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Virtual range of motion analysis of the neck of *Amargasaurus cazaui* (Sauropoda: Dicraeosauridae)

D. Vidal, A. Serrano-Martínez, G. J. Windholz

Amargasaurus cazaui, a dicraeosaurid sauropod from the Lower Cretaceous of Neuquén (Argentina), had extremely elongated and forked cervical neural spines, a notable condition among its group. These peculiar, extremely elongated neural spines (with an orientation ranging from slightly anteriorly oriented in the posteriormost cervical vertebrae to a quite posteriorly inclined in middle to anterior ones) have led to propose several functional hypotheses. In order to test them, we have conducted a range of motion analysis using high-resolution 3D photogrammetric scans of the original fossils. To measure heights and angles in relation with the body, we have digitally mounted all preserved fossils. The osteologically induced curvature of the dorsal series, not very well preserved, compares favourably with the exquisitely preserved dorsal column of *Brachytrachelopan mesai* (another dicraeosaurid). The snout of our reconstruction is at 1.98 m above the ground in an osteologically neutral pose (higher than the 0.70 m obtained in previous studies). The prezygapophyseal facets are extremely large and antero-posteriorly elongated in all cervical vertebrae up to the cervicodorsal transition, substantially more than in *Brachytrachelopan* or other diplodocids (*i.e.*, *Diplodocus* or *Apatosaurus*). Dorsiflexion is limited due to the elongated, posteriorly directed spines, whereas ventriflexion is not. Ventriflexion allows the snout to reach the ground without dislocation or flexing/abducting the forelimbs, while maximum dorsiflexion allows a maximum height of 4.5 m. This implies that *Amargasaurus* was a medium to low browser, as previously proposed. Greater intervertebral flexibility than in other diplodocoids supports the absence of a double sail in the neck of *Amargasaurus*, as well as the ability to perform potential display and/or agonistic behaviors.

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