(SS34) Evolutionary history of key taxa and phytogeography of the Jurassic and Cretaceous floras of Eurasia

Date: August 29
Place: Room 5236 (oral), Room 6317 (poster)
Organizers: Lina Golovneva & Alexey Herman
Contact email address: Lina_Golovneva@mail.ru
Purpose: This symposium is devoted to the latest achievements in researching of the diversity and distribution of key taxa which determined the evolution of the Jurassic and Cretaceous floras and phytogeographic differentiation of Eurasia during late Mesozoic. The main topics for discussion are:
1) dispersion of early angiosperms in Eurasia and their rise to dominance in different regions;
2) extinction in late Mesozoic, mesophytic relicts;
3) centers of origin and migration routes of key taxa;
4) location of paleofloristic boundaries depending on climatic, geographic taxonomical and other factors.

Oral Presentation

Aug. 29 [AM1] Room: 5236

Chair: Alexei Herman

9:00-9:20 **The Late Jurassic-Early Cretaceous and Paleocene coal-forming plants of Transbaikalia and Far East** SS34-O01 (58)

Eugenia V. Bugdaeva, Valentina S. Markevich

9:20-9:40 **The Mesozoic genus *Protophyllocladus* Berry (Pinopsida)** SS34-O02 (376)

Natalya Nosova, Lina Golovneva

9:40-10:00 **The origin of boreal angiosperm flora in Northern Asia and the provincial division of the Siberian-Canadian palaeofloristic region in the Late Cretaceous** SS34-O03 (156)

Lina Golovneva

10:00-10:20 **Early Senonian flora of the Western Siberia: phytogeography and climate reconstruction** SS34-O04 (7)

Pavel Alexeev

Aug. 29 [AM2] Room: 5236

Chair: Lina Golovneva

10:50-11:10 **Turonian-Coniacian Arman Flora (North-eastern Russia) and palaeoclimate of the North Asia** SS34-O05 (182)

Alexei B. Herman, Robert A. Spicer

11:10-11:30 **Taxonomic and palaeoecological implications of mountain floras from the Okhotsk-Chukotka volcanic belts in connection with problem of evolution and expansion of angiosperms** SS34-O06 (467)

Sergey Shczepetov, Lina Golovneva

11:30-11:50 **New data on the Ust-Emuneret flora from the Upper Cretaceous volcanogenic deposits**

of Central Chukotka (Northeastern Russia): taxonomic composition, age and palaeoclimate SS34-O07 (341)

Maria Moiseeva, Alexandra Sokolova

11:50-12:10 **Cenomanian flora from Primorye region, Russian Far East** SS34-O08 (549)

Elena Volynets

Poster Presentation

Aug. 29 [PM1] Room: 6318

13:30-14:30 **Early Cretaceous flora from the Tetori Group in the Oguchi area, Hakusan City, Ishikawa Prefecture, Japan** SS34-P01 (445)

Yusuke Sakai, Shinji Sekido, Atsushi Matsuoka

SS34-O01 (58)

The Late Jurassic-Early Cretaceous and Paleocene coal-forming plants of Transbaikalia and Far East

Eugenia V. Bugdaeva, Valentina S. Markevich

IBSS FEBRAS, Russia, bugdaeva@ibss.dvo.ru

The coal-bearing deposits of Transbaikalia (Chita-Ingoda, Khilok, Bukachacha, Turga-Kharanor basins), Amur River region (Bureya and Zeya-Bureya basins) and Primorye region (Razdolnensky and Partizansky basins) were studied. On this territory three stages of coal accumulation can be distinguished: the Tithonian-Valanginian, the Barremian-Albian, and the Paleocene. The main Tithonian-Valanginian coal-forming plants were cyatheaceous ferns, conifers, and ginkgoaleans (*Pseudotorellia angustifolia* Dolud., *Erethmophyllum* sp.). This stage is most conspicuous in Bureya Basin. The coal formation at the second stage was the most considerable. The accumulation of abundant plant material was manifested on vast areas of Siberia and Far East. During the Barremian-Albian main coal-forming plants varied in composition depending on environments: in sea-side marshy plains they were represented by gleicheniaceous and cyatheaceous ferns, and taxodialeans, in intracontinental basins - cyatheaceous ferns, conifers (Miroviaceae, Cheirolepidiaceae, as well having affinity with Araucariaceae, Pinaceae) and ginkgoaleans *(Baierella, Sphenobaiera, Pseudotorellia*). The coal accumulation of third stage took place in Zeya-Bureya Basin. The mire plant communities were dominated by taxodialeans and polypodiaceous ferns. The composition of the Jurassic and Cretaceous mire communities shows their conservatism, probably, due to similar palaeoenvironments. Conifers and ginkgoaleans were indispensable participants of mire communities. Nevertheless, at the Mesozoic-Cenozoic boundary the composition of swamp communities changed drastically. Our research was supported by Russian Academy of Sciences (grant № 12-I-P28-01), Far East Branch of RAS (grant 12-III-A-06-075, 12-III-A-06-070).

Keywords: coal-forming plants, Late Jurassic, Early Cretaceous, Paleocene, Zeya-Bureya Basin.

SS34-O02 (376)

The Mesozoic genus *Protophyllocladus* Berry (Pinopsida)

Natalya Nosova, Lina Golovneva

Komarov Botanical Institute RAS, Russia, natanosova@gmail.com

The genus *Protophyllocladus* Berry, 1903, was established for the phylloclades of conifers from the Cretaceous of North America that were previously attributed to the genera *Thinnfeldia* (Corystospermales), *Salisburia* (Ginkgoales) and *Phyllocladus* (Pinopsida). Six species (*P. subintegrifolius* (Lesquereux) Berry (the type species), *P. lanceolatus* (Knowlton) Berry, *P. lobatus* Berry, *P. obesus* Hollick, *P. polymorphus* (Lesquereux) Berry and *P. simplex* Hollick) had been described to 1979, when Tanai, pointing to the variability of the phylloclade shape, united all species, except *P. lobatus*, under the name *P. subintegrifolius*. In the same year, Krassilov described *P. sachalinensis* from the Late Cretaceous of Sakhalin (Russia). Under this name he combined the remains previously described as *Thinnfeldia sachalinensis* Kryshtofovich et Baikovskaja and *Protophyllocladus polymorphus. P. sachalinensis*, however, is not a valid taxon since its basionym had been published without typification; moreover, our studies suggest the affinity of *Thinnfeldia sachalinensis* to the fern *Sachalinia sachalinensis* Vachrameev. In spite of numerous findings of *Protophyllocladus*, its epidermal stucture so far has not been studied in sufficient detail. The epidermal structure of the type material of *P. subintegrifolius* from the Dakota Formation of Kansas (USA) remains unknown. The description of this species from New Jersey (USA) only tells about the distribution of stomata on both surfaces (Berry, 1911). The structure of a stoma and some cells was briefly described for the material from Greenland and Japan (Seward & Conway, 1935; Tanai, 1979). New findings of *Protophyllocladus* from the Lower Cretaceous of the Tomsk oblast' (West Siberia) and the revised material from Sakhalin exhibit well preserved epidermal structures and are described respectively as two new species, *P. vachrameevii* (Golovneva & Nosova, 2011) and "*P. magathianus*" (in preparation). In contrast to *P. vachrameevii* possessing amphistomatic phylloclades and cuticular thickenings on the periclinal cell walls, Sakhalin's phylloclades are hypostomatic and lacking cuticular thickenings. Both species show a similar structure of stomata resembling that of some modern Podocarpaceae – in particular, *Phyllocladus* and *Acmopyle*. Morphologically, phylloclades of *Protophyllocladus* are very close to those of the former genus. This favors the idea of the podocarpaceous affinity of *Protophyllocladus*, despite the current lack of findings of reproductive structures associated with this fossil genus. *Protophyllocladus* was widely distributed in the Siberian-Canadian paleofloristic realm, being known from the Cretaceous of Alaska, the North-East of Russia, Western Siberia, Japan and Sakhalin, as well as the Euro-Sinian paleofloristic realm in Kazakhstan, Europe, Greenland and North America (USA and southwestern Canada).

Keywords: Cretaceous, Podocarpaceae, phylloclades, epidermal structure.

SS34-O03 (156)

The origin of boreal angiosperm flora in Northern Asia and the provincial division of the Siberian-Canadian palaeofloristic region in the Late Cretaceous

Lina Golovneva

Komarov Botanical institute, Russia, lina_golovneva@mail.ru

Early angiosperms appeared in the subtropical areas of the Euro-Sinian palaeofloristic region during the Neocomian-Aptian. Their spreading in the temperate areas of the Siberian-Canadian palaeofloristic region was related with the early-middle Albian climatic optimum. Ancient small-leaved angiosperms were characterized by low abundance, high taxonomic diversity and high endemism. The rise to dominance of angiosperms in the Northern Asia took place in the late

Albian-Cenomanian. The majority of angiosperm genera of this time originated firstly in subtropical areas and later migrated to the north. The formation of first boreal temperate angiosperm flora was related with the period of cool and humid climate in the Turonian-Coniacian. In this time many new boreal autochthonous genera were appeared. They were distributed mainly within Siberian-Canadian region and usually did not penetrate to the subtropical areas. The representatives of the family Platanaceae and genus *Trochodendroides* reached the greatest diversity and dominated in the lowland vegetation. The Asian part of the Siberian-Canadian palaeofloristic region are divided on the Chulym-Yenisei, the Leno-Viluj, the Northern Siberian, the Verkhoyansk, the Mountain Okhotsk-Chukotka, the Anadyr, the Amur, the Mountain Sikhote-Alin and the Sakhalin-Japan provinces. For coastal and northern provinces in comparison with continental and southern ones considerable survival of the early Mesozoic relicts was revealed. Climatic conditions played a significant role in definition of species diversity and degree of floristic differentiation. The epochs with warm and humid climate were characterized by great species diversity, polydominant plant communities with high-specialized species and by the large amount of newly formed taxa. During epochs of humid and cool climate there were a decline in species diversity, an increase of dominance degree in plant communities and prevalence of eurytopic species with extensive geographic and stratigraphic distribution. This resulted in indistinct boundaries between previously existing provinces. Epochs of warm semiarid climate were also characterized by reduced species diversity, but by predominance of stenotopic plants and pronounced endemism of floras in different areas. At the end of such epochs even weak climatic changes led to significant extinction because of narrow ecological specialization of species and genera. The majority of taxa of the first boreal angiosperm flora extinct in the end of the Maastrichtian. The formation of the second boreal angiosperm flora was related with the period of cool and humid climate near the Cretaceous-Palaeogene boundary. This flora consisted of representatives of Betulaceae, Ulmaceae, Juglandaceae, Fagaceae, Hamamelidaceae and many others families, which form the core of temperate boreal flora up to recent time.

SS34-O04 (7)

Early Senonian flora of the Western Siberia: phytogeography and climate reconstruction

Pavel Alexeev

Komarov Botanical Institute RAS, Russia, paulusalex@mail.ru

During Cretaceous time the most part of Western Siberia was covered by shallow sea and non-marine deposits accumulated only in south-eastern part of this region. The one of the most diverse Siberian floras, which consists of more than 45 species, existed here in the Coniacian – Santonian time. This flora was named Antibes flora after nearest settlement. This locality was formed in conditions of coastal plain near or within big river delta. The main feature of Antibes flora is the dominance of angiosperms species in comparison with the poor presence of gymnosperms. The angiosperms are presented here by such genera as *Trochodendroides, Nyssidium, Paraprotophyllum, Liriodendrites, Platanus, Celastrophyllum, Menispermites, Cissites, Araliaephyllum, Laurophyllum, Saliciphyllum, Paranymphea, Disanthophyllum, Archaeampelos, Wolfiophyllum.* There are only three genera of gymnosperms in the Antibes flora: *Ginkgo, Sequoia* and *Protophyllocladus.* Ferns are presented here by families Heroleandraceae, Schizaeaceae, Osmundaceae and Pteridaceae. Our investigations show that Antibes flora has common taxa both with Kazakhstan floras and floras of Eastern Siberia and North-Eastern Asia. The first group includes *Menispermites sibirica, Platanus simonovskiensis, Cissites* cf. *uralensis, Hymenophyllites* cf. *macrosporangiatus*; the second group includes *Paraprotophyllum antibessiensis, Trochodendroides sibirica, Nyssidium* sp., *Araliaephyllum* cf. *jarmoljukii.* This interesting mixture in systematic composition is due with the boundary position of the Antibes flora localities between the

Euro-Sinian phytogeographical region and the Siberian–Canadian region. Except this the Antibes flora contains many endemic species. Whereas relative richness of the Antibes flora with angiosperm species, firstly for the Western Siberia we use the CLAMP-analysis for climate reconstruction. According to its results we can conclude that in the early Senonian time in south part of the Western Siberia was warm-temperate humid climate with maximum precipitation during summer. Probably the proximity of the Western-Siberian Sea significantly influenced on the climate parameters toward the cooling and humidification.

Keywords: Late Cretaceous, Western Siberia, CLAMP.

SS34-O05 (182)

Turonian-Coniacian Arman Flora (North-eastern Russia) and palaeoclimate of the North Asia

Alexei B. Herman[1], Robert A. Spicer[2]

[1] *Geological Institute, Russian Academy of Sciences, Moscow, Russia, herman@ginras.ru*
[2] *The Open University, Milton Keynes, UK*

Arman Flora comes from volcanogenic-sedimentary deposits of the Arman Formation in the Arman River basin and from volcanogenic and volcanogenic-sedimentary rocks of the Nel'kandzha-Khasyn Interfluve, North-eastern Russia. It comprises about 80 fossil plant species belonging to liverworts, horsetails, ferns, caytonialeans, cycadaleans, bennettitaleans, ginkgoaleans, leptostrobaleans, conifers, gymnosperms *incertae sedis* and angiosperms. The Arman Flora is dated as Turonian and Coniacian due to its similarity with Penzhina and Kaivayam floras of Northwest Kamchatka and Tylpegyrgynai Flora of the Pekul'nei Ridge; the latter floras are securely dated due to the correlations of their plant-bearing beds with marine biostratigraphy. Turonian-Coniacian age of the Arman Flora is corroborated by isotopic (U-Pb SHRIMP and $^{40}Ar/^{39}Ar$) age determination for the plant-bearing layers. Our estimates using CLAMP and a new global gridded climate calibration demonstrate that for the Arman Flora plant physiognomy reflects a humid warm-temperate climate with warm summers, mild winters and a weak seasonality in precipitation. CLAMP analysis yielded a mean annual temperature of +8.2 ± 2.2°C, a warm month mean temperature of +18.7 ± 2.8 °C, a cold month mean temperature of -2.0 ± 3.8 °C, a mean growing season precipitation of 481 ± 392 mm, a mean monthly growing season precipitation of 88 ± 52 mm, a precipitation during three consecutive wettest months of 481 ± 276 mm, a precipitation during the three consecutive driest months of 143 ± 64 mm, an annual relative humidity of 74.1 ±10.4 % and a growing season length of 5.3 ± 1.4 months (all uncertainties are ± 2σ). This climate is most similar to those estimated for the Turonian Penzhina and Coniacian Kaivayam and Tylpegyrgynai floras (NE Russia). Six Turonian-Coniacian floras of North Asia were analysed using the CLAMP technique. These floras belong to the Siberian-Canadian Palaeofloristic Region characterised by a temperate climate (Vakhrameev, 1991). Judging from our estimates, they experienced wet warm-temperate climate ranging from almost cool- temperate (Penzhina Flora) to almost subtropical (Antibes Flora).

Keywords: Late Cretaceous, North Asia, fossil flora, palaeoclimate, CLAMP.

SS34-O06 (467)

Taxonomic and palaeoecological implications of mountain floras from the Okhotsk-Chukotka volcanic belts in connection with problem of evolution and expansion of angiosperms

Sergey Shczepetov, Lina Golovneva

Komarov Botanical institute, Russia, Shchepetov@mail.ru

The Cretaceous Okhotsk–Chukotka volcanic belt (OCVB) is a large volcanic province of Northeastern Eurasia related to active continental margin. It extends from the western coast of the Sea of Okhotsk to the east of the Chukchi Peninsula (3200 km long). The total thickness of volcanic deposits ranges between 2 and 4 km. The time of active eruptions is estimated from the Albian up to Campanian, but the greatest part of volcanic pile seems to be accumulated between the Turonian and Campanian. Volcanic rocks of the OCVB comprise lavas (basalts, andesites, rhyolites, ignimbrites) and pyroclastic interlayers, which have been formed in a continental environment. Ash-fall tuff deposits contain numerous localities of fossil plants. The Cretaceous mountain floras were significantly distinct from contemporaneous floras of adjacent coastal lowland, which were distributed from eastern (sea-side) margin of the volcanic belt. The Coniacian Chaun flora of Central Chukotka is typical mountain flora of the Okhotsk-Chukotka volcanic belt. It is characterized by predominance of ferns and conifers, rarity of angiosperms and by significant amount of the ancient early Cretaceous elements (some ferns, cycadophytes, czekanowskiales and ginkgoales). The Turonian-Coniacian (Penzhina, Kaivajam and Tylpegyrgynai) floras of coastal lowlands is characterized by dominating of flowering plants (the genera *Pseudoprotophyllum, Arthollia, Paraprotophyllum, Trochopedendroides, Dalembia, Menispermites, Araliaephyllum, Cissites, Viburniphullum, Quereuxia*) and by disappearance of the Lower Cretaceous relicts such as *Podozamites, Phoenicopsis* and cycadophytes. Systematic composition and palaeoecological features of mountain floras of OCVB confirm the coastal hypothesis for the dispersal and rise to dominance of flowering plants (Retallack**,** Dilcher, 1981). In spite of practically full absence of angiosperms, florogenesis and taxonomic evolution did not stop in mountain areas. There are many newly formed species and genera among ferns, cycadophytes and conifers The majority of these taxa had narrow geographic ranges inside OCVB. In consequence of high endemism of local floras the territory of this mountain volcanic belt was characterized by very high phytochorological differentiation during the Late Cretaceous.

SS34-O07 (341)

New data on the Ust-Emuneret flora from the Upper Cretaceous volcanogenic deposits of Central Chukotka (Northeastern Russia): taxonomic composition, age and palaeoclimate

Maria Moiseeva[1], Alexandra Sokolova[2]

[1] *Geological Institute of the Russian Academy of Sciences, Moscow, Russia; moiseeva@ginras.ru*
[2] *A.A. Borissiak Paleontological Institute of the Russian Academy of Sciences, Moscow, Russia*

The Ust-Emuneret flora is crucial for the correlation and dating of the continental volcanogenic deposits which were formed during the late stage of the evolution of Okhotsk-Chukotka volcanic belt. This flora comes from the Emuneret Formation of the Enmyvaam River Basin (Central Chukotka) and had not been formally described earlier. Lebedev (1987) published only a short preliminary list of species (29 taxa) for this fossil plant assemblage. The age of the Ust-Emuneret flora has been debated over last three decades. According to palynological data, it is late Turonian (Belyi, Belaya, 1998). Based on isotopic data, it was dated as Cenomanian – Turonian (92.7±2 Ma) (Kotlyar, Rusakova, 2004) or Coniacian – Santonian (86.8 ± 2.7 Ma) (Tikhomirov et al., 2006). Palaeomagnetic data indicate the late Santonian age of plant-bearing deposits (Raikevich, 1995). On the other hand, according to Lebedev (1987), the Ust-Emuneret assemblage is similar in its floristic composition to the Campanian Barykov flora of Ugol'naya Bay. Based on our new data the Ust-Emuneret flora includes 57 species of fossil plants comprising angiosperms (44 %), conifers

(31%), ferns (12%), ginkgoaleans (8.7%), czekanowskialeans (1.7%) and liverworts (1.7%). The flora is characterized by combination of Mesophytic elements (*Sphenobaiera, Ginkgodium, Phoenicopsis*) and advanced Late Cretaceous angiosperms and conifers. Angiosperms are the most numerous and diverse. Among them *Barykovia tchucotica* and several species of *Trochodendroides* are dominated. *Macclintockia ochotica* and representatives of genera *Menispermites, Cissites, Viburniphyllum, Zizyphoides, Renea, Paranymphaea, Dicotylophyllum* are less numerous. In general angiosperms are characterized by small size of leaf lamina and absence of platanoids. Conifers are quite diverse and among them scale-shaped morphotypes (*Brachiphyllum, Glyptostrobus, Cupressinocladus*) are dominated. Several species of Pinaceae (*Pseudolarix kolymensis, Pityophyllum, Pityospermum*, *Pityolepis, Cedrus lopatinii)* and Taxodiaceae (*Parataxodium, Sequoia*) are characteristic plants of this flora. The comparison of the Ust-Emuneret flora with other floras of Northeastern Russia reveals that it differs significantly from the Cenomanian-Turonian floras. Angiosperm taxa such as *Barykovia, Macclintockia, Trochodendroides* suggest a similarity with the Campanian Barykov and Upper Bystrinskaya floras. Conifers of the Ust-Emuneret flora are close to the Arkagala flora (Samylina, 1988). In our opinion the most probable age of the Ust-Emuneret flora is late Santonian (possibly extend to the early Santonian and early Campanian). This conclusion is consistent with the last isotopic and palaeomagnetic dates. The preliminary results of CLAMP-analysis indicate that the Ust-Emuneret flora existed in a temperate climate with mild frost free winters and dry conditions within the growing season.

SS34-O08 (549)
Cenomanian flora from Primorye region, Russian Far East

Elena Volynets

Institute of Biology and Soil Sciences, FEB RAS, Vladivostok, Russia, volynets61@yandex.ru

In Primorye, the Cenomanian flora occurs in the four areas. In Alchan Basin situated in northwestern part of Primorye region the fossil plants were collected from the upper part of Stolbovaya beds (late Cenomanian). On the east slope of Sikhote-Alin Ridge the fossil plants come from the Petrozuevka Floral horizon (late Cenomanian). In the southeastern Primorye in the Partizansk Basin the Cenomanian flora is divided into two assemblages: Brovnichi (late Albian-early Cenomanian) and Dadanschan (late Cenomanian) from the eponymous formations. In the southwestern Primorye in the Razdol'naya Basin the Cenomanian fossil plants were newly found. These plants were included in early (late Albian-early Cenomanian) and late (late Cenomanian) assemblages from the Korkino Group. The late Albian-early Cenomanian floral assemblages are characterized by the mainly ferns (*Anemia, Birisia, Gleichenites*), conifers (*Athrotaxopsis, Sequoia, Taxites*), and rare angiosperms (*Araliaephyllum*). Angiosperms predominate in the late Cenomanian floral assemblages. They mostly are represented by "platanoid" leaves. The aquatic angiosperms (*Quereuxia, Potamogeton, Cobbania*) and ferns (*Salvinia*) have been found. Among the conifers the representatives of genus *Sequoia, Parataxodium, Metasequoia, Thuja, Mesocyparis* and others are present. Ferns are rare. The work was supported by the Presidium of the Russian Academy of Science (grant 12-I-P28-01).

Keywords: flora, plant, assemblage, Cenomanian, Primorye.

SS34-P01 (445)
Early Cretaceous flora from the Tetori Group in the Oguchi area, Hakusan City, Ishikawa Prefecture, Japan

Yusuke Sakai[1], Shinji Sekido[2], Atsushi Matsuoka[3]

[1] *Graduate School of Science and Technology, Niigata University, 8050, Ikarashi 2-no-cho, Nishi-ku, Niigata 950-2181, Japan, f11e081j@mail.cc.niigata-u.ac.jp*
[2] *Komatsu City Museum, 19, Marunouchi Koen, Komatsu 923-0903, Japan*
[3] *Department of Geology, Niigata University, Niigata 950-2181, Japan*

The Tetori Group is a middle Jurassic - lower Cretaceous sequence distributed in the Inner Zone of Southwest Japan. It consists of three Sub-groups: Kuzuryu, Itoshiro and Akaiwa Sub-groups in ascending order. The Itoshiro and Akaiwa Sub-groups consist mainly of non-marine deposits. The Tetori Flora is subdivided into four floras, the kuzuryu, Oguchi, Akaiwa, Tamodani floras in ascending order. We report a new flora from the Oguchi area, Hakusan City, Ishikawa Prefecture. The Oguchi area is located in the north of the Kuwajima Kaseki-kabe, a famous fossil-bearing outcrop containing the Oguchi Flora. In the Oguchi area, the Tetori Group can be divided into three formations: Gomijima, Kuwajima and Akaiwa formations in ascending order. The Gomijima Formation is represented by basal conglomerate. The Kuwajima Formation consists of alternating beds of fine-grained sandstone and black mudstone. The sedimentary sequences of the Kuwajima Kaseki-kabe belong to the Kuwajima Formation, which is dated as Barremian to Aptian based partly on U-Pb age of a tuff bed. The Akaiwa Formation is characterized by coarse-grained arkose sandstone and orthoquartzite-bearing conglomerate. The new flora includes 12 genera and 14 species : *Birisia onychioides* (Vassilevskaja & Kara-Mursa) Samylina, *Cladophlebis* sp., *Coniopteris burejensis* (Zalesskey) Seward, *Ginkgoites digitata* (Brongniart) Seward, *Gleichenites* sp., *Nilssonia nipponensis* Yokoyama, *Nilssonia* sp., *Onychiopsis elongata* (GEYLER) Yokoyama, *Osmundopsis distans* (Heer) Kimura & Sekido, *Podocarpus reinii* (Geyler) Matsuo, *Podocarpus tedoriensis* Matsuo, *Podozamites lanceolatus* (Lindley & Hutton) Braun, *Taeniopteris* sp. and *Carpolithes* sp. The flora includes abundant fern, especially *Coniopteris*. It seems that the horizon containing the new flora is equivalent to the stratigraphic level of the Kuwajima Kaseki-kabe.

Keywords: Tetori Group, stratigraphy, Tetori Flora, Tetori-type floras, Early Cretaceous.