


Experiment title:

Study of fossils of Coleoptera Leiodidae in amber by X-ray phase contrast microtomography

Experiment number:
EC530

Beamline:

BM5

Date of experiment:

from: 09/12/2009 to: 15/12/2009

Date of report:

27/02/2013

Shifts:

6

Local contact(s): Paul Tafforeau

Received at ESRF:

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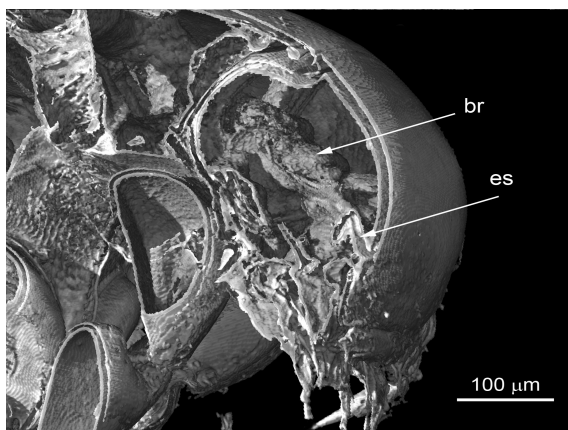
Ricardo Perez de la Fuente, student

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Report:

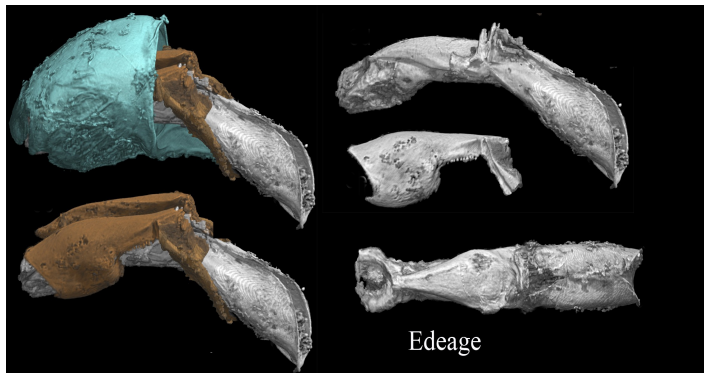
20 amber fossils have been scanned: one from eocene amber (Dominican republic), 3 from cretaceous amber (Myanmar and Spain), 1 from Sparnacian (Oise) and 15 from Baltic amber. Two essential results have been obtained, one methodologic, one scientific:

1 – The high level of coherence of the beamlight of ESRF synchrotron radiation allows to get tomographic pictures with a level of resolution far above conventional methods, allowing a detailed restitution of internal structures, which was not done before (Perreau & Tafforeau, 2011 and next picture obtained during the EC530 experiment, showing the internal morphology of the head of *Micronemadus microtomographicus* Perreau & Tafforeau, 2011, especially remains of the brain, and below the virtual dissection of genitalia).



br=brain

es=epistomal suture



2 – The specimens from dominican amber (25 million years) and baltic amber (35-40 million years) can be assigned to genera (and in some cases to species groups) which were first described on extant fauna. Then the extant genera and species groups were already present at the Eocene period (Perreau, 2012). The few cretaceous samples (circa 100 million years) available at the time of EC530 experiment suggest that they belong to different genera and perhaps even tribes as the extant fauna (results not yet published, but presented to international conferences).

Two papers have been published, but all results have not yet been published, three others papers are in preparations.

The titles and abstracts of the two published papers follows:

1 - Perreau M. & P. Tafforeau, 2011. Virtual dissection using phase-contrast X-ray synchrotron microtomography: reducing the gap between fossils and extant species. *Systematic entomology*, 36: 573-580.

Abstract:

Fossils provide excellent opportunities for bringing to light evolutionary trends, and testing phylogenetic hypotheses. However, the difficult access to internal structures limits the provision of accurate descriptions, and thus limits the comparisons of fossil specimens with extant fauna. The virtual dissection of amber fossils by propagation phase-contrast X-ray synchrotron microtomography (PPC-SR μ CT) allows incomparable possibilities for the visualisation of genital structures, which are of prime importance in assessing the taxonomic status and phylogenetic relationships in many groups of insects. The method is illustrated on one new species of Coleoptera Leiodidae Anemadini in Baltic amber: *Nemadus microtomographicus* sp. n.

2 - Perreau M., 2012. Description of a new genus and two new species of Leiodidae (Coleoptera) from Baltic amber using phase contrast synchrotron X-ray microtomography. *Zootaxa*, 3455: 81-88.

Abstract.

One new genus and two new amber fossil species of Leiodidae are described: *Catops perkovskyi* sp. n. (Cholevinae Cholevini) and *Tafforeus cainosternus* gen. n., sp. n. (Leiodinae Pseudoliodini); using virtual dissection by propagation phase contrast synchrotron X-ray microtomography, which allows for visualization of the genital structures in a non-invasive way. The external and internal morphology of the new species is compared to that of the extant related species. Putative evolutionary relationship between *Tafforeus* and the genus *Cainosternus* Notman, 1921, and their placement in the tribe Pseudoliodini are discussed.