

## **PARAsitic Diversity, vectors, host and transfers in Early Cretaceous Dinosaur-aSsociated vertebrates**

### **ABSTRACT**

#### **Context**

Parasitic animals are known to have evolved with the acquisition of a complex life cycle passing through egg, larvae, multiple cysts (i.e., resistance stages), and usually a brief adult stage. The segmentation of parasites' life cycle has appeared along with the acquisition of several – and very different – hosts over one individual lifespan. We know that significant switches in hosts are thought to happen along with (1) a biotic expansion of the parasites and (2) ecological perturbations on the side of the hosts, the latter applying largely to most terrestrial vertebrates in the context of rapid climate change and drastic reduction of wild territories in profit of livestock exploitations. We ignore though if parasite transfers between vertebrates always occurred this way ? Early on, could different animals have played specific roles in disease transfers as vectors and which were their animal hosts ? To tackle these main questions, the 4-years PARADI<sup>2</sup>S project offers to study (1) mineralized 150-100 million years old faeces of vertebrates for their content in internal parasites, in order to document parasitic changes over time; and (2) ancient ectoparasitic animals preserved in amber to understand how they changed in hosts over time.

#### **State of the art and objectives**

The PARADI<sup>2</sup>S project aimed to:

- Unravel the chemical signal contained in mineralized fossil stools.
- Examine collections of exceptionally preserved plumage/furs of Early Cretaceous dinosaurs/mammals.
- Analyze the endoparasitic content of several hundreds of vertebrate coprolites.
- Infer direct vertebrate host switch by main lineages of parasites.

#### **Results**

- WP1. We studied about 600 fossil feces of successive geological ages and characterized the vertebrate
- WP2. We assessed the elemental chemistry of fossil feces and showed it reflects diagenesis
- WP3. Assess the isotopic signal of fossil feces and showed it can be a proxy for paleoenvironmental reconstructions
- WP4. We identify 30 fossil endoparasitic inclusions and designed a project to distinguish them from fossil pollens
- WP5. We described new cases of Early Cretaceous ectoparasitic arthropods and set a benchmark for the recognition of fossil blood in amber and then of hematophagous insects.
- WP6. We discovered and unveiled the paleobiodiversity of a co-eval fossil site of that of Bernissart, Belgium, which is worldwide famous for providing among the first described dinosaurs.

#### **Conclusions**

PARADI<sup>2</sup>S project allowed the following conclusions:

- The recognition of fossil parasites in mineralized faeces implies more comparative taphonomy studies to be properly done
- It is though well-preserved calcium-phosphate faeces and could inform on host-parasite transfers
- Amber can preserve ancient molecules indicative of ancient ecologies
- Fossil faeces could be used as paleoenvironmental proxy, in place or complement of skeletal remains

It aligns with RBINS's strategic goals for 2020–2025, enhancing our understanding of how parasites and micro-organisms evolve through time depending on their hosts environments.

**Keywords**

Parasitism, fossil feces, amber, terrestrial vertebrate assemblages, elemental chemistry, isotopic signal, mites, blood-sucking insects, helminths identification.