(SS38) Triassic and Jurassic plants: systematics, diversity variation and environmental background

Date: August 27
Place: Room 5334 (oral), Room 6318 (poster)
Organizers: Yongdong Wang, Mihai E. Popa, Maria Barbacka & Gaetan Guignard
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Purpose: The Late Triassic and Jurassic time intervals record the remarkable Mesophytic plant assemblages, characterized by a variety of plant groups, such as ferns, pteridophytes and domination of gymnosperm groups. Also, the Triassic-Jurassic boundary records one of the most severe mass extinctions of the Phanerozoic, a biotic turnover which is reflected in Late Triassic and Early Jurassic floral changes. The symposium proposes to address systematic aspects related to Triassic and Jurassic pteridophytes and gymnosperms of all types, but also phytobiogeographic and phytostratigraphic problems of these time intervals.
The symposium will organize oral presentations focusing on three aspects of the T-J plants: 1) to emphasis the systematics of the major plant groups during the Triassic and Jurassic period; 2) to report the progresses of biodivetsity change and turnovers across the Triassic and Jurassic boundary intervals, and to show the relationships of floral response to the T-J extinction events; 3) to report the update results on the environmental background of the Triassic and Jurassic periods based on fossil plant studies, including palaeo-CO_2, greenhouse climate reconstruction, global warming, palaeoecology and palaeoenvironment.

Oral Presentation

Aug. 27 [AM1] Room: 5334

Chairs: Maria Krystyna Barbacka, Chunlin Sun

9:00-9:40 **[Keynote] Experimental approaches to understanding the flammability of ancient ecosystems – a case study of variations in fire activity across the Triassic-Jurassic boundary event** SS38-O01 (24)

Claire M. Belcher

9:40-10:00 **Evolution of the floras through the Late Triassic to the Middle Jurassic based on the materials from one section in the Junggar Basin, NW China** SS38-O02 (94) (Cancelled)

Shenghui Deng, Yuanzheng Lu

9:40-10:00 ***Ashicaulis beipiaoensis*, a new species of osmundaceous rhizome from the Middle Jurassic of Liaoning, Northeast China** SS38-O07 (524) (moved from PM2)

Ning Tian, Yong-Dong Wang, Wu Zhang, Zi-Kun Jiang, David L. Dilcher

10:00-10:20 **Preliminary results of plant succession research in the Liassic delta, Mecsek Mts., Hungary** SS38-O03 (20)

Maria Barbacka

Aug. 27 [AM2] Room: 5334

Chairs: Maria Krystyna Barbacka, Chunlin Sun

10:50-11:10 **Fertile organs and in situ spores of a dipteridaceous fern (*Clathropteris obovata* Ôishi) from the Upper Triassic in Sichuan, China** SS38-O04 (562)

Yongdong Wang, Liqin Li, Gaëtan Guignard, David L. Dilcher, Ning Tian, Zikun Jiang

Chairs: Yongdong Wang, Shenghui Deng

11:10-11:30 **The new type of Late Triassic ovulate scales associated with Brachyphyllum-like leaves** SS38-O05 (21)

Maria Barbacka, Grzegorz Pacyna, Jadwiga Ziaja, Danuta Zdebska

11:30-12:10 **[Keynote] An aquatic fern leaf from the Late Triassic of Western Liaoning, China** SS38-O06 (503)

Chunlin Sun, Tao Li, Wenhao Wu, Lixia Wang, Lijun Zhang

Aug. 27 [PM2] Room: 5334

Chairs: Yongdong Wang, Shenghui Deng

14:30-14:50 ***Ashicaulis beipiaoensis*, a new species of osmundaceous rhizome from the Middle Jurassic of Liaoning, Northeast China** SS38-O07 (524) (move to AM1)

Ning Tian, Yong-Dong Wang, Wu Zhang, Zi-Kun Jiang, David L. Dilcher

14:50-15:10 **The Early Jurassic plants from the Shenzhen area of Guangdong Province, southern China and their significance** SS38-O08 (563)

Yongdong Wang, Xiangwu Wu, Xiaoju Yang, Wei Duan, Liqin Li

15:10-15:30 **[Concluding remarks]** SS38-O09

Yongdong Wang

Poster Presentation

Aug. 27 [PM1] Room: 6318

13:30-14:30 **Integrated palaeobotanical and palynological analysis of the terrestrial deposits of the Ravenscar Group (Middle Jurassic), northeast Yorkshire, UK** SS38-P01 (484)

Sam Slater, Charles Wellman

New interpretation of the genus *Grenana* Samylina (gymnosperms) from the Middle Jurassic of Uzbekistan SS38-P02 (377)

Natalya Nosova, Natalia Gordenko

The spore peaks at the terrestrial Triassic-Jurassic boundary in NW China SS38-P03 (599)

Lu Yuanzheng, Deng Shenghui

Reconstruction of paleovegetation using analysis of plant fossils and sedimentary facies of the Hinabata Fomation, the uppermost part of Triassic Nariwa Group, Southwest Japan SS38-P04 (600)

Hirokazu Yukawa, Ge Sun, Shigeyuki Suzuki

Experimental approaches to understanding the flammability of ancient ecosystems – a case study of variations in fire activity across the Triassic-Jurassic boundary event

Claire M. Belcher

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Fire is a natural process integral to the order and function of our planet, variations in Earth's past fire activity can be related to variations in atmospheric oxygen concentration (Belcher et al., 2008; Glasspool and Scott, 2010; Belcher et al., 2010a), changes in climate (Collinson et al., 2009; Belcher et al., 2010b) and evolutionary events (Edwards et al., 2010; He et al., 2012). It is therefore essential that we are able to better understand the record of ancient fires events. The record of fossil charcoals provides key evidence that fires have occurred in Earth's past (Scott, 2000), where variations in the abundance of fossil charcoals are taken to represent increases and decreases in fire activity. However, no fossil record is perfect because all fossils are subject to depositional and preservational bias. This means that understanding what variations in the fossil record of charcoal really mean remains a question of scientific debate. The fossil record of charcoal can be supplemented with experimental approaches, which estimate the potential flammability of ancient floras. Here I use the record of floral change across the Triassic-Jurassic boundary as an example case study where modern analogues of the Triassic-Jurassic floras were tested for their flammable potential using a state-of-the-art fire propagation apparatus. The results indicate that the climate-driven shift from dominantly broad- to dominantly narrow-leafed morphologies across the Triassic-Jurassic boundary had the potential to increase fire activity. This is consistent with the observed five-fold increase in the abundance of fossil charcoal at the time.

Keywords: fire, charcoal, Triassic-Jurassic, palaeobotany, fire ecology.

SS38-O02 (94)

Evolution of the floras through the Late Triassic to the Middle Jurassic based on the materials from one section in the Junggar Basin, NW China

Shenghui Deng, Yuanzheng Lu

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The Haojiagou Section of the Junggar Basin, Xinjiang Province, Northwestern China, has been a continually developed of the Upper Triassic to the Lower Cretaceous. The lithostratigraphical succession of the Upper Triassic and the Lower and Middle Jurassic, which yield abundant plant fossils are the Haojiagou Fm.(T_3h), Badaowan Fm. (J_1b), Sangonghe Fm. (J_1s) and Xishanyao Fm. (J_2x) in ascending order. Based on the studies of more than a decade, five floral assemblages were established to show the evolution of the flora through the Late Triassic to the Middle Jurassic in the Junggar Basin of Northwestern China. **1.** *Danaeopsis-Cladophlebis ichunensis* Assemblage, contained in the Lower Member of the Haojiagou Formation, consisting of 19 species in 13 genera, is dominated by ferns that belong to the Maratiaceae, Osmundaceae, Dipteridaceae, *Cladophlebis* and *Sphenopteris*. The occurrence of *Danaeopsis fecunda*, *Cladophlebis kaoiana*, *Cl. paralobifolia*, *Cl. ichunensis*, *Cl. nebbensis*, *Cl.* cf. *shensiensis* and *Sphenopteris chowkiawanensis* indicates Upper Triassic age. **2.** *Hausmannia-Clathropteris minoria* assemblage, yielded the Upper Member of the Haojiagou Formation, consists of 17 species in 13 genera and is dominated by ferns. It is possibly of the Late Triassic age. **3.** *Todites princeps- Clathropteris elegans* Assemblage occurs in the Lower Member of the Badaowan Formation, including 15 species of 12 genera. It is dominated by ferns and

with many ginkgoes and conifers, but without Cycadopsida. Due to the occurrence of *Todites princeps* and *Clathropteris elegans* it is considered to be early of the Early Jurassic. **4.** *Coniopteris gaojiatianensis-Cladophlebis* Assemblage is yielded from the Upper Member of the Badaowan Formation, which consists of 22 species in 15 genera, mainly belonging to ferns. Many typical Jurassic elements, such as *Coniopteris gaojiatianensis, Selaginellites drepanoformis, Equisetites lateralis, Raphaelia diamensis, Ginkgoites sibiricus, Sphenobaiera longifolia* and *Czekanowskia rigida* demonstrates that the age of this assemblage is middle Early Jurassic. **5.** *Phlebopteris-Marattiopsis* Assemblage, from the Sangonghe Formation, consists of 23 species in 15 genera, which is markedly characterized by many thermophilic elements and several species of *Coniopteris*. The thermophilic elements include *Phlebopteris polypodioides* of Matoniaceae, *Dictyophyllum* of Diptoptaceae, *Marattiopsis asiatica* of Marattiaceae, *Zamites* of Cycadales, scale-like leaf conifer *Brachyphyllum* (*Hirmeriella*?) and a possible gnetalean plant *Cadmisega ephedroides*. This assemblage is late Early Jurassic in age and possibly links with the Toarcian global paleoenvironment event in ocean. **6.** *Coniopteris-Phoenicopsis* Assemblage contains in the Xishanyao Formation, representing the evolution peak of the Jurassic floras in Xinjiang. It consists of more than 60 species, which include the Bryophyta, Lycophyta, Sphenophyllales, Filicopsida, Cycadopsida, Ginkgoposida, Coniferopsida and some classification unknown cones and seeds and is obviously dominated by the Filicopsida and Ginkgoposida. It is comparable with the Middle Jurassic Yorkshire Flora and other Middle Jurassic floras in China, and therefore is considered as the Middle Jurassic in age.

Keywords: flora, assemblage, evolution, Late Triassic, Jurassic.

SS38-O03 (20)

Preliminary results of plant succession research in the Liassic delta, Mecsek Mts., Hungary

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The Early Jurassic (Liassic) fossil macroflora locality in Hungary is connected with the occurrence of coal deposits in the region of Pécs and Komló. The plant remains, numbering about 5000 specimens, come from between the coal seams as well as from drilling cores; all specimens have been deposited in the Palaeobotanical Collection of the Hungarian Natural History Museum. The basis for the present study comes from a wider background material used for the earlier completed vegetation reconstruction of the Mecsek Mts. Jurassic delta plain, based on the co-occurrence of species on particular rock slabs. Using statistic methods, five species groups were distinguished. Considering the natural delta dynamics, the main factors that delimited the occurrence and distribution of those groups were the moisture, and the degree of disturbance of the habitats. The groups show different adaptations to circumstances, from the driest (relatively, since water is abundant in the delta plain) to swamps, and from highly disturbed to almost undisturbed areas. Each group has well defined environmental preferences, which in case of particular species assign them to specific niches. The niche requirements of particular species are very different, but it can also be seen that no species existed which occupied the whole territory. This means that the various plant species were adapted to quite narrowly defined circumstances. The aim of the present study was to detect the succession of the plant species and plant communities one after another on the same point of the area in a given period of time, using data provided by materials originating from drilling cores. This way the changes in plant cover induced by local changes in the habitat can be perceived. The cores contain a series of specimens following each other in a long period of time. This study represent a preliminary phase that helps to obtain data on the changes of plant association in the

given territory, which in the future may provide more accurate explanations on the causes of changes, perceived by plant adaptations. In delta conditions, such alterations can be quite rapid, initiated by flooding when whole plant communities that existed there for shorter or longer periods of time on alluvial deposits, can appear or disappear. The study was mainly based on cores from Rücker (between 62.5 to 788.9 m), and some specimens from Váralja (between 625.8m -1072.5 m) and Máza (between 713 and 1041.2 m), which provided material totalling about 200 specimens. This study was supported by OTKA 100658.

Keywords: palaeoecology, delta, plant succession, Liassic, Hungary.

SS38-O04 (562)

Fertile organs and in situ spores of a dipteridaceous fern (*Clathropteris obovata* Ôishi) from the Upper Triassic in Sichuan, China

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As a representative fossil member of the family Dipteridaceae, the genus *Clathropteris* was reported worldwide from the Mesozoic strata; however, its fertile structures including sporangia and in situ spores are relatively poorly known. In this study, fossil compressed specimens of the dipteridaceous fern *Clathropteris obovata* Ôishi are investigated from the Upper Triassic in Guangyuan, Sichuan Province, China. The specimens show extremely preserved fertile organs and in situ spores. The sori are round to oval in shape and exindusiate. Each sorus contains 10-20 sporangia with vertical to oblique annuli. Each sporangium produces around 128-256 trilete spores that are triangular to subtriangular in outline, covered with subverrucate, subbaculate and granular sculptures. Spores range from 22-65 μm in diameter (average 41 μm) and they are comparable to several dispersed trilete spore genera, including *Converrucosisporites*, *Conbaculatisporites* and *Clathropterisospora*. This is the first species of genus *Clathropteris* from Eurasia which shows detailed structures of sori, sporangia, annuli and in situ spore characters, and is therefore helpful for further understanding the diversity and evolution of the dipteridaceous fern linage through time.

Keywords: Dipteridaceae, *Clathropteris*, sporangia, in situ spores, Upper Triassic.

SS38-O05 (21)

The new type of Late Triassic ovulate scales associated with Brachyphyllum-like leaves

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Patoka is the newly discovered locality of not particularly rich, but very interesting flora. The locality is situated in south-western Poland, within the region of Upper Silesia and is a part of the so called Triassic Germanic Basin. Its age has been estimated as Upper Triassic (Keuper), probably Norian. Neighbouring localities provide older (Carnian) and younger (Rhaetian) floras and exceptionally interesting vertebrate assemblages with dinosaurs and dicynodonts. Norian floras from Europe and North America are very poorly known, thus this new locality contributes valuable data filling up gaps in our knowledge on this period. The assemblage from Patoka is dominated by branches of *Brachyphyllum* type which is the most interesting taxon on this territory. Besides branches and isolated leaves also *Pachylepis* scales are found, with cuticle that agrees with those of the *Brachyphyllum* leaves. Also a new type of ovulate scales were found, with two oval lobes – probably allowing ovule attachment, and one reduced lobe between them, all in one plane. The scales also show similar cuticular characteristics as the mass of *Brachyphyllum* leaves in the same rock slabs. Together with branches and scales, so far one ovule was found, whose shape and size suggests that it may well be associated with the scales. The ovule is oval and has an exposed micropylar beak. Inside the micropyle pollen grains of unknown affinity were found. The *Brachyphyllum*-type conifers are accompanied by fragments of cf. *Czekanowskia* leaves, and isolated seeds of unknown affiliation and gymnosperm wood.

Keywords: palaeobotany, conifers, ovulate scales, pollen grains, Poland.

SS38-O06 (503)

An aquatic fern leaf from the Late Triassic of Western Liaoning, China

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Marsileaceae, a heterosporous aquatic fern family, consists of three extant genera, *Marsilea*, *Pilularia*, and *Regnellidium* (Kramer 1990). All of them possess sporocarps as reproductive structures. Now more than fifty fossil species have been assigned to Marsileaceae. Among them, *Crybelosporites herberoides* Burger from the Late Jurassic was the oldest microspore fossil record assignable to Marsileaceae (Kotova 1983, Lupia et al. 2000), and the oldest macrofossil record was *Regnellites nagashimae* Yamada and Kato from the Late Jurassic to earliest Cretaceous (Berriasian) (Yamada and Kato 2002). The fossil leaves as impression were discovered in mudstone of the Late Triassic Yangcaogou Formation of Western Liaoning, China. Fertile materials and Rhizomes were not found. The leaves attached at a common point on the apex of the petiole are composed of two leaflets joined basally in an opposite arrangement. The petiole is incomplete, at least longer than 5 mm long by 1mm wide. The leaflets are fan shaped with the basal angle 170-190° , and 10-14mm long by 20-26mm wide at the widest part. The leaflet is commonly divided into four wedge-shaped lobes with 7-10mm long by 5-8mm wide at the terminal margins of lobes. Each lobe is usually subdivided one time into two ultimate lobes. The apices of the lobes are blunt or obtuse. The veins are conspicuously dichotomous, but not anastomosing, and there is not marginal vein. The present specimen as aquatic fern is very similar in gross leaf form to that of *Regnellites nagashimae* Yamada and Kato with two leaflets in an opposite arrangement from the Late Jurassic to earliest Cretaceous (Berriasian) of Western Japan attributed to Marsileaceae. However, the leaflets of Japanese specimen are entire, and the veins are normally dichotomous, but partially anastomosing. In leaflet form, the

present specimen shows also some similarity to species of *Marsileaceaephyllum* from Cretaceous in the different regions of the world. The leaf of *Marsileaceaephyllum* has normally four wedge-shaped leaflets. The terminal margins of leaflets are mostly crenate but some entire. Venation is dichotomous, then anastomosing with a marginal vein or not (Skog and Dilcher 1992, Nagalingum 2007, Hu et al. 2008, Herman and Kvacek 2010).The morphological characters of the present specimen, including leaf size, shape and thin petiole, look like an aquatic fern, which would most probably represents a new genus and the earliest record of Marsileaceae.

Keywords: aquatic fern, Late Triassic, Yangcaogou Formation, Western Liaoning, China.

SS38-O07 (524)

Ashicaulis beipiaoensis, a new species of osmundaceous rhizome from the Middle Jurassic of Liaoning, Northeast China

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A new species of structurally preserved fern rhizome, *Ashicaulis beipiaoensis* (Osmundaceae) is described from the Middle Jurassic Tiaojishan Formation in Beipiao of Liaoning, Northeast China. The rhizome, with a maximum diameter of 4.0–4.5 cm, is composed of a homogeneous pith, an ectophloic–dictyoxylic siphonostele, a two–layered cortex and a mantle of adventitious roots and petiole bases. The xylem cylinder consists of 13–16 xylem strands. The petiole base is characterized by a homogeneous sclerotic ring and a crescent–shaped sclerenchyma mass in the vascular bundle concavity. One large homogeneous sclerenchyma mass accompanied with several smaller thick–walled fiber clusters occur in the petiolar stipular wings. Comparisons of anatomical features suggest that *Ashicaulis beipiaoensis* sp. nov. shows distinct differences with previously reported fossil and living osmundaceous taxa, but bears close similarities to *O. shimokawaensis* from the Middle Miocene of Hokkaido, Japan, a close relative to extant subg. *Osmunda*. The new species from the Jurassic in China may represent an evolutionary link between the Jurassic *Ashicaulis* to the living *Osmunda*. *Ashicaulis beipiaoensis* and *O. shimokawaensis* may represent a failing branch in the evolutionary tree of Osmundaceae. Fossil species of *A. beipiaoensis* provides further information for understanding the development and geological occurrences of the osmundaceous rhizomes in the Northern Hemisphere.

Keywords: Osmundaceae, *Ashicaulis*, Middle Jurassic, western Liaoning, China.

SS38-O08 (563)

The Early Jurassic plants from the Shenzhen area of Guangdong Province, southern China and their significance

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The alternating sequences of marine and non-marine Triassic-Jurassic formations are well developed in the Guangdong Province, representing one of the most remarkable coal-bearing series in southern China. The Lower Jurassic Jinji Formation is widely distributed in Guangdong, with continuously outcropped sections of rich marine and non-marine fossil fauna. It conformably overlies the Upper Triassic Xiaoping Formation, representing one of the potential sequences yielding the Triassic - Jurassic boundary in southern China. However, fossil plants from the Lower Jurassic in Guangdong Province are very rare. In recent years, we have collected rich fossil plant specimens of the Lower Jurassic Jinji Formation in the Dapeng area of Shenzhen city, in the southern Guangdong Province. These plant fossils are preserved as impressions with more than 100 specimens, and they are systematically ascribed to 12 genera, including *Equisetites*, *Clathropteris*, *Cladophlebis*, *Otozamites*, *Zamites*?, *Williamsoniella*, *Nilssonia*, *Pagiophyllum*, *Sphenolepis*, *Elatocladus* as well as *Taeniopteris* and *Ixostrobus*. Among them, bennettitales are the dominant group and they are represented by *Otozamites*. In particular, two specimens of *Otozamites* leaves with stems, and a bennettitalean female flower *Williamsoniella* are found in this locality. Some fossil ammonites (*Hongkongites hongkongensis*) and bivalves (including *Astarte*, *Luciniol*, *Mesomilthra*, *Pseudotrapezium*, *Protocardia* and *Homomya*) were also documented in association with these fossil plants. These fossil ammonite-bivalve assemblages suggest that the age of the plant fossil horizon is Hettangian to Sinemurian (Early Jurassic). This work represents not only the first discovery of fossil plants in Shenzhen area, but also the first document of Jurassic plants in Guangdong and the Peal River Delta regions. Further investigations of such plant fossils will be helpful for the correlation of the Early Mesozoic coal-bearing strata in Guangdong area, and will deepen our understandings for the plant diversity variations of Triassic and Jurassic transition in southern China; additionally, it will provide terrestrial plant evidences for exploring the palaeoecology, palaeoclimate as well as palaeogeography of southern China.

Keywords: Early Jurassic, fossil plants, Jinji Formation, Shenzhen of Guangdong, China.

SS38-P01 (484)

Integrated palaeobotanical and palynological analysis of the terrestrial deposits of the Ravenscar Group (Middle Jurassic), northeast Yorkshire, UK

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Palynomorphs and plant macrofossils from Middle Jurassic terrestrial deposits of the Ravenscar Group from the Cleveland Basin in northeast Yorkshire are described. The assemblage provides new insight into the underrepresented plant record at this time. Assemblages of abundant, diverse and well preserved spores/pollen have been recovered from numerous horizons throughout the sequence. Palynological samples have been spiked with *Lycopodium* tablets to determine absolute abundances. Megaspores are found present from the Bathonian Long Nab member of the Scalby Formation. Preservation of megaspores is outstanding and in three-dimensions. Combined analysis using light microscopy, scanning electron microscopy and transmission electron microscopy reveals the presence of at least two species (*Paxillitriletes phyllicus* and *Minerisporites institus*) of lycopsid affinity. Abundant and well preserved plant megafossils are present in the famous plant beds scattered throughout the sequence. Palaeogeographic reconstructions show upland areas surrounding the coastal plains of the inner Cleveland Basin. Northern upland areas were dominated by coniferous forests whilst the lowland areas were characterised by low-standing vegetation including

sphenotypes and pteridophytes. The assemblage indicates a warm-temperate climate with distinct monsoonal wet and dry seasons. Palaeoenvironmental reconstructions indicate deltaic and fluvial conditions with intermittent marine incursions in the Aalenian and lower Bajocian. Integration of palaeobotanical data with published dinosaur footprint data and dinosaur coprolites from the Ravenscar Group will potentially cast light on floral and faunal interactions.

Keywords: Megaspores, lycopsid, microspores, *Paxillitriletes phyllicus, Minerisporites institus*.

SS38-P02 (377)

New interpretation of the genus *Grenana* Samylina (gymnosperms) from the Middle Jurassic of Uzbekistan

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The genus *Grenana* (Samylina, 1990) was described from the Middle Jurassic of Angren, Uzbekistan, on the basis of co-occurrence of isolated leaf fragments with dichotomizing narrowly linear segments, ovuliferous organs with collars, and detached seeds, and was placed by its author into the corystosperms. Samylina united these isolated organs under one generic and specific name (*G. angrenica*) based on common epidermal characters, and selected a leaf fragment as a holotype. Over the next years, various authors favored the ginkgoaceous affinity of *Grenana*; in order to test this assumption, we have performed a revision of this genus. Following Samylina, we believe that all the remains ascribed to *Grenana* belong to one plant. However, our investigation of the leaf fragments indicates that *"Grenana"* represents a junior synonym of *Baiera*. Despite the fragmentariness of the material, the good preservation of the cuticle allowed us to establish a new species *Baiera angrenica* (in preparation). By its narrow segments and single-veined terminal lobes, *B. angrenica* is most similar to *B.* cf. *furcata* from the Middle Jurassic of Northwest China, but differs from the latter by its epidermal characters. Moreover, *B.* cf. *furcata* was found in association with ovuliferous organs described as *Yimaia qinghaiensis*, which are significantly different from the ovule-bearing organs from Angren. Seeds co-occurring with the leaves of *B. angrenica* are ovate with an uneven base and a mucronate micropylar tip. The integument consists of sarcotesta and sclerotesta. The maceration reveals a thick cuticle of the integument with stomata, a thin cuticle of the nucellus, and a megaspore membrane. We assign these seeds to the genus *Allicospermum*. The ovule-bearing organs from Angren are best regarded as a new species of *Ginkgo*, *G. grenana* (in preparation), on the basis of their specific morphology. They consist of a peduncle usually furcating into 2(-3) short pedicels, each with a cup-shaped collar. The ovuliferous organs of *G. grenana* are comparable with those of the Middle Jurassic *G. ginkgoidea* and *G. yimaensis*, but in these two species, pedicels are much longer. Short pedicels are present in the Early Cretaceous *G. apodes*, but in this species, ovuliferous organs bear up to 6 collars. The ovuliferous organs from Uzbekistan are closely similar to those of the Paleocene *G. cranei* and modern *G. biloba*, but collars in the latter are sessile. The Angren material differs from all the discussed species by its association with *Baiera*-type leaves.

Keywords: *Angren, Ginkgo, Allicospermum, Baiera*, ovule-bearing organs.

SS38-P03 (599)

The spore peaks at the terrestrial Triassic-Jurassic boundary in NW China

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The Haojiagou Section in the Junggar Basin, NW China, is a famous terrestrial Triassic-Jurassic boundary section. It has been studied in detail in palynology, flora, bivalves and organic carbon isotopes. The Tr-J boundary has been placed between the Haojigou formation (T3) and the Badaowan formation (J1). The palynological assemblage below the boundary is characterized by the typical Triassic taxa, such as *Aratrisporites*, *Chordasporites* and *Taeniaesporites*, and is predominated by nonstriate bissaccate. The palynological assemblage above the boundary is characterized by several peaks of spores abundance. Spores dominate the palynological assemblage, mainly including *Densoisporites*, *Asseretospora*, *Dictyophyllidites*, *Concavisporites*, *Cyathidites*, and so on. But it is easy to miss the peaks if the spaces between samples were wide because the peaks are very short in time. The similiar peaks are also found above the Triassic-Jurassic boundary of the section in Newark basin, eastern North America, the St. Audrie's Bay section in England, and the Csővár section in Hungary. It is thought as an evidence of a large-scale floristic turnover. Some studies have showed that ferns would usually be the first inhabitant after a major crisis in terrestrial ecosystems, so fern spore peaks often occurred above important boundaries, such as the Cretaceous-Tertiary boundary and the Permian-Triassic boundary. But, in southern China, the Triassic-Jurassic boundary is not characterized by spores peak, instead of a sudden increscent of *Classopollis*. This may be due to a lack of the earliest Jurassic strata.

Keywords: palynology, terrestrial Triassic-Jurassic boundary, China.

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Reconstruction of paleovegetation using analysis of plant fossils and sedimentary facies of the Hinabata Fomation, the uppermost part of Triassic Nariwa Group, Southwest Japan

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The Upper Triassic Nariwa Group is mostly composed of non-marine deposits except the marine Jito Formation and characterized by the abundance in plant fossils. According to Suzuki and Asiedu (1995), the Nariwa Group is divided into the Niga, Jito, Mogamiyama, Hina and Hinabata Formations.The youngest Hinabata Formation is especially known that prolific plant fossils are preserved. These plant fossils are known as the Nariwa flora. As a study of this flora in detail, Oishi (1932) reported as many as 82 species, including 23 new species. The Nariwa flora now consists of 39 genera and 112 valid species so far. This study is to make clear paleovegetation and paleoenvironment of the Hinabata Formation using. Fluvial deposit of the Hinabata Formation was subdivided into three facies, channel fill deposit, natural-levee deposit and floodplain deposit. According to the analysis of sedimentary facies of deposits which yield plant fossils, we found that the floodplain had been dominated by the Pteridophyta, natural-levee and around there had been dominated by the Gymnospermae. A number of Pteridophyta *Thaumatopteris* was yielded from thin layer with fossil branches. *Cladophlebis*, and *Neocalamites* were sometimes yielded with only one species. So it might be considered that there had been habitat segregation in these ferns at least. In natural-levee deposits the Gymnospermae *Phoenicopsis* beds were observed. *Podozamites* beds were observed into both the floodplain deposits and the natural-levee deposits. So it is thought that the

Phoenicopsis or *Podozamites* forest had existed in natural-levee. This idea is supported by petrified root of gymnosperm which was found on the top of natural-levee unit. In the Hinabata formation, *Podozamites* was found in most plant fossil beds. It is inferred that *Podozamites* had been dominant in this area.

Keywords: paleovegetation, paleoenvironment, the Nariwa Group, the Hinabata formation, Upper Triassic.