

16/12/2024

A pollen-based paleoecological and evolutionary journey from Caribbean coasts to Pyrenean slopes



The fossil pollen analysis is of particular importance in the deciphering of the origin and evolution of ecosystems, and it allows us to gain a global perspective on these processes. The Institut Català de Paleontologia (ICP-CERCA) participates in the recent publication of two books, two major compilations of fossil pollen studies in the Caribbean mangroves and Pyrenean forests, which reveal new insights in their respective fields.

The fossil pollen allows us to decipher the origin and evolution of ecosystems as disparate as tropical mangroves and European mountain forests. Additionally, they inform us about the role of factors such as regional tectonics, continental drift, climate changes, sea level fluctuations and human pressure on these ecosystems over time.

Mangroves are forests from tropical intertidal zones that are fundamental for maintaining biodiversity and the ecological functioning of coastal ecosystems. They also constitute the largest reservoirs of blue carbon as a mitigator of global warming. The current Caribbean mangroves are fairly well known, but their origin and evolution had not been addressed globally and in detail until the publication of the book "Origin and Evolution of Caribbean

Mangroves". This book gathers practically all existing studies (more than 150 locations, from the Cretaceous to the Quaternary) on fossil pollen from Caribbean mangroves and provides a different perspective from the classical hypotheses on the origin, evolution, diversification, and biogeography of these ecosystems. There is no such compilation for any other mangrove region in the world.

The most striking finding is that Caribbean mangroves did not originate in the Cretaceous, as previously believed, but much later, in the Eocene, as "de novo" communities, and not as descendants of supposed earlier pantropical mangroves. These mangroves underwent their greatest evolutionary revolution in the Eocene-Oligocene transition (EOT), where the dominant species changed radically, began to diversify in the Neogene and, also contrary to previous beliefs, did not reach their current composition until the Plio-Pleistocene.

The varved (annually-laminated) sediments of the Pyrenean Lake Montcortès, situated inside the "Geoparc Orígens", constitute the longest, continuous, and most detailed Late Holocene sequence known for the Iberian Peninsula. The pollen analysis of these sediments is the best paleovegetation record available in the whole Mediterranean region for the last 3000 years. A recently published book, "Vegetation and Landscape Dynamics of the Iberian Pyrenees During the Last 3000 Years", synthesizes the paleovegetational studies developed to date and compares the results with the known climatic shifts and the archaeological and historical records from the Bronze Age to the present.

The Montcortès forests were in a nearly pristine condition until the Late Bronze Age, with the main environmental drivers of change being climatic. The first signs of anthropization did not appear until the Iron Age, but no extensive deforestations were recorded until the Roman domination. Since then, climate and human activities, as well as their interactions, have been the decisive drivers. Three main deforestation events were recorded during Roman, Medieval, and Modern times, but forests always recovered, even after a reduction of 70% in forest cover during the Middle Ages. This bulk resilience was also paralleled by high constancy in spatial arrangement (mosaic resilience) and taxonomic composition (community resilience). The Montcortès section is considered a reference paleoecological section for the Mediterranean region, especially for the western sector.

Valentí Rull

Institut Botànic de Barcelona (CSIC)

Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA)

Universitat Autònoma de Barcelona

Valenti.rull@icp.cat

References

Rull, V. (2024). **Origin and Evolution of Caribbean Mangroves: A Time-Continuum Ecological Approach** (1st ed., Vol. 252). *Springer International Publishing AG*.

<https://doi.org/10.1007/978-3-031-57612-6>

Rull, V., & Vegas-Vilarrúbia, T. (2024). **Vegetation and Landscape Dynamics of the Iberian Pyrenees During the Last 3000 Years: The Montcortès Palynological Record** (1st ed., Vol. 251). *Springer International Publishing AG*. <https://doi.org/10.1007/978-3-031-57441-2>

[View low-bandwidth version](#)