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A new titanosauriform sauropod (Dinosauria: Saurischia) from the Lower Cretaceous of Hyogo, Japan

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Table of contents

Abstract	3
Introduction	3
Systematic paleontology	4
Dinosauria Owen, 1842	5
Saurischia Seeley, 1887	5
Sauropoda Marsh, 1878	7
Macronaria Wilson and Sereno, 1998	9
Titanosauriformes Salgado, Coria, and Calvo, 1997	53
Discussion	55
Conclusion	57
Acknowledgements	57
References	58
Appendix Taphonomy of Caudal Elements	66

Abstract

A new genus and species of titanosauriform sauropod is erected based on a partial skeleton found in the Lower Cretaceous Sasayama Group of Hyogo Prefecture, SW Japan. The new taxon is here named as *Tambatitanis amicitiae* **gen. et sp. nov.**, which is diagnosed by the following features of the caudal vertebrae, chevrons and braincase: the postzygapophysis and the summit of the neural spine of the anterior caudal vertebrae are located beyond the posterior border of the centrum, the spine of the anterior caudal vertebrae is curved strongly anteriorly and bow-shaped in lateral view, the summit of the neural spine is expanded and hemispherical with its anterior face excavated by the posterodorsal extension of a deep and narrow SPRE, the transverse process of the anterior caudal vertebrae are short and L shaped, the anterior chevron is the longest among sauropods in proportion to body size, the distal ends of the anterior chevrons are rod-shaped, the distal ends of the mid chevrons are transversely thin and anteroposteriorly long without cranial processes, and the dorsal border of the shaft of the paroccipital process that forms the ventral margin of the posttemporal fenestra is short mediolaterally and V-shaped in posterior view. A phylogenetic analysis suggests that *T. amicitiae* is a basal titanosauriform, possibly belonging to the East Asian endemic clade Euhelopodidae. The caudals and chevrons are described in detail in order to document highly autapomorphic features of the new taxon as well as potentially phylogenetically informative characters. The discovery of *T. amicitiae* suggests that East Asian basal titanosauriforms were diverse not only in the number of the taxa but also in the morphological variation of the caudal elements.

Key words: Sauropoda, Titanosauriform, Early Cretaceous, Sasayama Group, Japan, East Asia

Introduction

Titanosauriform sauropods diversified during the Cretaceous, and represent the only sauropod clade that persisted until the very end of the Cretaceous. Their high diversity during the Cretaceous has been mostly documented from the southern continents, especially from South America (Mannion and Otero 2012), but during the last decade, it has been increasingly recognized that titanosauriforms were more diversified in northern continents during the Cretaceous than previously thought. This re-evaluation of the global sauropod diversity pattern is prompted by the revisions of existing remains and the new finding of Cretaceous sauropod remains from North America (*e.g.*, D'Emic 2013 and the references therein), Europe (*e.g.*, Díez Díaz *et al.* 2013 and the references therein), and Asia (*e.g.*, D'Emic *et al.* 2013 and the references therein), although the number of titanosauriforms, especially that of titanosaurs known from the southern continents, is still overwhelmingly larger than that of the northern continents. Recently, phylogenetic analyses of basal titanosauriforms were conducted by two sets of authors (D'Emic 2012; Mannion *et al.* 2013), based on comprehensive revision of the fossils of the group, including the recently found East Asian titanosauriforms. They largely agreed in recovering a monophyletic group, Euhelopodidae, which was composed of most of the Early Cretaceous East Asian titanosauriforms, but one of the phylogenetic analyses of Mannion *et al.* (2013), in which quantitative characters were treated as continuous data, suggests that Euhelopodidae breaks up to form a paraphyletic grade. In order to resolve this issue, arguments on the adequacy of

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