indicated a shallow water body and stable water chemistry throughout the record. Repeated peaks of *Alchornea*, reflecting pioneer forest, were immediately preceded by horizons with coarse sands, demonstrating repeating initial phases of forest regeneration after natural riverine disturbance. In the savannas of the Llanos Orientales diatom assemblages showed an Amazonian affinity. In general, diatom-based reconstructions of the water bodies matched well with the pollen-based reconstructions of regional environmental change, while sediment analysis was very helpful to better understand changes in the abiotic setting of the lakes. We concluded that collaborative projects between research groups focussed on diatoms and pollen are productive and should be stimulated.

Results were/are published as follows:  
Velez, MI et al., J. Quat. Sci. 18 (2003), 17-30 (montane forest site)  
Velez, MI et al., Palaeo-3 173 (2001), 197-214 (rainforest site)  
Velez MI et al., The Holocene (in review) (savanna site 1)  
Velez MI et al., Diatom Research (in review) (savanna site 2)  
Velez MI et al., Palaeo-3 (in review) (dry forest Patia Valley site)

Henry Hooghiemstra

### **Three graduate theses which address pollen-related topics:**

#### **Palynological record of recent sediments from the estuary of the Caravelas River, Bahia – Brazil**

Paulino Pereira Oliveira (paulino@uefs.br)

Supervisor: Prof. Dr. Francisco de Assis Ribeiro dos Santos (fasantos@uefs.br)

Co-supervisor: Prof. Dr. Ruy Kenji Papa de Kikuchi (rkikuchi@cpgg.ufba.br)

Presentation date: Nov.20<sup>th</sup>.2003

#### **Pollen morphology of mangrove shrubs and trees from Northeastern Brazil.**

Francisco Hilder de Magalhães e Silva

(hildermagalhaes@hotmail.com)

Supervisor: Prof. Dr. Francisco de Assis Ribeiro dos Santos (fasantos@uefs.br)

Pages: 40

Presentation date: NOV.25<sup>th</sup>.2002

#### **Palynotaxonomy of the tribes Byttnerieae, Hermannieae and Helictereae (Malvaceae s.l.) from Bahian flora, Northeastern Brazil.**

Marileide Dias Saba (mdsaba@uol.com.br)

Supervisor: Prof. Dr. Francisco de Assis Ribeiro dos Santos (fasantos@uefs.br)

Presentation date: DEC.16<sup>th</sup>.2002

Prof. Dr. Francisco de Assis Ribeiro dos Santos  
Laboratório de Micromorfologia Vegetal  
Departamento de Ciências Biológicas - UEFS  
Av. Universitária, s/n  
44031-460 Faria de Santana - BA  
tel. + 55 75 224-8238  
fax + 55 75 224-8033/8019

## NEW BOOKS

### **A CHECK-LIST OF DESMIDS (CHLOROPHYTA, ZYGNEMAPHYCEAE) OF FRANCE. COLLECTION PATRIMOINES NATURELS 41, ISSN: 1158-422X.**

Kouwets F.A.C., 1999, hardback.

150 pp. EUR 15.00 (in French).

An annotated check-list is presented of all desmid taxa reported from France. Altogether, 1364 taxa are listed, including over 200 poorly known and doubtful taxa, with reference to the pertaining publications. In addition, 452 synonyms are included.

To order online:

<http://www.pensoft.net/notes/10846.stm>

### **L'EVENEMENT MESSINIEN: APPROCHES PALEOBIOLOGIQUES ET PALEOECOLOGIQUES.**

GEODIVERSITAS 24 (3) : 497-684.

Neraudeau D., Goubert E, 2002, hardback.

EUR 42.50 (in French).

To order online:

<http://www.pensoft.net/notes/10952.stm>

### **ORGANIC WORLD OF EASTERN SIBERIA IN THE PHANEROZOIC (ORGANICHESKII MIR VOSTOCHNOY SIBIRI V FANEROZOE).**

Odintsova M.M. (Ed.), 1982, 240x170, b/w graphs, tabs, paperback. 89 pp. EUR 29.00 (in Russian).

A collection of 9 papers on fossil insects, certain fossil plants, palaeoecology and biostratigraphy of Siberia, Russia.

To order online:

<http://www.pensoft.net/notes/10792.stm>

### **POLLEN AND SPORES OF WEST SIBERIA: JURASSIC TO PALAEOCENE (PYLTSA I SPORY ZAPADNOY SIBIRI: YURA- PALEOTSEN). PROCEEDINGS OF THE ALL- UNION OIL RESEARCH GEOLOGY PROSPECTING INSTITUTE (VNIGRI), NO. 177. Samoilovich, SR, et al, 1961, 268x185, 149 plates of b/w micrographs, 2 text-figs, index, hardback, 660 pp. EUR 87.00 (in Russian).**

A compendium of the Jurassic to Paleocene pollen and spore kinds of western

Siberia, Russia.

To order online:

<http://www.pensoft.net/notes/10797.stm>

### **Polenes y Esporas Aerovagantes en Canarias: incidencia en alergias.**

#### **MANUAL DE IDENTIFICACION ILUSTRADO PARA MUESTROS DE AIRE.**

La Serna Ramos I.E., Domingez Santana M.D., 2003. Materiales Didacticos Universitarios/ Botanica 1. ISBN 84-7756-5-49-X

Universidad de la Laguna. Servicio de Publicaciones. Campus Central, 38200 La Laguna. Santa Cruz de Tenerife.

On sale at :

BREOGAN c/Ayala 96, 28001 Madrid. Tel. 917 259072. E-mail: [breogan@breogan.org](mailto:breogan@breogan.org).

LEMUS BOOKSHOP c/Heraclio Sánchez 64, La Laguna, Tenerife. Tel. 922 251461. Price: € 21

E-mail: [lemuscb@teleline.es](mailto:lemuscb@teleline.es).

Web page: [www.librerialemus.com](http://www.librerialemus.com)

This book contains a new, comprehensive aerobiological study of the Canary Islands, which is essential for a complete understanding of the air quality in the islands as many of its biotic components are involved in both chronic and acute allergic conditions.

The opening chapters are devoted to various definitions of aeropalynology and pollenosis and to the origin and morphological characteristics of atmospheric palynomorphs. The authors begin by describing, from a botanical point of view, certain groups of microalgae, fungal spores, bryophytes, lichens and ferns before going on to deal with some of the morphological aspects of the pollen grain and its function in the extraordinary process of pollination. Chapters 5 and 6 describe in detail the methods followed in the arrangement of the experimental devices and the daily analysis of the results.

The main body of the book centres on an exhaustive descriptive catalogue of 139 airborne palynomorphs grouped into algae, lichens, bryophytes, ferns and phanerogams, giving a description of each as seen under a light-microscope, together with its allergenic characteristics. Further details are included for the spermatophytes, such as their pollination type and

time of flowering together with notes on the distribution and usual ecological habitat of the species in question. These descriptions are accompanied by 12 splendid colour photographs taken under the microscope showing the enormous diversity which exists among the pollens and spores that inhabit the air we breath. Without any doubt, familiarity with these descriptions and illustrations will enable all interested readers to identify these particles both in this and other regions.

The study has a complete glossary of terms related to aeropalynology plus two indexes, one

of vernacular and another of taxonomic names, plus a wide bibliography.

This book provides an excellent reference to aerobiological analyses, for the identification of many of the biological particles present in the air, not only in the Canary Islands but also in other parts of the Spanish Peninsula. Above all it is especially valuable as a reference to fungal species and their spores in view of their wide-ranging occurrence.

Consuelo Díaz de la Guardia

**PALYNOS** (ISSN 0256-1670) is published bi-annually (June and December) and is distributed electronically to all IFPS Councillors for local distribution to individual members of their **International Federation of Palynological Societies (IFPS)** affiliate society. News items, society activities, reviews, photos, from members are welcomed.

Please forward to the Editor:

**Anne-Marie Lézine**  
*lezine@lsce.saclay cea.fr*

and don't forget to visit our IFPS web site at:

**<http://geo.arizona.edu/palynology/ifps.html>**