

EARLIEST NORTH AMERICAN OCCURRENCE OF POLYCOTYLIDAE (SAUROPTERYGIA: PLESIOSAURIA) FROM THE LOWER CRETACEOUS (ALBIAN) CLEARWATER FORMATION, ALBERTA, CANADA

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INTRODUCTION

THE POLYCOTYLIDAE is a family of short-necked (pliosaur-morph) plesiosaurs, with examples known from epicontinental marine deposits of every major landmass except Antarctica. Our knowledge of its diversity and distribution has increased tremendously in the last decade, with new material described from North America (Sato, 2005; Albright et al., 2007; Schumacher, 2007; Schmeisser, 2008), South America (Gasparini and de la Fuente, 2000; Salgado et al., 2007), Africa (Bardet et al., 2003; Buchy et al., 2005), and Asia (Sato and Storrs, 2000; Arkhangel'skii et al., 2007). Polycotylid diversity is greatest in the Late Cretaceous, and particularly so in the Turonian; however, knowledge of the group's initial history in the Early Cretaceous is limited to a handful of specimens from North America (Storrs, 1981; Druckenmiller, 2002) and Australia (Kear 2003, 2005).

The specimen described here, TMP (Royal Tyrrell Museum of Palaeontology) 95.87.01, is an Early Cretaceous short-necked (pliosauromorph) plesiosaur discovered in 1995 in an enormous, open-pit oil sands mine near the town of Ft. McMurray, in northeastern Alberta, Canada (Fig. 1). Owing to its serendipitous discovery using heavy machinery, the skeleton, which is contained in a large concretion, was broken into many large fragments. Reassembly of the concretion revealed that approximately 80 percent of the skeleton is present, including much of the axial skeleton, girdle elements, and portions of all four limbs. Although no skull was associated with the skeleton, the postcranial remains can be confidently referred to Polycotylidae, making this the oldest unequivocal remains of the clade in North America.

Institutional abbreviations.—AM, Australian Museum, Sydney; BMNH, Natural History Museum, London, UK; KUPV, University of Kansas, Natural History Museum and Biodiversity Research Center, Lawrence; MNA, Museum of Northern Arizona, Flagstaff; QM, Queensland Museum, Brisbane, Australia; SAM, South Australian Museum, Adelaide; SGU, Saratov State University, Department of Historical Geology and Paleontology, Russia; SM, Strecker Museum, Baylor University, Waco, Texas; TMM, Texas Memorial Museum, University of Texas at Austin; TMP, Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta, Canada; UMUT, University Museum, University of Tokyo, Japan.

GEOLOGICAL CONTEXT

TMP 95.87.01 was discovered in the northeastern portion of the Syncrude North Mine in a three-meter thick, heterolithic, very fine- to medium-grained glauconitic sandstone unit of the Wabiskaw Member of the Clearwater Formation (Fig. 2). The Wabiskaw Member is the basal unit of the dominantly marine Clearwater Shale, which overlies the continental to marginal marine deposits of the McMurray Formation (McLearn, 1933; Mellon and Wall, 1956). This Member is generally considered

to be lowermost Albian in age (Flach, 1984; Hayes et al., 1994). In the absence of recent radiometric dates for the Wabiskaw Member (Williams et al., 1962), biostratigraphic evidence, based on ammonites from the overlying Clearwater Formation, constrains its minimum age to the lower Albian substage (Jeletzky, 1968; Stelck and Kramers, 1980; Kauffman et al., 1993). Placement of a maximum age on the unit is problematic because no ammonites have been described from the Wabiskaw Member, nor have they been reported from the underlying McMurray Formation. Palynological analyses place the top of the underlying McMurray Formation near the Aptian-Albian boundary (Burden, 1984). This agrees closely with foraminiferal microfaunas recorded from the upper McMurray Formation and lower Clearwater Shale, which also places this contact within the Lower Albian substage (Mellon and Wall, 1956; Caldwell et al., 1993).

PHYLOGENETIC ANALYSIS

A maximum parsimony analysis was performed to better elucidate relationships of TMP 95.87.01 within Plesiosauria. It was scored into the data matrix of Druckenmiller and Russell (2008b, Appendix 1) resulting in a matrix of 32 taxa and 152 characters (excluding *Callawayasaurus colombiensis* [H] and [R]). The data matrix scores for TMP 95.87.01 are presented in Table 1. The data were analyzed in PAUP*4.0b10 (Swofford, 2002); multistate taxa were treated as polymorphic, gaps were treated as missing data, and all qualitative characters were treated as unordered. Branches with a maximum tree length of zero were collapsed. A heuristic search was performed and the starting tree was obtained via stepwise random addition sequence, with 100 replicates. The run implemented tree bisection and reconnection (TBR) with the MulTrees option in effect, and the tree was rooted on *Simosaurus* using the setting “make outgroup paraphyletic with respect to in-group.” Clade support was determined through a bootstrap analysis using 1000 replicates in an unweighted heuristic search. The treatment of quantitative data and other methodological details follows that of Druckenmiller and Russell (2008b).

SYSTEMATIC PALEONTOLOGY

Superorder SAUROPTERYGIA Owen, 1860
Order PLESIOSAURIA de Blainville, 1835
Family POLYCOTYLIDAE Williston, 1908
Genus and species indet.

Figures 3–5

Occurrence.—Wabiskaw Member of the Clearwater Formation (Lower Cretaceous, lower Albian). Found in the Syncrude Canada Ltd. oil sands North Mine, approximately 25 km north of Fort McMurray, Alberta, Canada; UTM (NAD83) 6322167.0 N, 458543.0 E.