

Historical biogeography and diversity of the ornithischian dinosaurs from the Jurassic and Cretaceous of the European archipelago

Dinosaurs are a dominant group of land vertebrates that comprises three major lineages, the predominantly meat-eating theropods that included the famed *Tyrannosaurus*, *Velociraptor*, *Archaeopteryx*, and their relatives, including all birds, the sauropodomorphs with the largest land vertebrates to ever roamed the Earth, and the ornithischians that were represented by some of the most distinctive and recognizable of all dinosaurs, such as *Triceratops*, *Stegosaurus*, *Ankylosaurus*, and their kin.

The ornithischians, or ‘bird-hipped’ dinosaurs, first appeared in the Triassic or the earliest Jurassic (~200 million years ago) and died out together with other non-bird dinosaurs at the end of the Cretaceous (66 million years ago). Throughout their ~134 million-year-long evolutionary history, ornithischians achieved global distribution, evolved considerable diversity, different body sizes, and especially numerous ‘exaggerated’ structures, such as horns, frills, or a unique body armor.

Despite that the research on ornithischians has intensified in recent years, leading to the description of many new intriguing species and potential recognition of new widely-distributed groups, numerous aspects of their evolutionary history are currently contentious. These also include the routes of their global dispersal.

The primary goal of this project is to explore the migration routes of the ornithischian dinosaurs, with special emphasis on those representatives of the group that inhabited the modern-day Europe. During the Jurassic and Cretaceous, Europe was formed by several islands that were separated from each other by warm and shallow seas. Even though such settings might indicate that the dinosaurs, and, indeed, any other vertebrates tied to lands, must have had substantial difficulties when attempting to migrate over long distances, the European record of ornithischians is surprisingly rich and includes members of all major groups, such as the stegosaurs, ankylosaurs, and even some distant relatives of *Triceratops*. Interestingly, and perhaps unexpectedly, the most abundant and diverse European ornithischians, the ornithopods, are arguably the most problematic, while being of particular importance as recent studies proposed that they might have originated on the European islands. The European representatives of Ornithopoda include ‘primitive’ members of the group called the rhabdodontids, various ‘thumb-spiked’ iguanodonts as well as the ‘duck-billed’ hadrosaurids and their kin. Considering that most these groups are distributed globally, such composition of the European ornithopod faunas indicates that several lineages of these dinosaurs arrived to Europe independently, or left the European islands to inhabit neighboring or even distant landmasses.

The project will aim to answer the following general questions: (1) how many ornithischian lineages independently arrived to Europe, when they arrived, and where they originated; (2) how many lineages emigrated, when, and where; (3) whether there are any signs of an ‘accelerated’ morphological evolution associated with their migrations; (4) what was the impact of global environmental changes (such as sea level oscillations) on their migrations; and (5) how diverse were the ornithischian faunas that inhabited the European archipelago during the Jurassic and Cretaceous. The project will additionally include detailed studies of the members of Rhabdodontidae and their closest relatives, whose anatomy might prove crucial for a better understanding of the early evolution of ornithopods.

The study will be based on extensive surveys and studies in museum collections, and will implement a wide specter of phylogenetic and biogeographic methods that have been recently developed and introduced to be applied to study the interrelationships and migrations of groups of organisms known primarily from the fossil record.

Because no project has specifically investigated the migration routes of the ornithischian dinosaurs that inhabited the European archipelago, the subject is largely unexplored and remains open for large-scale studies. This provides an extraordinary opportunity to significantly enrich the knowledge of the ornithischian dinosaurs. It is expected (and preliminary investigations indicate) that the results of the project will reveal complex migrations and a higher diversity of the European ornithischian lineages during the Jurassic and Cretaceous than is usually assumed, and will greatly impact future research of the ornithischian dinosaurs in general.