

(GS03) Cenozoic palynology and botany

Date: August 27, 30

Place: Rooms 5233, 5234 (oral), Room 6325 (poster)

Oral Presentation

Aug. 27 [AM1] Room: 5233

Chair: Takeshi Saito

9:00-9:20 **Fruit ecology of Paleogene and Neogene plant assemblages: Tracing shifts in dispersal syndromes** [GS03-O01 \(251\)](#)

Johanna Kovar-Eder, Ute Knoerr

9:20-9:40 **Paleogeographic and age interpretations of the La Cira Fossil Horizon, Middle Magdalena Valley, Colombia using palynological data** [GS03-O02 \(407\)](#)

Diego Pinzón, Guillermo Rodríguez, Felipe De La Parra

9:40-10:00 ***Spirematospermum* from Japan and its phytogeography** [GS03-O03 \(532\)](#)

Minoru Tsukagoshi, Yoshitaka Matsuhashi

10:00-10:20 **Palynology of hypersaline lakes in southern Western Australia: insights into highly dynamic lacustrine history** [GS03-O04 \(381\)](#)

Francisca E. Oboh-Ikuenobe, Carlos Sanchez Botero, L. Gabel, Kate Schlarman

Aug. 27 [PM3] Room: 5234

Chair: Takeshi Saito

17:00-17:20 **Late Oligocene flora from the Makum Coalfield, Assam, India and its palaeoclimatic and palaeogeographic significance** [GS03-O05 \(493\)](#) (Cancelled)

Gaurav Srivastava, R.C. Mehrotra

17:00-17:20 **Ecostratigraphy of the Subathu Formation of Jammu region, Jammu** [SS12-O03 \(482\)](#)

Yengkhom Raghmani Singh (moved from SS12)

17:20-17:40 **First record of a fungal palynomorph “peak” around the probable Oligocene/Miocene boundary, Gulf of Suez, Egypt** [GS03-O08](#) (move to SS37)

Haytham El Atfy, Rainer Brocke, Dieter Uhl

Aug. 30 [AM2] Room: 5234

Chair: Takeshi Saito

10:50-11:10 **Sclerophylls, open vegetation and no fire. The past breaks a paradigm of the present** [GS03-O06 \(224\)](#)

Greg Jordan, Ray Carpenter

11:10-11:30 **Palynostratigraphy of the Eocene Esmeraldas Formation, Middle Magdalena Valley Basin, Colombia** [GS03-O07 \(433\)](#)

Guillermo Rodríguez, Francisca Oboh-Ikuenobe, Carlos Jaramillo, Milton Rueda, Edwin Cadena

Poster Presentation

Aug. 27 [PM1] Room: 6325

13:30-14:30 **Cleared leaf collection of modern Japanese species for studying the Eocene-Oligocene Kobe Flora** [GS03-P01 \(167\)](#)

Kumiko Handa, Akira Yokoyama

Vegetation, sea-level and climate changes during the Messinian salinity crisis recorded in the Montemayor-1 core, lower Guadalquivir basin, southwestern Spain [GS03-P02 \(221\)](#)

Gonzalo Jiménez-Moreno, José Noel Pérez-Asensio, Juan Cruz Larrasoaña, Julio Aguirre, Jorge Civis, María Rosario Rivas-Carballo, María F. Valle-Hernández, José Angel González-Delgado

GS03-O01 (251)

Fruit ecology of Paleogene and Neogene plant assemblages: Tracing shifts in dispersal syndromes

Johanna Kovar-Eder, Ute Knoerr

State Museum Natural History Stuttgart, Germany, johanna.eder@smns-bw.de

The distribution of fruit dispersal syndromes is an essential trait in modern vegetation. Recently this was demonstrated for different forest types in China and Japan (Knörr et al. in press). 35 Eocene and Neogene floras from Europe (fruits, leaves, and pollen of woody taxa) were analyzed to trace fruit dispersal syndromes in the fossil record, i.e. in paratropical, broad-leaved evergreen, mixed mesophytic, broad-leaved evergreen and broad-leaved deciduous forests. The dispersal syndromes distinguished are fleshy and non-fleshy zoochorous, anemochorous, autochorous, and hydrochorous. Additionally, zonal and azonal taxa were distinguished to test whether the dispersal syndromes are equally distributed in the zonal and azonal record. The results show very similar partitions of dispersal fractions in the fossil record compared to modern forests. Paratropical forests bear highest values of fleshy zoochorous taxa and lowest of anemochorous ones. Fleshy zoochorous proportions are still high in broad-leaved evergreen forests. They are lowest in subhumid sclerophyllous and broad-leaved deciduous ones. For anemochorous taxa this trend is antidromic, lowest values derive from paratropical forests and highest from subhumid sclerophyllous and broad-leaved deciduous ones. Non-fleshy zoochorous taxa always show relatively low percentages but their values are somewhat higher in subhumid sclerophyllous and broad-leaved deciduous forests than in broad-leaved evergreen ones. Autochorous and hydrochorous proportions are always very low. Independently whether Eocene or Neogene, the azonal record always increases the anemochorous fraction. This study unravels an important vegetational trait from the fossil plant record thus contributing to an improved understanding of former ecosystems.

Keywords: fruit dispersal modes, forest types, IPR vegetation analysis, leaf, fruit.

GS03-O02 (407)

Paleogeographic and age interpretations of the La Cira Fossil Horizon, Middle Magdalena Valley, Colombia using palynological data

Diego Pinzón¹, Guillermo Rodríguez², Felipe De La Parra²

¹ *Instituto Colombiano del Petroleo, ECOPETROL-ICP, GEMS LTDA., Colombia, diegopinzon1@hotmail.com*

² *Instituto Colombiano del Petroleo, ECOPETROL-ICP, Colombia*

The Middle Magdalena Valley Basin, Colombia is a intramontane basin resulted by the fragmentation of a big foreland basin due to the evolution of the Northern Andes. The sedimentary continental record of the basin was affected by syntectonic deposition and is highly asymmetrical. The La Cira Fossil Horizon, a freshwater mollusk horizon has been traditionally used as a correlation element. However, the lateral extension, paleogeography, age of the horizon and stratigraphic relationships with adjacent basins are not clearly understood. Palynological data from 14 sites of the La Cira were compared with a dated section of this horizon in order to constrain the age and stratigraphic correlation of the sites. The comparison was performed by using the Maximum Likelihood method. These samples were also compared with data from adjacent basins in order to understand its stratigraphic relationships. Results indicate that the age of the La Cira is 17.7 to 16.1 m.y. (T-13 Zone) and it is correlative with lacustrine deposits of the Barzalosa Formation in the Upper Magdalena Valley basin, suggesting a major lacustrine event. The spatial distribution of the *Pediastrum/Botryococcus* ratio suggests environmental differences in the La Cira, with a North-South gradient. These differences could be related to changing hydrography and pluviosity patterns. This results combined with more proxies will contribute to the understanding of the paleogeography of the La Cira and its relationships with adjacent basins during the Northern Andes evolution.

Keywords: Miocene, *Pediastrum*, *Botryococcus*, lacustrine.

GS03-O03 (532)

***Spirematospermum* from Japan and its phytogeography**

Minoru Tsukagoshi¹, Yoshitaka Matsuhashi²

¹ *Osaka Museum of Natural History, Japan, mtsuka@mus-nh.city.osaka.jp*

² *Research Institute of Sanyu Sangyo Co., Ltd., Japan*

The fruits of *Spirematospermum*, including many seeds, were discovered from the Early Miocene Nakamura formation in Kani City, central Japan. The fruit is a capsule. The seed coat has spiral structures. Although the seed is tightly compressed, the inner structure of the seed is observable. These fruits and seeds were identified as *Spirematospermum wetzleri* by the characteristics of testa, operculum, anatropous ovule and chalazal chamber. The presence of a chalazal chamber supports the view that *Spirematospermum* is closely related to Musaceae. *Spirematospermum* has been discovered from Miocene in Far East of Russia (Early Miocene of Omoloi River and Middle Miocene of Mamontova Gora). This occurrence of *Spirematospermum* is the first record in Japan. Stratigraphical and phytogeographical distributions of *Spirematospermum* have been known from the Late Cretaceous to the Pliocene in Europe, the Late Cretaceous and the Paleocene in North America, and the Oligocene to the Miocene in West Asia. The occurrence of *Spirematospermum* from the Miocene in East Asia and its absence from the Paleogene suggest that the genus had expanded its distribution from Europe to Asia in Oligocene after the closure of Turgai strait.

Keywords: Nakamura formation, spiral structure, chalazal chamber, Turgai strait, Musaceae.

GS03-O04 (381)

Palynology of hypersaline lakes in southern Western Australia: insights into highly dynamic lacustrine history

Francisca E. Oboh-Ikuenobe, Carlos Sanchez Botero, L. Gabel, Kate Schlarman

Missouri University of Science and Technology, USA, ikuenobe@mst.edu

The Yilgarn Craton in Western Australia is one of the last pieces of Archean crusts that are almost intact. Characterized by a unique set of factors that combine an arid climate, a very low topographic relief and almost no tectonic activity, this region hosts hundreds of shallow ephemeral hypersaline lakes with a great diversity in pH values that range from neutral to highly acidic conditions. They preserve features characteristic of four stages of flooding, desiccation, evapoconcentration, and eolian erosion and deposition, which are indicative of a highly dynamic sedimentation regime. The lakes can undergo all four stages within a very short period of time. Mineralogical, sedimentological, geochemical and palynological analyses of 10 cores from seven localities (1 neutral lake, 1 sandflat, 5 acidic lakes) are aimed at studying the evolution of hypersalinity and acidity in the region. The palynological component comprises identification and interpretation of dispersed organic matter (palynofacies analysis) and morphological differentiation of major palynomorph groups (pollen, spores, algae, fungi) in the 10 cores. There is no apparent relationship between palynofacies assemblages, lithology and depth, thus making correlation within and between lakes impossible. Modern arid and halophilic dominant flora is well represented by high percentages of Myrtaceae, Chenopodiaceae, *Acacia* and Fabaceae in the core samples. The high abundance of pollen clumps that are usually not completely developed indicates a very short distance of transport. This implies that the organic material in the sediments reflects mostly the flora that surrounds each lake and not necessarily the regional flora. Also notable is the presence of the acidophilic alga *Dunaliella?* in all the cores, which can be used as a proxy for acidic conditions in the sediments. One of two cores from the acidic Lake Aerodrome drilled close to 60 meters of sediments, and penetrated two lignitic units of the upper Eocene Werillup Formation. The lignites preserve abundant palynomorphs of temperate forest and freshwater aquatic plants representing deposition in swamps. The abundance of *Nothofagus* indicates a cooling trend toward the end of the Eocene. The cooler climate and freshwater deposition contrasts with the modern arid and saline conditions of the study area, and highlights the Cenozoic climatic evolution of Australia. AMS ¹⁴C dates from the upper parts of the cores confirm palynological evidence for reworking that is likely a result of the highly dynamic nature of the lakes.

Keywords: Yilgarn Craton, palynofacies, *Dunaliella*, Werillup Formation, climate.

GS03-O05 (493)

Late Oligocene flora from the Makum Coalfield, Assam, India and its palaeoclimatic and palaeogeographic significance

Gaurav Srivastava, R.C. Mehrotra

Birbal Sahni Institute of Palaeobotany 53 University Road, Lucknow-226 007,

gaurav_jan10@yahoo.co.in

There are many outcrops of the Tertiary sediments in northeast India and a large number of fossils have been described from there. Among all of them the Oligocene sedimentary basin of Makum Coalfield is not fully explored and there is need to explore it for better understanding of the palaeofloristics of the region. Keeping in view the meagre work done in the basin, the present investigation has been undertaken to explore and work out in detail the megafossils from this area to build up the palaeofloristics, to reconstruct the palaeoclimate as well as palaeogeography of India and to trace the antiquity of various taxa and their evolution. The reconstruction of the palaeoclimate is based on both qualitative and quantitative analysis of the data. The distribution pattern of the modern equivalents of the fossil flora clearly indicates the prevalence of the tropical climate in the region during the deposition of the sediments. As majority of the taxa occur in tropical evergreen to moist deciduous and littoral and swampy forest, a warm and humid climate may be envisaged in Upper Assam during the Late Oligocene. The quantitative reconstructed climate data indicates a monsoonal climate during the Late Oligocene in the Upper Assam, India. The absence of Southeast Asian elements in the fossil assemblage provides clear evidence that suturing between the Indian and Asian plates was not completed till the Late Oligocene.

Keywords: northeast India, megafossil, monsoon.

SS12-O03 (482)

Ecostratigraphy of the Subathu Formation of Jammu region, Jammu

Yengkhom Raghmani Singh

Department of Earth Sciences, Manipur University, Imphal (India), yengmani@gmail.com

The palynological data recovered from the different horizons of the Subathu Formation in Jammu region was analyzed to search age marker palynofossils during the present investigations. On the basis of palynological assemblage of the Subathu Formation has palynostratigraphically been divided into four biozones such as *Homotryblium* spp. assemblage zone, *Spiniferites* spp. Assemblage zone, the Microforaminiferal linings assemblage zone, and the *Pediastrum* spp. Assemblage zone in the ascending order of stratigraphy. On the consideration of the FAD and LAD limits of the age diagnostic taxa, these zones range from Selanian to Ypresian for the *Homotryblium* spp. assemblage zone, Ypresian for *Spiniferites* spp. Assemblage zone, Lutetian for the Microforaminiferal linings assemblage zone, and Post-Lutetian for the *Pediastrum* spp. Assemblage zone in the ascending order of stratigraphy. The Microforaminiferal zone is not made the geological range due to complete absence of age marker species. However, on the consideration of stratigraphic position within this succession of lower zone and upper zone, it is probably considered as Lutetian. On the basis of palynoflora the *Homotryblium*, *Spiniferites*, Microforaminiferal linings assemblage zones has been deposited during transgressive phase i.e. marine environment condition whereas the *Pediastrum* spp. Assemblage zone has been freshwater condition during the Subathu sedimentation regime.

Keywords: FAD, LAD, microforaminiferal linings, transgressive phase, freshwater.

GS03-O08

First record of a fungal palynomorph “peak” around the probable Oligocene/Miocene

boundary, Gulf of Suez, Egypt

Haytham El Atfy^{1,2}, Rainer Brocke¹, Dieter Uhl^{1,3}

¹ *Senckenberg Research Institute, Frankfurt am Main 60325, Germany, helatfy@senckenberg.de*

² *Geology Department, Faculty of Science, Mansoura University, Mansoura 35516, Egypt*

³ *Senckenberg Centre for Human Evolution and Palaeoenvironment, Tübingen University, Tübingen 72076, Germany*

Very well-preserved palynomorph assemblages were recorded from the microscopic examination of 30 subsurface cutting samples of the Nukhul Formation (GH 404-2A Well) from the Gulf of Suez, Egypt. These assemblages witnessed a very minor record of marine palynomorphs (e.g. dinoflagellates) and were dominated mainly by highly diversified fungal taxa, fresh water algae (e.g. *Pediastrum* and *Botryococcus*), in addition to a sparse record of miospores. The stratigraphy and age of the Nukhul Formation is still highly debated despite its potential as reservoir in the Gulf of Suez. Some authors referred it to the Early Miocene, however, recent publications shift it to the latest Oligocene-Early Miocene. Thus, the Nukhul Formation still forms one among the numerous stratigraphic puzzles of Egyptian stratigraphy. In our material, a considerable fungal proliferation composed of diverse and well-preserved fungal spores, fructifications, and hyphae were recorded. This composition shows a distinct fungal “peak” within the interval from 11370 to 11430 ft. in the GH 404-2A Well which is considered a new finding that has neither been recorded within the Nukhul Formation nor within the Tertiary in Egypt before. This bio-event may be associated with the known Mi-1 glaciation event at the Oligocene–Miocene boundary, although we cannot exclude that it represents more local events related to the rifting of the Gulf of Suez during this period. The rich diversity of the fungal remains may be interpreted as indication of an episodic prevalence of a humid climate in the area of deposition. In addition, the co- occurrence of freshwater algae like *Pediastrum* and *Botryococcus* with some aquatic fungal genera such as *Involutisporonites*, *Paragrantisporites*, and *Reduviasporonites* suggest the existence of shallow, pond- or lake-like aquatic habitats.

Keywords: Nukhul Formation, Tertiary, *Pediastrum*, *Botryococcus*.

GS03-O06 (224)

Sclerophylls, open vegetation and no fire. The past breaks a paradigm of the present

Greg Jordan¹, Ray Carpenter²

¹ *School of Plant Science, University of Tasmania, Australia, greg.jordan@utas.edu.au*

² *University of Adelaide, Australia*

There has been intense recent interest in the contribution of fire to plant evolution. One important part of this issue is whether modern fire adaptations and open, sclerophyllous vegetation are ancient or modern. A long held view is that modern fire adaptations are essentially Neogene in origin, and correspond to increases in charcoal and pyrogenic plant groups during this period. This view is challenged by extensive evidence for fire in the Mesozoic and Paleocene and ancestral state analyses of phylogenies which appear to show that fire adaptations in some plant groups extend this deep in time. There is uncertainty about these ancestral state analyses because they fail to allow for biases resulting from systematic extinction of pyrophobic groups. The great southern hemisphere family, Proteaceae, is central to this argument. This ancient family has a strong fossil record, and is impressively represented in both sclerophyllous, pyrogenic vegetation and in pyrophobic closed forest. We present evidence that amphistomatous fossil leaves of Proteaceae provide a strong indicator of the presence of open vegetation. This proxy, combined with phylogenetic and current

species distributions, shows that Palaeogene sclerophyllous lineages of the family occurred in fire free, open sclerophyll vegetation. We propose that this evidence can be used to argue against the antiquity of fire adaptations.

Keywords: evolution of fire adaptation, macrofossils, phylogeny, Paleogene, Neogene.

GS03-O07 (433)

Palynostratigraphy of the Eocene Esmeraldas Formation, Middle Magdalena Valley Basin, Colombia

Guillermo Rodríguez¹, Francisca Oboh-Ikuenobe², Carlos Jaramillo³, Milton Rueda⁴, Edwin Cadena⁵

¹ *Instituto Colombiano del Petroleo, ECOPETROL–ICP, Colombia, guillermo.rodriquezf@ecopetrol.com.co*

² *Missouri University of Science and Technology, USA*

³ *Smithsonian Tropical Research Institute, Panama*

⁴ *PALEOFLOTA LTDA., Colombia*

⁵ *North Carolina State University, USA*

The Eocene Esmeraldas Formation is a very important oil reservoir in the Middle Magdalena Valley Basin, Colombia, which is a product of the fragmentation of a Cenozoic foreland basin by the uplift of the Northern Andes. The lateral continuity of the formation, as well as its correlations with lithostratigraphic units in adjacent basins is not clearly understood. The Los Corros Fossil Horizon, a molluscan horizon in the upper part of the Esmeraldas Formation, has been used to trace the top of the formation. This horizon is not laterally continuous over the basin and its age is still debatable. Some of the key palynostratigraphic events in Northern South America are not present in the palynological record of the Esmeraldas. Palynological data from 82 samples from an outcrop section in the Nuevo Mundo Syncline area and from seven previously studied wells have been integrated with a palynological zonation of northern South America in order to date the Esmeraldas Formation. The age ranges from the late Early Eocene to the Late Eocene. The Esmeraldas Formation is correlative with the upper Picacho Formation and the lower part of the Concentracion Formation in the Eastern Cordillera, and the upper Mirador Formation and the base of the Carbonera Formation in the Llanos Foothills. The Los Corros Fossil Horizon is Late Eocene and is time-correlative with a marine transgression in the central Llanos Foothills. A non-metric multidimensional scaling analysis suggests that floras from the Middle Magdalena Valley were different from the Llanos Foothills area during the Middle to Late Eocene. This is apparently due to taphonomic effects. The results of this study contribute to a better understanding of the overall evolution of the Middle Magdalena Valley Basin and the evolution of the northern Andes.

Keywords: South America, Cenozoic, continental, Corros, palynology.

GS03-P01 (167)

Cleared leaf collection of modern Japanese species for studying the Eocene-Oligocene Kobe Flora

Kumiko Handa¹, Akira Yokoyama²

¹ *Museum of Nature and Human Activities, Hyogo, Japan, handa@hitohaku.jp*

² *Kobe, Japan*

The Eocene-Oligocene Kobe Flora in southwestern Honshu, Japan, has been known as fossil leaves are beautifully preserved on fine whitish tuffs or tuffaceous mudstones. Although the cuticles are not preserved in most cases, the fine venation pattern is well imprinted. The collections of this fossil flora contain more than ten thousand specimens, represented largely by leaves and also including silicified wood, fruits, seeds, and other organs. As the initial stage of the study of this fossil flora, we prepared a modern reference collection of cleared leaves for comparison with fossil leaves; this reference collection comprised 308 slides of modern species, covering 119 genera and 50 families in Japan. The materials were collected from mature trees in the Kobe Municipal Arboretum and the Kyoto Botanical Garden between 1979 and 1982. The dried leaves were decolorized, bleached, stained with safranin O, and mounted between two sheets of glass slide with a synthetic resin. This cleared leaf collection is housed in the Museum of Nature and Human Activities, Hyogo with the registration numbers C3-00001 to C3-00309. We have provided a list and photographs of the cleared leaves in a PDF file in order to understand the utility of this collection in the study of fossil leaves.

Keywords: reference collection, fossil leaf impressions, fine venation, Hyogo Museum of Nature and Human Activity.

GS03-P02 (221)

Vegetation, sea-level and climate changes during the Messinian salinity crisis recorded in the Montemayor-1 core, lower Guadalquivir basin, southwestern Spain

Gonzalo Jiménez-Moreno¹, José Noel Pérez-Asensio¹, Juan Cruz Larrasoña², Julio Aguirre¹, Jorge Civis³, María Rosario Rivas-Carballo³, María F. Valle-Hernández³, José Angel González-Delgado³

¹ *Universidad de Granada, Spain, gonzaloj@ugr.es*

² *IGME, Zaragoza, Spain*

³ *Universidad de Salamanca, Spain*

The Messinian salinity crisis (MSC) is one of the most fascinating paleoceanographic events in the recent geological history of the Mediterranean. However, the relative role that tectonic processes and sea level changes had, as triggers for restriction and isolation of the Mediterranean Sea from the open ocean, is still under debate. In this study we present a detailed pollen, dinocyst and magnetic susceptibility analysis of a sequence of late Neogene marine sediments from the Montemayor-1 core (lower Guadalquivir basin, southwestern Spain), which provides a continuous record of paleoenvironmental variations in the Atlantic side of the Betic corridors during the Late Miocene. Our results show that significant paired vegetation and sea level changes occurred during the Messinian likely triggered by orbital-scale climate change. Important cooling events (i.e., glaciations) and corresponding glacio-eustatic sea-level drops are observed in this study at ca. 5.95 and 5.80 coinciding with the timing and duration of oxygen isotopic events TG32 and TG22-20. It is generally accepted that the onset of the MSC begun at ca. 5.96 ± 0.02 Ma. Our study therefore suggests that the restriction of the Mediterranean could have been triggered, at least in part, by a strong glacio-eustatic sea level drop linked to oxygen isotopic events TG32.

Keywords: palynology, vegetation, climate variability, eustatic fluctuations, Messinian salinity crisis.

IPC/IOPC 2012 Tokyo, Japan