



## New olenelline trilobites from the Northwest Territories, Canada, and the phylogenetic placement of *Judomia absita* Fritz, 1973

I. WESLEY GAPP<sup>1</sup>, BRUCE S. LIEBERMAN<sup>1</sup>, MICHAEL C. POPE<sup>2</sup> & KELLY A. DILLIARD<sup>3</sup>

<sup>1</sup>Department of Geology and Biodiversity Institute, University of Kansas, 1475 Jayhawk Blvd, 120 Lindley Hall, Lawrence 66045, USA. E-mail: wes123@ku.edu

<sup>2</sup>Department of Geology and Geophysics, Texas A&M University, College Station, TX 77843, USA. E-mail: mcpope@geo.tamu.edu

<sup>3</sup>Department of Physical Sciences and Mathematics, Wayne State College, 1111 Main Street, Wayne, NE 68787, USA. E-mail: kedilli1@wsc.edu

### Abstract

The Early Cambrian olenelline trilobites are a diverse clade and have been the subject of several phylogenetic analyses. Here, three new species of *Bradycallotaspis* Fritz, 1972 (*B. coriae*, *B. nicolascagei*, and *B. sekwiensis*) and one new species of *Nevadella* Walcott, 1910 (*N. saupeae*) are described from the Sekwi Formation of the Mackenzie Mountains, Northwest Territories, Canada. In addition, new specimens potentially referable to *Nevadella ovalis* McMenamin, 1987 were recovered that may expand that species' geographic range, which was thought to be restricted to Sonora, Mexico. The results of a phylogenetic analysis incorporating several olenelline taxa, including *Judomia absita* Fritz, 1973 from the Sekwi Formation, are also presented herein. This species has been assigned to various olenelline genera, including *Judomia* Lermontova, 1951 and *Paranevadella* Palmer & Repina, 1993. Phylogenetic analysis suggests this species is closely related to *Judomia tera* Lazarenko, 1960 from Siberia. This phylogenetic relationship provides further support for the hypothesis that a close biogeographic relationship existed between Laurentia and Siberia during the Cambrian.

**Key words:** Trilobita, Olenellina, Cambrian radiation, phylogenetics, paleobiogeography

### Introduction

Cambrian trilobites have served as foci for several phylogenetic studies (e.g., Cotton 2001; Lieberman 2002; Paterson & Edgecombe 2006). Among Cambrian trilobites, the Olenellina Walcott, 1890, is a diverse and widely distributed suborder of trilobites from the Early Cambrian. Further, these have provided important data used in various evolutionary and biogeographic studies of the Cambrian radiation (e.g., Fortey *et al.* 1996; Smith & Lieberman 1999; Lieberman 2003; Meert & Lieberman 2004). Phylogenetic studies suggest olenellines are a basal suborder within Trilobita (see Lieberman & Karim 2010 for a recent discussion of phylogenetic studies of trilobites). In particular, Lieberman (1998) reassessed the group, making it monophyletic, by removing the superfamily “Fallotaspidoidea” (quotation marks denoting paraphyly after Wiley 1979). A phylogenetic analysis of the suborder was conducted by Lieberman (2001).

Olenelline trilobites are known from several localities in the Sekwi Formation, Mackenzie Mountains, Northwest Territories, Canada (Fig. 1, 2). The Sekwi Formation is between 715 and 770 m thick in the Mackenzie Mountains, and can be constrained to the late Early Cambrian, Cambrian series 2, stages 3 and 4 (Fritz 1972; Randell *et al.* 2005; Dilliard *et al.* 2007, 2010). The formation consists of interbedded carbonate, shale, and sandstone, comprising mainly weathered limestone and dolostone and was deposited during the *Fallotaspis*, *Nevadella*, and *Bonia-Olenellus* trilobite zones (Dilliard *et al.* 2007, 2010). A detailed description of the formation and the regional geology as well as the localities is provided in Dilliard *et al.* (2007, 2010) and we refer the interested reader to those publications for more information (also see Abe *et al.* 2010).