(SS14) The evolutionary history of conifers that are now endemic to Asia

Date: August 27
Place: Room 5233 (oral)
Organizers: Atsushi Yabe & Ben LePage
Contact email address: a.yabe@dinosaur.pref.fukui.jp
Purpose: Most of the conifer genera that are now endemic to Asia were once distributed widely across the different continents in the Northern Hemisphere during the Quaternary, "Tertiary," and even Cretaceous. Despite the large amount of fossils that have so far been described, the evolutionary history of these paleoendemics, biogeographic dispersal patterns, and habitats of these early representatives are still not well understood. This symposium is intended to synthesize the current advances in the study of these conifers that are now endemic to Asia to better understand their evolutionary history. The symposium will include systematic relationships, ecology, phytogeography, and any other topics related to these conifers.

Oral Presentation

Aug. 27 [AM2] Room: 5233

10:50-10:55 **[Opening address]** SS14-O01

Atsushi Yabe

Chair: Hong Yang

10:55-11:30 **[Keynote] Cenozoic floral change in East Asia: A phytogeographic perspective** SS14-O02 (536)

Kazuhiko Uemura

11:30-11:50 **The evolutionary history of Asian Taxodiaceae and Pinaceae** SS14-O03 (274)

Ben A. LePage

11:50-12:10 **Cenozoic fossil records of Asian "endemic" conifers in Japan and their implications for phytogeography** SS14-O04 (581)

Atsushi Yabe

Aug. 27 [PM2] Room: 5233

Chair: Ben LePage

14:30-14:50 **Biogeography of endemic and near-endemic podocarps in Asia** SS14-O05 (163)

Paul J. Grote

14:50-15:10 **Paleocene coniferous remains from Northeast Japan** SS14-O06 (199)

Junji Horiuchi

15:10-15:30 **Miocene fossil forest and permineralized plants from Shimokawa, Hokkaido, Japan** SS14-O07 (319)

Midori Matsumoto, Kousuke Kashiwabara, Yohei Yasukuni, Kazuo Terada

15:30-15:50 **Miocene *Metasequoia* from Yunnan, southwest China and its biological implications** SS14-O08 (556)

Li Wang, Zhe-Kun Zhou, Yao-Wu Xing, Tao Su, Frédéric MB Jacques, Yu-Sheng (Christopher) Liu

Aug. 27 [PM3] Room: 5233

Chair: Atsushi Yabe

16:20-16:40 **Palaeoecology of fossil forests dominated by *Metasequoia* and *Glyptostrobus* in the Plio-Pleistocene Kobiwako Group, Central Japan** SS14-O09 (585)

Chiyomi Yamakawa, Arata Momohara, Takeshi Saito

16:40-17:00 **Variations of leaf stomatal frequencies complicate the reconstruction of ancient atmospheric CO_2 concentrations using fossil *Metasequoia* leaf cuticle** SS14-O10 (273)

Qin Leng, Li Wang, Hong Yang

17:00-17:20 **How decay and diagenesis influence stable carbon isotope signals in plant fossils? Asian paleoendemic conifers as an example** SS14-O11 (588)

Hong Yang, Qin Leng, Weiguo Liu, Neal S. Gupta

17:20-17:40 **The endemic conifers of Asia: Comparison and analysis** SS14-O12 (303)

Jinshuang Ma

SS14-O02 (536)

Cenozoic floral change in East Asia: A phytogeographic perspective

Kazuhiko Uemura

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Cenozoic megafossil floras in Japan and its adjacent areas are well-constrained in space and in time, and provide a basis for interpreting floral change in East Asia. Notably these floras grew under a humid climate, as is the case in the present east marginal areas of Eurasia. Paleocene floras from Bureja and Kuji anomalously consist of many broad-leaved deciduous taxa, such as platanoids, trochodendroids, and betulaceous genera. The middle Eocene was a major period of coal accumulation in East Asia and the floras are characterized by broad-leaved evergreen and deciduous taxa, with common associations of ferns, palms, and deciduous conifers. Subtropical and thermophilic taxa are also common. Late Eocene and Oligocene floras are known from Kitami, Kobe, Sasebo, and many localities in Primorye and North Korea, some of which were called as "*Engelhardia*" floras. Although these floras include a few middle Eocene relicts, the composition consists mainly of modernized, broad-leaved deciduous taxa, such as *Alnus*, *Betula*, *Carpinus*, *Quercus*, *Fagus*, *Ulmus*, and *Acer.* Pinaceous conifers are also common. During the Neogene, three major floral types are recognized in Japan. The Neogene thermal maximum in East Asia has been recorded around 16 Ma, namely during the late early to earliest middle Miocene. Before this warm interval, the early early Miocene floras are characterized by diverse broad-leaved deciduous and coniferous taxa. In contrast, the late early to earliest middle Miocene floras include many broad-leaved evergreen taxa, such as *Quercus* (*Cyclobalanopsis*), *Cinnamomum*, "*Machilus*", and *Ilex*, together with some southern conifers. During the late middle Miocene to Pliocene, broad-leaved deciduous taxa become abundant again, and are often dominated by *Fagus* species. The modern East Asian conifers, such as *Cunninghamia*, *Cryptomeria*, *Glyptostrobus*, *Metasequoia*, *Pseudolarix*, *Sciadopitys*, and *Taiwania* that were so prevalent during the Cretaceous and Tertiary of

North America, Europe, and Asia are clearly relics with significantly restricted distributions. The mesic to humid climate in East Asia throughout the Cenozoic may have played an important role in the survival of these conifers.

Keywords: East Asian endemic conifer, paleoclimate, megafossil flora, Neogene, Paleogene.

SS14-O03 (274)
The evolutionary history of Asian Taxodiaceae and Pinaceae

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Many genera of the Taxodiaceae are well represented in Early Cretaceous to Pleistocene deposits in the middle to high latitudes of North America and Eurasia. Exchange of these elements between Asia and North America occurred across the Spitsbergen and Beringian corridors, which were functional during the Early Cretaceous, while exchange between North America and Europe occurred through the North Atlantic land bridges that were functional during the early Tertiary. The distribution patterns of genera such as *Metasequoia*, *Glyptostrobus*, and *Taiwania* indicates that these genera grew and reproduced under a diverse range of climatic and environmental conditions throughout geologic time, including the cold and unique lighting conditions of the polar latitudes. Although some representatives of the Pinaceae appear as early as the Late Jurassic and Early Cretaceous, they were rare components over the landscale and most of the genera first appear in the high-latitude and high-altitude regions of North America during the early Tertiary. Increasing global aridity and cooling, as well as landscape stabilization together with increasing competition for resources and habitat by the Pinaceae, appear to have forced the Taxodiaceae out of North America, Europe, and most of Asia during the Miocene and Pliocene. In addition, nutrient acquisition through mycorrhizal associations corresponds to late Tertiary global cooling and the turnover of the Taxodiaceae-dominated to Pinaceae-dominated floras. Japan has a rich history of Taxodiaceae during the Tertiary, with seven genera identified in the fossil record. Of these only *Cryptomeria* remains as a constituent of the modern flora, while five are endemic to China and one to North America. Details of the taxonomic and biogeographic history of representatives of both families are examined.

Keywords: China, Cretaceous, Eurasia, Japan, land bridges.

SS14-O04 (581)
Cenozoic fossil records of Asian "endemic" conifers in Japan and their implications for phytogeography

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There is nearly complete Cenozoic plant-bearing succession recognized in Japan, except for the Paleocene and lower Eocene period. They provide important data to help understand the history of the vegetation and climate. The known endemic conifers in East Asia include 12 genera

(*Cephalotaxus* (Cephalotaxaceae), *Thujopsis*, *Cryptomeria*, *Cunninghamia*, *Glyptostrobus*, *Metasequoia*, *Taiwania* (Cupressaceae), *Sciadopitys* (Sciadopityaceae), *Cathaya*, *Nothotsuga*, *Keteleeria*, *Pseudolarix* (Pinaceae)), among which 10 have been recognized in macrofossil data in Japan and one of two other genera (*Cathaya*) was recently reported based on pollen grains. The most diverse fossil records are found within *Metasequoia* and *Glyptostrobus*. They were the main constituents of the swamp floras. Although *Taxodium* is present in East Asia during the Paleogene is became extinct at the end of the Oligocene, while *Metasequoia* and *Glyptostrobus* flourished until the end of the Pleistocene. On the other hand, *Cryptomeria,* a conifer endemic to Japan, was once more widespread and extended into Europe. The genus became common in Japan during the middle Miocene, when the distribution of *Metasequoia* and *Glyptostrobus* began to shrink. *Cryptomeria* became dominant during the last glacial–interglacial cycle. Although *Metasequoia* and *Glyptostrobus* were the dominant constituents in the swamp forests, other conifer genera such as *Cunninghamia*, *Taiwania*, *Sciadopitys,* and *Pseudotsuga* were present in Japan as well as some of the late Tertiary European floras. *Sciadopitys* and the most elements of Pinaceae appeared in fossil record following the Oligocene climate deterioration, although there are some ambiguous reports of these genera in the Cretaceous. Stratigraphic succession after the formation of the Sea of Japan during the early to middle Miocene, contains various temperate conifers and angiosperms. Endemic conifers in East Asia changed their abundance independently in response to the change in climate as well as topography. Recent molecular analyses infer that the Japanese Islands might have been a corridor for the expansion of some conifer genera to Eurasia during the Quaternary.

Keywords: East Asia, endemic conifers, paleobotany, phytogeography.

SS14-O05 (163)

Biogeography of endemic and near-endemic podocarps in Asia

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The conifer family Podocarpaceae consists of 18 extant genera, of which 8 occur in Asia, including Malesia. Of these genera, several were once much more widespread, as indicated by the fossil record, but are currently endemic or nearly endemic to Asia. *Dacrydium* or *Dacrydium*-like pollen has been reported from the late Cretaceous of the Antarctic Peninsula and southern Australia. Macrofossils are known from the Eocene to Miocene in Australia, and pollen, from the Paleocene to Pliocene. Pollen of this genus has also been reported from the Pliocene of New Guinea and the late Miocene to Pliocene of Vietnam. Pollen similar to *Dacrydium* has also been described from several Miocene sites in northern Thailand and an Oligocene-Miocene core in southern Thailand. Charcoalified wood from the Oligocene or early Miocene of northern Thailand is similar to wood of extant *Dacrydium*. Plants of *Dacrydium* may have migrated to Asia by long distance dispersal from Gondwana. The genus is currently found in Asia from Myanmar and southern China to New Guinea, western Pacific islands, and New Zealand. Pollen showing affinity to *Dacrycarpus* has been reported from the late Cretaceous of the Antarctic Peninsula, southeastern Australia, and New Zealand. In addition, macrofossils of *Dacrydium* are known from Eocene deposits in southern South America, from the Eocene to Miocene of Australia, and the Oligocene to Miocene of New Zealand. Based on pollen, this genus lasted until the Miocene in southern South America and the Pleistocene in Australia. Pollen has also been recorded from the Miocene of Borneo and the Pliocene of Vietnam. Migration of this genus into Asia may have occurred with the collision of the Australian plate with the Eurasian continent. *Dacrycarpus* currently occurs from Myanmar to China to New Guinea, as well as in New Caledonia, Fiji, and New Zealand. The extinction of *Dacrydium* from Australia and of *Dacrycarpus* from South America and Australia may have been related to the cooling and the increased aridity that occurred in these areas during the Tertiary.

Keywords: Asia, biogeography, *Dacrycarpus*, *Dacrydium*, Podocarpaceae.

SS14-O06 (199)

Paleocene coniferous remains from Northeast Japan

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Information on Paleocene vegetation in Japan is obscure. The Minato Formation in Iwate Prefecture, Northeast Japan was formerly considered to be Eocene to Oligocene in age, but palynological study by Horiuchi and recent fission-track dating study revealed the formation to be Paleocene in age. Dicotyledonous angiosperms are the main components in most of the stratigraphic horizons and localities but a conifer dominated horizon is also recognized. Many of the angiosperm genera, and some of the species from the formation are also known from North America, Greenland, Scotland, Xinjiang, and Kamchatka. In addition to these angiosperms, gymnosperms including the Ginkgoaceae (*Ginkgo*), Pseudotorelliaceae (*Pseudotorellia*), Zamiaceae (*Dioonopsis*) and a rich conifer flora including Pinaceae (*Pseudolarix*, cf. *Pseudotsuga*), Cupressaceae (*sense lato*, *Chamaecyparis, Cupressinocladus, Thuja, Thujopsis, Cunninghamia, Glyptostrobus, Metasequoia, Sequoia, Taxodium*), Cephalotaxaceae (*Cephalotaxus*), Taxaceae (cf. *Taxus*) and conifers of uncertain affinity are also recognized based mainly on cuticular analysis with additional studies on reproductive organs. Beside the megafossils, pollen grains belonging to Pinaceae, Podocarpaceae, Cupressaceae (*sense lato*) and Sciadopityaceae are recognized from the Minato Formation. Among the conifers, *Pseudolarix, Cunninghamia, Glyptostrobus, Metasequoia, Thujopsis,* and *Cephalotaxus* are now endemic to East Asia and *Sequoia* and *Taxodium* are now endemic to North America. *Chamaecyparis*, *Thuja*, *Pseudotsuga* and *Taxus* are present in both regions. The discovery of these genera from the Paleocene of Japan adds further to our understanding of the evolutionary history and paleophytogeography of these conifers during the Cenozoic.

Keywords: Cephalotaxaceae, Cupressaceae (*sense lato*), cuticular analysis, Pinaceae, Taxaceae.

SS14-O07 (319)

Miocene fossil forest and permineralized plants from Shimokawa, Hokkaido, Japan

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The middle Miocene Mosanru Formation (ca.12 Ma) is exposed at Shimokawa, northern Hokkaido, Japan and contains permineralized *in situ* stumps and logs, and other macrofossils. The Mosanru Formation is composed of volcanic and sedimentary rocks and is sub-divided into lower and upper parts based on lithology and sedimentary facies. The lower part is mainly exposed in the Nayoro River in the eastern part of Shimokawa and contains basal conglomerates, volcanic tuff, and

sedimentary rocks deposited in terrestrial floodplain and fluvial environments. Exposures where the *in situ* stumps are preserved reveal a sequence of six fining-upward units that are each capped by a layer of sediment deposited under flood conditions. The cyclic nature of these deposits suggests periodic local to regional-scale instability. The fossil plants preserved in the second and third units include permineralized *in situ* stumps and logs of *Salix*, *Alnus*, *Ostrya*, *Cercidiphyllum*, and *Acer*. These plants are consistent with a deciduous broad leaved riparian forest community. The fourth unit contains wood of *Salix*, *Ostrya*, and *Cercidiphyllum*, while *in situ* stumps and roots of *Picea* are preserved in the fifth unit. The sixth unit contains *in situ* stumps of *Ostrya* and *Cercidiphyllum*. The upper part of this formation is exposed in and around the Nayoro River, Mosanru River, and Rubeno-sawa in the central part of Shimokawa. Like the lower part of the formation the upper the upper part has seven fining-upward sequences. Each unit is capped with a peaty silicified layer (S1~S7). Conglomerates near the S1 layer contain petrified wood of *Abies, Picea, Pseudotsuga, Taxodioxylon* (assumed to be *Glyptostrobus*), *Pterocarya, Populus,* and *Cercidiphyllum*. The floral assemblage contains elements from upland, riparian, and wetland (lowland) habitats. In addition, anatomically well preserved permineralized plants were reported from the thick dark-brown colored quartz beds associated with each lignite bed in the upper part of the Mosanru Formation. Abundant fertile and vegetative remains of *Osmunda, Picea, Tsuga*, *Glyptostrobus, Alnus*, and *Decodon* from the S3 layer are well preserved and details of their anatomy are providing a basis for interpreting phylogeny. The genus *Glyptostrobus* is an example of a once widely distributed genus whose area has been contracted in the course of geological time. The first appearance of this genus was presumably in the late Cretaceous. The secondary distributed center is East Asia in Tertiary. *Glyptostrobus* was still regional remained in the Shimokawa until the late middle Miocene.

Keywords: fossil forest, Hokkaido Japan, middle Miocene, permineralized plants, swampy environment.

SS14-O08 (556)

Miocene *Metasequoia* from Yunnan, southwest China and its biological implications

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The Cretaceous and Paleogene *Metasequoia* fossils in China have mainly been reported from the northeastern parts of the country. The Neogene fossil record of this genus is rare in China and was discontinuously distributed in Jilin, Zhejiang, and Taiwan, near the eastern coast of the Pacific Ocean. So far *Metasequoia* fossils have not been reported from central and western China. Recently numerous well-preserved leafy shoots and seed cones were discovered from a middle or late Miocene deposit near the western slope of the Ailao Mountains in central Yunnan, southwest China. The assignment of these fossils to *Metasequoia* is based on the shape and decussate arrangement of the leaves and seed cone scales, and the diagnostic structure of the leaf cuticle. The internal anatomy of the cuticle (periclinal and antclinal walls) closely resembles that previously described from the extant *Metasequoia* and some Neogene *Metasequoia* in Japan and America. Because it is a common element in a number of stratigraphic layers, *Metasequoia* appears to have been a dominant forest constituent together with *Alangium*, *Acer*, and Bambusoideae species. The floral assemblage is consistent with that seen in wetland and riparian environments. Our finding indicates that *Metasequoia* grew as far south as Yunnan and suggests that *Metasequoia* was probably more widely

distributed in China during the middle or late Miocene. The migration of *Metasequoia* into southwest China from northern or eastern China might be associated with the following events: (1) the cooling trend during the late Oligocene; (2) expansion of the arid zone that extended from western to eastern China to northwestern China around the Oligocene-Miocene boundary; and/or (3) the regression of the Tethys Sea in Russia during the late Oligocene.

Keywords: fossil, *Metasequoia*, Miocene, palaeoecology, phytogeography.

SS14-O09 (585)

Palaeoecology of fossil forests dominated by *Metasequoia* and *Glyptostrobus* in the Plio-Pleistocene Kobiwako Group, Central Japan

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Two fossil forests dominated by *Metasequoia* and *Glyptostrobus* discovered in the Plio-Pleistocene Kobiwako Group, around the Lake Biwa, central Japan. One late Pliocene (2.6 Ma) fossil forest is exposed in the riverbed of the Yasu River and the other, an early Pleistocene (1.8–1.9 Ma) fossil forest is exposed in the Echi River. Based on the taxonomic composition of the *in situ* stumps, fruits and seeds, and pollen, the paleovegetation and paleoecological setting of these *Metasequoia* and *Glyptostrobus* dominated wetland forest communities were reconstructed. Fossil wood of *Glyptostrobus* was distinguished from that of *Metasequoia* based on their anatomical characteristics including presence of visible gaps between the ray cells in tangential as well as radial sections and the maximum number of ray cell stacks with less than 30 cells. The late Pliocene fossil forest was mainly composed of *Metasequoia* and *Glyptostrobus*, with minor amounts of *Salix*, *Cornus*, and *Fraxinus*. The early Pleistocene fossil forest was dominated by *Metasequoia*, *Glyptostrobus*, and *Alnus*. Sedimentary facies of these deposits including the fossil forests exhibited as a whole, a fluvial back-marsh and floodplain environment. Apportionment of the wood from different stratigraphic horizons indicates *Metasequoia* grew over a long period of time in a stable environment, while *Glyptostrobus* and *Alnus* grew in unstable environments characterized by short-interval floods. The forest floor vegetation of the *Glyptostrobus* forest was mainly composed of submersed Cyperaceae, whereas that of *Metasequoia* included *Dichocarpum*, *Polygonum*, and *Viola* that grew on mesic soil. The differences in the composition of the forest floor vegetation indicates *Glyptostrobus* grew in the waterlogged backswamp sub-environments, while *Metasequoia* grew in better drained sub-environment such as the levees. The vegetation surrounding the wetland was composed of mixed evergreen conifers and deciduous broad-leaved forest, including *Chamaecyparis pisifera*, *Tsuga*, *Picea*, and *Acer*. The composition of the late Pliocene fossil forest included plants that today are mainly distributed in the warm temperate climate zones, such as *Ficus* cf. *nipponica* and *Eurya japonica* as well as rich extinct elements including *Cathaya*, *Sequoia*, and *Pseudolarix*. Alternatively, assemblages of the early Pleistocene wetland forest consisted of plants that are more characteristic of the cool temperate zones, such as *Betula maximowicziana*, *Pterocarya rhoifolia*, and *Menyanthes trifoliata*. The change in taxonomic composition in and around the wetland forests dominated by *Metasequoia* and *Glyptostrobus* was possibly caused by global climatic deterioration that began during the late Pliocene.

Keywords: fossil woods, multidisciplinary approach, paleoecology, Quaternary, wetland forest.

SS14-O10 (273)

Variations of leaf stomatal frequencies complicate the reconstruction of ancient atmospheric CO_2 concentrations using fossil *Metasequoia* leaf cuticle

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Ancient atmospheric CO_2 concentrations can be precisely measured from air bubbles trapped in ice cores, which however, have a time limitation - the oldest ice cores so far obtained are about 800,000 years old. For a deeper record of geological time, proxies that recorded CO_2 concentrations are applied, among which the stomatal frequencies (stomatal density, stomatal index, or stomatal number per (needle) length)) of higher plant leaves are considered to be one of the most reliable methods. The inverse relationship of leaf stomatal frequency and atmospheric CO_2 partial pressure is species-specific, thus plant taxa with a long evolutionary history, morphological stasis, a continuous and widely distributed fossil record, and a living representative for comparison would be ideal. Since *Metasequoia* Miki meets all of these criteria it can play a key role in reconstructing ancient CO_2 concentrations since the Late Cretaceous. The relationship between leaf stomatal frequency and CO_2 concentration was established by analyzing *M. glyptostroboides* Hu *et* Cheng leaves collected from herbarium sheets, mature living trees, and saplings cultivated in growth chambers/green houses under controlled CO_2 concentrations. However, recent observations on leaves collected from different locations of the same tree and leaves at the same location of individual plants, but with different ages (*M. glyptostroboides* saplings, young trees, and mature trees) show that the stomatal frequencies vary considerably. While our observations do not necessarily weaken the significance of using *Metasequoia* (and other "model" plants, e.g., *Ginkgo* L.) for paleoclimatic reconstruction, we suggest that 1) a better understanding of stomatal frequency variations on leaves from various locations in a tree and from various developmental stages (ages) of a plant, as well as their relationships to atmospheric CO_2 concentrations should be achieved to facilitate a better calibration of ancient CO_2 concentrations based on plant leaf stomatal frequencies, and 2) before this is done, caution should be exercised when fossil leaves are selected for the reconstruction of ancient CO_2 concentrations.

Keywords: ancient atmospheric CO_2 concentrations, *Metasequoia,* stomatal frequency.

SS14-O11 (588)

How decay and diagenesis influence stable carbon isotope signals in plant fossils? Asian paleoendemic conifers as an example

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Both molecular and bulk stable carbon isotope technologies are being increasingly applied to study plant compression fossils that yield rich physiological, ecological, and environmental information for paleobotanists and organic geochemists. However, how decay and diagenesis influence the fidelity of molecular and stable isotope signals in plant fossils remain elusive. We investigated Cenozoic conifer fossils, archeological plant remains, as well as their modern counterparts with various degrees of degradation using integrated morphological (light microscope and SEM), bio-molecular (Py-GC-MS and NMR), and isotope (IRMS) approaches. Bulk and *in situ* molecular carbon isotope analyses of modern and fossil *Metasequoia* leaves indicate that bulk carbon isotope values ($\delta^{13}C$) of these samples are closely linked to the degree of tissue degradation, while the $\delta^{13}C$ values of lipid molecules remain constant during decay. The initial 1‰ negative shift of bulk $\delta^{13}C$ in early decay samples is due to the rapid removal of ^{13}C enriched liable components such as mono- and disaccharides, amino acids, hemicelluloses and pectin. Following long-term preservation, the $\delta^{13}C$ values of various Cenozoic conifer fossils exhibit 4‰-5‰ positive shift in comparison with their modern counterparts. Morphological and molecular analyses show that the positive shift is primarily due to the removal of ^{12}C enriched components such as carbohydrates and lignin, as indicated by SEM and molecular level investigations using pyrolysis analysis. The degradation and preservation of certain compounds in fossil and archeological samples are further confirmed by NMR analysis. In addition to the change of atmosphere CO_2 $\delta^{13}C$, the shift of $\delta^{13}C$ values observed in these plant remains can be explained by decay and early diagensis that these plant materials have experienced. Thus, a better understanding of tissue decay and diagenesis at the molecular level is critical to evaluate stable isotope signals obtained from fossil conifers and the inference of their habitat changes.

Keywords: Cenozoic, conifers, degradation, geochemistry, habitat.

SS14-O12 (303)

The endemic conifers of Asia: Comparison and analysis

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Although the systematics of conifers has been studied for more than three hundred years, the taxonomy and evolutionary history of this diverse group of plants is still not fully understood, especially in Asia. East Asia is renowned for possessing a large number of relictual monotypic or almost monotypic gymnosperm genera that were once much more widely dispersed across the Northern Hemisphere. The taxonomy and evolutionary status of the Asian taxa has been analyzed at the generic and specific levels and the results are discussed in light of the world checklist of conifers as well as modern floras from Asia and the world. Aspects of their traditional and modern taxonomy and conservation status are also addressed. There are 6 families, 35 genera, 192 species and 92 infra-species are distributed in Asia, with 17 genera (*Amentaxus, Cathaya, Cephalotaxus, Cryptomeria, Cunninghamia, Fokienia, Glyptostrobus, Keteleeria, Metasequoia, Microbiota, Nothotsuga, Platycladus, Pseudolarix, Pseudotaxus, Pseudotsgua, Sciadopitys, Taiwania*, and *Thujopsis*) or 48.57% of total genera of the world being endemic to eastern Asia. It is important to note that the native populations of these endemics are in need of protection and conservation because most of their habitat has been damaged by economic and social development in Asia over the last century.

Keywords: Asia, conifers, endemic, floras, review.