

PERISSORIGIN

Origin and early radiation of perissodactyls based on precious fossil collections

DURATION

1/02/2023 - 1/05/2025

BUDGET

164 955 €

PROJECT DESCRIPTION

Perissodactyls are odd-toed ungulate mammals that include extant horses, tapirs, and rhinoceroses. Although most perissodactyls today are threatened with extinction, they are in fact the survivors of a much more diverse group that was very abundant during the Paleogene (66-23Ma). They also included the largest known terrestrial mammals, such as *Paraceratherium*. The first stages of their evolutionary history, starting at cat size, remain however poorly understood; one of the reasons being their abrupt appearance on the three continents of the northern hemisphere and their very rapid diversification into several superfamilies. Several hypotheses have been put forward to explain their origin. Some fossil evidence links the perissodactyls with the Phenacodontidae, primitive ungulates that are now extinct, suggesting a North American origin for perissodactyls. Yet, the recent discovery of numerous *Cambaytherium* remains in India, which show a very close morphology to that of the first perissodactyls, makes of this mammal the best candidate for the title of sister group to the perissodactyls. However, the association of *Cambaytherium* with true perissodactyls in the same fossil site raises the question of their biogeographical origins. These discoveries are to be put in parallel with molecular data suggesting that the notoungulates, an extinct group of native South American ungulates would be related to perissodactyls, painting a "Gondwanan" origin completely contrasting with the traditional vision. Several independent studies have been carried out to revise the first stages of perissodactyl evolution in the last decade. However, no major synthesis with a global vision and a broad taxonomical sample, including key European fossil specimens, has yet been carried out today.

The PERISSORIGIN project examine the questions related to the origin of perissodactyls, from a phylogenetic and palaeogeographical point of view. The project provides a major synthesis of the fossil record that will be placed it in an upgrade phylogenetic framework and will also study and monitor the major evolutionary trends that are emerging within the five perissodactyl superfamilies, at the very beginning of their diversification.

The methodology of the PERISSORIGIN project is based directly on the study and observation of fossil specimens of perissodactyls from the precious collections of the Royal Belgian Institute of Natural Sciences, guaranteeing access to the fossil data required for this project. These collections include a series of exceptionally well-preserved complete skeletons of the equid *Eurohippus* and an almost complete skeleton (one of only two in existence) of the STEM-perissodactyl *Hallensia* from Messel (a UNESCO World Heritage site). Micro-CT scanning of these specimens as well as all RBINS type and figured specimens of early perissodactyls will allow to access hidden and therefore unknown characters, which will be described for the first time. The complete study of these unpublished specimens will considerably improve our knowledge of the basal morphology of these European perissodactyls and allow comparison with other major groups of perissodactyls and related taxa from elsewhere thanks to a strong collaboration network. These collections enable us to rescore these fossil specimens into a new synthetic morphological characters' matrix to obtain a new phylogeny, which will serve as a basis for the paleobiogeographic study. This work will also be an opportunity to identify and document major evolutionary trends within the different basal superfamilies, such as those related to molarization patterns, dental homology, finger reduction which will enable us to better understand the ecology of these early perissodactyls. Furthermore, we will also be able to consider the intraspecific variability, which is often undocumented.

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The different stages of the project will be presented at international congresses, and all the results (anatomical descriptions, phylogenetic analyses, paleobiogeographic study, evolutionary trends) will be published in international scientific journals. All digitized specimens will be incorporated into the repository platforms VirtualCollections and Morphosource in order to facilitate future access to the data. Furthermore, casting and 3D printing projects of the most important specimens are to be considered in order to complete the RBINS' comparative collections.

This project will make it possible to decipher the origin and evolution of a group that is nowadays very fragile, which played a key role in ecosystems during a crucial period in the history of mammals and to ensure that the RBINS paleontological collections are at the forefront of the study of these issues and attractive for future international collaboration.

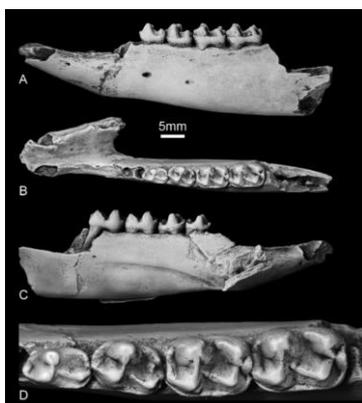


Figure 1: Mandible of *Cymbalophus cuniculus* from Erquelinnes, Belgium (IRSNB M 167), one of the oldest perissodactyls of Europe.



Figure 2: Skeleton of *Hallensia matthesi* (IRSNB M 1465) from Messel.



Figure 3: Skeleton of *Eurohippus messelensis* (IRSNB M 1851) from Messel.

CONTACT INFORMATION

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LINKS

<https://www.naturalsciences.be/en/science/research/evolution-and-the-web-of-life/projects/perissorigin>