VERTIGO

Deciphering early stages of VERTebrate evolution: insights from long IGnored Belgian Devonian fossil Organisms

DURATION
15/12/2020 - 15/03/2023

BUDGET
154 551 €

PROJECT DESCRIPTION

The evolutionary history of vertebrates began, at the latest, during the early Cambrian (c. 520 Myr) with the first occurrence of elongated and laterally flattened soft-bodied organisms known as chordates, possessing a notochord (the forerunner of the vertebral column) but devoid of backbone and jaw. Vertebrates subsequently underwent major anatomical changes, such as the acquisition of a vertebral column, development of a skull, formation of jaws, and adaptations to terrestrial life. In the VERTIGO project, we propose to focus on two of the major steps of the evolutive history of vertebrates, namely (i) the evolution of early soft-bodied chordates and (ii) the radiation of a group of early vertebrates (euphaneropids).

Early chordate and early vertebrate fossils provide our only direct information on the origin of vertebrates and on how their distinctive body plan evolved. Unfortunately, the fossil record of early chordates and part of the early vertebrates (i.e. euphaneropids, in the scope of this project) is extremely scarce as these organisms mostly consist of decay-prone soft parts (e.g. muscles) that are usually degraded and lost prior to fossilisation, making the interpretation of their anatomy highly challenging. As a result, the affinities of soft-bodied fossils of purported chordates, such as *Metaspriggina* or *Pikaia*, remain highly debated.

Euphaneropids (‘naked anaspids’) are a group of early jawless vertebrates. Because they are generally preserved as imprints, the same issues of preservation and interpretation of morphological characters occur. Euphaneropids are the group that first demonstrated the presence of (i) gill filaments enclosed by gill pouches, (ii) paired anal fins and pelvic fins, and (iii) an intromittent organ in vertebrates. Consequently, and in spite of its scarcity in the fossil record and the usual poor preservation of the fossils, this group of jawless vertebrates is crucial for our understanding of early vertebrate evolution.

Although early stages of vertebrate evolution are regularly clarified by new finds of fossils, serious gaps remain in our understanding of the modalities and the timing of the character acquisitions. To overcome these issues, the VERTIGO project proposes to focus on the study of new findings of putative early chordates and early vertebrates (euphaneropids) from the Early Devonian of Belgium. It is crucial to retrieve as much anatomical details as possible from these unique specimens for systematic, phylogenetic and evolutionary purposes. In this aim, we plan to use state-of-the-art imaging and spectroscopy techniques allowing new sources of morphological contrasts and a spatial resolution of their (bio)chemistry: band-pass emission macroscopy and Synchrotron-based micro X-ray fluorescence major-to-trace elemental mapping.

The major impact of the project is measured in terms of scientific knowledge. Nothing is known about Devonian soft-bodied chordates and about euphaneropids from Belgium, and this project offers new insights within chordate/vertebrate evolutionary history. Moreover, future capacities and skills regarding the methodologies implemented in this project will be highly significant since they potentially represent a new starting point in our way to study soft-bodied chordates and early vertebrates.

On the contrary, impacts of the project on 'economy', 'policy and public services', and 'collection management and conservation' will be minor. Fossil specimens, studied in this project, are exceptional from a scientific point of view, and they could be exhibited later in the RBINS and Centre Grégoire Fournier galleries, but they will not have a major impact on economy, policy and public services. Regarding the 'collection management and conservation' aspects, the results obtained thanks to Synchrotron-based µXRF elemental mapping will be of interest since they will inform us about the chemical composition of soft-bodied vertebrate fossils and the way to better preserve them from a curatorial viewpoint.

The impact on 'civil society' will be moderate because scientific dissemination to the general public will be encouraged. Finally, impact on 'culture and heritage' will be moderate too, because this project aims at valorising a part of the unknown palaeontological heritage from Belgium, housed in both historical collections and in historical Palaeozoic localities.

The project results will be exploited and disseminated to the academic community thanks to various channels: (i) in international meetings (for instance, the Early and Lower Vertebrates Meetings), (ii) through high-ranked science journals, (iii) online (the partners will ensure their papers are advertised on their social media pages such as ResearchGate, Mendeley, etc.).

An important output of this project is the communication of the results towards the general public. It will be performed through various activities: (i) the dissemination capabilities of RBINS, which is extremely efficient and active on social media (e.g. its Twitter and Instagram channels), (ii) the collaboration with the local administrations where the excavations will occur (they will help us with the organisation of excavations and we will help them by providing scientific content for their communal communication), (iii) online articles to popular blogs, such as The Conversation, which aims to make research accessible to the public and to inspire young students.

CONTACT INFORMATION

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