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**A phylogeny of Plesiosauria (Sauropterygia) and its bearing on
the systematic status of *Leptocleidus* Andrews, 1922**

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A phylogeny of Plesiosauria (Sauropterygia) and its bearing on the systematic status of *Leptocleidus* Andrews, 1922

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Abstract

Leptocleidus Andrews, 1922 is a poorly known plesiosaur genus from Lower Cretaceous successions of the UK, South Africa, and Australia. Historically, there has been little consensus regarding its phylogenetic position within Plesiosauria, largely because of its seemingly aberrant combination of a relatively small skull and short neck. As a result, a diverse array of potential sister groups have been posited for *Leptocleidus*, including long-necked Cretaceous elasmosaurids, Early Jurassic “rhomaleosaurs”, and Middle to Late Jurassic pliosaurids. A cladistic analysis including *Leptocleidus*, and a new, apparently morphologically similar specimen from Alberta, TMP 94.122.01, was undertaken to assess their phylogenetic position within Plesiosauria.

A character-taxon matrix was assembled afresh, consisting of 33 operational taxonomic units sampled broadly among plesiosaurs. 185 cranial and postcranial characters used in plesiosaur phylogenetics were critically reanalyzed, of which 152 were employed in the parsimony analysis. The results indicate a basal dichotomous split into the traditionally recognized pliosauroid and plesiosauroid clades. Nested within Pliosauroidae, a monophyletic Leptocleididae was recovered, consisting of *L. superstes* Andrews, 1922 and *L. capensis* (Andrews, 1911a). In contrast to earlier suggestions, *Leptocleidus* neither clusters with *Rhomaleosaurus*, which was found to be paraphyletic, nor with large-skulled pliosaurid taxa, such as *Simolestes*. Rather, a sister group relationship between Cretaceous Polycotylidae and Leptocleididae was recovered, which is here named Leptocleidoidea. Although TMP 94.122.01 is superficially similar to *Leptocleidus*, several discrete characters of the skull nest this new taxon within Polycotylidae. Compared to other phylogenetic hypotheses of plesiosaurs, these results are more congruent with respect to the stratigraphic distribution of leptocleidoids. A classification for Plesiosauria is presented.

Key words: plesiosaur, cladistics, Pliosauridae, Polycotylidae, Leptocleidoidea

Introduction

Plesiosaurs (Sauropterygia: Plesiosauria) constitute a clade of secondarily aquatic, carnivorous tetrapods that existed throughout much of the Mesozoic. The fossil record of plesiosaurs is extensive and demonstrates that they were morphologically diverse, globally distributed, and temporally long-lived. However, despite a long history of collection spanning nearly two centuries, relatively little attention has been devoted to unraveling their evolutionary relationships, especially when compared to contemporaneous, terrestrial non-avian dinosaurs.

The application of cladistic methods to the interpretation of plesiosaur phylogeny is in its infancy. To date, most studies concerning plesiosaur relationships have employed a limited number of taxa assumed to represent larger monophyletic clades within Plesiosauria (Hampe 1992; Bardet *et al.* 1999; Carpenter 1999; Gasparini *et al.* 2002; Gasparini *et al.* 2003). Sato (2002) conducted an important large-scale analysis of elasmosaurs. However, the number of phylogenetic studies undertaken to reveal global patterns of plesiosaur relationship has been limited (Brown & Cruickshank 1994; Druckenmiller 1999). The first major cladistic analysis of Plesiosauria was that of O’Keefe (2000, 2001a), which later had its taxic representation expanded and the data reanalyzed (O’Keefe 2004b). O’Keefe’s (2001a) data matrix also provided the basis for Smith’s (2003) phylogenetic analysis.

With the discovery of new material, and the redescription of existing specimens, has come the need to incorporate new morphological data into a phylogenetic context. Recent discoveries of plesiosaur material from the Syncrude Canada Ltd oil sand mines in northern Alberta (Druckenmiller & Russell 2003) underscores the need to reassess plesiosaur phylogeny. In particular, a new Alberta plesiosaur, TMP 94.122.01, raises several questions regarding plesiosaur relationships. This new taxon, originally described as *Nichollsia borealis* Druckenmiller & Russell, 2008, currently lacks a valid name because of preoccupation of *Nichollsia*. Pending the publication of a replacement name (Druckenmiller & Russell in press), we refer to this taxon throughout this work by reference to its catalogue number, TMP 94.122.01. Interestingly, TMP 94.122.01 superficially resembles another Early Cretaceous taxon, *Leptocleidus* Andrews, 1922, with which it shares