Pollen Databases:
"Play it again… !"

4th and 5th october 2002

A joint meeting for APD, EPD, NAPD, LAPD and GPD

Hôtel Mercure Les Almohades Casablanca
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Objectives

Colleagues from the African Pollen Database, the North-American Pollen Database, the South-American Pollen Database and the European Pollen Database are invited to present their recent research in paleoenvironmental studies based on pollen analyses.

The aims of this meeting were the following :

- To increase scientific exchanges between Scientists of Africa and Europe
- To develop links between databases from Africa and Europe through the integration of North African (Mediterranean) data
- To present the recent scientific works, concerning in particular the Mediterranean periphery
- To take stock of the activity of each database (data, nomenclature, management tools, visualisation, varied products, etc.)
- To debate the common future of our activity for a better integration of our works in the IGBP/PAGES (PEP III) programme.

Agenda

Friday 4th october

Morning 9h : «Africa »

Ballouche, A. *L'enregistrement palynologique et archéobotanique des pratiques de l'agriculture dans l'Holocène moyen du Maroc septentrional*

Elenga H. *La contribution du projet APD dans l'acquisition de données polliniques dans la zone forestière d'Afrique centrale*

Rahmani, K. *Une biozonation palynologique réalisée au Maroc occidental et méridional et corrélation avec des biozonations établies en Europe, en Amérique du Nord et en Afrique du Nord*

Meadows, M-E. *Late Pleistocene and Holocene vegetation change in the mediterranean climate region of southwestern Africa*

Lamb, H., Darbyshire, I. *Vegetation change in Kenya and Ethiopia during the last 3000 years*

Coffee Break

Rucina S.M. *The effects of land use on composition and distribution of plant species in Embu-Mbeere, Kenya*

Cazet J.-P., Lézine A.-M., Ten-Hage L. *Les algues d'eau douce, marqueurs des variations hydrologiques du fleuve Niger au cours de la dernière déglaciation*

Edorh T. *Modern pollen data from Nigeria*

Sowunmi A. *Holocene environmental changes in coastal southwestern Nigeria*

Cheddadi, R. Taieb, M., Ortu, E., Damnati, B. *Preliminary palynogical results from Lake Ifrah, Middle Atlas, Morocco*

Afternoon 14h « Europe and Latin America »

Dubois, J.M. *Present and past geographic range of five taxa using precipitation and temperature seasonality*

Jalut, G. van Campo, E. *et al.* *Holocene Climatic Change in the Western Mediterranean*

Sadori, L. *Lago di Vico, central Italy: the late Pleistocene and Holocene pollen record*

Schneider R., de Beaulieu J.-L., Magny M., Bossuet G., Vannière B., Millet L. *Lago dell'Accesa : une séquence du Tardiglaciaire toscan en haute résolution*

Coffee break

Lézine A.-M. et al. *Le lac Maliq (Albanie) à l'Holocène, un enregistrement palynologique de moyenne altitude dans les Balkans*

Bradshaw R., Holmqvist B., Berglund B. *Objective mapping of large pollen datasets - A Scandinavian example*

Hicks, S. *Latest developments with Pollen Monitoring Programme data*

Marchant R. et al. *Pollen-based biome reconstructions for Latin America: applications at a range of spatial and temporal scales and links to climate and vegetation model output.*

Saturday 5th October

Morning 9h

Lézine, A.-M.,: Elenga, H. *The African Pollen Database*

Cheddadi, R. *The European Pollen Database*

Makhmara, H., Hoepffner, M. *Medias tools*

Grimm, Eric C. *Status of NAPD and GPD*

Coffee break

Database open session: PEPIII, 6th EU framework, etc. « *Where are we going?* »

Afternoon 14h : free

Participants

Name	*First name*	*Country*	*City*
BALLOUCHE	Aziz	France	Caen
BARRERE	Danielle	France	Toulouse
BENKADDOUR	Abdelfattah	Maroc	Marrakech
BENZAKOUR	Mohammed	Maroc	Rabat
BRADSHAW	Richard	Danemark	Copenhague
CAZET	Jean-Pierre	France	Paris
CHEDDADI	Rachid	France	Arles
DE BEAULIEU	Jacques-Louis	France	Marseille
DAMNATI	Brahim	Maroc	Tanger
DUBOIS	Jeanne-Marine	France	Marseille
EDORH	Thérèse	Togo	Lomé
ELENGA	Hilaire	Congo	Brazzaville
GRIMM	Eric	USA	Springfield
HICKS	Sheila	Finlande	Oulu
HOEPFFNER	Michel	France	Toulouse
LAMB	Henry	RU	Aberhystwyth
LEWDEN	Dorothée	France	Paris
LEZINE	Anne-Marie	France	Paris
MAKHMARA	Hassan	France	Toulouse
MARCHANT	Robert	Pays-Bas	Amsterdam
MEADOWS	Mike	Afrique du Sud	Cape-Town
RAHMANI-ANTARI	Kamila	Maroc	Rabat
RUCINA	Stephen	Kenya	Nairobi
SADORI	Laura	Italie	Rome
SOWUNMI	Bisi	Nigeria	Ibadan
VAN CAMPO	Elise	France	Toulouse

Abstracts

L'ENREGISTREMENT PALYNOLOGIQUE ETARCHÉOBOTANIQUE DES PRATIQUES DE L'AGRICULTURE DANS L'HOLOCÈNE MOYEN DU MAROC SEPTENTRIONAL

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Le Nord-Ouest du Maroc est probablement la région dont l'histoire holocène de la végétation est la plus anciennement étudiée (Reille 1970, 1977, Ballouche, 1986, Ballouche & Damblon, 1988, Damblon, 1991, Marret & Turon, 1994). Les données présentées ici sont acquises sur un site archéologique néolithique de la région de Tétouan qui a fait l'objet d'échantillonnages palynologiques et archéobotaniques. Malgré leur caractère ponctuel, elles peuvent donc très bien s'insérer dans cette histoire mieux connue.

En raison des limites inhérentes au milieu de dépôt fermé, l'intérêt méthodologique du croisement de l'analyse pollinique avec l'étude carpologique des macrorestes est discuté et des résultats majeurs sur l'enregistrement de l'agriculture céréalière au VII° millénaire av. J.C. sont présentés. Ce sont là les plus anciens indices d'agriculture aujourd'hui connus au Maghreb, mis en évidence dans un horizon culturel du Néolithique ancien cardial. Le contexte archéologique bien daté et l'étude parallèle des restes animaux, permettent de compléter l'histoire de la végétation rendue par les différentes séquences tourbeuses du Rif occidental et d'esquisser les dynamiques paysagères des anthroposystèmes holocènes. La documentation de ces épisodes précoces d'action anthropique sur la végétation justifie la recherche dans cette partie du Bassin méditerranéen de sites favorables à des études plus poussées en insérant la palynologie dans un approche transdisciplinaire.

Au-delà, il s'agit aussi pour nous de rechercher des éléments de référence pour la compréhension des rapports sociétés-environnement aux différentes échelles de temps.

OBJECTIVE MAPPING OF LARGE POLLEN DATASETS A SCANDINAVIAN EXAMPLE

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We have applied a novel quantitative technique to the classification of pollen data that is independent of plant ecological definitions of modern vegetation units. The units of classification are based on recognition of nodal groups of data points in multivariate space, which are then assigned names based upon their taxonomic composition. Forest types obtained in this way are not comparable to the traditional subdivision of Scandinavian forests into spatial units but we believe that this is an objective way of analysing forest dynamics throughout Holocene. Using a sequence of forest-historical maps from 10 500 years BP until present, with 500 years resolution, we discuss and evaluate the driving forces behind the time-space dynamics of the forest types.

There are a number of broad-scale trends and patterns apparent in the maps that we discuss further:

- the late-Holocene spread of spruce-dominated boreal forest;
- the dissolution and reformation of pine dominated boreal forest during the mid-Holocene and the associated culmination and fall-back of deciduous forest types;
- the dynamics of major ecotones, specifically the "limes norrlandicus" and a distinctive east-west gradient of forest types in southern Sweden that has persisted for most of the Holocene.

LES ALGUES D'EAU DOUCE, MARQUEURS DES VARIATIONS HYDROLOGIQUES DU FLEUVE NIGER AU COURS DE LA DERNIÈRE DÉGLACIATION

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La situation privilégiée de la carotte CH22-KW31 (3°31'1N, 5°34'1E, 1180 m de profondeur d'eau) a déjà permis une analyse détaillée des variations paléoenvironnementales et paléoclimatiques des derniers 30 000 ans, sur la base de l'étude des grains de pollen et des spores (Cazet, 2001).

Parallèlement, l'étude des algues vertes d'eau douce, présentée ici apporte des informations très précises sur l'histoire hydrologique du fleuve, notamment au cours de la dernière transition glaciaire/interglaciaire. Soixante et onze types d'algues ont été déterminés et regroupés en 10 groupes taxonomiques au niveau générique. L'écologie de ces algues autorise à distinguer plusieurs phases hydrologiques :

- les phases climatiques les plus défavorables (le début de la déglaciation et le «Younger Dryas» sont caractérisées par de fortes concentrations en *Botryococcus*, qui suggèrent des écoulements de surface depuis des milieux humides peu profonds, oligotrophes ;
- les phases d'apport fluviatiles intense du fleuve Niger sont caractérisées par de fortes concentrations en *Pediastrum*. Deux périodes peuvent être identifiées : (1) entre 14 et 9 ka B.P.) s'enregistre l'augmentation progressive du débit du fleuve (2) entre 9 et 7 ka B.P., les apports du fleuve sont à leur maximum ;
- Deux phases particulières sont enregistrées autour de 8.3 et 7.8 ka B.P. qui se traduisent par de fortes baisses dans les pourcentages de *Pediastrum.* La première est caractérisée par des pourcentages importants de deux taxons mésotrophes : *Staurastrum* et *Cosmarium* alors que les grains de pollen de plante aquatiques (*Typha*) enregistrent leurs plus importantes valeurs. Lors de la seconde, *Straurastrum* est associé au taxon hypertrophe *Scenedesmus* ; les grains de pollen en provenance du Sahel et du Sahara sont bien représentés, ce qui suggère que cette dernière phase correspondrait à la période de sécheresse qui est enregistrée dans toute l'Afrique Nord-tropicale autour de 7.5 ka B.P.

Ces variations intègrent deux paramètres distincts : les fluctuations d'intensité des précipitations de la mousson atlantique et les variations du niveau relatif de la mer dont l'amplitude, au cours de la période étudiée sont de l'ordre de 120 m.

THE EUROPEAN POLLEN DATABASE

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During the past two years, the EPD had no specific fund for an active data collection. Therefore, most of the data collected and archived in the EPD was contributed in the frame of related scientific projects. Thus, there are new data from the western Mediterranean (Spain, Portugal and Italy) and from France. This data was contributed in the frame of a European (FOSSILVA) and a French (ECLIPSE) projects. Concerning the status, this data will be restricted (see the EPD protocol) until the end of the projects and then it will be available as unrestricted data. Taxonomy has been checked, metadata collected and completed and C14 age/depth models have been developed for these new data. During the past year we have also developed chronologies based on calibrated C14 dates for more than 200 pollen records. However, this data is not yet implemented in the EPD.

PRELIMINARY PALYNOGICAL RESULTS FROM LAKE IFRAH, MIDDLE ATLAS, MOROCCO

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Lake Ifrah is located in the Middle Atlas, Morocco. The border of the lake has been cored in year 2000 using a Wright modified corer. Here we present the preliminary palynological results.

Although, the pollen record is not dated yet, its comparison with other well documented pollen records from Middle Atlas such as lake Sidi Ali and lake Tigalmamine (Lamb et al., 1995 and 1999) allows a discussion of its time frame.

The pollen record from lake Ifrah shows a continuous heavy presence of steppe elements mainly *Artemisia*, Chenopodiaceae and Gramineae which represent more than 80% of the total pollen sum from the base up to c. 180cm. Within the upper part, the evergreen oak pollen increase up to c. 30%. Both pollen records from lake Sidi Ali and lake Tigalmamine indicate that during the Holocene, an evergreen oak forest dominated the landscape and that *Cedrus* appeared between 7 and 6000 years BP. The pollen data from lake Ifrah suggest that the record spans part of the last glacial maximun and the post-glacial period. The Holocene period is missing. During the glacial maxumim, an *Artemisia* steppe dominated the landscape while the arboreal pollen represent less than 15% of the total pollen sum. Chenopodiaceae and Gramineae taxa are also abundant. Pollen percentages of *Cedrus* and evergreen oak began to increase at the end of the glacial period and the arboreal pollen reached 30%. Such period may be compared to the Allerod which is followed by a 'Younger Dryas-like' period where the steppe re-expanded. During the upper part of the pollen diagram (last 170 cm) the arboreal pollen, mainely evergreen oak, dominate the pollen diagram which may correspond to the early Holocene.

Such interpretation needs to be supported by C14 dates, which are expected soon.

FIRST POLLEN DATA FROM ALBANIA, A 12,000 YEARS HISTORY OF LAKE MALIQ

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The first pollen data from Albania (Lake Maliq, 40°21'N, 20°25'E, 818 m altitude) contribute new information to the discussion of the vegetational, hydrological and climatological history of the Balkans since 12,000 yr B.P. During the late-glacial, a perennial lake expanded at Maliq. It was surrounded by a complex vegetation association composed of steppe and mixed forest elements. The highly diverse forest flora suggests that the late-glacial forest refugia were more developed here at middle-, rather than at higher-altitude, as previously suggested. The forest developed after 9800 yr B.P., while the water level remained high in the Korçë basin until 5000 yr B.P. Different environmental conditions, characterized by lower available moisture and warmer winters progressively took place after this date. Then, the development of human activity in the Korçë basin *ca* 4500 yr B.P. was coeval with conditions characterized by an increase in winter temperatures and a decrease in summer moisture.

LATE-GLACIAL ENVIRONMENTAL CHANGES AT LAGO DELL'ACCESA, (TUSCANY)

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Lago dell'Accesa is located 10 km to the south of the Massa Maritima town, in the Grosseto province, (50 km S-E of Siena) (42°59'11" N, 1°33'31" W of Roma, 157 m asl).

The lake depth is 39 m, its surface, about 16 ha and its is catchment covers about 5 square kilometres. The lake as a karstic origin. The lake is fed by a subaquatic spring (l'inferno); its outlet is at the origin of the Bruna river.

The lake lies at the contact of between three main geological formations : to the East and North-East, Permian schists, to the West and North West highly karstified Retico (?) dolomitic limestone, and to the South and the West Eocene clayey schists. A large Pleistocene detritic cone covers the Permian schist to the east of the lake. The annual precips are around 850 mm/year, with a marked summer drought in July and August. The natural vegetation is constituted by degraded sclerophillous oak forests, but most of the hills around the lake are covered by cereals and olive trees fields.

Preliminary coring revealed a thick sediment accumulation on the lake margin. Here we report on the first results of a multidisciplinary study applied to a 18 m core (AC ¾) derived from the eastern shore. The sediment is constituted by clayey marls and marls in the lower part; marls aleternating with 3 major peat layers during the Holocene. The latest suggest periods of lake level lowering.
Magnetic susceptibility, sediment analysis, pollen and chironomids analyses, tephrostratigraphy and 1C dating are applied to this sequence.

The first results suggest that the Late-Glacial Interstadial occurs between 15.90 m and 13.80 m and the Younger Dryas between 13.80 m and 12.10 m. Such a high sedimentation rate, unique in central Italy allows a high resolution study of environmental changes. During this interval, two tephra layers are identified: the lowest at 15.20 m corresponds to the Yellow Napolitanian Tuff dated at around 12.300 years BP (uncal), the second at 13.00 m presents great mineralogical similarities with the LST, but occurs in a pollen zone typical of the Younger Dryas.

The preliminary pollen sequence suggests a landscape rich in *Juniperus* at the end of the full glacial and shows a major expansion of thermophilous trees (mostly deciduous *Quercus*) during the Late-Glacial Interstadial.. Nevertheless steppe elements still present indicate a mozaic like vegetation. The presence of a continuous *Picea* pollen curve is in agreement with the hypothesis of a glacial refuge in the North Apennine for this coniferous. They are no clear evidences of oscillations during the Late-Glacial Interstadial and the Younger Dryas, but a higher resolution is needed before to conclude.

PRESENT AND PAST GEOGRAPHIC RANGE OF FIVE TAXA USING PRECIPITATION AND TEMPERATURE SEASONALITY

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The aim of this study is to show that it is possible to reconstruct fairly well present and past geographical range of taxa, using seasonal distribution of precipitation and temperature.

The preliminary test has been carried out on five taxa from different vegetation types. The present day distribution has been obtained from Atlas Florae Europaea and Atlas of North European vascular plants: north of the Tropic of Cancer I-III and it was corrected with local floras. Distribution areas of *Picea abies*, *Tilia cordata*, *Fagus sylvatica*, *Quercus ilex* and *Betula spp.* were georeferenced on a 0.5° grid using GRASS GIS. Climatic dataset outcoming from New *et al*. (1999) has been chosen for the studied area. New *et al*. interpolate data on a 0.5° grid using thin-plate spline procedure, taking into account elevation. These data are freely avaible from the Climatic Research Unit.

The gridded presence/absence of each taxa was then interpolated to mean monthly values of precipitation and temperature. The presence frequency for the 24 climatic values were recovered and used to determinate a degree of "affinity" of the taxa for precipitation and temperature values. Present distribution was simulated using this "affinity" index and then compared to real range for each taxa. A threshold value for this index was determined for each taxa in order to optimize the degree of agreement between the two distribution maps. This threshold is then used for past reconstructions of the taxa ranges.

Kappa statistic (Monserud, 1990) show fair to very good agreement between simulated taxa ranges and observed distributions of these taxa. Discrepancies may be explained by ecological/geological characteristics of taxa.

In order to test the reliability of the approach we have simulated the ranges of the five taxa at 6000 years BP and compared them with the observed data from the European Pollen Database.
These past reconstruction could be improved by adding other climatic parameters such as water availability or the growing degree days.

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MODERN POLLEN DATA FROM NIGERIA

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L'analyse pollinique de 22 échantillons de surface prélevés au Nord et au Sud du Nigeria a permis de mettre en évidence les relations entre la végétation naturelle et la pluie pollinique et de souligner l'anthropisation des milieux naturels.

Les résultats montrent une nette différence entre les données des échantillonnages effectués dans les milieux à climat guinéen et celles des prélèvements faits dans les milieux à climat soudanien. Ils indiquent une grande diversité pollinique : au total 170 taxons ont été identifiés.

Le Sud du Nigeria est caractérisé par un plus grand nombre de taxons d'arbres indicateurs de milieux humides et parfois d'une forte anthropisation.

Les plus forts pourcentages de taxons d'herbacés (80 %) se retrouvent dans les échantillons prélevés au Nord du Nigeria à climat plus sec.

La présence de quelques taxons soudano-guinéens dans la majorité des spectres est à noter.

Ce travail souligne l'importance de la palynologie dans la caractérisation des environnements végétaux.

Status of NAPD and GPD

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Over the last year few data have been added to the North American Pollen Database, although a backlog of contributions has accumulated. The delay has been because of the necessity of integrating the EPD and GPD pollen variables tables before adding any new data. This task has now been completed, and a new complete GPD pollen variables table is imminent. Following the recommendations of the PAGES Data Board Meeting held spring 2002 in Switzerland, it is proposed that an XML format will be developed for transferring data to and from the database and for data distribution. Tilia will be modified to handle this format. However, the XML format is not proprietary and will facilitate the development of other software for data entry and manipulation.

THE MEDITERRANEAN AND AFRICAN DATABASE AND MEDIAS-France

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MEDIAS-France has built some database with Mediterranean and African environmental data, as requested by research teams, for scientific field experiment and networks.

These database will be described.

And information will be given on the improvement of some Mediterranean and African database centres, like the PASS centre in Nairobi (Kenya), through European, American and African supports.

Perspectives will be proposed for the near future on these matters.

LATEST DEVELOPMENTS WITH POLLEN MONITORING PROGRAMME DATA

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The PMP was founded in 1996 so only a handful of monitored pollen deposition data series are longer than 6 years. Moreover, new data for the same sampling point are produced each year. These features present challenges to the database, not experienced by the other databases to which fossil pollen profiles are contributed. To prepare a meaningful publication a modern deposition data series needs to be well over 5 years in length. The majority of the data in PMPdata, therefore have not been published and are not yet publicly available. Nevertheless the pollen monitoring community is being encouraged to send data to the database as it becomes available. The PMP has focused on a number of aspects which encourage data collection and contribution and, at the same time, insure quality and security until the data contributors have published their results and are happy to open their data to the public.

These include:

- a web page where anyone can find clear and detailed instructions of how to monitor pollen deposition and collect the necessary meta data in a standardized way;
- provision on the web page for submitting data (both metadata and pollen counts) to the data manager;
- a portal system with different security levels through which data can be accessed;
- an internet based interactive tool for questioning the database and visualizing the answer to the question in map and graphical form.

The PMP had its 4th International meeting 25 – 30th September in Lublin, Poland. A report of the latest developments with respect to the 4 points detailed above, as demonstrated at that meeting will be presented. Data can already be used to evaluate models of pollen dispersal and to calibrate with temperature, throwing a new light on the interpretation of fossil pollen profiles. These aspects will be briefly explained.

HOLOCENE CLIMATIC CHANGES IN THE WESTERN MEDITERRANEAN, FROM SOUTH-EAST FRANCE TO SOUTH-EAST SPAIN

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Holocene climatic changes along coastal regions from south-east France to south-east Spain were studied using pollen ratios. Comparing modern pollen rain, vegetation and climate along selected transects from the Atlantic Ocean to the Mediterranean, we obtained threshold values of pollen ratios corresponding to the different climatic conditions along the transects. These pollen ratios and threshold values were employed to characterize the Holocene climatic changes from nine Mediterranean coastal sites. The results were compared with data from marine and continental pollen sequences distributed in the western Mediterranean basin, and with additional regional data independent of human activity : lake-level fluctuations, alpine glacier advance and retreat chronology,^{14}C anomaly and cooling phases in Eastern France and Central Europe. The role of anthropogenic activities and climate on the changes in vegetation is discussed. Six major changes in vegetation cover were identified. They correspond to aridification phases that occurred around 9500-9000 ^{14}C yr B.P. (10900-9700 cal.B.P.), 7500-7000 ^{14}C yr B.P.(8400-7600 cal.B.P.), 4500-4000 ^{14}C yr B.P. (5300-4200 cal.B.P.), 3700-3300 ^{14}C yr B.P. (4300-3400 cal. B.P.), 2600-1900 ^{14}C yr B.P. (2850-1730 cal. B.P.) and 1300-1000 ^{14}C yr B.P. (1300-750 cal. B.P.). These arid episodes were regional responses to more global climatic changes and determined the changes in the vegetation cover. Humans undoubtedly enhanced the vegetation changes, but none the less had to adapt to these new climatic conditions.

VEGETATION CHANGE IN KENYA AND ETHIOPIA DURING THE LAST 3000 YEARS

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Pollen data from a 625 cm sediment core from Crescent Island Crater, a sub-basin of Lake Naivasha, Kenya, provide an 1100-year record of vegetation change at a mean time resolution of 15 years. Earlier data from the same core show a record of lake depth (and thus inferred rainfall variation) in the form of changing sedimentary facies, supported by salinity inferences based on diatom and chironomid assemblages. Stratigraphic variation in the abundances of aquatic and semi-aquatic plants and chlorophyte algae generally supports the reconstructed lake depths. Woody Afromontane and woodland plant taxa decreased relative to Poaceae (grasses) during low rainfall periods, and increased during high rainfall periods. Decrease in the extent of lower montane forest coincident with favourable climate conditions after about AD 1700 were probably caused by Kikuyu immigration and population expansion around that time, as indicated by simultaneous appearance of the food crop *Zea mays* (maize). Increases in ruderal herbaceous and exotic tree pollen during the twentieth century indicate increased local landscape disturbance during the colonial period. There is little direct pollen evidence for accelerating clearance of the montane forest during recent decades.

Pollen and charcoal analysis of sediment cores from two lakes in the highlands of northern Ethiopia provide evidence that the vegetation has changed in response to human impact during the last 3000 years. The natural, pre-disturbance vegetation of the area was *Podocarpus* - *Juniperus* forest. At about 500 BC, following Semitic immigration to northern Ethiopia, the forests were cleared and replaced by a secondary vegetation of *Dodonaea* scrub and grassland that persisted for 1800 years. Grasslands were dominant from about 1200 to 1400 AD, probably as a result of further intensification of grazing, perhaps exacerbated by drought. *Juniperus* forest, with *Olea* and *Celtis*, then expanded from AD 1400 to 1700, possibly because of drought-induced depopulation followed by increased rainfall. Deforestation and soil erosion has again intensified during the last three centuries. Since forest regrowth was possible after 1800 years of human impact, northern Ethiopia should again be capable of supporting forest under appropriate land management.

STATUS OF THE APD

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The African Pollen Database started in 1996 at Bierville and since this first meeting, 175 fossil (late Quaternary) pollen sites and 1194 modern pollen data have been gathered. Pollen data are available as tilia or excel files and paradox tables. Quick look pollen diagrams, references and associated information can be found on the APD Web Page at Medias-France. The modern pollen data set is associated with climate and vegetation variables, thus providing all necessary information for climate or vegetation reconstruction. Photos are also available.

APD has been funded by the European Union (INCO-DC programme) and UNESCO (IGCP 341). It is now partly supported by CNRS.

APD participates to the session organized for pollen databases by E. Grimm during the next ICP congress in Granada (Spain).

MULTIPROXY ET MÉTADONNÉES

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Le but de la présentation est de montrer les travaux en cours à Medias concernant :

- notre réflexion sur les métadonnées décrivant les données paléo-climatologique. Notamment, l'étude d'un profil dérivé de la norme du FGDC et l'étude d'une architecture de catalogues distribués basés sur la norme ISO 23950 (Z3950) ;
- le prototype de serveur de données multi-proxy pour accéder à des bases de données distantes, basé sur le protocole DODS (Distributed Oceanographic Data System) et le serveur d'application LAS (Live Acces Server).

POLLEN-BASED BIOME RECONSTRUCTIONS FOR LATIN AMERICA: APPLICATIONS AT A RANGE OF SPATIAL AND TEMPORAL SCALES AND LINKS TO CLIMATE AND VEGETATION MODEL OUTPUT

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The biomisation method, initially developed in temperate latitudes, is able to reconstruct modern Latin American biomes as reflected in a map of modern potential vegetation. This modern calibration, based on ecological and environmental information, allows us to reconstruct biomes at specific past time periods and determine patterns of change relative to the modern calibration. At 6000 radiocarbon years before present (yr BP) there are coherent regional patterns of change from the modern reconstruction; mainly to biomes characteristic of slightly more xeric environmental conditions throughout Latin America. These changes in biome assignments from the modern situation can be interpreted as a biotic response to climatic aridity. However, this transition is not recorded everywhere; a number of sites do not change their biome assignment relative to the modern calibration. These asynchronous assignments, are thought to result from either a non-linear response of Latin American vegetation to the ambient climatic changes or to differential climatic change. At 18,000 yr BP the picture is more uniform; a generally cool and dry environment is reflected in biome assignments of cold mixed forests, cool evergreen forests and cool grasslands/shrub. However some sites, specifically those in Central Mexico and lowland Colombia, remain unchanged in their biome assignments, although the affinities that these sites have to a specific biome do change. These "anomalies" can be interpreted as an altitudinally differential response of the vegetation to climatic shifts, changes in moisture sources and the importance of edaphic controls on the vegetation. These changes in biome assignment at 6000 and 18,000 yr BP are consistent with numerous previous continental regional and local interpretations on vegetation history. As a unifying methodology has been applied to all the Latin American pollen data our reconstruction of biomes is considered a more objective basis for interpretations of large spatial scale vegetation dynamics, and the environmental controls on these. This objective approach provides a data set suitable for comparison with output from vegetation and climate models.

One area within Latin America with a high quantity and quality of pollen data is Colombia. This collection principally stems from a research focus of the University of Amsterdam group over the past 40 years. This resource allows a much higher resolution to be achieved within the analysis. Biomes are reconstructed at 15 "time windows" from the present day to 18000 yr BP. At 18,000 yr BP; a generally cool and dry environment is reflected in biome assignments of cold mixed forests, cool

evergreen forests and cool grassland/shrub, the later extending to lower altitudes than presently recorded. This signal is strongly recorded at 15,000 and 12,000 yr BP; the vegetation at these times also reflecting a relatively cool and dry environment. At 9000 yr BP there is a shift to biomes thought to result from wetter, possibly slightly cooler environmental conditions. Coeval with the Latin American reconstruction, at 6000 yr BP the biomes are mainly characteristic of warmer environmental conditions relative to those of the present day. This trend continues until between 4000 and 3000 yr BP when there is a shift to more mesic vegetation that is thought to equate to an increase in precipitation levels. The period between 2500 and 1000 yr BP represents little or no change in biome assignment and is interpreted as a period of environmental stability. The influence attributed to human-induced impact on the vegetation is recorded from 5000 yr BP in Colombia, but is particularly important from 2000 yr BP. The extent of this impact increases over the late Holocene period, and is recorded at increasingly high altitudes. Despite these changes, a number of sites do not change their biome assignment throughout the analysis. This asynchronous vegetation response is discussed within the context of site location, non-linear response of vegetation to late Holocene environmental change, regionally differential signals, localised human impact, and methodological artefacts.

LATE PLEISTOCENE AND HOLOCENE VEGETATION CHANGE IN THE MEDITERRANEAN CLIMATE REGION OF SOUTHWESTERN AFRICA

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The paper reviews recent palaeoecological work dealing with the winter-rainfall region of the southwestern Cape, South Africa. The record remains fragmented, although recent work from the vicinity of the West Coast and the Cederberg contributes significantly to our understanding of the nature of environmental changes in the region. Increasingly it is becoming apparent that the Last Glacial Maximum in the winter rainfall region was both cooler and wetter than present, although the extent to which reduced carbon dioxide concentrations could have been responsible for the observed vegetation changes needs also to be accounted for. The Holocene remains enigmatic with respect to elucidating change, in part because the southwestern Cape region itself is not environmentally homogeneous and in part because the spatial and temporal resolution of the reconstructions is less than optimal. Nevertheless, it is possible to reveal what appears to be a warmer and drier phase in the early to mid-Holocene, perhaps associated with a higher sea level stand. The recent past is dominated by disturbance indicators consequent upon occupation of the landscape by colonial settler farmers. The implications of these changes under future climate change scenarios are briefly reviewed.

BIOZONATION PALYNOLOGIQUE DANS LE PALÉOZOÏQUE SUPÉRIEUR MAROCAIN. CORRÉLATION AVEC LES BIOZONATIONS ÉTABLIES EN EUROPE, EN AMÉRIQUE DU SUD ET EN AFRIQUE DU NORD

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L'étude palynologique de niveaux paléozoïques dans 5 sondages et une coupe de terrain, au Maroc occidental et méridional a permis avec l'inventaire des spores, des Acritarches et des Chitinozoaires de distinguer 13 biozones palynologiques ou palynozones du Silurien supérieur au Dinantien. Différents taxons dont la répartition stratigraphique est bien établie dans d'autres régions du globe (Amérique du Nord, Europe occidentale et Afrique du Nord), ont conduit à dater précisément les biozones reconnues au Maroc. Ces dernières se répartissent ainsi :

- 1 biozone au Silurien supérieur (Pridoli) ;
- 2 biozones au Dévonien inférieur (Praguien-Emsien) ;
- 2 biozones au Dévonien moyen (Eifélien-Givétien) ;
- 5 biozones au Dévonien supérieur (Frasnien-Famennien-Strunien) ;
- 3 biozones au Dinantien (Tournaisien-Viséen inférieur).

Cette biozonation établie pour la première fois au Maroc a permis de réaliser des corrélations intéressantes aussi bien locales (Meseta marocaine, Maroc central et oriental), régionales (Algérie, Libye et Tunisie) et enfin continentales (Europe du sud-ouest, Bassins ardenno-rhénans, Canada et Amérique du Nord). Ces corrélations ont également aidé à retracer l'évolution paléobiogéographique du Maroc qui a toujours constitué une zone charnière entre les domaines gondwanien et laurasien.

BIOZONATION PALYNOLOGIQUE DANS LE PALÉOZOÏQUE INFÉRIEUR DU MAROC OCCIDENTAL ET MÉRIDIONAL CORRÉLATION AVEC LA BORDURE NORD GONDWANIENNE ET LES ZONES AVALONIENNES

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Dans le Maroc occidental et méridional, sept sondages et une coupe de terrain ont fait l'objet d'une étude palynologique qui a révélée de nombreux microfossiles organiques (Acritarches et Chitinozoaires). Les différentes associations rencontrées du Cambrien moyen au Caradoc ont autorisé l'établissement de 7 palynozones. Celles-ci sont basées sur les taxons index de Chitinozoaires et d'Acritarches qui coexistent avec des marqueurs bio-stratigraphiques au Maroc ou dans d'autres régions de référence. La biozonation établie a également permis de :

- dater ou de préciser de nombreuses subdivisions au sein de la série paléozoïque des secteurs étudiés (Cambrien moyen, Arénig moyen, Arénig supérieur - Llanvirn) ;
- d'établir des corrélations aussi bien locales (Anti-Atlas, Méseta marocaine), régionales (Algérie, Libye), qu'intercontinentales (Amérique du Nord, Canada, Europe).

L'évolution paléobiogéographique retracée depuis le Cambrien moyen jusqu'au caradoc a montré que le Maroc occupant une «zone charnière» entre le Nord Gondwana et la zone avalonienne au Paléozoïque inférieur, a toujours été associé aux divers phénomènes géologiques qui s'y sont succédés.

THE EFFECTS OF LAND USE ON COMPOSITION AND DISTRIBUTION OF PLANT SPECIES IN EMBU-MBEERE, KENYA

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A survey was conducted in Embu and Mbeere districts of central Kenya to assess the composition and distribution of vegetation in different land use types along an agro-ecological gradient from high altitude high rainfall to low altitude low rainfall land use types. The survey consisted of 24 parallel sub-transects located along a main transect and traversing several agro-ecological zones. Numbers and relative percentages of trees, shrubs, herbs, sedges and grasses were enumerated in each land cover/ land use type on the sub-transect.

This study was part of a larger project implemented in three other sites in East Africa to use land use change analysis as an approach to study the root causes of land degradation and loss of biodiversity and included analysis of soil erosion and fertility indicators in the plots where vegetation surveys were done. The project also utilized information from local communities on their perceptions on environmental changes and their knowledge on key species indicators on soil productivity.

Preliminary results on vegetation change analysis indicate that an increase in land use intensification reduces the diversity of wild tree species of conservation interest but increases diversity of common exotic plants. Increase in cultivation reduces tree cover but increases the abundance and cover of herbaceous plant species. The study has generated plant indicators of soil productivity based on comparisons of plant abundance in the transect with soil characteristics. Land use change has reduced the abundance of plant species of economic value like medicinal plants.

LAGO DI VICO, CENTRAL ITALY: THE LATE PLEISTOCENE AND HOLOCENE POLLEN RECORD

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Lago di Vico (510 m asl) is located in central Italy, at about 50 km northwest of Rome, and occupies the central collapse caldera of the Vico strato-volcano. The maximum depth of the lake is ca. 50 m, the maximum diameter is ca. 5 km, and the surface is ca. 12 km^2. The catchment area (ca. 40 km^2), exclusively formed by volcanic rocks, is delimited by the edge of the caldera, peaking 965 m asl at Monte Fogliano where an estimate of the rainfall provided a value of about 2000 mm. Just south of the caldera, at the closest meteorological station of Ronciglione (441 m asl), the mean annual precipitation (over 40 years) is about 1400 mm and the mean annual temperature is 13.6°C.

The pollen record from Lago di Vico spanning the last 90,000 years (Magri, Sadori, 1999) is chronologically framed by seventeen AMS dates, all internal consistent, one $^{40}Ar/^{39}Ar$ date and tephrochronological analyses.

At the base of the pollen record, soon after the $^{40}Ar/^{39}Ar$ date 87,000±7000 B.P., three expansions of arboreal vegetation are found in close succession. These forest phases, locally named Etruria I, Etruria II and Etruria III are in the stratigraphical position of St Germain II and precede the pleniglacial steppe. During the last pleniglacial the presence of angiosperm mesophilous trees refugia in the area is suggested by sparse weak arboreal fluctuations. The lateglacial is characterized by an arboreal expansion less important than in other Italian sites. The main characteristics of the Holocene vegetation, dominated by deciduous oaks; are the absence of important changes in the floristic composition of the forest and the presence of several marked drops of the tree pollen concentration. Even if clear signs of man presence is detected before, a strong human impact on vegetation is recorded only when cultivation became extensive, around the date 2630±95 B.P. The Holocene pollen sequence of Lago di Vico, recording without interruptions the history of vegetation and environment until at least Roman times, is at present one of the best Italian Holocene lacustrine record.

HOLOCENE ENVIRONMENTAL CHANGES IN COASTAL SOUTHWESTERN NIGERIA

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The palynological study of an 11-metre core from a site in coastal southwestern Nigeria, adjacent to the easternmost portion of the present-day "Dahomey Gap" in the Republic of Bénin, indicates significant and very dramatic environmental changes during the Middle and Late Holocene periods. The lowland semi-deciduous rain forest and its edaphic variants formed the prevalent vegetation communities throughout, except for *Rhizophora*. There were savanna elements among the forest species. *Rhizophora* was abundant and predominant from ca. 8576 ± 48 BP to some time just prior to ca. 3109 ± 26 BP. By ca 3109 ± 26 BP., *Rhizophora* disappeared abruptly and completely. At that time there were phenomenal increases in both *Alchornea* and fresh water swamp elements, especially *Lygodium*. There was also a reduction in components of the semi-deciduous forest. A sharp rise in *Elaeis guineensis* occurred only after the increase in *Alchornea*. These developments reflect the major controlling influence of the late Holocene drier climate, reported from several parts of west Africa. There might have been another factor responsible for the later, sharp rise in *Elaeis guineensis*. There seems to be evidence from the terrestrial core studied that the present-day coastal savanna in southwestern Nigeria, west of the Niger Delta, occurring as a mosaic within the forest, became established just prior to ca 3109 ± 26 BP. The extent to which it can be regarded as the easternmost extension of the "Dahomey Gap" is discussed.

Meeting Report

POLLEN DATABASES: 'PLAY IT AGAIN…"

The latest scientific meeting of the African Pollen Database (APD) took place in Casablanca, Morocco on 4th and 5th of October 2002. The workshop brought together palynologists from Europe, North America and, of course, Africa to discuss their latest research results, this time under the theme: 'African palynology: late Quaternary-modern data'. The workshop series was established in 1994 to allow palynologists to participate in the development of a pollen database and to make decisions concerning its content, technical structure (general agreements, protocols), location and organisation. The first workshop was held in Lund (Sweden) under the aegis of the "Biome 6000" project (global vegetation mapping at 6000 years BP) and marked the beginning of the international effort that will eventually result in the creation of a Global Pollen Database. Subsequently, the workshop was held in association with the 14th symposium of the Association of French Speaking Palynologists (APLF) "Palynology and Global Change" in Paris (1995) and was followed by a special workshop in Bierville (1996), where the African Pollen Data Base (APD) was formally constituted. Several workshops have since been organized for APD to prepare and organize the network, viz, in London (July 1998), in Aix-en Provence, Toulouse and Paris (1998-1999), in Durban (August 1999), Nanjing (2000) and Nairobi (2001).

The workshop was structured around more than 20 presentations by scientists from more than a dozen countries. The first morning was given over to Africa, with papers by Aziz Ballouche (Morocco), Hilaire Elenga (Congo), K Rahmani (Morocco), Mike Meadows (South Africa), Henry Lamb (Wales), Stephen Rucina (Kenya), Jean-Pierre Cazet et al. (France), Therese Edorh (Togo), Adebisi Sowumni (Nigeria) and Rachid Cheddadi et al. (Morocco). Papers covered diverse topics but focused mainly on late Pleistocene and Holocene vegetation change, although several papers concerned themselves with modern pollen-vegetation relationships. Participants were in effect taken on a palaeoecological tour of the continent, with representation of most of Africa's biomes (mediterranean, arid, savanna and tropical forest) and studies of environments ranging from the coast to the highest mountains. A richly rewarding morning indeed.

In the afternoon, the palynological pathway wandered around Europe. Again, the late Pleistocene and Holocene provided the focus for the papers by Elise van Campo et al (France), Laura Sadori (Italy), Jacques-Louis de Beaulieu et al. (France) and Anne-Marie Lézine et al. (France). Other papers concentrated on contemporary climate-vegetation relationships (Jeanne-Marine Dubois, France), on statistical manipulations and mapping of large pollen data sets (Richard Bradshaw et al., Denmark) and of the latest developments in the area of pollen monitoring (Sheila Hicks, Finland). The final paper of the day was presented by Rob Marchant (The Netherlands) on pollen-based biome reconstructions for the continent of South America.

The second day provided delegates with an opportunity to hear about progress concerning the various data bases that will eventually make up the Global Pollen Data Base. Anne-Marie Lézine and Hilaire Elenga (Congo) demonstrated progress with the APD in particular, which now has more than 175 Quaternary sites represented and a large component of modern pollen data (see http://medias.obs-mip.fr:8000/apd/). Rachid Cheddadi then discussed the European Pollen Database, housed in Arles, and the more than 1000 sites that this now contains. Eric Grimm, he of 'Tilia' fame, from the United States presented a view on the status of the North

American Database and progress within the Global Pollen Database. The World Data Centre is home to the pollen data and the information can be extracted from: http://www.ngdc.noaa.gov/paleo/pollen.html Certainly there have been many successes in this venture. There are data from thousands of cores and surface samples, the data are available free of charge, the World Data Centre provides excellent infrastructural support that gives the archive credibility. The final formal paper of the meeting was presented by Hassan Makhmara and Michel Hoepffner on the role of Medias (http:/medias.obs-mip.fr) in terms of information and database management.

The workshop then evolved into discussion mode and there was lively debate, most especially around the thorny issue of funding. The new European Sixth Framework may offer some opportunities in this regard. In terms of future directions, it was agreed that facilitating linkages between various databases should be a priority and that this would further the relevance of pollen data, especially as it relates to climate and other attributes of environmental change. The establishment of a strong network of palynologists contributing meaningfully to important global debates around climate change, land use change and sustainability was seen as an important potential spin-off and would take the GPD beyond the mere database function.

The meeting was an exciting opportunity for African palynologists to meet again and explore pressing scientific and administrative problems. The facilities at the designated Hotel Mercure les Almohades in Casablanca certainly made this task feasible. As usual, Michel Hoepffner, Danielle Barrere and Anne-Marie Lézine provided excellent administrative support for the meeting. This was my second opportunity to attend an APD workshop and, as was the case in the previous meeting in Nairobi, the atmosphere was a most pleasing mix of scientific scrutiny and relaxed and personable interaction.
Palynologists may spend much of their time peering into the microscope, but that appears to make them anything but dull. As expected, under the expert guidance of Hilaire and Hassan, there were considerable social as well as scientific benefits to the workshop experience! "Vive l'APD!" and, if funding allows, Cape Town beckons in 2003.

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