Waxing and waning marine reptile diversity prior tot he K/Pg bundary

Diverse clades of reptiles occupied the upper levels of marine food chains in the Mesozoic, an iconic peculiarity of that Era which abruptly ended at the Cretaceous-Palaeogene boundary. Among these, several long-lived groups became extinct long before the end of the Cretaceous, as other groups concomitantly radiated, resulting in substantial turnover events within the Mesozoic itself. However, the biodiversity dynamics of Mesozoic marine reptiles as a whole have never been computed, so the evolution of their global diversity is poorly understood. We assembled comprehensive cladistic datasets for the major groups of Jurassic-Cretaceous marine reptiles: Ichthyosauria, Plesiosauria, Mosasauroidea, Thalattosuchia, Dyrosauridae, Hesperornithiformes, Pleurosauria, and Cryptodira. We analysed each of these datasets under a common methodological framework (implied weighting maximum parsimony) and then created 1000 supertrees randomly sampling the most parsimonious trees from each clade prior to time-calibration, under a Bayesian framework (Hedman's algorithm). We then computed the phylogenetic diversity of Mesozoic marine reptiles through time and used Fritz & Purvis'D to mesure the phylogenetic clustering of extinction at each stage boundary of the earliest Jurassic–earliest Paleogene interval. Finally, we calculated the evolution of per-clade disparity using the cladistic datasets.

Our results highlight important episodes of turnover in Middle Jurassic and earliest Cretaceous. Both are marked by high levels of extinction selectivity and temporarily reduced phylogenetic diversity; the severity of some of these events surpasses that of the K-Pg boundary extinction. The effects of a potential 'Jurassic-Cretaceous' boundary extinction were most prominent in the Valanginian, more than 6 Ma after the boundary itself. Furthermore, with more than 110 inferred lineages in the Albian, marine tetrapods were more speciose during the 'middle' Cretaceous than are today's limbed marine tetrapods. This was followed by a gradual decline, as ichthyosaurs, pliosaurids, and early polycotylids vanished, in a series of non-selective (i.e. statistically unclustered) extinctions. However, the disparity of each individual clade remains roughly constant or increases during the Late Cretaceous. The latest Cretaceous extinctions are among the most phylogenetically clustered in our dataset, consistent with the high ecological impact of the Cretaceous-Paleogene event for marine communities.