
Towards an adaptive landscape for short-necked plesiosaurians

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Abstract

Plesiosauria is the most diverse and probably the most disparate clade of secondarily aquatic tetrapods. The frequency and intensity of morphological convergences within this group and the strong constraints of the aquatic medium make Plesiosauria an ideal model for testing the processes of morphological diversification. The adaptive landscape of plesiosaurians has been summarised to two global morphotypes: one for short-necked forms (pliosauromorphs) and one for long-necked forms (plesiosauromorphs). Although these were historically conceived as long-lived, monophyletic clade, it is increasingly clear that these body plans each arose multiple times independently during the evolutionary history of Plesiosauria, providing evidence of a macroevolutionary adaptive landscape. We investigate the morphological diversification of the two major groups of short-necked plesiosaurians: Pliosauridae and Polycotylidae. Using an updated phylogenetic dataset incorporating most plesiosaurians and a morphological dataset summarising the Bauplan and diet-related features, we investigate the rates of evolution, patterns of morphospace occupation, and disparity over time of these two clades. Our results show that a handful of clearly distinct craniodental architectures exist within pliosaurids and polcotylids and that several episodes of convergent evolution affected these clades. This indicates that while there is probably no such thing as single ‘pliosauromorph’ morphotype, the craniodental adaptive landscape of these animals might be quite simple, with a few optimal morphologies.

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