

A systematic and anatomical revision of Late Jurassic angelsharks (Chondrichthyes: Squatinidae)

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Abstract

The skeletal and dental anatomy of the Late Jurassic squatinoids of southern Germany are reviewed and their relationships with living angelsharks and other neoselachians are discussed in light of new anatomical data. Two Late Jurassic angelshark species, differing mainly in size, body proportions, and dental morphology, are recognized: †*Squatina alifera* (MÜNSTER, 1842) from Solnhofen and †*Squatina acanthoderma* (FRAAS, 1854) from Nusplingen. †*Squatina speciosa* (MEYER, 1856), also from Solnhofen and commonly regarded as valid, is considered a junior synonym of †*S. alifera* concurring with recent studies of their teeth. The available nominal genus †*Pseudorhina* JAEKEL, 1898 is resurrected for †*S. alifera* and †*S. acanthoderma*, and may include other Jurassic taxa based on isolated teeth. †*Pseudorhina* is hypothesized to be monophyletic based on its derived, conspicuously-shaped basihyal cartilage and dental root structure. Comparisons with the skeletal anatomy of extant angelsharks are provided, revealing that the Jurassic holomorphic fossils are markedly conservative and similar to living angelsharks, but that they differ in various respects (e.g. configuration of orbital roof and postorbital processes, positioning of foramina in the ethmoid region). †*Pseudorhina* shares with extant *Squatina* various derived features, including a marked groove in the cranial roof that accommodated the orbital process of the palatoquadrate, a distinctive quadrate process of the palatoquadrate having no suspensory function, basally triangular lower labial cartilages, expanded anterior basiventrals, slender and anteriorly concave puboischiadic bar, and triangular and anteriorly extending pectoral fin lobes; some of these features are independently derived in other neoselachian lineages. †*Pseudorhina* retains the basal hypnosqualean condition of low and tightly articulated platelike supraneurals, corroborating that the more slender, taller and widely spaced supraneurals of living *Squatina* species are derived. †*Pseudorhina* represents an extinct lineage of Jurassic angelsharks that may have survived until later in the Mesozoic as implied by the occurrence of †*Pseudorhina*-like teeth in strata younger than the Jurassic. This, in turn, implies that while one lineage of angelsharks underwent extinction sometime in the mid-Mesozoic, another and perhaps slightly younger angelshark lineage flourished and survives to the present.

Introduction

The Jurassic was indisputably an important period in the evolution and radiation of modern sharks and rays (neoselachians). Only few modern lineages of neoselachians were present in the Lower Jurassic, even though the fossil record of neoselachian sharks can be traced with confidence back into the Triassic (THIES 1982, CUNY & BENTON 1999). Palaeozoic remains of neoselachians (e.g. DUFFIN & WARD 1983a, TURNER & YOUNG 1987, DUFFIN et al. 1996) are questionable because they lack a triple-layered enameloid ultrastructure, which is probably the best character for identifying isolated neoselachian teeth (CUNY & BENTON 1999). The absence of modern neoselachian lineages before the Jurassic suggests that there was probably no modern neoselachian radiation prior to the Lower Jurassic (MAISEY et al. 2004).

The Upper Jurassic lithographic limestones of southern Germany (Nusplingen and Solnhofen) and their lateral equivalents in France are noteworthy because of the abundance of well-preserved skeletons of vertebrates, especially actinopterygians and chondrichthyans (e.g. WOODWARD 1889, HEINEKE 1906, SAINT-SEINE 1949, KUHN 1961, SCHWEIZER 1964, LAMBERS 1999, DIETL & SCHWEIGERT 2001).

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