NECLIME

NECLIME Annual Conference 2023

Graduate School of Horticulture, Chiba University

Matsudo, August 30 – September 6, 2023

Abstracts

CHIBA UNIVERSITY

NECLIME Annual Conference 2023 in Matsudo, Japan
30th August – 6th September

Organizers:

Arata Momohara, Graduate School of Horticulture, Chiba University
Angela A. Bruch, ROCEEH Research Center, Heidelberg Academy of Sciences, Senckenberg Research Institute
Torsten Utescher, Senckenberg Research Institute and Natural History Museum
Yoichi Watanabe, Graduate School of Horticulture, Chiba University
Chiyomi Yamakawa, Lake Biwa Museum, Shiga Prefecture
Ryoma Hayashi, Lake Biwa Museum, Shiga Prefecture
Takeshi Saito, Faculty of Science and Technology, Meijo University
Atsushi Yabe, National Museum of Nature and Science
Takuto Shitara, Tama Forest Science Garden, Forestry and Forest Products Research Institute, Forest Research and Management Organization
Kaori Momohara, National Institute for Agro-Environmental Sciences

Co-sponsor:

Graduate School of Horticulture, Chiba University

Venue:

Room D-112
Graduate School of Horticulture, Chiba University,
648 Matsudo, Matsudo, Chiba
with Zoom online

Main Topics:

Marine – terrestrial connection
Evolution of climate, vegetation, biogeography in Asia
Extreme environments (e.g., high latitudes, high altitudes, high CO^2 world)
Paleogene – biogeography, climate, and evolution
Quantifying past plant biodiversity and vegetation history
Regional signals of past climate and vegetation to be compared with future scenarios

Contact:

arata@faculty.chiba-u.jp

General Schedule

30 August: Registration (17:00 JST–) and icebreaker (18:00 JST–)
31 August: Sessions (15:00 JST – 20:15 JST in Room D-112 with online)
1 September: Sessions (15:00 JST – 20:00 JST in Room D-112 with online)
2 September: Excursion to Mt. Takao, west Tokyo
3 – 6 September: Excursion to Lake Biwa, Nara & Mt. Odaigahara

Start time	**Country**	**Difference to JST**	**Time zone**
7:00	UK	-8	Greenwich Mean Time (GMT)
8:00	Czech Republic, Germany, Italy, Hungary, Poland, Serbia, Slovakia, Spain	-7	Central European Time (CET)
9:00	Turkey, St. Petersburg /Russia	-6	Turkey Time (TRT), Moscow Time (MSK)
10:00	Armenia	-5	Armenia Time (AMT)
11:30	India	-3:30	Indian Standard Time (IST)
11:45	Nepal	-3:15	Nepar Time (NET)
13:00	Vietnum	-2	Vietnum Standard Time (VST)
14:00	China	-1	China Standard Time (CST)
15:00	Japan	0	Japan Standard Time (JST)
16:00	Vladivostok/Russia	+1	Vladivostok Time (VLAT)

Wednesday, August 30

17:00 – 17:50 JST Registration (Room D112)

18:00 – 20:00 JST Icebreaker (Seikyo Cafeteria)

Thursday, August 31

Zoom online: open from 14:40 JST
https://us06web.zoom.us/j/81612426941?pwd=dnlrU0NLYkNsc3d2QlpsMG9ZOTBMZz09
Meeting ID: 816 1242 6941
Passcode: 706762

14:30-15:00 JST **Setting of presentation file and testing operation**

15:00 JST **Arata Momohara**
Welcome and technical Instructions

15:05 JST **Angela A. Bruch** & **Torsten Utescher**
Introduction and news from NECLIME

Chair Atsushi Yabe

15:30 JST **Oleksandra Chernomorets**, Jakub Sakala & Ludwig Luthardt
Paleoclimatic signal captured in growth rings of fossil wood from the Upper Cretaceous – Paleogene of Antarctic

15:45 JST **Ulrich Salzmann**, Nick Thompson, Julia Brugger, David Hutchinson, Matthew Pound, Stephanie Strother, Torsten Utescher, Thomas Hickler & Dan Lunt
A global reconstruction of vegetation and terrestrial climate of the warm early Eocene

16:00 JST **Anna L. Averyanova** & Valentina F. Tarasevich
Upper Oligocene Aschudasty flora from the Zaisan depression (Eastern Kazakhstan)

16:15 JST **Svetlana Popova**, Anna L. Averyanova, Torsten Utescher & Valentina Tarasevich
Oligocene vegetation pattern of central Asia based on palaeobotanical data with using quantitative approaches

16:30 JST **Desa Djordjevic Milutinovic**
Platanus neptuni island forests in the Oligocene of Serbia

16:45 JST 15 min break

Chair Yong-Jiang Huang

17:00 JST **Jia Li**, Shi-Tao Zhang, Xue-Yan Li, Cong-Li Xu, Yuan Zhu, Ruo-Han Zuo & Lin-Bo Jia
New fossils reveal the Paleogene establishment of relict Craigia (Malvaceae) in its extant range

17:15 JST **Linbo Jia**, Tao Su, Weicheng Li, Shufeng Li, Yongjiang Huang & Zhekun Zhou
The floristic differentiation of Southwest China: Insights from Cedrelospermum and Ailanthus fossils

17:30 JST **Jessica McCoy**, Martha E. Gibson, Emma P. Hocking, Jennifer M.K. O'Keefe, James B. Riding, Raymond Roberts, Stewart Campbell, Geoffrey D. Abbott & Matthew J. Pound
Oligocene-Early Miocene (33.9-15.97 Ma) palaeoclimate reconstruction of the British Isles using a Bayesian climate model on palynological data

17:45 JST	**Matthew J. Pound**, Jennifer O'Keefe, Martha Gibson, Ingrid Romero, Noelia Nuñez-Otaño, Sophie Warny, Jessica McCoy, Mallory Pilié, Margaret E. Alden, Jeremyah R. Cabrera, Hoa Dang, C. Jolene Fairchild, Julia Fitzpatrick, Taylor Horsfall, Savanah Jones, June E. Lennex-Stone, Christopher A. Marsh, Rebecca Morgan, Iola Nkau, Alyssa A. Patel, Tyler M. Spears, Laikin Tarlton, Liberty F. Smallwood, Chloe Todd, L. Olivia VanderEspt, Kerry Webber, Cortland F. Eble, William C. Rember, James Starnes; Mac H. Alford, Alyson Brink & Harvey E. Belkin *Fungi in a Warmer World: Middle Miocene fungi and global palaeoclimates*
18:00 JST	**Shun Ikeda** & Arata Momohara *Leaf morphology variation of Protosequoia from the Upper Miocene in Central Japan*
18:15 JST	**Atsushi Yabe** & Kazuhiko Uemura *The mid-Pliocene Aguni Flora from Aguni-jima Island, central Ryukyu Archipelago, Japan—the earliest known evidence of subtropical forest in the Ryukyus*
18:30 JST	15 min break
On-line	Chair Matthew J. Pound
18:45 JST	**Shreyasi Basak**, Swagata Paul, Suryendu Dutta, Mahasin Ali Khan, Ruby Ghosh & Subir Bera (on-line) *Evidence of Dipterocarp-dominated forest in the western part of Bengal Basin during the Eocene inferred from pollen analysis and resin chemistry of lignite sediments*
19:00 JST	**Subir Bera**, Meghma Bera, Shreyasi Basak, Mahasin Ali Khan, Dipak Kumar Paruya, Krishnendu Acharya & Bapi Goswami (on-line) *Diversity of Meliolales in the Siwalik forest of Eastern Himalay*a
19:15 JST	**Olesia V. Bondarenko** & Torsten Utescher (on-line) *Early Paleogene vegetation of the pacific side of Eurasia*
19:30 JST	**Elżbieta Worobiec**, Grzegorz Worobiec, Przemysław Gedl & Wojciech Granoszewski (on-line) *Oligocene palynoflora and palaeoenvironment from Grabówka, northern Poland*
19:45 JST	**Grzegorz Worobiec** & Elżbieta Worobiec (on-line) *Contribution of fungal non-pollen palynomorphs to palaeoecological reconstructions based on pollen assemblages: a case study from the Miocene lignites from Poland*
20:00 JST	**Rafał Kowalski** (on-line) *Miocene heathers and possible fire-prone communities in Central Europe*

Friday, September 1

Zoom online: open from 14:40 JST
https://us06web.zoom.us/j/87112839127?pwd=Z1VESk1CMWtBUFQ3SWhDcnVjUlFKUT09
Meeting ID: 871 1283 9127
Passcode: 386221

14:30-15:00 JST **Setting of presentation file and testing operation**

	Chair Angela A. Bruch
15:00 JST	**Zhe-Kun Zhou**, Jia Liu, Lin-Lin Chen, Robert A. Spicer, Shu-Feng Li, Jian Huang, Shi-Tao Zhang, Yong-Jiang Huang, Lin-Bo Jia, Jin-Jin Hu & Tao Su *Cenozoic plants from Tibet: an extraordinary decade of discovery, understanding and significance*
15:15 JST	**Shi-Tao Zhang**, Yi-Min Tian, Jia Li, Zhe-Kun Zhou & Su Tao *Late Cenozoic Crustal Deformation and Paleoclimate transition on the Southeastern Edge of the Tibet Plateau*
15:30 JST	**Jia Liu**, Zhe-Kun Zhou & Tao Su *The formation and evolution of the rain shadow effect in the central Himalaya during the late Cenozoic*
15:45 JST	**Yong-Jiang Huang**, Tao Su, Lin-Bo Jia, Jin-Jin Hu, Yun-Heng Ji & Zhe-Kun Zhou *Wildfire under climate and vegetation change from the Neogene of the southeastern margin of the Tibetan Plateau*
16:00 JST	**Jian Huang**, Napussawan Thongsangtum, Shi-Hu Li , Shu-Feng Li & Tao Su *A "cooler" Cenozoic flora from northern Thailand and its geological interpretation*
16:15 JST	**Arata Momohara** & Ayano Ito *Oceanic climate enhanced development of beech-dominant forests in Japan since the Neogene*
16:30 JST	15 min break
	Chair Arata Momohara
16:45 JST	**Angela A. Bruch**, Mika R. Puspaningrum, Iwan P. Anwa & Christine Hertler *The environment of Homo erectus in Sangiran - Vegetation and climate in Eastern Java at 1 Ma*
17:00 JST	**Neevin I.A.**, Ryabchuk D.V., Taldenkova E.E. & Elkina D.V. *Reconstruction of paleogeographic development coastal areas of the East Siberian shelf seas in the Neopleistocene – Holocene*

17:15 JST	**Ekaterina S. Nosevich**, Alexandr Yu. Sergeev, Daria V. Ryabchuk, Vladimir Zhamoida, Leonid M. Budanov & Igor A. Neevin *Coastline and palaeoclimate of New Siberian Islands (East Siberian Sea) during Late Pleistocene according pollen data*
17:30 JST	**Takuto Shitara**, Tetsuya Matsui & Arata Momohara *Climate impact on the extermination of Larix gmelinii from the Japan Archipelago after the last glacial maximum*
17:45 JST	**Martina Stebich**, Torsten Utescher, Salman Khan, Birgit Gaye, Sushma Prasad & Arshid Jehangir *Holocene changes of vegetation, climate and land use in Northern India based lacustrine sediments of the Manasbal lake (Kashmir valley)*
18:00 JST	15 min break
On-line	Chair Jian Huang
18:15 JST	**Edoardo Martinetto** & Steven R. Manchester (on-line) *Enigmatic carpological fossils from the Neogene of Europe possibly represent the extant genus Sideroxylon (Sapotaceae)*
18:30 JST	**Chiyomi Yamakawa**, Yayoi Ueda, Ryoma Hayashi, Etsuko Kamiya & Yuko Nishimura (on-line) *Reconstruction of the wetland forests at the Pliocene-Pleistocene boundary based on fossil forests around Paleo-Lake Biwa, central Japan*
18:45 JST	Dipak Kumar Paruya, Ruby Ghosh, Oindrila Biswas, **Ranita Biswas**, Mahasin Ali Khan & Subir Bera (on-line) *Vegetation and climate inferred from phytolith assemblages of Late Miocene to Early Pleistocene sediments of Arunachal Himalaya*
19:00 JST	**Meghma Bera**, Shreyasi Basak, Mahasin Ali Khan, Dipak Kumar Paruya, Krishnendu Acharya, Bapi Goswami & Subir Bera (on-line) *Evidence of mycoparasitism on the phylloplane from the Upper Siwalik sediments of Arunachal Himalaya*
19:15 JST	**Manjuree Karmakar**, RanitaBiswas, Dipak Kumar Paruya, Biswajit Mukherjee, Oindrila Biswas, Ruby Ghosh & Subir Bera (on-line) *Identifying the climatic driver affecting the bilobate phytolith spectra of Western Ghats, India during the Holocene*
19:30 JST	**Angela A. Bruch** & **Torsten Utescher** **Final discussion and closing of the conference**

Saturday, September 2

Excursion to Mt. Takao, west Tokyo

7:50 Meet at ticket office in front of entrance gate of JR Matsudo Station and depart.
9:40 Takaosan-guchi Station – cable car – Mt. Takao botanical tour and Yakuo-in temple
14:00 lunch in Takaosan-guchi
15:00 Takao 599 Museum
16:10 Departure from Takaosan-guchi Station – 18:10 Matsudo

Sunday, September 3

Excursion to Lake Biwa, Nara & Mt. Odaigahara

8:10 Departure from JR Matsudo Station
12:00 Arrival at Kusatsu City, Hotel Boston Plaza Kusatsu
13:00 Lake Biwa Museum (lunch, museum tour, and Lake Biwa)
19:00 dinner

Monday, September 4

8:30 Departure from Kusatsu by bus
9:00 Latest Pliocene fossil forest in the Kobiwako Group in Konan City
12:40 Arrival at Nara City, Comfort Hotel Nara, lunch
14:00 Mt. Kasuga natural evergreen broadleaved forest, walking in Nara City
19:00 dinner

Tuesday, September 5

7:15 Departure from Nara by bus
10:45 Arrival at Mt. Odaigahara, lunch, trekking for *Sciadopitys verticillata* stand and *Fagus crenata* forest
15:30 Departure to Nara
20:30 dinner

Wednesday, September 6

8:30 Tour with guidance in English by Nara SGG Club (volunteers) for Kasuga-Taishya (Shinto Shrine), Todaiji Temple (Great Buddha), and KoufukuJi National Treasure Museum
12:00 Break up in Nara City

Instructions for Presenters

Each presentation is **within 14 min. including 2 - 4 min. discussion.**

To reduce time of laptop change, we suggest you to **transfer your PPT file to a laptop set at the venue** and test its operation in advance of the session.

We provide a **guest account** to access Wi-Fi in the venue to each on-site attendant.

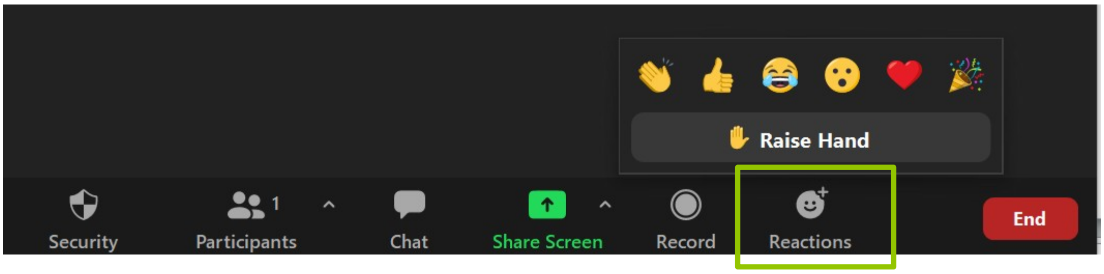
For on-line presenters, we recommend **uploading prerecorded contribution to a google-drive before 28th August.** We will send an email showing the URL for upload to on-line presenters. The preferred format of pre-recorded contribution is **mp4**.

The presentation at the venue is also **conducted via Zoom**.

The technical host will admit those in the waiting room, so please allow enough time for us to do so. For the purpose of identification, we kindly ask that your **Zoom name corresponds to your real name**.

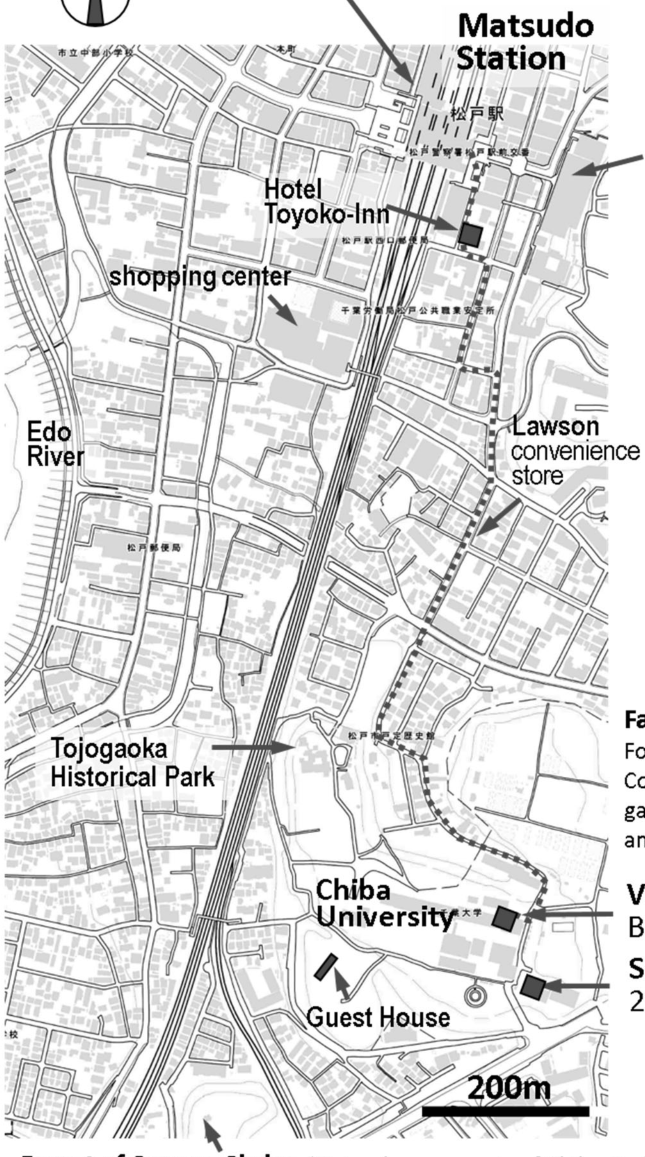
You open your PowerPoint before the presentation and click on *Share Screen* to start your presentation. A window will open and you will need to **confirm your screen selection**.

During discussions, please use the ***Raise Hand*** option to signal to the session host that you would like to speak. You will find this option by clicking on *Reactions*.



A window will open with all possible reactions in the top row and a larger “raise hand” button in the second row. A blue hand icon will then appear next to your name in the list of participants. The conveners will then invite you to ask your questions, but please remember to unmute your microphone yourself before you start speaking (the technical host cannot unmute you).

Atre Matsudo
shopping center & restaurants (7F. until 22:30)



Ito-Yokado
shopping center,
restaurants, food court

Faculty of Horticulture, Chiba University
Founded as the Chiba Prefectural Technical College of Horticulture in 1909. Western style gardens in the campus were made by teachers and students in years of the college foundation.

Venue
Building D, 1F. Room D -112

Seikyo Cafeteria
2F. Ice breaking party

Forest of Sengen Shrine (Natural monuments of Chiba Prefecture).
A small climax evergreen broadleaved forest composed of large trees of *Castanopsis sieboldii*, *Quercus acuta*, and *Cinnamomum japonicum* has been protected religiously by a Japanese Shinto shrine.

Tojogaoka Historical Park and Tojo House (Nationally designated important cultural properties)
Founded as a villa and garden of Akitake Tokugawa (last feudal lord of Mito Domain, younger brother of the last shogun) in 1884. House of traditional Japanese construction and a Japanese-western style garden with large umbrella pine trees (*Sciadopitys verticillata*). 9:30 – 17:00 except for Monday

Upper Oligocene Aschudasty flora from the Zaisan depression (Eastern Kazakhstan)

Anna L. Averyanova[a], Valentina F. Tarasevich[a]

[a]Komarov Botanical institute of RAS, Saint-Petersburg 197736, Russia

The fossil flora of the Aschudasty locality (coll. 3026) was found in the sediments of the Oshagandy Formation of the Zaisan depression (Eastern Kazakhstan). The samples contained both microremains and imprints of leaves and generative organs of gymnosperms and angiosperms. The age of this flora was determined as the Upper Chattian according to biostratigraphic and magnetostratigraphic data. In the spore-pollen spectrum of the flora of “Aschudasty-3026”, woody plants predominate (almost 96%), of which slightly more than half are flowering plants. Among conifers, pollen of the *Picea* dominates (about 30%). Among the flowering plants, *Alnus* pollen (42.6%) is distinguished by an abundance, together with other Betulaceae accounting about 47% in total. There are single grains of herbaceous plants (ferns, monocots). The spectrum from "Aschudasty-3026" shows similarity with the composition of the Lower Miocene spore-pollen spectrum from the Kumyrtas locality (Central Kazakhstan). They are brought together by the dominance of pollen of flowering broad-leaved species, but the high content of pollen of small-leaved taxa is especially noticeable, namely, in Kumyrtas birch and alder are in the amount of 36%, and in Aschudasty alder counts 42.6%. Based on macroremains, 16 taxa were identified here, including 2 ferns (*Salvinia mildeana* Shap., *S. natanella* Shap.), 3 representatives of gymnosperms (*Glyptostrobus europeus* (Brongn.) Heer, *Metasequoia disticha* (Heer) Miki, Taxodioideae gen.sp.), and 11 flowering plants (Apocynaceae: *Periploca kryshtofovichii* Kornilova; Betulaceae: *Alnus* spp. (leaves, seed), *Carpinus* sp. (inflorescence), *Corylus jarmolenkoi* Grub., *Ostrya antiqua* Grub.; Fagaceae: *Fagus antipovii* Heer; Juglandaceae: *Carya cordioides* Iljinskaja, *Juglans zaisanica* Iljinskaja (?); Salicaceae: *Populus balsamoides* Goepp.; Ulmaceae: *Ulmus carpinoides* Goepp., *U. drepanodonta* Grub.). The climate during the accumulation of the Oshagandy Formation was warm-temperate seasonal, colder compared to the beginning and end of the Rupelian in Eastern Kazakhstan. Based on the study of the macroremains (leaf blades are slightly deformed, lie parallel to each other, rounded fronds of Salvinia fern are often found between the leaves of angiosperms), it can be concluded that the fossilization took place in the coastal zone of a stagnant shallow freshwater basin. This research was funded by RSF project № 23-27-00076.

Evidence of Dipterocarp-dominated forest in the western part of Bengal Basin during the Eocene inferred from pollen analysis and resin chemistry of lignite sediments

Shreyasi Basak[1], Swagata Paul[2], Suryendu Dutta[2], Mahasin Ali Khan[3], Ruby Ghosh[4#] & Subir Bera[1*]

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[3]Department of Botany, Sidhu-Kanho-Birsha University, Purulia, West Bengal
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[#]Deceased on 18.04.2023
[*]Corresponding author: berasubir@yahoo.co.in

The Bengal Basin with its long geological history is one of the largest geosynclinal basins of the world and its western most part is included in India in the geographical province of West Bengal. While the other Cenozoic basins of India are palynologically well explored, data specially from the Palaeogene sedimentary strata of the Bengal Basin is quite meagre. The present work deals with the palynomorph analysis of Middle-Late Eocene lignite sediments from Panagarh Domra sector in the Burdwan district, West Bengal, India (23°27′ N, 87°27′ E). The palynoassemblage consists of 53 species under 40 genera of angiosperms, pteridophytes and fungi, where angiosperm pollens are predominant (93.45%) followed by pteridophytic spores (2.09%) and fungal spores. Among the angiosperms, pollen grains of Dipterocarpaceae are the most dominant (34.61%) having a close resemblance to those of extant genera *Shorea* and *Hopea* of this family. The recovered palynoflora can be categorized into six ecological complexes namely, (i) fresh water, (ii) brackish water mangrove, (iii) coastal plant, (iv) fern, (v) fungal and (vi) plant taxa of uncertain affinities. The major GC-MS products of recovered resins from the lignite sediments are sesquiterpenoid and triterpenoid components of angiospermic origin. Furthermore, the exclusive occurrence of cadalene-based C_{15} bicyclic sesquiterpenoids, including some bicadinanes in the Bengal resins points towards their Dipterocarpoideae (Diptercarpaceae) source. The study also suggests that a warm tropical climate was prevalent supporting the dipterocarp-dominated vegetation in the area during deposition.

Evidence of mycoparasitism on the phylloplane from the Upper Siwalik sediments of Arunachal Himalaya

Meghma Bera[1, 2], Shreyasi Basak[1], Mahasin Ali Khan[3], Dipak Kumar Paruya[1], Krishnendu Acharya[1], Bapi Goswami[4] & Subir Bera[1*]

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[4]Department of Geology, University of Calcutta, Kolkata-700019
[*]Corresponding authors: berasubir@yahoo.co.in

Fungi in nature grow on different groups of organisms including fungi. A fungus interacting with another fungus may or may not have a direct relationship with the host for nutrient transfer and is accordingly considered as either mycoparasitic or simply fungicolous. Fungal associations with different life forms in the past are already reported but evidence of mycoparasitic relationships in the fossil record is rare. The present study deals with three hyperparasitic fungi growing on five different fungi primarily parasitizing five angiosperm leaves recovered from the Late Pliocene to Early Pleistocene sediments of Arunachal Himalaya. The study revealed that the epiphyllous fungi (Mycobiont I) belong to the Meliolaceae, Asterinaceae, Erysiphaceae and Glomerellaceae of Ascomycota, whereas the mycoparasites/hyperparasites (Mycobiont II) are cf. *Trichoderma* sp., cf. *Botrytis* sp. and cf. *Arthrobotryum-Podosporium* complex. High annual precipitation and temperature are known to be critically important for the vegetative growth and development of fruit bodies of the mycobionts. CLAMP (Climate Leaf Analysis Multivariate Program) analysis of fossil host leaves shows MAP (mean annual precipitation) of 189.86 cm and MAT (mean annual temperature) of 25.38 °C in the study area during deposition. Hence, it is clear that during Late Pliocene to Early Pleistocene, Arunachal Himalayan region developed a favourable habitat for large number of leaf inhabiting fungi including the mycoparasites.

Diversity of Meliolales in the Siwalik forest of Eastern Himalaya

Subir Bera[1*], Meghma Bera[1,2], Shreyasi Basak[1], Mahasin Ali Khan[3], Dipak Kumar Paruya[1], Krishnendu Acharya[1] & Bapi Goswami[4]

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[2]Department of Botany, Vidyanagar College, Charashyamdas, South 24- Parganas-743503
[3]Department of Botany, Sidhu-Kanho-Birsha University, Purulia
[4]Department of Geology, University of Calcutta, Kolkata-700019
[*]Corresponding authors: berasubir@yahoo.co.in

Investigations on fossil fungi is known since the beginning of palaeobotanical research, though the records of fossil fungi are comparatively less utilized source of information concerning diversity, structure, activities and evolution of fungi in the geological past. In recent years, interest in fossil fungi has been greatly increased as the importance of fungi in a wide variety of dynamic interactions with plants, animals and the surrounding environments has been recognized. The present study deals with leaf inhabiting Meliolales from the eastern Himalayan Siwalik sectors (Darjeeling, Bhutan and Arunachal Pradesh) and their potential mode of interactions with respective angiosperm hosts. The study reveals parasitic and hyperparasitic/mycoparasitic interaction of the recovered fungal morphs with their fossil hosts. Twenty four species under three genera closely comparable to *Meliola, Asteridiella* and *Amazonia* of Meliolacea and one species under one genus similar to *Armatella* of Armatellaceae have been recovered from diverse group of angiosperm host leaves. Further. *Trichoderma* and *Arthrobotryum-Podosporium* complex found to develop hyperparasitic relationship with two species of *Meliola.* The analysis of hosts of the fossil fungi revealed that the forest type in the lower Siwalik (Middle–late Miocene) was generally evergreen to semi-evergreen with an increasing trend of moist deciduous elements towards the middle (Pliocene) and upper Siwalik (Late Pliocene–early Pleistocene) time supporting the luxuriant growth of Meliolales in the Siwalik forest.

Vegetation and climate inferred from phytolith assemblages of Late Miocene to Early Pleistocene sediments of Arunachal Himalaya

Dipak Kumar Paruya[1], Ruby Ghosh[2#], Oindrila Biswas[3], Ranita Biswas[1], Mahasin Ali Khan[4] & Subir Bera[1*]

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[#]Deceased on 18.04.2023
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Morphological uniqueness of phytoliths has established them as a promising plant proxy in various Quaternary climate-vegetation reconstruction studies as well as in archaeological contexts. Deep-time phytolith analysis is a comparatively new approach and such data is meagre compared to those from shallow-time sediments.The present study has been undertaken to check preservation potential of phytoliths and to enrich deep-time phytolith based data from Siwalik sedimentary strata of Eastern Himalaya. Both grass and non-grass phytolith morphs are recovered from the studied sediments. Grass phytolith morphs like BILOBATE, CROSS, TOWER, SADDLETALL, SADDLECOLLAPSED and different non-grass spheroid morphs and epidermal plates are recovered from Upper Siwalik sediments (Late Pliocene to Early Pleistocene). BILOBATE and CROSSmorphs indicate presence of Panicoideae grasses while SADDLETALL and SADDLECOLLAPSED morphs represent Bamboo. TOWERmorphs on the other hand may indicate presence of Pooideae grasses although it is a redundant morph for both Panicoideae and Bambusoideae. Non-grass morphs like different types of SPHEROIDECHINATES may indicate presence of Arecaceae or palms and woody plants. From Middle Siwalik sediments (Late Miocene to Early Pliocene) BILOBATE morphs recovered represent PANICOIDEAE grasses and BILOBATE SCOOPED indicate Oryzoideae grasses. Other grass phytoliths recovered are BULLIFORMFLABELLATE, STOMATE and elongated types. Non-grass phytoliths recovered from Middle Siwalik sediments represent different angiosperms prevalent during the time of deposition. Presence of Panicoideae and Bambusoideae grass subfamilies along with family Arecaceae indicates a warm-humid climate during the Upper Siwalik while, presence of BILOBATE and BULLIFORM FLABELLATE morphs may indicate warm climate with water stress conditions during the Middle Siwalik. Moreover, dark brown to black colorization of certain phytolith morphs recovered mostly from Middle Siwalik sediments suggest forest fire induced charcoalification during deposition.

Early Paleogene vegetation of the Pacific side of Eurasia

Olesia V. Bondarenko[a], Torsten Utescher[b,c]

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Vegetation is the most visible component of the ecosystem, reflecting changes in the ecological situation of the territory. At present, the vegetation cover of the Pacific coast of Eurasia is one of the most interesting world phenomena both in terms of biological diversity and ecosystem organization. Early Paleogene vegetation types of the Pacific coast of Eurasia are reconstructed in time and space using a Plant Functional Type (PFT) approach, for the first time applied on the large palaeobotanical record of this region. The palaeobotanical data used in this reconstruction are compiled from extensive literature resources on a total of 110 reasonably well-dated floras, including 79 palynofloras, 30 leaf floras, and one carpoflora covering the early Paleocene (Danian) to early Eocene (Ypresian), i.e. a time-span of ca. 25 Myr, in total. The palaeobotanical records originate from continental deposits of 73 localities situated along the Pacific coast of Eurasia, including the Far East of Russia, Eastern Siberia, China, and Japan. All palaeofloras considered were carefully re-evaluated regarding the validity of taxonomic identifications and Nearest Living Relatives (NLRs) of the fossil taxa. All assigned NLRs were scored in terms of PFTs using a system with 27 classes. Based on the obtained PFT diversities, changes in the structure of the vegetation are investigated regarding the proportion of aquatic plants, the ratio of herbal, shrubby and arboreal PFTs, as well the ratio of deciduous and evergreen angiosperm plants. Moreover, the PFT diversity spectra obtained from the palaeofloras are interpreted in terms of vegetation types. A map series is presented that shows the spatial distribution of these types for a total of three stratigraphic levels of the early Paleogene of East Asia. The study was carried out with the support of the Russian Science Foundation (project No. 22-27-00098, https://rscf.ru/project/22-27-00098/).

The environment of *Homo erectus* in Sangiran - Vegetation and climate in Eastern Java at 1 Ma

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The human fossil site Sangiran in Java, Indonesia, is among the richest hominid localities outside Africa. The site is located in the central part of the island characterized by a seasonal monsoon climate. Its deposits cover an uninterrupted sequence of sediments ranging in age from Early to Middle Pleistocene. Climate reconstructions based on pollen records from this succession reflect tropical monsoonal conditions slightly less seasonal than today.

At 1 Ma *Homo erectus* was already well established in eastern Java. For this time period, paleovegetation maps were developed based on paleotopographic and -climatic estimates and respective restrictions of modern vegetation units. Lowland monsoonal forests dominated the landscape all over eastern Java, while lowland everwet forests cover only small areas and are restricted mainly to the slopes of volcanoes. Montane forest and subalpine vegetation units are restricted to higher elevations. The small areas covered by coastal vegetation and mangrove forests are naturally restricted to the palaeocoastline, while riparian vegetation is evenly distributed on the map according to the distribution of river courses. These results provide for the first time a spatial sense of how topography and hydrology, rainfall patterns and vegetation units could have been distributed in the paleolandscape of Sangiran *Homo erectus*.

Paleoclimatic signal captured in growth rings of fossil wood from the Upper Cretaceous – Paleogene of Antarctic

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Keywords: fossil wood, growth rings, Antarctic, paleoclimate

At present, there does not exist a comparative instance of a polar forest from the Late Cretaceous and Paleogene era. This ecosystem type presents an exclusive prospect for comprehending the extreme conditions that prevailed in this region, as well as the specific adaptations of organisms to such circumstances. The extensive palaeobotanical record from the Antarctic region serves as evidence that during a greenhouse type of climate, this region was densely inhabited by vegetation. Nonetheless, these plants had to adapt to a distinct solar regime: a period of half-year mild polar nights.
The fossil material utilized for the study was extracted from the uppermost Lower Cretaceous to Paleocene (Albian - Danian) strata at James Ross and Seymour Islands, located in the Antarctic Peninsula. For a detailed analysis of growth rings, 36 samples were selected from several Formations (Whisky Bay Formation, Santa Marta Formation, Lopez de Bertodano Formation, Sobal Formation) out of 114 samples studied and analyzed from the collections of Czech Geological Survey and British Antarctic Survey. These 36 samples are derived from the two most frequently encountered taxa of gymnosperms in the collections: *Agathoxylon* and *Podocarpoxylon.* All these samples exhibit more than 10 growth rings. Based on Mean Sensitivity Index and Mean Ring Width values, a climatic trend for the period was created and compared to existing research (Barral et al. 2017; Huber et al. 2018; Poole & Cantrill & Utescher 2005). The climatic signal extracted from the growth rings corresponds to the existing climatic trends of this region. This study confirms that growth rings of fossilized wood can be used to reconstruct paleoclimate with a sufficient number of samples for the research.

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Platanus Neptuni island forests in the Oligocene of Serbia

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An unusually rich Oligocene plant association was found in 2007 on Mt. Fruška Gora, in Serbia, consisting of four clearly defined groups of plants: *Platanus neptuni, Arecaceae, Daphnogene* and *Cupressaceae*. These four morphotypes are clearly different from each other, which points to the assumption that they inhabited different habitats and did not compete with each other. The plants are mainly represented by leaf compression/impression in marl, but also by fallen trunks trapped in the sediment. A large number of palm leaves (*Arecaceae*) and petrified trees indicate that the fossilisation of this association took place rather quickly and under the influence of strong kinetic energy that made it possible for large and heavy palm leaves and trunks to be transported to the depositional environment. The driver of such high kinetic energy could have been a tsunami, or some other sudden natural disaster.

In the examined paleo-association, the dominant taxon is that of *Platanus neptuni* mf. *fraxinifolia*. It includes almost 50% of the discovered plants, is characterised by distinct leaf polymorphism, and appears in at least three leaf-forms. *Arecaceae* appear in two distinct leaf forms (*Phoenicites* and *Sabalites)*. While *Daphnogene* and *Cupressaceae* are mostly represented by a single leaf- forms characteristic for those morpho-taxa.

In the Oligocene, the region of today's Fruška Gora was an island, or a group of islands in the Paratethys Sea, influenced by tropical or humid subtropical climate.

This paper is the continuation of the research into the Oligocene *Platanus neptuni* forest communities that was started in 2007 (Djordjević Milutinović & Dulić, 2009):

Djordjević-Milutinović, D. & Dulić, I. (2009): Leaf polymorphism of *Platanus neptuni* mf. *fraxinifolia* (Johnson & Gilmore) Kvaček & Manchester from Oligocene deposits at Janda (Mt. Fruška Gora, Serbia), Bulletin of the Natural History Museum, 2: 7-33, Belgrade

A "cooler" Cenozoic flora from northern Thailand and its geological interpretation

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Fossil plant assemblages were discovered in the Li Basin, Lamphun Province, Thailand, within Oligocene to Miocene sediments. Over 320 specimens were collected, providing an opportunity to understand the Cenozoic flora, vegetation, and climate evolution in northern Thailand and Indochina. The flora comprises over 40 taxa, including ferns, conifers, and angiosperms, such as Fagaceae *(Quercus*, *Castanopsis*), Lauraceae (*Actinodaphne*, *Cinnamomum*, *Machilus*, etc.), Fabaceae (*Cassia*, *Albizia*, etc.), *Sequoia*, *Calophyllum*, *Syzygium*, *Ficus*, *Strychnos*, *Spondias*, *Carpinus*, *Engelhardtia*, *Bridelia*, *Ziziphus*, *Cyclosorus*, *Dryopteris*, *Carex*, *Typha*, and others. Fagaceae and Fabaceae are the most abundant and important taxa of the flora, which are pantropical in terms of floristics. The vegetation composition suggests that they originated from a tropical montane evergreen broadleaved forest.

The Coexistence Approach (CA) and Climate Leaf Analysis Multivariate Program (CLAMP) were used to quantitatively reconstruct the palaeoclimate. The results indicated a mean annual temperature (MAT) of approximately 18°C, a coldest month mean temperature (CMMT) of around 9°C, and almost 1700 mm of precipitation (MAP), indicating a humid subtropical climate.

The modern Li Basin has a typical tropical lowland monsoon climate, and the corresponding vegetation is tropical monsoon forest. However, the Oligocene-Miocene flora is similar to the modern subtropical vegetation of southern China, and the climate was cooler than the present day. In the context of the global temperature change from hot to cold in the Cenozoic era, the process of cold to hot in this region, reflected by plant fossils, may indicate a decrease in latitude, most likely due to the continuous southward movement of Sibumasu and Indochina Blocks.

Keywords: Oligocene, Miocene, Thailand, macrofossil, Indochina, palaeoclimate

Wildfire under climate and vegetation change from the Neogene of the southeastern margin of the Tibetan Plateau

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The southeastern margin of the Tibetan Plateau experienced dramatic climate and vegetation changes during the Neogene that potentially had an important impact on the regional wildfire history. Due to the joint effect of global climate cooling and regional surface uplift, temperature in the region became cooler from the Miocene to the Pliocene. As a response, vegetation changed that was featured by the contraction of warm-affinity types and the rise of temperate-affinity ones. By the Pliocene, the region witnessed a wide spectrum of vegetation, ranging from subtropical evergreen broadleaved forest in the southern part to deciduous broadleaved forest, sclerophyllous evergreen broadleaved forest, mixed coniferous forest and shrubby meadow in more northern parts. This prominent spatial variation of vegetation was chiefly related to the great altitude gradient, although latitude might also play a role. The occurrence of vegetation types such as the deciduous broadleaved forest and mixed coniferous forest would cause wildfire when climate was also appropriate. Sedimentary macroscopic charcoals suggest that wildfire came to be wide and frequent in the region during the Pliocene. To date, these wildfires are known to have occurred in deciduous broadleaved forest and mixed coniferous forest. Besides vegetation character, climate condition was also responsible for the fire occurrences. Under the influence of the Asian monsoon, the southeastern margin of the Tibetan Plateau experienced significantly dry winter and early spring during the Neogene. In the dry season, these fire-prone vegetation types would probably cause a wildfire at the presence of some ignition source. This will improve our knowledge of the vegetation-wildfire interaction from the geological time of the southeastern margin of the Tibetan Plateau.

Key words: charcoal, paleovegetation, palaeoclimate, Pliocene, wildfire

Leaf morphology variation of *Protosequoia* from the Upper Miocene in Central Japan

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Protosequoia primaria (Miki) Miki is a fossil taxon which was described based on fossil shoot, cone, and seed from the early Late Miocene (about 9.7 Ma) sediment of the Seto Porcelain Clay Formation in central Japan. This genus is characterized by its shoot which is composed only of spirally arranged scale-like leaves and distinguished from extant *Sequoia sempervirens*, which produces both scale-like and pinnate linear leaves. Here, we report variation between linear and scale-like leaves on *Protosequoia* type shoot from the type localities of the late Miocene porcelain clay formations to show that *Protosequoia* is a variation of *Sequoia*. Changes on leaf morphology from linear to scale-like in a branch accompany with the leaf epidermal changes as the stomatal orientation from parallel to slanting to a midvein and decrease of the aspect ratio of epidermal cells. This change is observed similarly in modern *Sequoia sempervirens* shoot, indicating the *Protosequoia* type shoot is within the variation of *Sequoia*, although type specimen of *Protosequoia,* with smaller leaf size and absolute dominance of scale-like leaves, exhibits feature that is distinct from *Sequoia sempervirens*. The dominance of scale-like leaves on shoot is observed in the sunny upper crown of tall trees in modern old-growth forests in California. This phenomenon is explained by the trees' response to higher water stress as they grow taller. The pedological analysis of the porcelain clay formations indicates that the paleosol was formed under a warm climate with distinct seasonal changes in rainfall. This evidence indicates that the absolute dominance of scale leaves on *Protosequoia* shoots may have been influenced by water stress resulting from seasonal rainfall changes, which were promoted by the development of the East Asian Monsoon.

The floristic differentiation of Southwest China: Insights from *Cedrelospermum* and *Ailanthus* fossils

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Northwest Yunnan–Xizang and Southeast Yunnan–West Guangxi are two regions with distinct differences in pedigree age and appearance in southwestern China. The two regions are characterized by young flora dominated by herbaceous plants and ancient flora dominated by woody plants, respectively. It is unknown how the floristic differentiation of these two regions has formed. Here we report new fossil records of *Cedrelospermum* and *Ailanthus* from the two study regions. We also review the fossil history of the two genera, particularly those in Southwest China. The fossil history of the two genera in Southwest China is as follows: *Cedrelospermum* occurred in the middle Eocene to late Oligocene of Xizang (*C. tibetica*) and the late Eocene of Southeast Yunnan (*C. asiaticum*). *Ailanthus* appeared in the middle Eocene to late Oligocene of Xizang (*A. maximus*) and the late Eocene of Southeast Yunnan (*A. confucii*). Our results show that both Northwest Yunnan–Xizang and Southeast Yunnan–West Guangxi floras grew *Cedrelospermum* and *Ailanthus* in the Paleogene, but the species are different since the late Eocene. The genus level similarity of Northwest Yunnan–Xizang and Southeast Yunnan–West Guangxi floras support the hypothesis that floristic exchanges have occurred between the two regions. However, the difference in species indicates that the two floras have separated from each other since or before the late Eocene due to environmental differentiation. The woody *Cedrelospermum* and *Ailanthus* have disappeared from Xizang, and have been replaced by a generally younger herbaceous flora. In contrast, *Ailanthus* occurs presently in Southeast Yunnan, providing evidence for the archaic nature of the flora. Our study provides fossil evidence for the similarity and differentiation of the floras of Northwest Yunnan–Xizang and Southeast Yunnan-West Guangxi in the geological past.

Identifying the climatic driver affecting the bilobate phytolith spectra of Western Ghats, India during the Holocene

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Phytoliths are opaline siliceous particles that get deposited within inter and intra cellular regions of the plants. In grasses silica short cell phytoliths (GSSCPs) are subfamily specific, so they act as one of the reliable plant proxies in deciphering the palaeoclimatic fluctuations. In Maharashtra part of the Western Ghats variation of rainfall influences the distribution of modern grasses in the region.As the entire study area is Panicoid grass dominating irrespective of the rainfall variations, BILOBATE is considered to be the dominant silicomorph. In the present study, the BILOBATES extracted from modern grasses and surface soil samplescan be classified into three categories based on their total length i.e. small BILOBATE (<15µm), medium BILOBATE (15-25µm) and long BILOBATE (> 25 µm). Principal Component Analysis (PCA) shows that frequencies of small BILOBATES (< 15 µm) increase with increase in rainfall, whereas that of long BILOBATES (> 25 µm) increases with decrease in rainfall. The phytolithspectra of 1.25 m deep Mahabaleshwar forest profile has identified three distinct phases i.e. during 11.9 ka to 8.4 ka a dry phase is noticed as reflected by the occurrence of long BILOBATES in higher frequencies, whereas between 8.4 ka to 5.3 ka a wet phase is noticed as reflected by the higher frequencies of small BILOBATES and decline in the frequencies of long and very long BILOBATES and between 5.3 ka to 1 ka- again a drier phase is inferred from increased frequencies of long BILOBATES and decreased frequencies of small BILOBATES. Thus, mean annual precipitation (MAP) is suggested to be the crucial climatic parameter affecting the BILOBATE phytolith profile in the overall phytolith spectra of the region.

Miocene heathers and possible fire-prone communities in Central Europe

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Recently studied middle Miocene deposits exposed in two open-pit lignite mines in Central Poland (Tomisławice and Lubstów) have provided a rich and taxonomically diverse collection of mesofossils. The exquisitely preserved remains, mainly disseminules, enabled detailed morphological and anatomical observations with remarkable results. One of the most interesting findings from these fossil assemblages are charcoaled flowers and vegetative parts related to modern heathers (tribe Ericeae within the Ericaceae family).

The modern Ericeae includes *Calluna*, *Daboecia*, and *Erica*, the latter having a wide geographic distribution from northern Europe to South Africa, and from the Canary Islands to western Asia and Madagascar. Although the Ericaceae has an extensive fossil record in Europe, there are only a few reports on preglacial Ericeae remains. Materials from the fossil assemblages from Tomisławice and Lubstów revealed the presence of a new fossil-genus *Maiella* (Kowalski & Fagúndez 2017), which currently represents the oldest representative of Ericeae. Preliminary observations of accompanying fossil flowers suggest that heathers in the middle Miocene of Central Poland were well diversified (presumably three were three more taxa of heathers). Further studies are needed to ascertain their biodiversity and the relationship between these fossil flowers and extant Ericeae.

Many heathers today occur in a warm and dry climate with severe summer droughts. In such areas, fire is a crucial ecological factor, and many representatives of the tribe Ericeae have developed specific adaptations to survive in fire-prone ecosystems. Abundant charcoaled flowers and the autecology of their living relatives may suggest that wildfires were probably one of the crucial factors controlling the Miocene wetland ecosystems in the Polish Lowland.

While wildfires in the European Cenozoic were well-documented, however, little is known about the past fire-prone communities. Results of our investigations on middle Miocene **heathers from Poland** enrich knowledge on the biodiversity of fire-prone communities in the Miocene of Central Europe and provide clues on weather extremes (drought) in the past.

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New fossils reveal the Paleogene establishment of relict *Craigia* (Malvaceae) in its extant range

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Whether East Asian relict plants have recently taken refuge in their extant ranges or have long been inhabitants in those areas remains uncertain due to insufficien fossil records. Here, we report well-preserved new fossil fruit valves of an East Asian relict genus, *Craigia*, from the late Eocene of Southwest China, in its extant geographic range. The front projection of these fruit valves has a vertical crease in the middle and pinnate veins, whereas their back projection possesses a stout vascular bundle in the middle separating two flask-shaped locules. Morphological comparisons suggest the placement of these fruit valves within the fossil species, *C. oregonensis*. Based on recent fossil records, *Craigia* possibly originated in the high latitudes of Northeast Asia during the Paleocene. It migrated to Southwest China by passing through Central Asia and Tibet when the climate in these areas was warm and wet during the early Paleogene. Our finding of *Craigia* fruit valves in Southwest China suggests that the genus arrived in and has inhabited its extant geographical range, at least since ~ 34 million years ago (late Eocene).

The formation and evolution of the rain shadow effect in the central Himalaya during the late Cenozoic

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The formation of the Himalaya during the Cenozoic is widely concerned in Earth science research. The strong rain shadow effect in the Himalaya leads to limited precipitation and an arid environment on the northern slope and within the Tibetan Plateau. However, when and how did the intense rain shadow effect originate and evolve? There is still no consensus. The wide distribution of the late Cenozoic lacustrine sediments on the northern slope of Himalaya provides important information about the formation and development of this most active tectonic region in the Tibetan Plateau. We focus on the late Cenozoic lacustrine sediments of the Shishapangma region in the central Himalaya through high-resolution palynological analysis to reconstruct the evolution of paleovegetation and paleoclimate. The results indicated that cedar and alpine oak forest grew in the study area during the Middle Miocene with much wetter environment, while alpine meadow, shrub and grassland developed after the late Miocene. The central Himalaya obtained a critical elevation and the rain shadow effect was enhanced after the late Miocene.

Enigmatic carpological fossils from the Neogene of Europe possibly represent the extant genus *Sideroxylon* (Sapotaceae)

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Some globose carpological remains from the Italian Pliocene showed only a few external characters, partly corresponding to those of some seeds of Sapindaceae. Interestingly, these seed characters matched those of some enigmatic European fossil carpological remains assigned to the fossil-genus *Sapindoidea* Kirchheimer. Cross-sections of the Italian specimens showed a complicated, and possibly taxonomically diagnostic internal structure, which suggested examination of the fossils with the aid of X-ray tomography, and comparison to extant specimens, in particular those of the genus *Sideroxylon* (Sapotaceae), which already showed similar cross-sections. Virtual casts and surface renderings from micro-CT scanning data revealed the 3-dimensional complexity of the internal morphological characters, that were not visible by standard reflected light microscopy. Application of the micro-CT methodology confirmed the hypothesis that the fossil seeds are similar to extant ones of *Sideroxylon* (Sapotaceae), in particular those of *S. mascatense*. No other taxa with globose, smooth seeds are known to show the same complex internal ruminate structure. Comparison with members of *Sideroxylon* from Macronesia showed consistent differences in both internal and external seed morphology, thus suggesting that the fossils are not their closest relatives, and their lineages may have diverged several million years ago.
Nowadays, *S. mascatense* is growing in arid climates of SW Asia and NE Africa. The proposed systematic affinity to *S. mascatense* of some European fossil seeds detected in humid subtropical palaeofloras suggests that, during late Cenozoic, some members of *Sideroxylon* may have developed an adaptation to the aridity that increasingly affected the Mediterranean and western Asia. The last occurrence datum for the European *Sideroxylon* is fixed by Piacenzian (ca. 3 Ma) fossils from central Italy, so that the Piacenzian/Gelasian transition is the most probable extirpation time of this genus from Europe.

Oligocene-Early Miocene (33.9-15.97 Ma) palaeoclimate reconstruction of the British Isles using a Bayesian climate model on palynological data

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The Oligocene-Early Miocene (33.9-15.97 Ma) was an interval characterised by a warmer and wetter palaeoclimate than present, thus reconstruction of deep-time palaeoclimates allow for the better understanding of climate dynamics in the context of a developing Antarctic ice sheet with pCO_2 levels like those in a warming world. Existing data suggests that in the North Atlantic, Late Oligocene sea-surface temperatures increased with corresponding declines in pCO_2 (700-300 ppm), pointing to changes in oceanic circulation at that time. The Miocene was identified as an interval of interest in the recent IPCC AR6 report as a geological analogue for middle-late 21st century anthropogenic climate change. The Oligocene-Early Miocene-age palaeoenvironmental record from the British Isles has been reconstructed at selected sites, although no attempts to reconstruct the palaeoclimate have been made thus far. Here we present the results of application of Bayesian probability-density-function-based modelling using Climate Reconstruction Software (CREST) to nearest-living relative records derived from palynological data. Results of the analysis are the first Oligocene-Early Miocene-age palaeoclimate record from the British Isles. We also present a new method of assigning Köppen-Geiger (K-G) signatures to reconstructions. Our results indicate that the Oligocene-Early Miocene palaeoclimates were just as warm, if not warmer, than present, as reconstructed K-G classifications ranged from a subtropical warm summer signal with no overall dry season (*Cfb*) to a tropical rainforest climate (*Af*), which was most prevalent in orbitally forced pulses during the Chattian. Our reconstructions show that the British Isles' precipitation regime became monsoon-driven, with a dry-winter

season, during a short interval in the Chattian before the regime reverted to a no-dry-season signal. Early Miocene-age reconstructions reconstructed no overall dry season; thus, we suggest a westerly trade wind system was established earlier than the previously anticipated Middle Miocene.

Oceanic climate enhanced development of beech-dominant forests in Japan since the Neogene

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There is a rich beech fossil record in Japan dating from the Paleogene to the Holocene, which allows for the continuous tracing of the evolutionary history of the genus and allows us to understand the environmental background that facilitated the genus to obtain a dominant state in present-day forests. In addition to the temperate climate, the oceanic climate was an important factor in controlling beech distribution and dominance in the forests in Japan. With the cooling climate, beech species began expanding their distribution in the Northern Hemisphere in the middle Eocene and appeared in Japan in the late middle Eocene. Beech species became dominant in forests in Japan during the Miocene along with the development of the oceanic climate by the opening of the Sea of Japan and with the strengthening of the monsoon. Fagus crenata appeared until the Late Pliocene and became dominant in forests in central Japan in the late Early Pleistocene coinciding with the onsetting inflow of the Tsushima Warm Current to the Sea of Japan in interglacial stages. During the full-glacial stages since the late Middle Pleistocene, the cold and dry climate caused by the strong winter monsoon limited the distribution of beeches into refugia at humid places, including the inland. During the deglaciation since ca 19 ka, the beech population began to grow and its distribution expanded, controlled by the development of the Tsushima Warm Current, as well as latitudinal and altitudinal temperature clines.

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Reconstruction of paleogeographic development coastal areas of the East Siberian shelf seas in the Neopleistocene – Holocene

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The research reveals climate change in the Pleistocene. The results obtained within the framework of the project fundamentally expanded the previously available databases. For all 29 cores studied, a comprehensive analysis of the data obtained to date was performed, which made it possible to draw preliminary conclusions about the conditions of the sedimentation environment at the last stage of the paleogeographic development of the territory. According to the analysis of acoustic-seismic materials, AU4 - AU1 deposits were studied by sampling. Horizons of AU4 - AU2, which were tested in the course of field work, represent the upper parts of the sections of the corresponding seismic sequences that have passed the subaerial stage during cooling and regressions (Middle Pleistocene, Zyryanka Cooling and LGM, respectively), and they are composed of extremely dense deposits, which led to the short length of the obtained cores. The sampled deposits of AU4 are characterize the unstable conditions of the sedimentation environment in a freshwater reservoir that had low bioproductivity, the proximity of drift sources. AU3 cores are also characterize the freshwater environment, low bioproductivity, but have a larger fine-grained composition. The cores selected in AU2 characterize an active hydrodynamic sedimentation environment, low paleosalinity of the reservoir, and stability of hydrochemical conditions. The deposits of AU1 were sampled by the largest number of soil cores, and when choosing stations according to the profiles of the AS profiles, it was possible to obtain material for studying various age sections of the deposits and, thus, to trace the development of the post-LGM transgression. This research was carried out in frame of project № 22-27-0041 of Russian Science Foundation.

Coastline and palaeoclimate of New Siberian Islands (East Siberian Sea) during Late Pleistocene according pollen data

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The East Siberian Sea is one of the least explored areas of the Russian Arctic. During marine geological expeditions by A. P. Karpinsky Russian Geological Research Institute (VSEGEI), carried out in 2018 and 2020, new data about the geological sequence and genesis of the East Siberian Sea Quaternary deposits were collected. Three bottom sediment cores were taken around New Siberian and Vilkitsky Islands and another one – at the south-east of archipelago in 150 km from Chaunskaya bay. They were studied with grain-size, geochemical, palynological, diatom analysis, and radiocarbon dating.

Late Glacial Maximum (LGM) deposits were sampled in a core (71,48158° N, 170,31736°E), remoted from the New Siberian archipelago itself. The bottom layer of the core is dated 22 147 – 22 274 cal.BP (IGANams7556). Pollen record indicate that the significant part of the core was formed in continental zone, which correlates with results of diatom analysis. Trees are absent. Shrubs are represented only by *Betula nana*. Among herbs (up to 88.9%) Poaceae (up to 30.8%), Cyperaceae (18.5%) Saxifragaceae (up to 10.8%), Asteraceae (up to 16.1%), Rosaceae, Brassicaceae (up to 7.4%) and Polygonaceae (up to 6.7%) dominate. *Woodsia*, *Sphagnum* and *Equisetum* spores were observed. Palaeoecological reconstruction characterizes cold conditions of Polar desert with poor vegetation (Nosevich, 2016). Summarizing the results of analytical studies, it can be assumed that the deposits of the lower part of core accumulated in a shallow freshwater basin near the sources of terrigenous material.

Closer to the New Siberian Islands archipelago sea bottom sediments are presented with grey sandy loam. For this layer the date 15438 - 15617 cal. BP (IGANams 8979) was obtained. Its pollen spectra contain *Betula nana* (up to 8.9%), *Alnaster* (up to 5.2%) and *Salix* (up to 7.0%), but shrubs don't exceed 18,3%. Cyperaceae (up to 20.4%), Saxifragaceae (up to 6.5%) and Chenopodiaceae (up to 5.6%) predominate. The salinity of the sediment via bromine (Br) is measured from 2.1 to 5.9‰. Taking into account the grain sizes sequence and texture of the layer it can be alleged that it was the freshwater margins with high speed flow and Polar desert conditions were in the region. Continental deposits were covered with Holocene marine grey clay. Its pollen spectra characterizes with high concentration of pollen and spores with poor grain preservation. Single *Pinus* were found. *Betula nana* accounts for up to 41.2%. Herbs range from 57.0%

to 69.5%. Poaceae dominate (up to 21.7%), Cyperaceae appear in the spectra (up to 12.0%). Asteraceae (6.1%), Ranunculaceae (4.7%) were noted, Fabaceae and Polygonaceae were seen. Dinoflagellates and algae are presented.

The New Siberia Island is surrounded with several lines of underwater hills, which were usually described as Last Glacial (Weichselian) moraine sediments (Grosswald, 1998). In fact, they are made of dense grey clay-silt without insertions, dated 12040 – 12108 cal. BP (IGANams 8977). Their pollen spectra include *Betula nana* (up to 12.5%) and *Alnaster* (up to 9.2%). Coniferous trees (up to 21.5%) are presented by *Abies*, *Tsuga* and *Larix*. *Juglans* was mentioned. Several samples of this dense layer also include grains of *Corylus* sp., *Platicaria* sp., *Pterocarya* sp., *Carya* sp. Diatoms are absent, salinity of the sediment via Br is measured at 1.4-7.7‰. These should indicate shallow freshwater lagoon sediments, which were later covered with Holocene marine deposits. However, results of pollen analysis do not correlate with the previous spectra for New Siberian Island continental sites (Anisimov, 2002) and stands out from pollen spectra of marine deposits that is why investigations are carried out further.

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Oligocene vegetation pattern of central Asia based on palaeobotanical data with using quantitative approaches

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The Eocene -Oligocene border represents a transitional time period when vegetation changed from subtropical to warm temperate vegetation following for a widespread climate cooling which affected biospheric changes as extinction of different groups of living organisms not only plants.

Paleobotanical records allow to characterize the Oligocene vegetation of Central Asia, including Kazakhstan, as deciduous warm temperate with a predominance of Pinaceae, Cupressaceae, Betulaceae, Salicaceae, Fagaceae, etc. (Averyanova et al., 2021). Rupelian vegetation still has heterogeneous appearance with subtropical elements were still present as relics to the south of the Aral Sea (Boytsova and Panova, 1973). By the Chattian (late Oligocene), the heterogeneity had smoothed out; Betulaceae and Pinaceae, which formed mixed mesophilic forests, became the main dominants here (Akhmetjev, 1993). Here we present the result of comprehensively studied Buran palaeoflora which originated from the eponymous formation of eastern Kazakhstan, it developed immediately after the Eocene-Oligocene transition (EOT). Given flora being such kind of key flora for Kazakhstan region which allow to trace the origin of warm-temperate Turgai flora type widespread by the end of the Oligocene - the beginning of the Miocene in the mid-latitudes of Eurasia and which can be considered as an ancestress of modern warm temperate vegetation type. Based on obtained original macrofossil and microfossil records various quantitative approaches have been performed. Vegetation is interpreted in terms of Plant Functional Type (PFT)-based reconstructions that allow discussing the results in the context of previous studies on coeval palaeofloras from neighboring areas. Climate parameters calculated using the Coexistence Approach (CA). It was reconstructed seasonal, from cool to moderately warm climate. Quercus and Castanea spp., dominating at the very beginning of the Rupelian, as well as Comptonia, Salicaceae, Betulaceae, were replaced at the middle of Rupelian by Carya, Cotinus with the participation of Ulmaceae and Betulaceae. The PFT method, based on data from fossil leaves, shows a local predominance of woody vegetation with 85% diversity for 5, 6, 23 and 24 PFT classes). The ecospectra of the microfloras reflecting a regional signal additionally reveal a significant diversity of conifers. To compare the vegetation pattern based on microfloras in latitudinal direction eleven palaeofloras from western Siberia, Dzungariya, northwest China and Primorye were analysed extra. The changes that took place on the territory of Kazakhstan were the result of regional biospheric restructuring associated with the retreat of the meridional Turgai Strait, which connected the tropical and Arctic latitudes and contributed to the transfer of heat to the latter. The gradual rise of the Tibetan Plateau, located to the east of the investigated area, which led to the retention of moist air masses from the southeast, played an important role in climate aridification. As a local result of these movements, there was an almost complete change of plant communities at the EOT boundary in Kazakhstan. This research was funded by RSF project № 23-27-00076.

Fungi in a Warmer World: Middle Miocene fungi and global palaeoclimates

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A lack of long-term and large-scale information on how fungi will respond to climate change is a major barrier to understanding how this important kingdom will react to 21st century anthropogenic warming. Using the Middle Miocene (16-12 Ma) as a past warm interval, the Fungi in a Warmer World project has been expanding our taxonomical, ecological and climatological knowledge of fossil fungi. Here we present the Middle Miocene fungal records from Antarctica, Slovakia, Thailand, UK and USA to demonstrate the ecological and climatological information that can be inferred from palaeomycology.

A global reconstruction of vegetation and terrestrial climate of the warm early Eocene

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The early Eocene (c. 56 - 47.8 Ma) is a key geological time interval to further our understanding of climate change and biosphere variability under high atmospheric CO_2 concentrations of more than 800 ppmv that could be already reached by the end of this century. Vegetation plays a crucial role in the global carbon cycle and climate, and future warming associated with high atmospheric CO_2 will alter modern vegetation patterns and biome distribution, consequently affecting vegetation-climate feedbacks. Here we present the most comprehensive global synthesis of vegetation and quantitative terrestrial climate estimates to date, compiled from more than 500 published palaeobotanical records, covering the Early Eocene Climatic Optimum (EECO; ca. 53-49 Ma) and early Eocene (Ypresian; 56.0-47.8 Ma). The floristic components of these palaeofloras are translated into 41 herbaceous to arboreal Plant Functional Types (PFT) and statistically grouped into palaeo-biomes. In addition, vegetation-based climate estimates are re-evaluated using Nearest Living Relative and Probability Density Function methods, to help constrain the large upper and lower limits of co-existence approach estimates. Our climate reconstructions suggest a warmer and more evenly distributed temperature across latitudes during the early Eocene, and highlight the importance of photic and hydrological seasonality as a major control of vegetation zonation in a warmer than present world. Our new vegetation reconstruction will be integrated with outputs of the global vegetation models LPJ-GUESS and BIOME4, driven by climate inputs from the Deep-Time Model Intercomparison Project (DeepMIP). We will discuss various approaches to generate data-model hybrid vegetation reconstructions that can be used as boundary conditions for future DeepMIP simulations.

Climate impact on the extermination of *Larix gmelinii* from the Japan Archipelago after the last glacial maximum

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Combinations of species distribution models (SDMs) and macrofossil analyses are practical tools for clarifying the ecological questions regarding which climatic variables affected the long-term changes of species' distributions during the Quaternary. Moreover, the recent development of paleoclimate simulations with high spatial and temporal resolutions, such as PaleoClim, has enabled researchers to project more precise species distributions. This study aimed to explore influence of climate changes after the Last Glacial Maximum (LGM; between ca. 27,000 and 19,000 years ago) on local extinctions of *Larix gmelinii* in Hokkaido, northern Japan. We constructed SDMs for the species by using the PaleoClim dataset to project potentially suitable habitats during nine time periods between the LGM and the present. Three different SDM algorithms (i.e., Maximum Entropy, Random Forest, and Boosted Regression Trees) were chosen to consider uncertainties of the model predictions, and the results were averaged to generate integrated maps for each period. The SDM results showed that when winter temperatures were approximately -35 °C, the probabilities of occurrence were the highest, whereas when temperatures increased, distribution probabilities decreased. Furthermore, when winter precipitation was below 100 mm, the probability of occurrence was the highest. The resultant suitable habitat distribution maps were overlayed with macrofossil records of the species for verification of the model results. The results of suitable habitats by the SDMs and the species' fossil records showed that *L. gmelinii* expanded after the LGM towards the northern regions of North Asia. In contrast, the species gradually retreated from Hokkaido. Our study partly supports the hypotheses that the dominant forest species changed from conifers to deciduous, broad-leaved trees after the LGM period in northern Japan.

Holocene changes of vegetation, climate and land use in Northern India based lacustrine sediments of the Manasbal lake (Kashmir valley)

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Ecosystems, rain-fed agriculture and economic prosperity of the densely populated Indian subcontinent critically depends on the amount and distribution of annual monsoonal precipitation. Given the uncertainties in future projections of Indian Summer Monsoon (ISM) and extreme events in a global warming scenario, understanding of past vegetation and climate dynamics including their underlying drivers, is crucial. Due to the scarcity of comprehensive, well-dated palaeoecological records, uncovering patterns and mechanisms of palaeoenvironmental changes in India remains a challenge.
Here we present new palaeoecological data from Manasbal Lake, Northern India, belonging to the Western Himalayas Ecoregion. Manasbal Lake (34°15’N and 74°40’E, 1580 m asl) is a marl lake situated in the Kashmir valley, bounded by the great Himalaya range in the north and the Pir Panjal range in the south. The annual precipitation ranges between ~200 and ~700 mm with contributions derived from both the mid-latitude winter westerlies and the Indian summer monsoon. Accordingly, today's valley flora has a dry-temperate character.
According to a set of radiocarbon data, the presented pollen diagram provides information on changes in regional vegetation and land use during the last approx. 12,500 years. The proportion of tree pollen varies between 30 and 70%. Over the studied period, minor fluctuations and a slightly increasing trend of the arboreal taxa towards the recent past can be observed. A continuous occurrence of mixed coniferous-deciduous forests is indicated by 10-25% Pinus accompanied by temperate deciduous trees (e.g. *Betula*, *Ulmus*, *Juglans* and *Corylus*) reaching values between 3-10%. In addition, *Quercus*, which is nearly absent from the recent vegetation, contributes 5-15% to the pollen flora. During the last millennium, higher proportions of *Platanus*, *Juglans* and *Morus* can be observed. Regular occurrences of (sub)-tropical taxa likely result from long-distant transport during the monsoonal season.
Widespread occurrences of open habitats are evidenced by abundant *Artemisia*, Poaceae and other open-ground taxa from the beginning of the Holocene. Agricultural

activity is suggested by Cerealia-type pollen and *Plantago lanceolata* type from about 4000 years BP.

In contrast to the terrestrial vegetation, larger variations in the riparian and aquatic component, in total pollen concentration as well as in geochemical proxies indicate significant changes in the sedimentation regime, lake level and in the lake (shore) habitats due to rapid climate fluctuations.

Oligocene palynoflora and palaeoenvironment from Grabówka, northern Poland

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In the Paleogene, northern Poland was a part of the NW European Tertiary Basin, where transgressive/regressive oscillations took place. The analysed samples from the Grabówka PIG-1 borehole, Kwidzyn Valley, northern Poland (from a depth of 87.70–82.50 m) yielded well-preserved terrestrial (pollen, spores, freshwater algae and fungal remains) and marine (dinoflagellate cysts) palynomorphs. In total, 165 fossil-species of sporomorphs and nearly 90 taxa of dinoflagellate cysts were recorded. The composition of the spore-pollen assemblage, including such stratigraphically important fossil-species as *Aglaoreidia cyclops*, *Boehlensipollis hohli*, *Cicatricosisporites dorogensis*, and *Cupanieidites eucalyptoides*, confirms the early Oligocene age of the strata. The sediments were accumulated in a near-shore marine environment. The presence of microsclerotia of dark septate endophytes (DSE), terrestrial fungi colonising living plant roots, in the lower part of the profile also may suggest proximity to the coastline. The basin was presumably a shallow one inhabited by *Glaphyrocysta* and *Homotryblium*, but dinoflagellate cysts that could benefit from brackish conditions surprisingly are missing. Changes in the frequency of particular palynomorph groups (dinoflagellate cysts, freshwater algae, and particular sporomorph taxa) most probably reflect mainly sea level oscillations. The results of the spore-pollen analysis indicate the presence of lush vegetation with numerous thermophilous elements (including members of the pantropical families Meliaceae and Sapotaceae as well as the subtropical-tropical families Arecaceae, Schizaeaceae, Cyatheaceae and/or Gleicheniaceae) in the neighbouring land area. The climate was subtropical and humid. The succession from Grabówka corresponds to the 5th Czempiń lignite seam group, correlated with the 5th Lusatian seam (= the Fifth Lusatian Seam Horizon) in the south-eastern territory of Germany. These strata represent an important correlation horizon for the lower Oligocene in this area.

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Contribution of fungal non-pollen palynomorphs to palaeoecological reconstructions based on pollen assemblages: a case study from the Miocene lignites from Poland

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Palynological investigations of coal-bearing deposits are crucial tool for palaeoenvironmental reconstructions of coal depositional environments. Pollen, spores, and non-pollen palynomorphs (NPPs) are a key to determine the composition and ecology of coal-forming plant communities, edaphic conditions and hydrology, their changes during the period of peat deposits formation, and accompanying climatic conditions. Fungal non-pollen palynomorphs are potentially valuable palaeoenvironmental indicators, however, pre-Quaternary fungal NPPs are rarely investigated and their potential as a source of data for palaeoecological interpretations is frequently untapped.

Palynological analysis of the middle Miocene 1st mid-Polish lignite seam from the Adamów Lignite Mine (Konin region, central Poland) revealed the presence of wetland and mesophytic vegetation. The study area was overgrown by palustrine wetland communities similar in their composition to modern pocosins. The climate was warm temperate and humid with mean annual temperature (MAT) 15.7–18.0 °C. (Worobiec et al. 2021). Remains of fungi saprophytic on decaying wood and on fallen leaves, found in lignite seam from Adamów, existed in a very humid, periodically flooded environment. Epiphyllous taxa [especially *Neomycoleptodiscus pertusus* (Dilcher) G.Worobiec] along with ascospores of *Potamomyces* sp. indicate a warm and humid climate with a high mean annual precipitation (Worobiec et al. 2022b). Similarly, palynoassemblages of the middle Miocene lignite seam from Drzewce (Konin region, central Poland) suggest that the area was overgrown by wetland communities resembling pocosins, similarly to neighbouring locality Adamów. The climate at that time was warm temperate and humid with mean annual temperature about 15.7–17.8 °C. (Worobiec et al. 2022a). The fossil fungal assemblage from Drzewce (terrestrial epiphyllous fungi, rhizosphere fungi, and aero-aquatic mitosporic fungi) indicates dense vegetation on damp, swampy soils and the presence of small, shallow-water bodies with variable water level or periodic reservoirs (Worobiec et al. 2022a).

Plant remains (sporomorphs and leaves) from KRAM-P 218 locality in the Bełchatów Lignite Mine (central Poland) suggest presence in the middle to late Miocene wetland, predominantly riparian vegetation of bottomland hardwood forest type and mesophytic communities in elevated places. The climate was warm temperate with mild winters and moderately wet with mean annual temperature of 13.5–16.5 °C (Worobiec and Szynkiewicz 2016, Worobiec and Worobiec 2016). Remains of epiphyllous fungi (especially *Neomycoleptodiscus pertusus*) point to a warm climate (Worobiec et al. 2017). From the above data it can be concluded that the results of investigations of fungal assemblages confirm the results of classical palynological analyses also completing the picture of the palaeoenvironment with data available only through the study of fungal remains. More attention to the Palaeogene and Neogene fungal NPPs is suggested considering their value as palaeoclimatic proxies.

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The mid-Pliocene Aguni Flora from Aguni-jima Island, central Ryukyu Archipelago, Japan—the earliest known evidence of subtropical forest in the Ryukyus

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The Ryukyu Archipelago (RA) is a continental archipelago located in the subtropical zone between the main island of Japan (Kyushu) and Taiwan, consisting of 160 volcanic and non-volcanic islands. It is home to many endemic plant and animal species and is characterized by a high level of biological diversity as a result of extensive changes in land configuration and climate during the Neogene period. RA is separated from the Eurasian continent by the Okinawa Trough, considered to be formed since the late Miocene (ca. 8-9 Ma), and there are two deep-water passages bordering the island chain (Kerama and Tokara Straits) since the Pliocene. This may have prevented the expansion of terrestrial organisms since the Pliocene. However, it has been impossible to determine when the subtropical forests of RA formed and when each component appeared, due to the lack of a pre-Pleistocene fossil record. Here, we report for the first time the mid-Pliocene fossil record of Aguni-jima Island, Central Ryukyus. Although taxonomic studies are still in progress, we demonstrate the similarity of this record to the modern subtropical forest and discuss the implications of this for phytogeography.

The fossil assemblage, referred to here as the Aguni Flora, was found in the southwest of Aguni-jima Island (N26°34', E127°12'), in the tuffaceous sandy mudstone or mudstone of the Fudenzaki Formation of the Aguni Group. The formation is mainly of terrestrial origin in the lower and middle parts and consists mainly of volcanic lapilli, volcanic conglomerate, lava and tuff interbedded with well laminated tuffaceous mudstone. The formation continues to change into cross-laminated tuffaceous sandstone with molluscan shells at the top. Plant fossils, mainly leaf remains, were collected from the laminated mudstone in the middle of the formation. The age of the formation is determined by U-Pb analysis of zircon grains from the underlying volcanic lapilli (AGD-03: 3.5±0.1 Ma) and the overlying tuff (AGD-01: 3.6±0.1 Ma). These ages are consistent with the calcareous nannofossil biostratigraphy of the upper marine deposits (CN12a: 3.6-2.8 Ma).

The Aguni flora consists of various angiosperm leaves and rare conifers. We have identified 71 leaf types, most of which are thick and entire-margined (about 70.4%) and could not be identified even to the genus level. The commonest leaves are *Syzygium* (*S.* cf. *buxifolia*) and *Elaeagnus* (*E.* cf. *umbellata*). The most diverse group is the legume family. It contains eight different types. The next largest groups are lauraceous and fagaceous. Each has seven types. Most of these fossil leaves have a similarity with the native species in the RA and southwest Japan, such as *Quercus* (*Cyclobalanopsis*) *miyagii*, *Cinnamomum doederleinii*, *C. yabunikkei*, while there are also some genera that do not exist in the present RA. They include *Keteleeria*, *Taiwania*, *Casuarina*, *Liquidambar*, *Gleditsia*, etc. It is clear that the Aguni flora represents a subtropical forest, close to its modern counterpart in RA, due to the abundance of oaks and laurels with Japanese chinquapin, figs and various evergreen elements. This new evidence clearly revises previous discussions that the subtropical forest of RA began sometime in the Pleistocene. We cannot say when it began, but we can at least provide evidence that a similar subtropical forest was already in existence during the middle Pliocene, which is just before the Pliocene climate optimum (3.3-3.0 Ma). It also contributes greatly to future phylogeographic and phytogeographic studies of each taxon.

Reconstruction of the wetland forests at the Pliocene-Pleistocene boundary based on fossil forests around Paleo-Lake Biwa, central Japan

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Wetland forests dominated by *Metasequoia* and *Glyptostrobus* at the Pliocene-Pleistocene boundary (2.6Ma) were reconstructed from in situ woods, fruits, seeds, and pollen assemblages from Lacustrine deposits of the Kobiwako Group, exposed in the Yasu River, Konan City, Shiga Prefecture, central Japan. At the Asaguni site in the river bed, the fossil forest, as evidenced by species composition of stumps, consisted of the deciduous conifers *Metasequoia* and *Glyptostrobus*, with the deciduous broadleaf trees *Salix*, *Fraxinus*, and *Cornus* (Yamakawa et al., 2017). Sedimentological assessments and plant macrofossil assemblages in the fossil forest beds suggest habitat partitioning of *Metasequoia* and *Glyptostrobus*, i.e. *Glyptostrobus* dominant stands grew in a water-logged back marsh, and *Metasequoia* dominant stands in drier environments. At the Yoshinaga site, consisting of a 20 m wide area about 70 m downstream from the Kosai Ohashi Bridge, a fossil forest consisting of 27 woods, including three fallen trees and 15 standing tree stumps, were found. Nine were identified as *Metasequoia* and Cupressaceae (other than *Metasequoia* and *Glyptostrobus*) based on the characteristics of wood anatomy. Diameter ranges from 10 cm to about 120 cm at the smallest, and most are 30-40 cm and 60-80 cm. Many fossil cones of *Metasequoia* are present in the upper layer of fossil stump inclusion deposits. This fossil forest consisted of Cupressaceae conifers, including *Metasequoia*, and it was different from the Asaguni site. The wetland forests dominated by Cupressaceae formed on the flood plain around Paleo-Lake Biwa, central Japan at the Pliocene-Pleistocene boundary.

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Late Cenozoic crustal deformation and paleoclimate transition on the southeastern edge of the Tibet Plateau

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The southeastern Tibet Plateau(TP), including northwest Yunnan and western Sichuan, is an important part of the TP. The formation and evolution of its crustal deformation and topography are closely related to the formation and evolution of the TP. Many scientists have proposed too many dynamic mechanisms for its formation. Two genetic models, two of which are recognized by most scientists, are tectonic extrusion or plate escape (Tapponnier et al., 1982) and crustal channel flow (Royden et al., 1997; Schoenbohm et al., 2006; Royden et al. al., 2008). The former believes that the ma-in driving force comes from the collision of the Cenozoic Indian plate and the Eurasian plate, resulting in the shortening and thickening of the crust in the north-south direction. After reaching a certain thickness, the blocks inside the plateau will be extru-ded laterally to form the current structural and geomorphic pattern. The latter believes that the crustal deformation and uplift of the Hengduan Mountains are due to the thickening of the plateau crust, and the melting of the lower crustal material flows to the surrounding areas, resulting in distributed deformation and surface uplift of the Hengduan Mountains. There is also a view that the uplift of the Hengduan Mountains was caused by the continuous extrusion of the Cenozoic Indian plate and the intraco-ntinental subduction between the Lhasa, Qiangtang, and Songpan-Garze blocks (Horton et al., 2002; Spurlin et al. al., 2005; Ding et al., 2007). The uplift of the TP is the main factor driving the climate transition from arid to humid in the middle and late Cenozoic in t-he southeastern margin of the plateau.

During the process of plateau uplift and block extrusion, due to the different degrees of shearing, strike-slip, and pull-apart effects of block boundary faults, faulted basins of various sizes are often formed along these fault zones, and the deposits in the basins are faithful Historical and environmental change information on fault activity is recorded. In recent years, we have carried out a large number of studies on the stratigraphy, sedimentology, stratigraphy chronology and paleobotany of such basins in this area. The research shows that the strata of the Middle and Late Cenozoic in the southeastern part of the TP are regular.

In terms of space, the Late Cenozoic sediments in the southeastern TPcan be divided into three components. The first is the sediments distributed along the Red River fault zone and its side during the middle-late Eocene to the Oligocene. They were formed in the shear-pull action of the western boundary of the large-scale extrusion of the Indochina block, such as The Honghe Basin, Jianchuan Basin, Luhe Basin, Wenshan Basin, etc.; the second is distributed in a series of north-south basins along the Xiaojiang fault system, which formed a sinistral strike-slip with the XianshuiheXiaojiang fault system, recording the Sino-Singapore The southeast extrusion process of the Sichuan-Yunnan diamond-shaped block from the middle and late Pliocene to the Pliocene, such as the Yuanmou Basin, Kunming Basin, Xiaolongtan Basin, etc.; the third is a series of NE-trending and depositions in north-north-east rift basins, which record the dextral strike-slip pull-apartment formed by the clockwise rotation of the Indosinian block during the middle and late Miocene to the Pliocene, such as Yingjiang Basin, Tengchong Basin, Baoshan Basin basin etc.

From the perspective of time, the Cenozoic strata in the southeast of the TP can be divided into two parts. The lower part is the red river-lacustrine deposits from the Paleocene to the early Eocene, representing dry and hot climate conditions, with sparse vegetation and common salts, etc. Evaporation deposits; the upper part is the river-lake deposits representing warm and humid climate from the middle and late Eocene to the Pliocene, rich in plant fossils, often with coal, diatomaceous earth and other minerals.

It is generally believed that the dry-wet climate transition in the late Cenozoic is due to the cooling of the global climate. The climate changes shown in the above sedimentary records are highly consistent with the crustal deformation and uplift stages of the plateau. These phenomena may indicate that the climate transition in the southeastern TP is closely related to the uplift of the plateau. The formation process of the TP controls the development and evolution of the topography and land-forms in the southeast of the plateau. Changes in topography and land forms lead to changes in the climate and environment, which in turn promotes the formation and evolution of biodiversity. The large-scale extrusion of blocks in the southeast of the TP in the middle and late Eocene was the result of thickening and uplifting of the plateau's crust to its current height. With the large-scale uplift of the plateau, the East Asian and Indian monsoons were gradually established, which fundamentally changed the TP. Due to the climate in the southeast, the hot and dry climate originally controlled by the planetary wind system has transformed into a muggy climate suitable for vegetation growth due to the advent of the monsoon.

Keywords: the Southeastern Margin of the Tibet Plateau; Plateau Uplift; Crustal Deformation; Climate Transition

Cenozoic plants from Tibet: an extraordinary decade of discovery, understanding and significance

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Plant fossils play an important role in understanding landscape evolution across the Tibetan Region, as well as plant diversity across wider eastern Asia. Within the last decade or so, paleobotanical investigations within the Tibet Region have led to a paradigm shift in our understanding of how the present plateau formed and how this affected the regional climate and biota. This is because: 1) Numerous new taxa have been reported. Of all the Cenozoic records of new plant fossil species reported from the Tibet (Xizang) Autonomous Region 46 out of 63 (73%) were documented after 2010. Among these, many represent the earliest records from Asia, or in some cases worldwide, at the genus or family level. 2) These fossils show that during the Paleogene, the region now occupied by the Tibetan Plateau was a globally significant floristic exchange hub. Based on paleobiogeographic studies, grounded by fossil evidence, thereare four models of regional floristic migration and exchange, i.e., into Tibet, out of Tibet, out of India and into/out of Africa. 3) Plant fossils evidence the asynchronous formation histories for different parts of the Tibetan Plateau. During most of the Paleogene, there was a wide east-west trending valley with a subtropical climate in central Tibet bounded by high (> 4 km) mountain systems, but that by the early Oligocene the modern high plateau had begun to form by the rise of the valley floor. Paleoelevation reconstructions using radiometrically-dated plant fossil assemblages in southeastern Tibet show that by the earliest Oligocene southeastern Tibet (including the Hengduan Mountains) had reached its present elevation. 4) The coevolution between vegetation, landform and paleoenvironment is evidenced by fossil records from what is now the central Tibetan Plateau. From the Paleocene to

Pliocene, plant diversity transformed from that of tropical, to subtropical forests, through warm to cool temperate woodland and eventually to deciduous shrubland in response to landscape evolution from a seasonally humid lowland valley, to a high and dry plateau. 5) Advanced multidisciplinary technologies and novel ideas applied to paleobotanical material and paleoenvironmental reconstructions, e.g., fluorescence microscopy and paleoclimatic models have been essential for interpreting Cenozoic floras on the Tibetan Region. However, despite significant progress investigating Cenozoic floras of the Tibetan Region, fossil records across this large region remain sparse, and for better understanding of regional ecosystem dynamics and management more paleobotanical discoveries and multidisciplinary studies are required.

Keywords: Tibetan Plateau, Cenozoic, paleobotany, flora, central valley, biodiversity

Excursion to Mt. Takao, west Tokyo (Saturday, September 2)

7:50 Gather at the ticket office in front of the entrance gate of JR Matsudo Station.
Change trains from the Joban Line to the Yamanote Line at **Nippori Station**.
8:45 Arrival at Shinjuku Station
9:00 Depart from **Shinjuku Station** via Keio Express.
9:40 Arrive at **Takaosan-guchi Station** - Kiyotaki Cable Railway Station - cable railway.
10:30 Reach **Takaosan Cable Railway Station** - walk through a forest of *Fagus japonica* mixed with *Abies firma* and *Cyclobalanopsis acuta* on the northern slope of Mt. Takao; a ravine forest of *Zelkova serrata*, *Cercidiphyllum japonicum*, *Euptelea polyandra*, *Alangium platanifolium*, and *Sinomenium acutum* around a bridge.
12:00 Visit Yakuo-in Temple.
13:00 Depart from **Takaosan Cable Railway Station** - cable railway - Kiyotaki Cable Railway Station.
14:00 Have lunch at Biwaya Seiryu-tei.
15:00 Explore Takao 599 Museum.
16:10 Depart from **Takaosan-guchi Station.**
17:20 Arrive at Shinjuku Station (with a partial break-up)
18:10 Arrive at Matsudo Station.

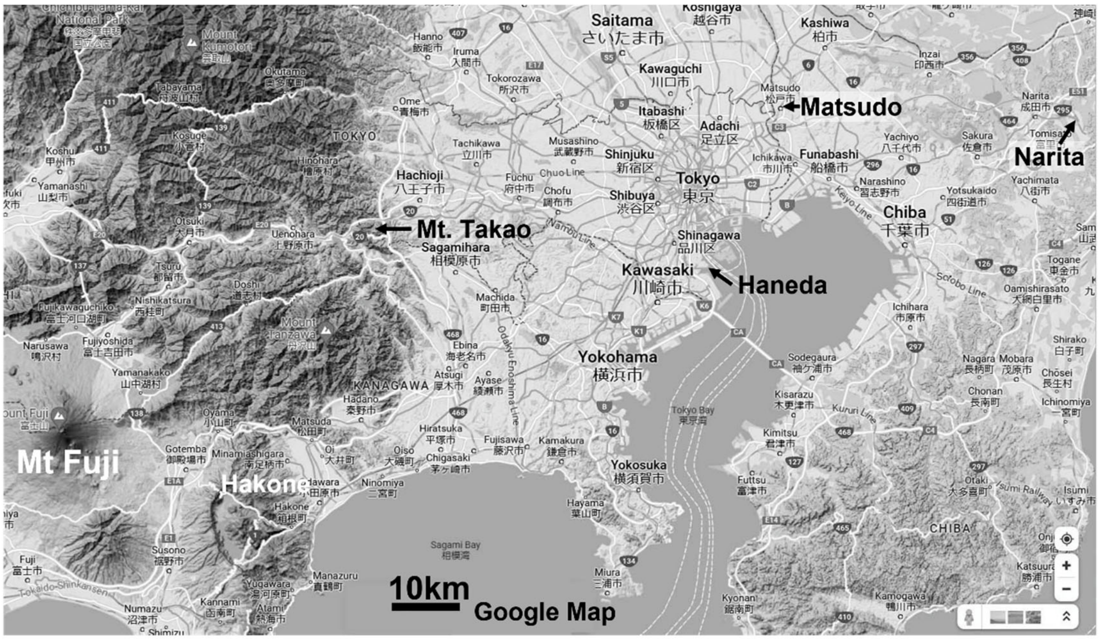

Fig. 1. Position of Mt. Takao

Table 1. Climate at alt. 470 m a.s.l. in Mt. Takao
Climatic normal between 1971 and 2000. 1km mesh data from JMA (2000).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°C)	0.6	1.3	4.8	10.2	14.8	18.2	21.7	22.6	19	13.3	8	3	11.5
Precipitation (mm)	47.9	61	108	125	112	176	172	231	264	166	96	35	1594

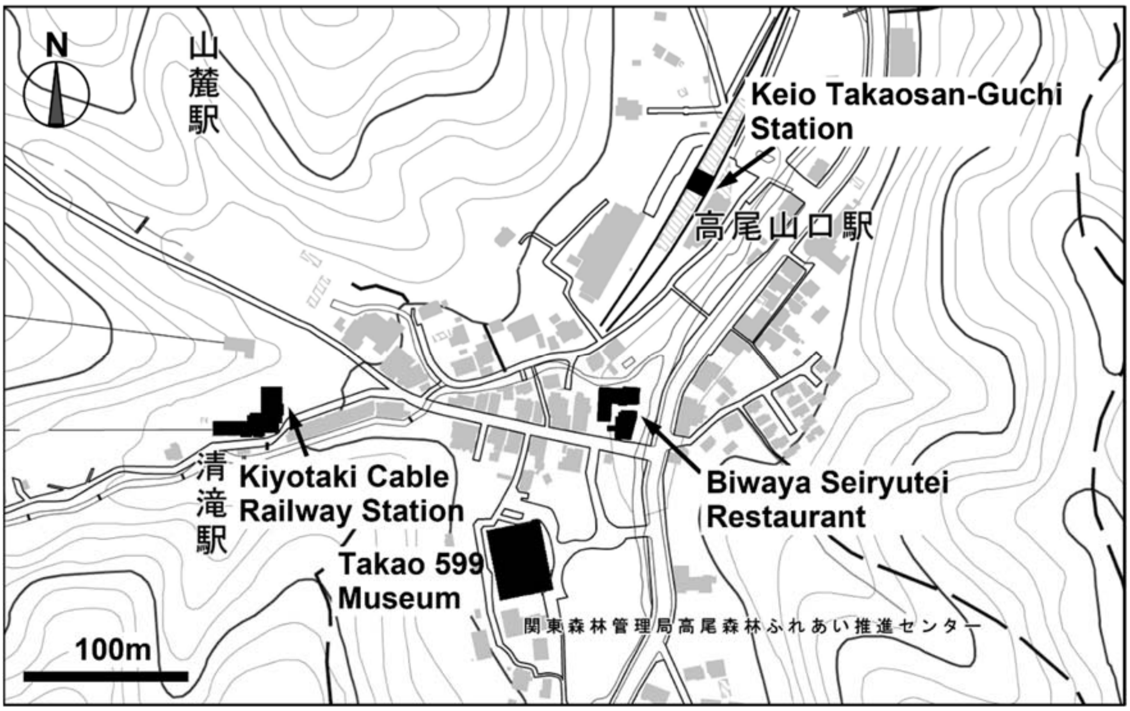

Fig. 2. Map of the base of Mt. Takao

(Made using topographic map of the Geospatial Information Authority of Japan)

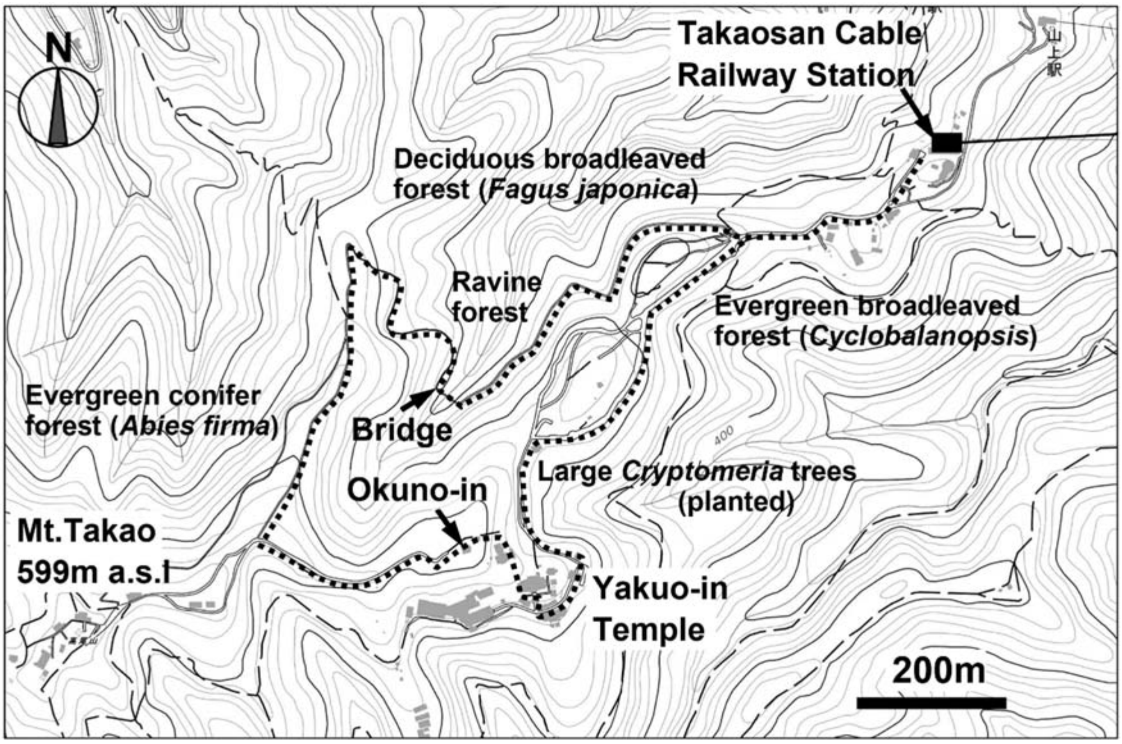

Fig. 3. Map of Mt. Takao

The counter interval is 10 m. Dotted line: planned walking route.

(Made using topographic map of the Geospatial Information Authority of Japan)

Forest vegetation in Mt. Takao

Arata Momohara

The forests in and around Mt. Takao (N35º37'30.1", E139º14'36.8", alt. 599.2m) have been preserved as part of the Yakuo-in Temple's land. The temple is believed to have been built in AD 744, with its oldest structure, Okuno-in, dating back to the early 17 century. The natural forest on Mt. Takao can be classified into four types based on research by Hayashi et al. (1966): *Abies firma* forest, *Fagus* forest, *Quercus* (*Cyclobalanopsis*) forest, and *Pinus densiflora* forest. Among these, the *Pinus densiflora* forest prevalent lower on the mountain has almost disappeared for the past several decades because of forest succession and disease damage. *Abies firma* forest, although currently dominated by evergreen *Quercus acuta*, have covered extensive areas on ridges and slopes according to Hayashi et al. (1966). *Fagus* forest dominated by *Fagus japonica* is located on the northern slope of Mt. Takao. Evergreen broadleaved forest dominated by evergreen *Quercus* (*Cyclobalanopsis*) is primarily distributed on the southern slopes of the mountain and at lower altitude on the eastern slope.

Artificial forests are mainly distributed on the foot of the mountain and consists of plantations of *Cryptomeria japonica, Chamaecyparis obtusa*, and *Pinus densiflora.* The large *Cryptomeria* trees in and around the Yakuo-in Temple were planted by the temple's supporters. Most of *Cercidiphyllum japonicum* trees found on the southern slope of the mountain are also planted population.

The elevation of the natural forest on Mt. Takao ranges from about 350m to 600m and the uppermost part represents a transitional zone between warm temperate evergreen broadleaved forest and cool temperate deciduous broadleaved forest. The warm temperate evergreen broadleaved forest is dominated by *Cyclobalanopsis* spp., *Castanopsis sieboldii*, *Machilus thunbergii* and the other Lauraceae around Tokyo. The cool temperate deciduous broadleaved forest is dominated by *Fagus crenata* and *Quercus crispula* (Kira, 1991). The forests in the transitional zone between warm and cool temperate zones in eastern Japan comprise species such as *Abies firma*, *Tsuga sieboldii, Pinus densiflora, Fagus japonica, Quercus serrata*, *Castanea crenata, Carpinus laxiflora* etc. (Nozaki and Okutomi, 1990). These forests are characterized by a high diversity of forest trees that blend both cool temperate and warm temperate elements.

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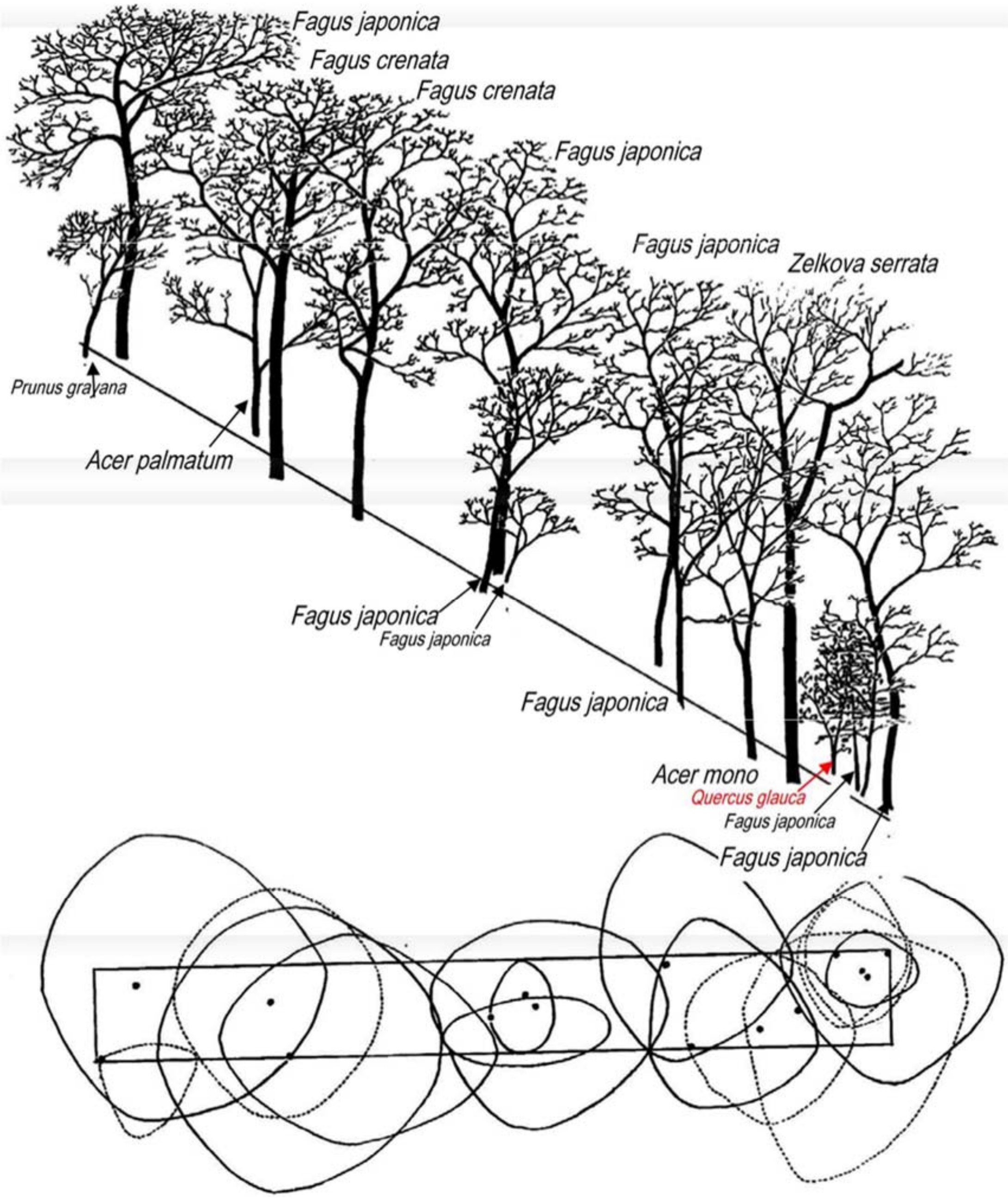

Fig. 4. A representative profile of a *Fagus* forest, comprising *F. japonica and F. crenata,* observed along a 5m × 50m transect at an altitude of 509m (modified from Hayashi et al., 1966).

Table. 2 Height class distribution of trees along the transect of the *Fagus* forest shown in Fig. 4 (Hayashi et al., 1966)

樹種 Species		樹高 (m) Height 5～10	10～15	15～20	20～25	25～30	計 Total
ブナ	*Fagus crenata*				2		2
イヌブナ	*Fagus japonica*	1	2	1	4		8
ケヤキ	*Zelkova serrata*					1	1
エンコウカエデ	*Acer mono* var. *marmoratum* f. *dissectum*			1			1
イロハモミジ	*Acer palmatum* var. *palmatum*	1		1			1
アカガシ	*Quercus acuta*	1					1
カヤ	*Torreya nucifera*	1					1
ウワミズザクラ	*Prunus grayana*						1

Table. 3 Understory plants in the transect shown in Fig. 4 (Hayashi *et al*., 1966) Cover degree 5, 75～100%; 4, 51～75%; 3, 26～50%; 2, 11～25%; 1, 1～10%; +, less than 1%.

階層 Layer	種類 Species		被度 Cover degree
shrub layer	アオキ	*Aucuba japonica*	5
	コバノガマズミ	*Viburnum erosum* var. *punctatum*	1
	アカガシ	*Quercus acuta*	1
	モミ	*Abies firma*	1
	ムラサキシキブ	*Callicarpa japonica*	1
	キブシ	*Stachyurus praecox*	+
	ガマズミ	*Viburnum dilatatum*	+
	ハナイカダ	*Helwingia japonica*	+
	ヒイラギ	*Osmanthus ilicifolius*	+
	アオハダ	*Ilex macropoda*	+
	シロダモ	*Neolitsea sericea*	+
	シラキ	*Sapium japonicum*	+
herb layer	アオキ	*Aucuba japonica*	2
	ミヤマシキミ	*Skimmia japonica*	2
	オオイトスゲ	*Carex sachalinensis* var. *alterniflora*	+
	カンアオイ	*Asarum nipponicum*	+
	テイカカズラ	*Trachelospermum asiaticum*	+
	モミ	*Abies firma*	+
	ヒイラギ	*Osmanthus ilicifolius*	+
	ジャノヒゲ	*Ophiopogon japonica*	+
	オオイトスゲ	*Carex sachalinensis* var. *sericea*	+
	アオハダ	*Ilex macropoda*	+
liana	キヅタ	*Hedera rhombea*	+
	キジョラン	*Narsdenia tomentosa*	+
	テイカカズラ	*Trachelospermum asiaticum*	+