

Evolution of a group of early jawless Vertebrates

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The evolutionary history of jawed vertebrates (which include 99% of today's vertebrate species) started about 440 million years ago during a period known as the Silurian. The Osteostraci are a now extinct group of jawless vertebrates that are sister to all jawed vertebrates. They are estimated to have inhabited earth from ca. 430 million years ago (Middle Silurian) to ca. 370 million years ago (Late Devonian) in what is today the Northern hemisphere. The osteostracans were bottom-dwellers that could mainly be found close to sea margins and in brackish and fresh water habitats. Their most preserved feature in fossils are their big head shields which exhibit a great amount of variation and were as such used for classification by most authors working on them.

Recently, a new and comprehensive evolutionary tree has been published and made it possible to examine the evolution of osteostracans more closely. This project combined the data on classification, location, habitat and age of the fossils with the changes in their morphological features to better understand the process of adaptation and dispersal of the Osteostraci throughout time. The results enabled the proposition of a general scenario of osteostracan evolution:

The origin of the osteostracans is likely located in the area of today's United Kingdom, in habitats close to sea margin zones. Throughout the Late Silurian (from ca. 430 to 420 million years ago), the osteostracans spread to further locations, mainly in the area of Spitsbergen and today's Scandinavian and Baltic regions (the latter then united in a continent called Baltica). This spread was facilitated by slowly sinking sea levels.

The first half of the Early Devonian (from ca. 420 to 407 million years ago) witnessed an explosion in both diversity of osteostracans and disparity (i.e. the amount of different morphological forms). The further decline of world-wide sea levels during this period enabled the colonisation of new habitats (mainly fresh water) and geographical areas. Fossils from this time period have been found all over today's northern hemisphere, from Central Asia via Europe (especially Ukraine) to Spitsbergen and the northern American continent. The geographical expanse was followed by a period of adaptation to the new habitats and ecological niches occupied (facilitated by a very limited ability for migration), resulting in more extreme morphological forms especially of the head shields. Together with a rise in sea levels from the later part of the Early Devonian both diversity and disparity of osteostracans were on sharp decline. Only very few species persisted over the next 30 million years until the last ones (found in today's northern America) became extinct during the Late Devonian.