

Organic-walled microfossils from the Terreneuvian Series (lower Cambrian) of southern New Brunswick, Canada: Implications for the Cambrian time scale

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Summary

Acritarchs recovered from Lower Cambrian sections in southern New Brunswick provide new constraints on the Terreneuvian and Series 2 boundary. In the Hanford Brook section, the lowest occurrence of the assemblage *Archaeodiscina umbonulata*, *Skiagia ornata*, *S. orbiculare* and *S. scottica* precedes the occurrence of small shelly fossils that were assigned by previous workers to the *Watsonella crosbyi* Zone. The first appearance of various species of *Skiagia* has been suggested to be an important global marker that approximates the base of Cambrian Series 2, and also approximates the time of the rise of trilobites. Based on acritarch assemblages, a previously dated 530 Ma ash predates the small shelly fossils assigned to the *Watsonella crosbyi* Zone in the Hanford Brook section.

Abstract

Avalonia in Newfoundland and New Brunswick contains sedimentary successions of great importance for understanding the early Cambrian time scale and, hence, for placing the early radiation of metazoans in a temporal framework. The base of the Cambrian is defined on the basis of trace fossils within the Chapel Island Formation on the Burin Peninsula, Newfoundland, at a level that approximates the appearance of complex trace fossils globally and which by correlation is at approximately 542 Ma. This also forms the base of the recently ratified basal Cambrian Terreneuvian Series. The succeeding Cambrian Series 2 remains to be formally defined but it is likely to be close to the first appearance of trilobites. In the Saint John area of southern New Brunswick a volcanic ash dated at ca. 530 Ma has been considered to provide a date for the approximate middle of the Terreneuvian, and is one of the rare available dates within the Terreneuvian globally. A limiting factor in the global correlation of the dated ash in New Brunswick is that it occurs in a section without age-significant fossils and correlation is based on small shelly fossils with potentially long stratigraphical ranges.

Recent sampling has recovered significant data on lower Cambrian organic-walled microfossils from key sections in southern New Brunswick. Several assemblages of age-significant acritarchs have been identified that can be readily compared with acritarch-based zones elsewhere, notably on Baltica. The record from southern New Brunswick is by far the most diverse and continuous record of lower Cambrian acritarchs recorded thus far within Avalonia, and provides new biochronological constraints on the dated ash in New Brunswick. Results for the Ratcliffe Brook Formation (at least in part an age-equivalent of the Chapel Island Formation) are available from classic sections at Somerset Street and Hanford Brook. The section at Somerset Street yielded filaments, leiospherids, *Ceratophyton* sp., and *Comasphaeridium* sp., in

strata underlying the ash bed dated at ca 530 Ma. A similar, but better preserved, assemblage of organic-walled microfossils including *Pterospermella velata*, *Comasphaeridium velvetum* and *Granomarginata prima* was recovered from the lower part of the Ratcliffe Brook Formation at Hanford Brook. This assemblage corresponds to the basal Cambrian acritarch assemblage on Baltica. A more diverse and abundant assemblage occurs in the upper part of the Ratcliffe Brook Formation at Hanford Brook, including *Archaeodiscina umbonulata*, *Skiagia ornata*, *S. orbiculare* and *S. scottica*. The lowest occurrence of this assemblage precedes the occurrence in this section of small shelly fossils that were assigned by previous workers to the *Watsonella crosbyi* Zone. The first appearance of various species of *Skiagia* has been suggested to be an important global marker that approximates the base of Cambrian Series 2, and also approximates the time of the rise of trilobites.

Several questions are raised by the new biochronological constraint from acritarchs on the New Brunswick sections. Correlation on the basis of assemblages of organic-walled microfossils is in conflict with the previously established correlation between the Somerset Street and Hanford Brook sections, and suggests that the 530 Ma ash predates, rather than post-dates, the small shelly fossils assigned to the *Watsonella crosbyi* Zone in the Hanford Brook Section. This result supports other recent suggestions that the *Watsonella crosbyi* Zone could be globally correlative in time rather than occurrences in Avalonia being older than those in Siberia and China.