The FASEB Journal / Volume 34, Issue S1 / p. 1-1

Anatomy | Free Access

New Late Jurassic Dinosaur (Ornithischia) from China Sheds Light on the Early Evolution of the Ornithopod Skeleton and Phylogeny of Ornithopoda

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First published: 20 April 2020
https://doi.org/10.1096/fasebj.2020.34.s1.09508

Abstract

Numerous partial to complete individuals of a new neornithischian dinosaur have been collected from the early Late Jurassic (Oxfordian) Shishugou Formation in northwestern China. The new taxon includes an ossified clavicle and, uniquely, a patellar sesamoid and trilobate maxillary and dentary teeth. Coeval taxa from the Shaximiao Formation in Sichuan, China (*Hexinlusaurus, Agilisaurus, Yandusaurus*), regarded in many recent analyses as falling outside of Cerapoda (Marginocephalia + Ornithopoda), lack many characters distributed among ornithopods that are present in the new Shishugou taxon, including a large hooked coracoid process, a small quadratojugal foramen, narrow and elongate frontals, well-developed epipophyseal ridges on the postzygapophyses of anterior cervical vertebrae, and a well-defined and elongate femoral neck with a deep femoral capital sulcus. However, the new Shishugou taxon also retains some plesiomorphic character states relative to most ornithopods such as having five sacral vertebrae, and a short, narrow lesser trochanter on the femur. Recent analyses of neornithischian dinosaurs are not in agreement over the taxonomic composition of Ornithopoda or Cerapoda, or the distribution of characters along the neornithischian branch. Putative synapomorphies of Ornithopoda vary from study to study, as does the taxonomic composition of the clade. In some studies, many erstwhile "ornithopods" such as *Thescelosaurus* and *Orodromeus* have been pulled out of Cerapoda

as basal neornithischians, while other studies recover a more inclusive monophyletic Ornithopoda. The current consensus of basal neornithischian and cerapodan phylogeny is poorly resolved. New taxa such as the Shishugou taxon that exhibit some, but not all, characters used in many studies to define Ornithopoda may help unclutter some of the resolution at the base of the cerapodan tree. The morphology present in the new taxon gives polarity to a suite of characters for basal neornithischian dinosaurs that may help provide a clearer diagnosis for Ornithopoda.

Support or Funding Information

National Science Foundation (NSF EAR 0922187, 1636753, NSF DDIG 1405834), National Geographic Society, The George Washington University, National Science Foundation of China (41120124002, 41688103)