

# Mesozoic holocephalians

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## Abstract

Almost all the Mesozoic holocephalians can be characterized either as myriacanthoids or chimaeroids. The inter-relationship of the Mesozoic holocephalians and their connections to the Paleozoic holocephalians is problematic. Evidence from dentitions and tooth structure is difficult to interpret; body form and skeletal design is superficially similar but poorly known. Reduction in the number of tooth plates comprising the dentition can be predicated on the basis of a morphologic series and the apparent shift in the direction of tooth plate growth can be explained, but a phylogenetic progression from a tooth plate with a base of laminar tissue and a crown of orthotrabecline to one of chimaeroid design, lacking both these features, is purely hypothetical. The skeletal evidence, especially cranial structure, indicates a difference in adaptive solutions to functional requirements. The myriacanthoid most similar to the chimaeroids in cranial structure is *Chimaeropsis*; the skull in that form cannot be studied further as the unique specimen has been lost. Myriacanthoid remains are still too sparse to permit speculation on relationships within this group of holocephalian fishes. More can be said about the evolution of the chimaeroids, although here, too, important parts of the record are missing. The availability of extant representatives makes it possible to affirm with some confidence the progressive reduction of tritoral tissue in the tooth plates and the increasingly sectorial nature of the dentition in these holocephalians. The classification of the known Mesozoic chimaeroids must be rethought: newly discovered specimens suggest that several of the generic assignments made by 19th century investigators are untenable. Genera were often based on tooth plates alone and differences in appearance due to age and wear may have led to the erection of spurious taxa. Discovery of associated dentitions will allow pruning of the nomenclature.

## Morphology and evolution of Mesozoic holocephalians

The fossil record shows, at the beginning of the Carboniferous period of the Paleozoic era, a great diversification of cartilaginous fishes with slow-growing tooth plates. The term “bradyodont” was coined to distinguish these chondrichthyans from the sharks that renew their teeth through an endless series of tooth buds from the dental lamina as worn teeth fell away. It is assumed, from observation of extant fishes with tooth plates or pavements of flattened teeth, that the bradyodonts were durophagous; and the anchorage of their tooth plates supports that speculation: in almost all of these fishes there is no separate, movable palatoquadrate. The upper tooth plates are braced against the underside of the skull. From embryological studies of extant bradyodont chondrichthyans (SCHAUINSLAND 1903, DIDIER 1995), we can be virtually certain that, in fossil bradyodonts, the developing palatoquadrate cartilages fuse with the chondrocranium at an early ontogenetic stage, making a firm platform for the dentition. The body form of these fishes is largely a mystery because most of them are known from tooth plates alone. From the few specimens that are preserved more or less entire, it is apparent that this group of chondrichthyans shared little besides their possession of tooth plates and fused palatoquadrates. These two characters were made the basis of the taxon Holocephali by BONAPARTE (1832) and, ever since, most paleontologists have been listing chondrichthyan tooth plates or tooth whorls under this category, removing them only when it could be demonstrated that free palatoquadrates exist.

Phylogenetic analysis of isolated tooth plates can be a fruitless exercise, but the record of these remains does indicate that the holocephalian fishes declined after the Carboniferous and by Mesozoic time had largely ceded their niche to batoid elasmobranchs and perhaps certain specialized osteichthyans. Of the myriad of Paleozoic holocephalians – coeliodonts, chondrenchelyids, copodonts, psammodonts, and

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