Paradi²s

PARAsitic DIversity, vectors, host and transfers in Early Cretaceous DInosaur-aSsociated vertebrates

DURATION
15/12/2020 - 15/03/2025

BUDGET
738 324€

PROJECT DESCRIPTION

Over geological times, biological crises and diversification events have fashioned the evolutionary history of plants and animals. Palaeontologists usually interpret the evolutionary success of a lineage and its demise in direct relation to environmental variations, including its food web and climate changes. The impact of interspecific associations, like parasitism, is usually neglected by palaeontologists, although parasitism and zoonotic diseases are well known to constrain the sustainable settlement of human and animal populations in historical periods. The soft body of ancient parasites is indeed extremely rarely preserved in the fossil record. However, since a dozen of years, evidences started to accumulate, showing examples of overlooked ectoparasites that were fossilized on their host (mites and fleas), fossil feces preserving digested structural inclusions, organic molecules and above all, cysts and eggs of parasites. This project aims at:

(1) analysing the **parasitic content of fossilised droppings of dinosaurs' associated faunas** (dinosaurs and other terrestrial vertebrates) from Early Cretaceous deposits of Belgium (Bernissart), France, Lebanon, and China, focusing on non-destructive methods (micro- and nano-CT scanning) but also using extractions through acid dissolution. The studied feces are 140-100 Ma in age and have been selected for (a) the already-existing knowledge about the potential scat producers, (b) their potential for parasites' preservation from published/unpublished preliminary observations.

(2) Examining, for the first time, large collection of dinosaurs, birds and mammals from the Lower Cretaceous of Liaoning (China) with exceptionally preserved plumages and furs, and of Early Cretaceous amber (fossilised tree resin) from Lebanon, for the **preservation of external parasites** (insects and arachnids). In parallel, the material of likely hematophagous insects (mostly dipterous) recovered from these deposits will be re-examined, focusing on their buccal appendages and relevant host range.

(3) improving our understanding of **fossil feces** using novel combination of technics to image their food/parasitic content at high resolution (Computed and FIB-SEM tomography); compare the level of preservation of some **original organic molecules** in and out of fossil feces (RAMAN and FTIR spectroscopy); link the fossil droppings elementary composition to **palaeotemperatures and climate** (XRF, isotopic geochemistry, cathodoluminescence, LIBS spectroscopy).

This project will document for the first time **the distribution of parasitic groups (and possible vectors) among terrestrial vertebrates, including dinosaurs, during the Mesozoic**. Distributions may suggest changes in hosts over time, with possible impacts on host fitness and communities as early as the Cretaceous. This would allow deciphering how parasites taxa were actually distributed in, and have affected, groups of ecologically-dominant terrestrial vertebrates in the History of Life.

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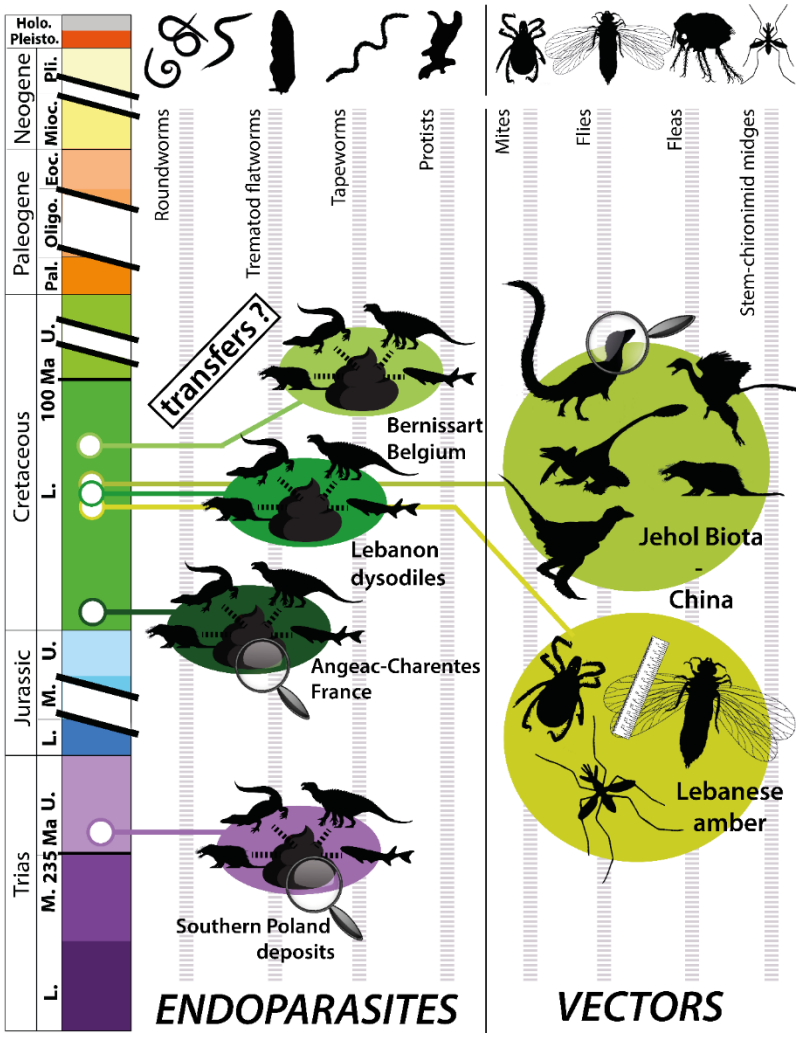
PARADI²S represents the very first integrative and multidisciplinary project dedicated to fossil (non-Quaternary) parasitism. The fact that hundreds of million years old parasitic relationships can be documented by fossils is largely untold to public, but even often ignored by evolutionary biologists and paleontologists themselves. PARADI²S dissemination plan therefore consists of a valorization strategy toward (**1**) general non-scientific public and (**2**) evolutionary biologists. Ultimately, (**3**) the community of parasitologists and researcher on pathogenic diseases will be targeted to communicate PARADI²S results. The project also provides an interesting new context for the testing of currently engineering developed algorithms of semi-automated detection/counting of endoparasites in feces (**4**). At a broader scale PARADI²S will evidence the **potential of among the most underrated fossil**s, fossil feces being rather common fossils in numerous terrestrial and marine ecosystems but remaining mostly seen as objects of curiosity. Where archaeoparasitology is yet routinely applied to document aspects of Quaternary practices (dietary, sanitary, and farming practices, migrations, and cultural exchanges, ethnomedicine or domestication), PARADI²S would represent a **milestone in the development of palaeoparasitology** to reconstruct various ecological aspects of the phanerozoic ecosystems.



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LINKS

https://www.researchgate.net/project/Parasitic-Diversity-vectors-host-and-transfers-in-Early-Cretaceous-Dinosaurs-Associated-Vertebrates