Vegetation responses during the end-Triassic biotic crisis: Mass rarity, mutations and extinctions

Lindström, Sofie

Publication date:
2022

Document version
Publisher's PDF, also known as Version of record

Document license:
Unspecified

Citation for published version (APA):
O.087 Development of high-diversity beech forest in the eastern Carpathians

Lestienne, Marion¹; Jamrichova, Eva²; Kuosmanen, Niina¹; Diaconu, Andrei-Cosmin³; Schafstall, Nick¹; Goliáš, Viktor⁴; Šulc, Václav⁵; Kuneš, Petr⁵

¹Department of Forest Ecology, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Praha 6, Czech Republic. ²Institute of Botany, Czech Academy of Sciences, Lidická 25/27, 602 00 Brno, Czech Republic. ³Department of Geology, Babeş-Bolyai University, Kogălniceanu 1, 400084, Cluj-Napoca, Romania. ⁴Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University in Prague, Albertov 6, 128 43 Prague 2, Czech Republic. ⁵Department of Botany, Faculty of Science, Charles University, Benátská 433/2, 128 01 Praha 2, Czech Republic.

Over recent decades, a surge in the number of large and uncontrolled wildfires has occurred in all terrestrial ecosystems and global warming may amplify this trend and threaten most ecosystems worldwide for the coming decades. These alterations of fire regimes will affect fire-prone systems but also forest ecosystems that have not historically experienced fires, such as European beech forests. These deciduous forests endemic to Europe are characterized by high plant diversity, and understanding their formation and decline is crucial to anticipating possible changes in these ecosystems as a result of global warming. In this context, the aim of this study is to understand how its forests have colonized Europe and what are the main factors explaining their high biodiversity. To fill this gap of knowledge, we applied a multi-proxy approach (macrocharcoal, pollen, macrofossils) and we estimate the palynological richness variation on a lake sediment core located in the northern Carpathians, Slovakia. Our results showed that low-diversity spruce woods were dominant until 5,200 cal. BP during a fire-prone period mainly due to climatic conditions. The establishment of late-successional, shade tolerant Fagus sylvatica was facilitated by fire disturbances, but its expansion coincided with major gaps in fire events from 3,900 cal. BP. The palynological richness has increased during the spruce wood/beech wood transition highlighting the importance of beech forests in maintaining plant biodiversity. However, the stronger increase of the richness is synchronous with the increase in human activities around 2,000 cal. BP, and then 350 cal. BP. By promoting the emergence of high-diversity beech wood at low frequency, fires have been a natural driver of vegetation changes in the Carpathians, similar to humans who later also shaped these landscapes.

O.088 Vegetation responses during the end-Triassic biotic crisis: Mass rarity, mutations and extinctions

Lindström, Sofie¹,²,³


Greenhouse gas emissions from large-scale volcanism in the Central Atlantic Magmatic Province (CAMP) are considered to have caused the end-Triassic mass extinction (ETME; 201.5 million years ago), but the impact on land plants has been debated, with some researchers suggesting that there was no extinction in plants during this biotic crisis. Yet, multiple spore-pollen records across the Triassic–Jurassic boundary testify that many plants
were severely decimated at the end of the Rhaetian (the latest Triassic) with some going extinct already during the crisis and some lingering on into the earliest Jurassic before ultimately disappearing from the fossil record. For plants, the concept of mass rarity—i.e., the reduction in abundances and/or reduction in geographic ranges of several species contemporaneously—may be more important than taxonomic extinction when evaluating the severity of a biotic crisis. In Triassic–Jurassic boundary successions from the European epicontinental sea and the northern European Tethys margin, two distinct phases of mass rarity in spores and pollen are recorded. During these two mass rarity phases, both previously dominant and rare plants were affected, which testifies to the devastating consequences the environmental and climatic effects of the CAMP-volcanism had on the terrestrial ecosystem. Combined stress from rising air temperatures, changing climate, wildfires, and volcanic-induced heavy metal pollution, was exacerbated by fragmentation and destruction of coastal and near-coastal lowland mire habitats during rapid sea-level changes most likely linked to crustal deformation due to ongoing magma emplacement. The responses of the vegetation are recorded as mass rarity, mutations, lingering of ghost taxa, restructuring of ecosystems and extinctions. This should resonate with ongoing and future climate change as it attests to the vulnerability of coastal and lowland vegetation to climatic and environmental disturbances, including rapid sea-level changes, which threatens entire ecosystems.

**O.089 Digging for Paleozoic roots of Mesozoic conifers**

Looy, Cindy V.1,2,3; Duijnstee, Ivo A.P.1,2; Blomenkemper, Patrick4; Kerp, Hans4; Bomfleur, Benjamin 4

1Department of Integrative Biology, University of California, Berkeley, USA. 2University of California Museum of Paleontology, USA. 3University and Jepson Herbaria, University of California, Berkeley, USA. 4Institute of Geology and Palaeontology, University of Münster, Münster, Germany.

Recent finds of mixed gymnosperm floras from Jordan have shown that typically Mesozoic gymnosperm lineages, bennettites, corystosperms and ‘modern’ conifers were already in existence during the late Permian. The suite of groups within the conifer lineage represented in the Jordan flora is particularly unexpected. Aside from common late Permian conifers (*Ullmannia* and *Quadrocladus*), they include the precocious, earliest records of typical Mesozoic forms (*Podozamites*, *Elatocladus*, and a *Rissikia*-like podocarp), but also unexpectedly late occurrences of walchian conifers (*Walchia* and *Otovicia*) that were so far known mainly from Late Carboniferous and early Permian Euramerican floras. Many specimens have well-preserved cuticles and, in addition to the vegetative leaves and leafy shoots, the flora also includes ovuliferous cones, isolated dwarf shoots and pollen cones containing *in situ* pollen. Using fluorescence and light microscopy, we continue to identify and re-assemble vegetative and reproductive plant organs and (pre)pollen within this seemingly anachronistic assemblage. Echoing the theme of precocious conifer occurrences in Jordan, earliest Guadalupian deposits of western equatorial Pangea (Texas) have yielded broad, multiveined conifer leaves (*Johniphyllum*) that co-occur with voltzian ovuliferous dwarf shoots with 3–5 adjoining sporophylls (*Wantus*). Such a combination of vegetative and reproductive characters was, thus far, only known from a successful Mesozoic voltzian conifer clade that ranged from *Aethophyllum* and *Heidiphyllum*/Telemachus in the Triassic to Krassiloviaceae in the Early Cretaceous. Exploration of the Jordanian and Texan floras has increased both the taxonomic diversity and the morphological disparity among...