

## **SAUROPOSEIDON AND KIN: GIANT TITANOSAURIFORMS FROM THE EARLY CRETACEOUS OF NORTH AMERICA AND EUROPE**

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*Sauroposeidon* is a giant titanosauriform from the Early Cretaceous of North America. The holotype is OMNH 53062, a series of four articulated cervical vertebrae from the Antlers Formation (Aptian-Albian) of Oklahoma. According to recent analyses, *Paluxysaurus* from the Twin Mountain Formation of Texas is the sister taxon of OMNH 53062 and may be a junior synonym of *Sauroposeidon*. Titanosauriform material from the Cloverly Formation of Wyoming may also pertain to *Paluxysaurus/Sauroposeidon*. The proposed synonymy is based on referred material of both taxa, however, so it is not as secure as it might be.

MIWG.7306 is a cervical vertebra of a large titanosauriform from the Wessex Formation (Barremian) of the Isle of Wight. The specimen shares several derived characters with the holotype of *Sauroposeidon*: an elongate cervical centrum, expanded lateral pneumatic fossae, and large, plate-like posterior centroparapophyseal laminae. In all of these characters, the morphology of MIWG.7306 is intermediate between *Brachiosaurus* and *Giraffatitan* on one hand, and *Sauroposeidon* on the other. MIWG.7306 also shares several previously unreported features of its internal morphology with *Sauroposeidon*: reduced lateral chambers (“pleurocoels”), camellate internal structure, ‘inflated’ laminae filled with pneumatic chambers rather than solid bone, and a high Air Space Proportion (ASP). ASPs for *Sauroposeidon*, MIWG.7306, and other isolated vertebrae from the Wessex Formation are all between 0.74 and 0.89, meaning that air spaces occupied 74-89% of the volume of the vertebrae in life. The vertebrae of these animals were therefore lighter than those of brachiosaurids (ASPs between 0.65 and 0.75) and other sauropods (average ASPs less than 0.65).

*Sauroposeidon* and MIWG.7306 were originally referred to Brachiosauridae. However, most recent phylogenetic analyses find *Sauroposeidon* to be a basal somphospondyl, whether *Paluxysaurus* and the Cloverly material are included or not. Given the large number of characters it shares with *Sauroposeidon*, MIWG.7306 is probably a basal somphospondyl as well. But genuine brachiosaurids also persisted and possibly even radiated in the Early Cretaceous of North America; these include *Abydosaurus*, *Cedarosaurus*, *Venenosaurus*, and possibly an as-yet-undescribed Cloverly form. The vertebrae of *Abydosaurus* have conservative proportions and solid laminae and the bony floor of the centrum is relatively thick. In these characters, *Abydosaurus* is more similar to *Brachiosaurus* and *Giraffatitan* than to *Sauroposeidon* or MIWG.7306. So not all Early Cretaceous titanosauriforms were alike, and whatever selective pressures led *Sauroposeidon* and MIWG.7306 to evolve longer and lighter

necks, they didn't prevent *Giraffatitan*-like brachiosaurs such as *Abydosaurus* and *Cedarosaurus* from persisting well into the Cretaceous.

The evolutionary dynamics of sauropods in the North American mid-Mesozoic are still mysterious. In the Morrison Formation, sauropods as a whole are both diverse and abundant, but *Camarasaurus* and an efflorescence of diplodocoids account for most of that abundance and diversity, and titanosauriforms, represented by *Brachiosaurus*, are comparatively scarce. During the Early Cretaceous, North American titanosauriforms seem to have radiated, possibly to fill some of the ecospace vacated by the regional extinction of basal macronarians (*Camarasaurus*) and diplodocoids. However, despite a flood of new discoveries in the past two decades, sauropods still do not seem to have been particularly abundant in the Early Cretaceous of North America, in contrast to sauropod-dominated faunas of the Morrison and of other continents during the Early Cretaceous.