CT-CEPH

A fresh look at Devonian, Early Carboniferous and Latest Cretaceous to Paleogene nautilid cephalopods from Belgium: major steps in nautilus evolution revealed by micro-CT and nano-CT scanning of RBINS-RMCA type collections

DURATION
15/12/2019 - 15/03/2024

BUDGET
170.898 €

PROJECT DESCRIPTION

X-ray computed tomography (CT-) scanning is completely revolutionizing the study of extinct organisms. Its non-invasive and non-destructive character makes it currently by far the most powerful method allowing fossils to be studied in three dimensions and in unprecedented detail. Not unimportantly, CT-scanning looks through and inside objects, revealing internal (hidden) structures and characters. Recent innovations in the field of CT-scanning allow obtaining unprecedented detail, up to a few micrometers in (voxel) resolution, and higher quality images of relatively dense materials, like fossils, even when completely encased in a hard sediment.

In 2016, the Royal Belgian Institute of Natural Sciences (RBINS) acquired two high-end X-ray CT-scanners: the micro-CT RX EasyTom (http://www.rxsolutions.fr) and the nano-CT XRE UniTom (https://xre.be/). Both scanners are currently nearly full time in use to help to accomplish the gigantic task of the full digitization of the RBINS and RMCA (Royal Museum for Central Africa) type collections, the aim of two multi-year Belspo funded projects, DiSSCo-Fed (2018-2023) and DIGIT-4 (2019-2023). With about 300.000 types and 48.000.000 general specimens, 45,000 and 3.000.000 respectively in their paleontology collections, the results of nearly two centuries of intensive collecting and research, these two Belgian Federal Scientific Institutions (FSI's) are one of the major players in the European framework of scientific research infrastructures for natural history.

One of the groups of fossils that is very well-represented within the RBINS paleontology collections are the Cephalopoda (Phylum Mollusca). Cephalopods are amongst the most diverse, intelligent and rapidly evolving marine invertebrates that have explored a multitude of evolutionary pathways since their entry point more than 500 myr ago. Their invention of a chambered shell providing an energy-efficient way to migrate up and down the water column, makes them stand out from all other mollusks. It is especially the internal organization of this complex three-dimensional buoyancy mechanism that allows to document major steps in their evolution. The latter makes from CT-scanning an extremely powerful method in the study of the evolutionary history of the Cephalopoda. It allows for the first time correct and detailed measurements of typical conch (shell) parameters, as well as the introduction and exploitation of new and/or previously underexplored and (partly) hidden parameters that will induce new insights in their evolutionary processes.

This project aims at gaining better insights in the complex evolutionary history of the Nautilida (Subclass Nautilia), the lineage leading up to the single surviving stock of externally shelled cephalopods alive today, extant nautilus. It focuses on Devonian, Early Carboniferous and Latest Cretaceous to Paleogene time slices of nautilid history, during which major steps in their evolution took place and which are not fully understood, and for which the RBINS and RMCA collections hold a large number of important specimens. It will exploit on (1) the ongoing mass-accumulation of nano-CT and micro-CT scanning data of RBINS & RMCA type specimens currently taking place within the scope of DIGIT and DiSSCo-Fed, and (2) the knowledge and expertise of the RBINS. It also aims to make a major contribution to the scientific valorization of the FSI collections by executing innovative research that is in full compliance with this BRAIN call Pillar 2 for Heritage Science.

CT-CEPH

This project has three main work packages in which it will:

1) study how nautilids survived the Cretaceous/Paleogene boundary mass-extinction and radiated afterwards during the Paleogene (this is, during their last surge);
2) compare this to how nautilids diversified during the biggest radiation event in their history by taking a 'fresh look' at 'old' Belgian Early Carboniferous nautilids;
3) re-evaluate whether nautilids are present in the Belgian Devonian fossil record (this is, the record leading up to the early Carboniferous radiation).

The results of the project will be disseminated through the collection database (metadata revision of all specimens studied), as well as through an as high as possible number of scientific papers, conference presentations, popular scientific texts and talks, next to media and social media coverage.

Next to scientific advancements in the understanding of the evolution and hierarchal structuring of the Nautilida and of the understanding of the evolution of life on Earth during major crises and changing climate and environmental conditions in deep time, the project also aims to stimulate a much larger societal and policy maker interest in the past, deep time, evolution, the fossil record, effects of climate change and the necessity for biodiversity conservation and the importance of an adequate conservation of paleontological heritage.

CONTACT INFORMATION

Coordinator

Bernard MOTTEQUIN
Royal Belgian Institute of Natural Sciences (RBINS)
OD Earth & History of Life
bmottequin@naturalsciences.be

Partners

Stijn GOOLAERTS
Royal Belgian Institute of Natural Sciences (RBINS)
Scientific Service Heritage
OD Earth & History of Life
stijn.goolaerts@naturalsciences.be

LINKS

hhttps://twitter.com/CtCeph
https://twitter.com/GoolaertsStijn