

COLOURINPALAEO

To colour or not to colour: COLOUR patterns and pigments in INvertebrates from the PALAEOzoic of Belgium

DURATION
01/05/2023 – 01/05/2027

BUDGET
€ 230 999

PROJECT DESCRIPTION

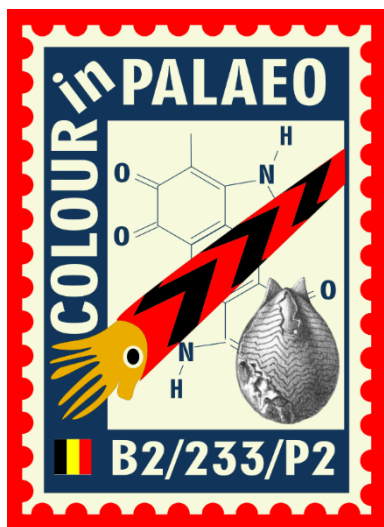
Almost nothing is known about the **evolution of shell colour in invertebrates**. This is largely due to the **ultra-rarity** of fossils in which **colour patterns and pigments** are preserved and immediately visible, and therefore easy to identify, especially when these are hundreds of millions of years old. This hampers our understanding of the role and function of colour in extinct animals, their ecology, mode of life, interactions, development, and evolution. A good example for this ultra-rarity is the **Palaeozoic of Belgium**, world-renowned for its exquisitely preserved fossils of the Devonian and Carboniferous (420 to 300 myr ago), enabling to document major transitions in ecosystem dynamics and the evolution of life on Earth (e.g. nekton revolution, terrestrialisation, major climate changes, anoxic events, biodiversity crises) but **from which only a few cephalopod, bivalve and gastropod mollusc and brachiopod shells were historically documented** preserving coloured traces (by L.-G. de Koninck and P. de Ryckholt, mid to late 19th century). However, recently, and during the ongoing digitisation activities of the Type and Figured collections of Royal Belgian Institute of Natural Sciences (RBINS) (DiSSCo-Fed and DIGIT projects), it was discovered that **many more specimens** preserve these traces, in particular those from Early Carboniferous shallow marine reef environments, hinting that Belgium is a **hotspot for the preservation of colour in deep time**, allowing to investigate its occurrence in different evolutionary lineages of marine invertebrates exactly during one of the main periods of revolution in geologic history, and thus with a very high potential to become **pivotal in the understanding of the role and function(s) of colour** in shell producing animals. Due to the development of new data acquisition and analyses techniques, and others becoming more readily available, the last decade has seen a renewed interest in the study of colour preservation in the fossil record. However, most of this renewed interest focusses on dinosaur skin and feathers, insects, or relatively young (Meso-Cenozoic) fossils. Palaeozoic invertebrates largely escaped this renewed interest, and this while every new discovery of such fossils may be **crucial in our understanding of early invertebrate evolution**. COLOURINPALAEO aims to change this situation. It will be the first project of such kind on a number of different evolutionary lineages of shelly invertebrates that builds on these recent advancements, wherefore it will be able to execute a next level of data mining on colour preservation in the Palaeozoic fossil record, both on the morphology of the patterns as well as on the chemistry of the pigments that are involved.



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COLOURINPALAEO is set out to **explore colour preservation in the Belgian Palaeozoic fossil record**, following the recent (re)discoveries of such ultra-rare specimens in the Palaeontology collections of the RBINS, to increase the current knowledge of the evolution of shell colour in invertebrates. It aims at a **further valorisation of our Belgian heritage collections by means of their scientific exploitation** by studying the occurrence of colour patterns and pigments by combining interdisciplinary research with recent advances in (i) non-destructive and non-invasive 2D and 3D imaging techniques, such as **multispectral photogrammetry and spectro-imaging**, to better visualize colour patterns and pigments, including those hidden from sight in natural (white) light, and (ii) advanced spectroscopic techniques, namely **Raman micro-probe spectroscopy, synchrotron trace elemental mapping and absorption spectroscopy** to identify the chemical signature of the pigments. It also aims at further strengthening the scientific expertise and know-how of the RBINS, in all the afore-mentioned fields, and will lead to an even higher level of digitisation of Belgian heritage.

In order to achieve these aims, the objectives are to **1) continue to explore** the RBINS Types and Figured and the general Palaeozoic Invertebrates collections in the search for additional material, **2) prospect** other public (e.g. University of Liège, Centre Grégoire Fournier of the Maredsous Abbey) and private (citizen-science initiative, reaching out to fossil hunters) collections to better assess the rarity of this type of fossils, **3) apply** novel non-destructive and non-invasive techniques and workflows developed within the RBINS Scientific Service of Heritage and at international partner IPANEMA, such as multispectral imaging to **better visualise** the colour patterns, also in 3D, and aid in the further development of the application of those techniques in natural sciences, **4) identify** the pigments and their mode of preservation by Raman spectroscopy, synchrotron trace elemental mapping and absorption spectroscopy, **5) conclude** from the patterns and preservation of pigments to better understand the evolutionary history of colour and its function(s) in extinct invertebrates, and **6) communicate** on the newly acquired insights to both the research and heritage environment as well as the general public.



CONTACT INFORMATION

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