13th NECLIME workshop of the working group on palynology

Scientific program and abstracts

October 23-26, 2024

Cracow, Poland

W. Szafer Institute of Botany
Polish Academy of Sciences, Cracow, Poland

HR EXCELLENCE IN RESEARCH

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SCIENTIFIC PROGRAM

October 23, 2024 (Wednesday) – Arrival day

October 24, 2024 (Thursday)

9:30 – 10:00

Registration

10:00 – 11:10

Magdalena Moskal-del Hoyo: ***Welcome address***

Elżbieta Worobiec, Grzegorz Worobiec, Dimiter Ivanov, Marianna Kováčová: ***Welcome address***

Dimiter Ivanov: ***Introductory notes and recent activities of Working Group***

Angela A. Bruch: ***General NECLIME announcements***

Elżbieta Worobiec, Jadwiga Ziaja, Krzysztof Stachowicz, Grzegorz Worobiec, Lucyna Śliwa: ***Palaeobotanical collection of the W. Szafer Institute of Botany, PAS, Cracow***

Nela Doláková, Marianna Kováčová, Jan Doboš: ***LM/SEM studies of palynomorphs from Lower and Middle Miocene sediments, Central and Eastern Paratethys***

11:10 – 11:40

Coffee break

11:40 – 13:00

Barbara Słodkowska: ***Reconstruction of the plant communities and their succession in the two profiles of Middle Miocene deposits from southern Wielkopolska***

Grzegorz Worobiec, Elżbieta Worobiec: ***Middle Miocene vegetation of the northern shores of the Central Paratethys Sea from Poland***

Grzegorz Pacyna: ***New data about Miocene floras from Nowy Sącz Basin***

Olena Sirenko: ***Pliocene stages of nature development in the Prydniprovska lowland (based on the results of palynological studies)***

13:00 – 14:00

Lunch: W. Szafer Institute of Botany, PAS, Lubicz 46

14:00 – 16:00

Visiting the exhibition: *History of the vegetation landscapes of Poland*

Discussion, including:

Biodiversity reflected in palynological assemblages

Pollen and NPPs as complementary environmental proxies

LM/SEM studies on fossil material

LM/SEM studies on modern material

NLRs of Neogene (and Paleogene) pollen types

Optional: Microscope works – recent and fossil pollen (Please don't forget to bring your slides)

16:00 – 18:00

Sightseeing of the Cracow Old Town

18:00

Dinner: Restaurant ***Gościnna Chata***, Sławkowska 10 (*dinner is not included in the workshop fee*)

October 25, 2024 (Friday)

10:00 – 13:00

Discussion and practice

Microscope works – reference collection study and discussion on the fossil material (Please don't forget to bring your slides)

Coffee will be available all the time

13:00 – 14:00

Lunch: *Novum Bistro*, Lubicz 42

14:00 – 15:00

Optional: Visit to the **Botanic Garden** of the Jagiellonian University, Kopernika 27

15:00 – 16:00

Final discussions and closing remarks

October 26, 2024 (Saturday) – Departure day

ABSTRACTS

LM/SEM studies of palynomorphs from Lower and Middle Miocene sediments, Central and Eastern Paratethys

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The pollen spectra mirrors evolution of landscape and climate changes in the Czech and Slovak regions of the Central Paratethys from the Burdigalian to Early Serravallian stages (Eggenburgian, Otttnangian, Karpatian, Badenian). These were compared with spectra from Eastern Paratethys. All the studied palynospectra are rich in thermophilous elements like: Sapotaceae, Palmae, *Engelhardia*, *Lygodium,* evergreen Fagaceae, Cornoideae-Mastixioideae. Subbasins system with highly complicated shoreline contours and a variable communication with the open sea dominated during the Lower Miocene environment.

Due to evaporation intensity the halophytes grew on the coast and at salt meadows (Chenopodiaceae, *Tamarix*, *Caryophyllaceae*, *Ephedra*). Representatives of heliophilous plants such as Oleaceae, Ericaceae, *Buxus* and Poaceae have a significant portion in the spectra. Rutaceae pollen (f.e. *Ptelea – Skimmia* type, *Citrus limon*) and Euphorbiaceae have been newly recognized based on LM/SEM studies. These type of taxa had been repeatly replaced by different stages of coal swamp (Taxodiaceae, Myricaceae, Cyrillaceae) and riparian plants (*Alnus, Fraxinus, Salix, Platanus*) together with ferns *(Lygodium, Pteris, Selaginella*). The aquatic flora appeared sporadically: *Sparganium*, *Potamogeton*, *Nelumbo*, Cyperaceae.

Karpatian (Late Burdigalian) and early Badenian (Early Langhian) - almost continuous presence of subtropical conditions with and low seasonality. Periodic changes in climatic factors – especially temperatures and precipitation and increasing seasonality were interpreted in the frame of the culminating Miocene climatic optimum (MCO) and the beginning of the Miocene Climate Transition (MCT) (evidence for the MCT and subsequent cooling during the Late Langhian – Early Serravalian). An increased percentage of “quercoids” were observed. Based on LM/SEM, we tried to distinguish (discussed) between evergreen and deciduous types (*Castanopsis – Lithocarpus – Trigonobalanopsis – Protobalanus*. *Quercus infrageneric* group *Q. cerris, Quercus* - infrageneric group *Quercus* vel. *Lobatae, Eotrigonobalanus*).

Pollen data from the Eastern Paratethys, indicated an earlier start of gradual cooling towards more arid and continental climate conditions. This trend may be linked to the presence of the vast moderate Eurasian continent.

Introductory notes and recent activities of Working Group

Dimiter IVANOV

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The main tasks of the NECLIME Working Group on Palynology is the taxonomic treatment of fossil palynomorphs and the identification of closest living relatives (NLRs). This is necessary with a view to improving the resolution of palynological data as a basis for paleoclimatic and paleoecological analysis. In addition, the palynology working group also consider issues of taphonomy and the possibilities of pollen preservation and their influence on the interpretation of data for environmental and climate reconstruction.

Since the creation of the working group until today, significant results have been achieved in the field of taxonomy of critical Neogene palynomorphs, assessment of their climatic requirements, expansion and refinement of data in the Paleoflora database.

In recent decades, the study of Neogene non-pollen palynomorphs (NPPs) has also been developed, with a view to their use as climate proxies.

The NECLIME Working Group on Palynology will continue the development of its activities and strive to improve the existing knowledge and the training of young specialists.

New data about Miocene floras from Nowy Sącz Basin (Polish Western Carpathians)

Grzegorz PACYNA

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Miocene strata in Nowy Sącz Basin were first described by Uhlig in 1888. These and subsequent studies revealed the presence of a thick sequence of marine, brackish and freshwater deposits. Lignites are very common in freshwater sediments and thin coal seams were even exploited at the beginning of the 20th century. Boreholes done in the 1960s and in the 1980s penetrated a thick sequence of Middle Miocene (Badenian-early Sarmatian, Serravallian) freshwater sediments (Biegonice Formation). They provided palynomorphs analyzed by Stuchlik (Oszczypko and Stuchlik 1972, Oszczypko et al. 1991) and rich seeds-fruits flora described by Łańcucka-Środoniowa (1975, 1977, 1979), however typical leaf macroflora have not been found in these boreholes. Leaf macroflora was first time discovered by me in the 1990s in a type section of the Biegonice Formation at Biegonice brickyard. Unfortunately open pit clay mine in Biegonice was closed at the beginning of the 21st century and plant-bearing fossil strata are unavailable there. Flooding of 2001 revealed not known earlier marine and freshwater deposits in the central part of the basin but unfortunately, they were not analyzed from a palynological and palaeobotanical point of view (Oszczypko-Clowes et al. 2009). Currently, Miocene freshwater sediments (upper part of Biegonice Formation) are exposed incidentally during construction investments and on a large landslide in the forest in Dąbrówka. This landslide revealed about 10 m long profile of mainly blue clays with gastropod shells but intercalations of lignite-bearing and leaf-bearing bluish and brownish clays, sideritic nodules and sands are also present.

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Pliocene stages of nature development in the Prydniprovska lowland (based on the results of palynological studies)

Olena SIRENKO

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According to the physical and geographical zoning of Ukraine, the study area is located within the modern forest-steppe vegetation zone, and the southern and south-eastern parts of the region in the area of the junction of the forest-steppe and steppe zones. Structurally, this territory belongs to the Dnipro-Donetsk Basin (DDB). Within the DDB, a continental regime existed in the Pliocene, and subaerial sediments represented in sections by alternating red-coloured fossil soils and brown-coloured clays were predominantly formed. Subaquatic sediments are traced in fragments. The Lower Pliocene includes the Sevastopol pedohorizon, the Ajdar horizon, and the Jarkov pedohorizon. The Upper Pliocene includes the Kyzylyr horizon and the Bogdanivka pedohorizon (Stratigraphic schemes of Precambrian and Phanerozoic of Ukraine 1993; Sirenko 2016, 2017). According to the palynological data, Sevastopol, Ajdar, and Jarkov deposits of the DDB correlate with marine and lagoonal marine Kimmerian rocks, and Kyzylyr and Bogdanivka deposits correlate with Akchagylian rocks of the Eastern Paratethys (Sirenko 2017). The Sevastopol, Jarkov and Bogdanivka pedohorizons were formed during warm stages, while the Ajdar and Kyzylyr clay horizons were formed during cool stages.

According to palynological data, it was found that at the beginning of the Sevastopol stage there were humid but relatively cool climatic conditions. The vegetation cover was dominated by broadleaf coniferous forests with *Picea*, but the main unifier of these forests was *Pinus*. In the middle part of the stage, the humidity of the climate decreased and the heat availability increased. The forest-steppe landscape became dominant. The area occupied by herbaceous vegetation significantly increased in the structure of the vegetation cover. The number and taxonomic diversity of thermophilic plants has increased in the forests. A slight cooling occurred at the end of the stage. At that time, the presence of deciduous plants of the moderate zone increased in the forest communities.

The Ajdar stage is associated with increased aridisation of climate, as evidenced by the expansion of the vegetation cover of quinoa-wormwood steppes (at the beginning of the stage) and meadow associations (at the end of the stage). During the periods of short-term warming that occurred in the middle of the stage, landscapes changed from forest to forest-steppe.

During the Jarkov stage, large areas were occupied by herbaceous coenoses, but the role of forbs in their composition was insignificant. Forest communities dominated by *Pinus* spp. and *Quercus* spp. grew mainly along river terraces and valleys. *Juglans* cf. *cinerea* L. grew in valley forests. The undergrowth consisted of *Corylus* sp.

The Kyzylyr stage was characterised by significant cooling and aridification of the climate, as evidenced by the depletion of plant communities compared to the Early Pliocene,

due to both deciduous plants of the moderately warm zone and thermophilic elements and thermophilic pines of the *Haploxylon* subgenus.

Paleogeographic conditions of the Bogdanivka stage were heterogeneous. In the first half of the stage, there were relatively warm and humid conditions but cooler than in the Early Pliocene, as evidenced by an increase in pine trees in the forests, as well as the decreasing role of deciduous plants, especially in the moderately warm zone. At the end of the first half of the stage, the part of herbaceous communities increased in the vegetation cover. In the second half of the stage, there was cooling and aridization of the climate, which was reflected in the vegetation composition. Almost all pines of *Haplohylon* subgenus disappeared from the forest communities, and thermophilic elements were occasionally found only in valley forests. At the end of the stage, forest-steppe landscapes dominated. Some thermophilic elements reappeared in the forests, but in much smaller numbers than at the beginning of the stage.

Reconstruction of the plant communities and their succession in the two profiles of Middle Miocene deposits from southern Wielkopolska

Barbara SŁODKOWSKA

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Palynological studies of the Miocene deposits from southern Wielkopolska display visible sedimentary cyclicity, allowed to establish the evolution of plant and climate during Middle Miocene. Material for the study was obtained from Solniki PGI-1 and Kamień PIG-1 boreholes. The whole palynological matter assemblage - palynomorphs (sporomorphs and phytoplankton) and phytoclasts (wood fragments, plants tissues, etc.) has been analysed.

Predomination of extensive swamps of 2nd Lusatian lignite seam in the top part of the Ścinawa Formation has been evidenced and this documented by pollen zone – the climate phase V Quercoidites henrici. There was very warm temperate to subtropical climate in this area. In the assemblage from the Kamień profile of the same age, the accumulation of pollen material took a place in the intramontane basin in which many pollen grains of coniferous trees growing on the surrounding hills reached to.

During the accumulation of the 2nd A Lubin lignite seam from Pawłowice Formation the Middle Miocene the pollen zone - climate phase VI Tricolporopollenites megaexactus occurred. A significant role took there the coniferous forest community. However, the swamp forest community was still essential for the lignite formation.

The top of the Middle Miocene sequence is represented by the silty-sand deposits of the Pawłowice Formation upper part, correlated with the pollen zone - climate phase VII Iteapollis angustiporatus. Coniferous trees are still frequent, it is however dominated by the mixed mesophilous forest community with some thermophilous plant taxons. The prevailing climate was warm temperate in this time.

Palaeobotanical collection of the W. Szafer Institute of Botany, PAS, Cracow

Elżbieta WOROBIEC, Jadwiga ZIAJA, Krzysztof STACHOWICZ, Grzegorz WOROBIEC, Lucyna ŚLIWA

W. Szafer Institute of Botany, Polish Academy of Sciences, Cracow, Poland

The W. Szafer Institute of Botany PAS is one of the most important disposers of scientific botanical collections – the KRAM Herbarium (currently National Biodiversity Collection of Recent and Fossil Organisms at W. Szafer Institute of Botany, Polish Academy of Sciences, acc. to Polish Roadmap for Research Infrastructures), which contains nearly 1.6 million specimens. Through participation in the OZwRCIN project (Open Resources in Digital Repository of Scientific Institutes, 2018–2021), a systematic digitisation of specimens from this collection has been started (https://rcin.org.pl/ib/dlibra). The palaeobotanical collection (KRAM P) is the most valuable and extensive collection of this type in Poland and one of the largest in Central Europe. It is created systematically since 1953 and currently comprises 105,315 items, including fossil floras and comparative collections of modern plants. The collection of Paleogene and Neogene floras is rich in fruits and seeds, rock fragments with plant imprints, preparations of entire leaves and other fragments of plants, plus cuticular slides. Particularly noteworthy is the collection of microscope slides of leaf cuticles and a unique collection of slides of cleared fossil leaves, as collections of this type are only found in a few scientific institutions in Poland and in the world. The palynological collection is the largest and oldest reference collection of modern plant pollen and spores in Poland. It comprises ca. 17,200 microscope slides of pollen and spores from 2,686 species (source: https://www.botany.pl/index.php/pl/).

Middle Miocene vegetation of the northern shores of the Paratethys Sea from Poland

Grzegorz WOROBIEC, Elżbieta WOROBIEC

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More than fifty palynological samples from Middle Miocene (Badenian and Sarmatian) marine deposits of the northern part of the Central Paratethys, southern Poland, from the Babczyn 2 and Kazimierza Wielka (Donosy) PIG 1 boreholes, were investigated. Both palynoassemblages containing, among others, spores and pollen grains of land plants and fungi were formed as a result of the terrigenous flux into the marine environment and originated from shores and adjacent inland vegetation that surrounded the Miocene Paratethys sea. Bisaccate pollen grains of *Pinus*, well-adapted to wind and water long-distance transportation, were the most numerous. The overall results of the palynological analysis, however, indicate that mesophytic forests (deciduous and mixed forests) on the land surrounding the Paratethys dominated at that time. These forests were composed of *Fagus*, *Tsuga* and other conifers (*Abies*, *Cathaya*, *Picea*, *Pinus*, *Sciadopitys*), *Quercus*, *Carya*, *Pterocarya*, Tilioideae, *Ulmus*, *Zelkova*, *Liquidambar*, *Acer*, *Betula*, *Carpinus*, *Alnus*, *Juglans* and others, with an admixture of thermophilous taxa. Wetland communities with *Taxodium* and/or *Glyptostrobus*, *Nyssa* and others that grown in swampy places were not so common (Peryt et al. 2024a, b).

The continuous presence of pollen grains of *Tsuga*, together with their usually good state of preservation, suggests that hemlock was most likely a common component of mixed forests in the areas adjacent to the shoreline. Similarly to *Tsuga*, the presence of numerous *Fagus* pollen grains in some samples and their usually continuous presence suggests that beech was presumably a significant component of a near-shore vegetation. Additionally, in some samples, *Fagus* pollen grains were accompanied by conidia of *Asterosporium asterospermum*, a fungus that is nowadays obligatory host-specific to beech and grows on its branches and twigs. The presence of *A. asterospermum*, that has less potential for long transportation comparing to pollen grains of *Fagus*, suggests that, besides coastal broadleaf and mixed forests, *Fagus* probably had grown directly on the seashores surrounding the Paratethys sea. The almost continuous presence of pollen grains of representatives of the Ericaceae family suggests the presence of shrub vegetation of heathland type in open areas adjacent to the shoreline.

As a modern equivalent of the Sarmatian northern seashore vegetation of the Paratethys with beech and ericaceous shrubs could serve maritime deciduous and mixed forests of the USA that grow on the barrier islands of the Atlantic Coast of North Carolina and along the coast of New England on the north (Bellis 1995, Greller 2018).

The overall results of the palynological analysis indicate that the Middle Miocene climate of northern shores of Central Paratethys Sea from Poland was warm temperate to

subtropical, mild (without severe winters), and rather humid and corresponds to the Cfa climate of the Köppen-Geiger climate classification (Peel et al. 2007). As a modern analogue could serve the climate of the Mid-Atlantic Coastal Plain North America, especially the climate of the southern part of Virginia (Great Dismal Swamp) and coasts of the Chesapeake Bay with mean annual temperature of about 15 ^{o}C (U.S. Fish and Wildlife Service 2006).

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