

Trilobite biostratigraphy of the Cambrian (Series 2-Miaolingian) Mount Cap Formation from archival industry cores, Interior Plains, Northwest Territories, Canada

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Summary

The Mount Cap Formation is an important source rock and potential target for petroleum extraction in the northern Canadian Interior Plains, with proven resources in the Colville Hills (Dixon and Stasiuk, 1998; Hannigan *et al.*, 2011). The formation is shale dominated with lesser silty carbonate and sandstone facies, and was deposited within an intracratonic basin during the Cambrian (MacLean, 2011). Biostratigraphic age constraint for this formation has mainly relied on trilobite collections from outcrops in the eastern Mackenzie Mountains (Aitken *et al.*, 1973; MacNaughton *et al.*, 2013). Outcrop material has also been augmented by collections from drill cores (Mobil Colville E-15, Petro Canada PCI Canterra BELE O-35, PEX-Gulf-Fina N. Colville L-21, BP *et al.* Losh Lake G-22, and Shell Keele River L-04). This material is documented mainly by internal Geological Survey of Canada (GSC) Paleontological Reports (see below), although a limited amount has been mentioned briefly in published reports (e.g. Macqueen and Mackenzie, 1973).

Trilobite collections from these cores have not previously undergone complete systematic identification; as a result, relative age determinations for the Mount Cap Formation in the subsurface have remained preliminary. Additionally, identifications in the internal GSC reports do not reflect advances in trilobite taxonomy and biostratigraphy. To address these issues the existing trilobite core collections have been reassessed. Previous work indicated biostratigraphic relative ages from the traditional lower Cambrian (*Bonnia-Olenellus* Assemblage Zone) into the traditional middle Cambrian (*Plagiura-Poliella* to *Glossopleura* assemblage zones) (Barnes *et al.*, 1974; Hills *et al.*, 1981). Re-analysis and systematic identification has produced more precise biostratigraphic age constraints (Fig. 1). The basal part of the Mount Cap Formation was deposited during the *Bolbolenellus euryparia* - *Nephrolenellus multinodus* interval-range biozones (upper *Bonnia-Olenellus* Zone) of the lower Cambrian (Stage 4, Series 2), and the formation ranges through into the *Glossopleura walcotti* Interval-range Biozone of the middle Cambrian (Wuliuan Stage, Miaolingian Series). In particular, the formation contains a diverse trilobite assemblage from the *Plagiura-Poliella* Assemblage Biozone, including taxa considered biostratigraphically important in the southwestern United States (Sundberg and McCollum, 2003). These include *Eokochaspis nodosa* Sundberg and McCollum, 2003 and '*Amecephalus arjosensis*' (Lochman, 1952). Both taxa are index fossils for respective interval-range biozones and occur at the base of the *Plagiura-Poliella* Assemblage Zone. The first occurrence of *Eokochaspis nodosa* defines the base of the traditional middle Cambrian in North America and delineates the important continental biostratigraphic correlation datum between the underlying Olenellid Biomere faunas of the lower Cambrian (Series 2) and the overlying Corynexochid Biomere faunas of the middle Cambrian (Palmer, 1984; Taylor *et al.*, 2012).

Increasingly precise biostratigraphy for the formation has helped constrain the timing of formation contacts and key sequence-stratigraphic surfaces. In particular, the subsurface contact between the Mount Cap and underlying Mount Clark Formation lies within the *Bonnia-Olenellus* Zone, as does a sequence boundary (maximum regressive surface) just above the formational contact. The maximum flooding surface associated with this sequence boundary lies within the *Plagiura-Poliella* Zone. A second sequence boundary occurs in the uppermost *Albertella* – basal *Glossopleura* Zone, with an associated maximum flooding surface in the lower part of the *Glossopleura* Zone. These biozone-calibrated surfaces can be used as a basis for correlation across the northern interior plains and beyond.

Laurentian		Assemblage Zones		'Restricted' Biozones		'Open Shelf' Biozones						
(Topazan)	<i>Ehmaniella</i>	<i>Altiocculus</i>	<i>Ptychagnostus gibbus</i>									
		<i>Ehmaniella</i>										
		<i>Elrathiella</i>										
		<i>Proehmaniella</i>										
Wuliuan (Delamaran)	<i>Glossopleura</i>	<i>Glossopleura walcotti</i>				<i>Ptychagnostus praecurrans</i>						
								<i>Albertella</i>	<i>Mexicella mexicana</i>			
	<i>Plagiura-Poliella</i>	<i>Poliella denticulata</i>										
						<i>Amecephalus arrosensis</i>						
	<i>Eokochoaspis nodosa</i>											
					Stage 4 (Dyeran)	<i>Bonnia-Olenellus</i>	<i>Nephrolenellus multinodus</i>					
<i>Bolbolenellus euryparia</i>												

Figure 1. Trilobite biostratigraphic scheme for the upper *Bonnia-Olenellus* to *Ehmaniella* zones, Laurentian stage names in brackets (scheme produced using zones defined by Sundberg, 1994; McCollum and Sundberg, 2007; Webster, 2011).

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