

FOREWORD

It is difficult to imagine a lizard more magnificent than a mosasaur. By the standards of the typical lizard—a small terrestrial insectivore—even the earliest mosasaurs are conspicuous for being large-bodied apex predators with uniformly aquatic habits. Indeed, the 45-foot-long *Tylosaurus proriger* has justly become known as the “Tyrannosaur of the Seas.”

Predatory mosasaurs appear in the fossil record of the circumequatorial Tethys Sea during a hot-house episode in Earth history when sea-surface temperatures at low latitudes climbed above 100 °F, or more than 37 °C. These oceanic reptiles rose to preeminence in marine ecosystems toward the end of the Cretaceous as other important groups of Mesozoic sea monsters—the long-necked plesiosaurs and dolphin-like ichthyosaurs—dwindled in diversity and abundance. Mosasaurs disappeared 66 million years ago, presumably extirpated by the Manhattan-island-sized asteroid that also killed off the giant dinosaurs (apart from a few small terrestrial birds). I must confess to being relieved that mosasaurs are long gone, as they most certainly would ruin a holiday at the beach.

One could hardly have missed such sea monsters in the world’s oceans, so fossil mosasaurs played central roles in convincing the scientific community by the early 1800s of the fact of extinction. Mosasaurs thereby contributed to the growth of evolutionary thought. How could God’s perfect design for an aquatic lifestyle—including flippers, tail fins, and live birth at sea—have been found wanting? Darwin had a better answer for that apparent conundrum.

Mosasaurs have captured our imaginations for centuries. We have learned so much more about them in the past few decades with the discovery of many new species, and better-preserved specimens of known species, from around the world. Just as important, there have been significant conceptual advances in the theory and methods used to infer mosasaur phylogeny. These advances have together revolutionized our understanding of mosasaur evolution. We now know, for example, that adaptations in the limbs and girdles for life in the open ocean, rather than on land, evolved twice within Mososauria, with the two main branches diverging from less modified aquatic species (formerly known as “aigialosaurs”) with limbs still proportioned much like those of terrestrial lizards.

From the very beginning, mosasaurs have been compared almost exclusively with varanids (the smallest crown clade including *Lanthanotus* and *Varanus*) among the

more than 10,000 species of lizards alive today. And mosasaurs are in some ways quite similar to Miocene to Recent *Varanus*, especially in having long-snouted skulls with expandable jaws and prehensile dentitions. But that resemblance could be due to convergence related to their shared predatory habits, rather than to propinquity of descent. Recent analyses of a broader range of lizards and more disparate sources of data seldom place mosasaurs close to crown varanids (much less *Varanus*). If accurate, that would explain the curious discontinuity in their respective fossil records: mosasaurs are exclusively Mesozoic in age (Late Jurassic(?) to Late Cretaceous), whereas crown varanids are known only from the Cenozoic (Eocene to Recent). Firm conclusions on these and many other questions in mosasaur biology and evolution remain elusive. Mosasaurs and their marine sister clade, the long-necked dolichosaurs, deservedly continue to be subjects of active research.

Dale A. Russell's classic 1967 monographic revision of the mosasaurs then known from North America—spoils of the “Bone Wars” waged by O. C. Marsh of Yale College and E. D. Cope of the Philadelphia Academy of Sciences—was the springboard for the modern era of mosasaur research. Russell's careful description of mosasaur form and function, thoughtful consideration of their habits and habitats, and his perceptive views of their phylogenetic relationships from the species level to more inclusive taxa, laid firm foundations for all later research, including my own.

A handwritten signature in black ink that reads "Jacques Gauthier". The signature is written in a cursive style with a large, stylized initial 'J'.

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