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Cretaceous fish otoliths – a synthesis of the North American record

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Abstract

Otolith studies revealed the presence of 43 teleost taxa in the North American Late Cretaceous. The stratigraphic and geographic distribution of the concerned taxa are summarized, and 10 new taxa are described: "genus Osteoglossidarum" *tavernei*, *Albula campaniana*, "genus Albulidarum" *ripleyensis*, "genus Ophidiidarum" *cavatus*, "genus Trachichthyidarum" *oscitans*, "genus Caproideorum" *dockeryi*, "genus Apogonidarum" *maastrichtiensis*, "genus Apogonidarum" *zideki*, "genus Pempheridarum" *huddlestoni*, and "genus Percoideorum" *severnensis*. In fact, only the Campanian and Maastrichtian records provide useful information for further analysis. All other data can be considered only as reference data, up to now isolated from their geographic and stratigraphic context. Looking to the previous fossil record of Cretaceous and Early Tertiary teleosts, two important lacunae in our data are apparent. First, there is a marked gap of at least 20 million years in the fossil record of osteichthyans between the Late Campanian and the Late Paleocene, both for the osteological and the otolith material. Secondly, no unquestionable perciform is yet recorded by Cretaceous skeletal remains. In the otolith-based fossil record of fossil fishes from North America, 40 % of the identified taxa are percoids. Comparison with unpublished data concerning a small otolith association of Campanian age from chalk facies in the Paris Basin shows that this association has no percoids, and mainly consists of strange groups that cannot be assimilated to Recent families. The Late Cretaceous greensands in North America constitute a depositional environment (near shore sandy mud bottom with abundant molluscs and a relatively slow sedimentation rate) that persisted until the present over widespread geographic areas; consequently, the fish fauna inhabiting such areas may not have been subject to rapid evolutionary change, and some aspects that we consider as "modern", e.g., the presence of percoids, can be traced far back in time. Cretaceous chalk facies, on the contrary, represents a depositional environment (continuous carbonate sedimentation with negligible clastic input, over huge epicontinental basin areas) that disappeared in the early Paleogene; consequently, many fishes associated with this environment have also disappeared.

Introduction

Evaluating the fossil record of otolith-based fish species, NOLF (1985: 27) cited less than 20 valid species for the whole Cretaceous, while for the Tertiary, this number is in the order of 1000.

A primary condition for otolith collecting is a non-consolidated sediment that can be sieved (sand, silt, clay, or marl). This means that no otoliths from sandstones, limestones, claystones, shales, and indurated marls are represented in our records. Another aspect concerns the mineral component of otoliths, which is aragonite, a metastable polymorph of calcium carbonate. Diagenetic processes often affect sediments in such a way that aragonite is dissolved while the stable polymorph calcite remains (e.g., oysters, pectinids, brachiopods, echinoderms are preserved, but no gastropods). This is the case for the majority of the Cretaceous deposits of Europe. Recrystallisation of otoliths into calcite is rather exceptional, which explains the absence of otoliths in the fossil record of this period. It is clear, however, that the scarcity of Cretaceous otoliths is an artefact: NOLF & STEURBAUT (1989) cited the U.S. Upper Cretaceous Coffee Sand and Ripley Formations among potential otolith-bearing strata, a statement that was based on the excellent preservation of aragonitic-shelled gastropods from these strata, as figured by SOHL (1960, 1964a, b).

In several areas of the Cretaceous in the southern and eastern United States, the prevailing chalk facies

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