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## **The Middle Ordovician bathyurid trilobite *Pseudoolenoides*, with a revised trilobite biostratigraphy of the Dapingian and lower Darriwilian of western Laurentia**

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## Abstract

The Middle Ordovician bathyrurid trilobite *Pseudoolenoides* Hintze has been treated in only a small handful of papers and few of its species have been adequately known. Here we revise all previously known species on the basis of new material and illustrations, and describe four new species, three of which are formally named. The genus now comprises 10 species, nine of which are formally named. Five of these are Dapingian and five are early Darriwilian in age. Cladistic parsimony analysis of the nine named species results in a generally well supported hypothesis of relationship which is fully congruent with stratigraphic order. A particularly well supported subclade (11 unreversed synapomorphies and 100% bootstrap support in 10,000 pseudoreplicates) consists of six species, including the type, which are likely a product of neotenic paedomorphosis. Three other species are resolved as successive sister taxa to this derived clade. A new trilobite zonation recently proposed for the Tulean and Blackhillsian stages (Lower Ordovician) is extended through Middle Ordovician (Dapingian and lower Darriwilian) rocks in western Laurentia. New species are *P. pogonipensis* (Dapingian; *Pseudoolenoides dilectus* Zone) and *P. fossilmountainensis* (lower Darriwilian; *P. fossilmountainensis* Zone), both from the Kanosh Formation of western Utah, and *P. oilcreekensis* (lower Darriwilian) from the Oil Creek Formation of Oklahoma.

**Key words:** Silicified, Utah, Oklahoma, taxonomy, biostratigraphy, cladistics, paedomorphosis

## Introduction

The bathyrurid genus *Pseudoolenoides* Hintze, 1953, has received detailed attention in only three publications: Hintze's (1953) original monograph of Lower and Middle Ordovician trilobite faunas of western Utah, Shaw's (1974) monograph of the Simpson Group trilobites of Oklahoma, and Fortey and Droser's (1996) paper on lower Dapingian trilobites of the Great Basin. Although the genus exhibits striking morphology, most of its species have never been illustrated to a modern standard. The goals of this study are to redescribe all of the type material of all species of *Pseudoolenoides*; to revise the species with the addition of new collections of silicified material from western Utah and of unfigured material from Oklahoma in the collections of the Oklahoma Museum of Natural History; to name and describe three new species and illustrate a fourth in open nomenclature; to present a formal hypothesis of phylogenetic relationship based on parsimony analysis; and to extend the trilobite zonation of Adrain *et al.* (2009) through the Middle Ordovician Kanosh Formation.