

Dinosaurs and amber: A new window to the Cretaceous world from 110 million years ago

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A fragment of dinosaur feather found in the site of Ariño (Spain). Credit: eLife

New findings of amber in the site of Ariño in Teruel (Spain) have enabled the reconstruction of a swampy paleoenvironment with a rich coastal resin forest from 110 million years ago, from the era of dinosaurs. This place featured conifers and understories of gymnosperms and ferns, and flower plants, where insects, turtles, crocodiles, mammals and dinosaurs such as the species *Proa valdearinnensis* and *Europelta carbonensis* lived.

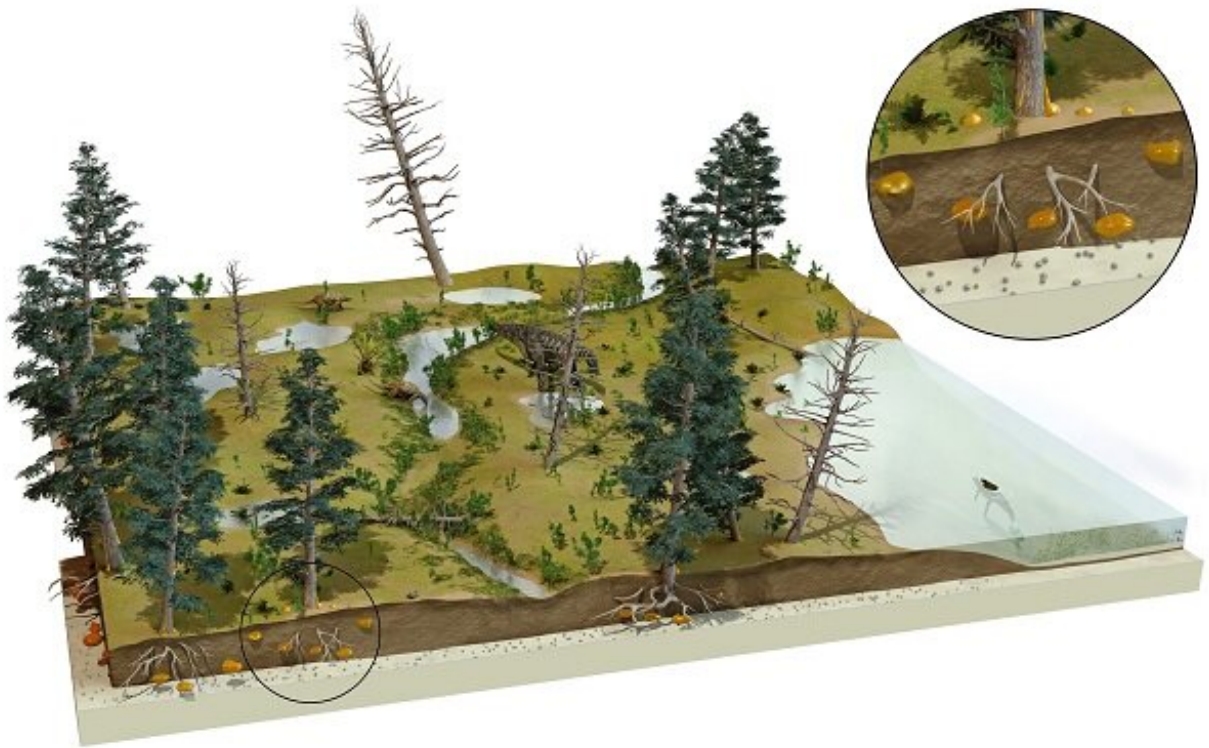
This is one of the main contributions of a paper published in the journal *eLife* which counts on the participation of members of the Faculty of Earth Sciences of the University of Barcelona and the Biodiversity Research Institute of the University of Barcelona (IRBio), the University of Oxford Museum of Natural History, the Spanish Geological and Mining Institute (IGME-CSIC) and the Dinópolis-Teruel Foundation, among a total of sixteen international institutions. The new findings confirm Ariño as one of the most complete and important sites in the Cretaceous field.

Ariño: From mining to paleontological richness

Ariño is a [site](#) inside an open mine of lignite, known for the many [fossil remains](#) of vertebrates found over the last years. Amber or fossilized resin in Ariño is associated with remains of dinosaurs and other vertebrates, and it is unusually rich in bioinclusions, that is, biological remains conserved in the inside (specially insects and other arthropods).

"The amber in Ariño is one of the most prolific ambers worldwide and

in previous excavations, it has provided fossil remains of eleven groups of insects, apart from mites, spiders, mammal hair, and a fragment of dinosaur feather", notes Sergio Álvarez Parra, first author of the article and member of the Faculty of Earth Sciences and the IRBio.



Reconstruction of a swampy paleoenvironment in Ariño (Spain) with a rich coastal resin forest from 110 million years ago. Credit: José Antonio Peñas

"These findings show the wise choice of sampling a site that would disappear since the collection of recovered fossils is still bringing scientific surprises although the extensive fossil layer of Ariño is not accessible anymore", says Luis Alcalá, former director of the Dinopolis-Teruel Foundation and current director of the Granada Science Park.

The finding of amber with fossil content near the dinosaur remains is exceptionally rare, only registered in three sites worldwide, located in Fouras (France), Pipestone Creek (Canada) and Bone Butte (United States).

Moreover, "the Ariño case is more exceptional since the vertebrate remains of the site and the bioinclusions of the amber are especially abundant and diverse", states Ricardo Pérez de la Fuente, member of the University of Oxford Museum of Natural History. Therefore, the study of the features of the Ariño amber has enabled researchers to differentiate two piece types: those related to resin produced by [tree roots](#) (root amber) and those related to the resin produced in the branches or the trunk (aerial amber).

Bioinclusions were only found in aerial amber pieces. "The distribution of each type of piece in the site and the features of the shape and external surface of root amber pieces shows these did not undergo any movement, this is why they have been found in the same place where the trees produced them about 110 million years ago. This feature has been identified for the first time in the fossil records", notes Xavier Delclòs, professor at the Department of Earth and Ocean Dynamics of the UB and member of IRBio.

"Moreover, in the amber, we also found Ceratopogonidae blood-sucker mosquitoes and dinosaur remains at the same stratigraphic range. This means that the possibility of mosquitoes biting those dinosaurs is an open option", says the expert Enrique Peñalver (IGME-CSIC). The geochemical analysis of amber indicates that the resin was produced by araucarians, a group of conifers that currently live in the southern hemisphere.



A trapped wasp in the amber piece. Credit: eLife/Sergio Álvarez Parra (UB-IRBio)

As part of the study, the analysis of microfossils (charophyte algae, pollen and ostracods) helps completing the paleoenvironmental information of the site in Ariño. "Considering the series of results we had from the site and those obtained in the new study, we could reconstruct the ecosystem where the resiniferous trees grew at an exceptional level, a scientific milestone rarely achieved so far in paleontology", notes Álvarez Parra.

As stated by Eduardo Espílez and Luis Mampel, from the Dinopolis-Teruel Foundation, "new data confirm the exceptionality of the site, where the team of the Dinopolis-Teruel Foundation has undergone excavations of 163 concentrations of vertebrates and has recovered more than 11,000 fossils since 2010, and where the studies will continue

during 2022".

This study is part of the doctoral thesis carried out by Sergio Álvarez Parra (UB-IRBio), who counts on the support from the Secretary of Universities and Research of the Catalan Government and the Social European Fund. Among the co-authors of the paper are the experts Jordi Pérez Cano, Carles Martín Closas, David Peris and Constanza Peña Kairath, from the Department of Earth and Ocean Dynamics and IRBio.

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More information: Sergio Álvarez-Parra et al, Dinosaur bonebed amber from an original swamp forest soil, *eLife* (2021). [DOI: 10.7554/eLife.72477](https://doi.org/10.7554/eLife.72477)

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