

JUVENILE MARINE REPTILES FROM THE LATE CRETACEOUS OF THE ANTARCTIC PENINSULA AND THEIR RELATIONSHIPS TO OTHER SUCH OCCURRENCES IN CENTRAL SOUTH DAKOTA AND BELGIUM

James E. Martin
Museum of Geology
South Dakota School of Mines and Technology
Rapid City, SD 57701

ABSTRACT

The Late Cretaceous deposits of Antarctica, South Dakota, and Belgium, have produced higher concentrations of juvenile marine reptiles, both isolated elements and associated skeletons, compared to elsewhere in the world. These concentrations of mosasaurs and plesiosaurs occurred in shallow marine waters, relatively near to shore. In contrast, the deeper, open water areas have produced few juvenile marine reptiles. These concentrations may have been sites where unique preservation occurred or where marine reptiles came into the shallows for birthing and where the young remained until they reached sufficient size and ability to navigate and survive in more open waters.

INTRODUCTION

Recent joint United States-Argentinean expeditions to Vega Island east of the Antarctic Peninsula resulted in the collection of numerous elements indicative of juvenile mosasaurs and plesiosaurs. These expeditions sponsored by the US National Science Foundation (OPP 9815231 & 0087972) and the Instituto Antartico Argentino were concentrated in the Cape Lamb and Sandwich Bluff members, Lopez de Bertodano Formation. These Maastrichtian sediments were deposited in very shallow marine environments where even terrestrial wading bird and dinosaur elements have been found (Case et al., 2000). From these deposits, partial skeletons and numerous isolated postcranial elements, particularly vertebrae, are attributable to mosasaurs and plesiosaurs, giant marine reptilian groups of the Late Cretaceous. In Antarctica, the plesiosaur specimens vastly outnumber those of the mosasaurs, unlike the situation in central South Dakota or Belgium.

For many years, relatively few elements of juvenile marine reptiles were known from the Late Cretaceous deposits of North America, one of the most prolific producers of mosasaurs and plesiosaurs in the world. A concentration of juvenile mosasaurs and even babies has been discovered in central South Dakota along the Big Bend of the Missouri River from the DeGrey and lower

Verendrye members of the Pierre Shale, a black marine shale deposited in the Late Cretaceous (Campanian) North American Epicontinental Seaway. The seaway was continental and therefore shallow, with some estimated depth ranges in the Big Bend area from 30 to 70 meters. In the Big Bend area, mosasaurs are exceedingly abundant. In contrast, only a few fragmentary plesiosaurs have been found in these deposits, so their ontogenetic stages are indeterminate at this time. Interestingly, in western South Dakota, hundreds of mosasaur specimens and many plesiosaurs have been collected by our parties from slightly older Campanian deposits of the Pierre Shale, but very few juveniles are known. This region represents deeper, open-water conditions compared to those in central South Dakota which were nearer to the eastern margin of the Epicontinental Seaway.

In the late nineteenth century and early twentieth centuries, extensive quarry operations were undertaken in the Late Cretaceous (type Maastrichtian) deposits in Belgium and the Netherlands. In Belgium, mining potassium-rich deposits for fertilizer resulted in approximately 50 partial mosasaur skeletons but only few plesiosaur elements for the National Museum of Belgium. These specimens were derived from shallow depths of 30-50 meters. Although the specimens had reposed in the Museum for approximately a century, the abundance of juvenile individuals was seldom noted.

JUVENILE MATERIAL

Antarctica

Most of the juvenile marine reptile material from Antarctica consists of juvenile partial plesiosaur skeletons, one mosasaur skull, and isolated vertebrae. Many vertebrae are very small, poorly ossified, and one plesiosaur vertebra even retains the notochordal canal. Two types of juvenile mosasaur vertebrae occur, those with fused haemel arches suggesting the Mosasaurinae or Halisaurinae and those with articulated haemals suggesting the Tylosaurinae or Plioplatecarpinae (=Russellosaurinae). Another mosasaur specimen represents a partial skull of a juvenile tylosaurine mosasaur. Adult specimens indicate that the Mosasaurinae are represented by three genera and four species, whereas the Russellosaurinae by two genera and two species (Martin et al., in press and subsequent observations). In addition to the mosasaurs, numerous plesiosaur specimens have been found on Vega Island. Two types of plesiosaurs occur in Antarctica; one is a typical elasmosaurid and the other appears to be a highly derived elasmosaurid. Of the six partial elasmosaurid skeletons noted during our expeditions, three were juveniles and four of eight elasmosaurid skeletons from nearby Seymour Island listed in Chatterjee and Small (1989) represent juveniles or young adults. Only a single skeleton of the derived elasmosaurid (*Aristonectes*) has been found, and it too is a juvenile individual (Gasparini et al., in press).

South Dakota

In the Big Bend area, partial skeletons of both Mosasaurinae and Plioplatecarpinae young have been observed, including a mother *Plioplatecarpus* containing at least two babies (Bell et al., 1996). Both adult and juvenile mosasaurs are found in abundance, and enough young specimens have been found through our efforts in the last decade that a growth series now exists for *Plioplatecarpus tympaniticus* and *Mosasaurus missouriensis*. Only a few vertebrae and two fragmentary plesiosaurs have been found whereas hundreds of mosasaur specimens have been secured. One of the plesiosaurs appears to be juvenile.

In western South Dakota around the Black Hills, numerous specimens of mosasaurs and plesiosaurs have been found; however, only one juvenile mosasaur skull (Plioplatecarpinae) and one baby plesiosaur skeleton (Martin, 1994) have been secured.

Belgium

Belgium has been famous for the diversity and abundance of mosasaur specimens from the type Maastricht units. Most of these specimens were described in a series of papers by Dollo (e.g. 1882, 1889) and later reviewed by Lingham-Solier (e.g. 1992, 1993). These papers were principally descriptive, so ontogenetic stage was not emphasized. The Maastricht units are best known for the occurrences of *Mosasaurus hoffmanni*, the first known mosasaur. The type specimen and most others in the literature are very large, and generally, the taxon has been considered as a giant species. Investigations of specimens in Brussels indicate that at least two juveniles are in the collections. These collections also contain numerous specimens of a smaller species, *M. lemmonieri*; most of these specimens are juvenile or young adults. Nearly all of the specimens of the Plioplatecarpinae are juveniles; the two specimens of the Tylosaurinae are adults. Of the specimens of *Prognathodon*, one of three is juvenile. Therefore, although assemblages of mosasaurs from the type Maastricht area have been generally considered adults, many specimens in fact represent juveniles or young adults.

SUMMARY

In Antarctica, South Dakota, and Belgium, a relatively high concentration of juvenile specimens is known compared to elsewhere in the world. In each case, these concentrations are in relatively shallow marine waters, relatively near to shore. In contrast, the deeper, open water area of western South Dakota has produced only two juveniles of hundreds of marine reptile specimens.

The Antarctic, South Dakota, and Belgian juvenile concentrations were found in very shallow marine sediments, but such concentrations are not found everywhere in similar depositional environments. Therefore, these concentrations may have been sites where unique preservation occurred or where ma-

rine reptiles came into the shallows for birthing and where the young remained until they reached sufficient size and ability to navigate and survive in more open waters.

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