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Silicified Late Ordovician Trilobites from the Mackenzie Mountains, Northwest Territories, Canada

by B.R. Hunda, B.D.E. Chatterton, and R. Ludvigsen

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To those of us who struggle awkwardly with mechanical engravers and sewing needles to prepare broken trilobite bits from frustratingly recalcitrant matrix, there is something distinctly magical about silicified faunas. You simply plop a chunk of limestone into a vat of acid and, a few days later, out come dozens (if not hundreds) of tiny, perfect, camera-ready trilobite sclerites! Right...well, even though we all know it isn't nearly that simple or straightforward, both the procedure and the fossils still retain certain mystical qualities.

For almost three decades Brian Chatterton and Rolf Ludvigsen, along with a coven of graduate students and colleagues, have practiced the black art of acid preparation on a magnificent array of silicified trilobite faunas from Cambrian, Ordovician, and Silurian rocks of the Mackenzie Mountains in northwestern Canada. In over two dozen papers and monographs (including, 20 years ago, the premiere issue of *Palaeontographica Canadiana*), they have collectively described and named hundreds of new trilobite taxa, elucidated the phylogenies and

ontogenies of numerous key lineages, and developed new biostratigraphic and paleoenvironmental models for faunas collected from thousands of metres of strata spanning some 100 million years of the lower Paleozoic. One hallmark of this impressive body of work has been superb photographic illustration of the full panoply of trilobite morphology, revealed in three dimensions and from every conceivable angle.

In *Palaeontographica Canadiana*, No. 21, Hunda, Chatterton, and Ludvigsen carry on the tradition, extending detailed documentation of silicified trilobite faunas into the Late Ordovician Edenian through Gamachian stages, to immediately below the base of the Silurian. The study utilizes collections (made two decades apart) from the lower Whittaker Formation east of Avalanche Lake in the Northwest Territories. A systematic account forms the critical core of the monograph, running to just over 65 of the 87 pages (including 21 plates). Thirty-three species-level taxa make up the total recorded diversity through the interval, although only 32 are described and illustrated. The mysterious 33rd taxon, cryptically labeled "Proetid," shows up only as a single occurrence marker at the top of the right-hand column in the range chart in text-figure 5, and one is left to speculate about its relative abundance in that lone sample and its significance overall. [In a similar vein, a search for the illustrations of *Cryptolithus tessellatus* from the area, referred to in the abstract, will draw a blank; although extensively discussed following the description of a new species of *Cryptolithus*, *C. tessellatus* does not, in fact, occur in these rocks and is not figured.] The authors describe a total of 15 new species (two left in open nomenclature) and seven previously known taxa receive supplementary attention. Genus-level descriptions are provided for eight taxa; two are identified only to family. Most taxa are known from a full array of holaspid elements and several are accompanied by illustrations of meraspid sclerites, but apparently no complete ontogenies are preserved. The plates are of the usual high standard set in earlier reports

and cover all faunal members, save for the aforementioned ethereal "Proetid."

The systematic documentation is generally solid and illuminating, but much of the interpretive component of the study is a little disappointing by comparison. These faunas, after all, derive from closely spaced samples through a stratal interval supposedly embracing two major pulses of Late Ordovician extinction among trilobites, and one is led to expect some interesting signals in the data. Indeed, one of the authors' stated goals was to look for changes across the two critical horizons ("Rawtheyan and uppermost Ordovician") to provide information on extinction and faunal turnover. The nearest approximation to an explicit assessment of extinction dynamics, however, is in a section entitled "Faunal Affinities" in which the word "trilobites" appears but twice, without a single reference to any taxon from the Avalanche Lake sections. A careful reading of the text, range charts, and zonal summary (under the heading of "Trilobite Biostratigraphy") is more enlightening but, at the same time, raises some methodological questions. As it turns out, neither of the two targeted extinction events can be clearly detected in the form of taxonomic turnover. The Rawtheyan extinction horizon isn't indicated on any of the included litho/sample logs or range charts. Based on earlier work, the uppermost Ordovician extinction horizon is pegged at the 110.6 metre-level in the authors' re-sampled and re-measured 98AV4B section. Unfortunately, the highest trilobite collection in this study was made at 110.1 metres – apparently no samples, and hence no faunas, were recovered from the critical interval, nor from beds at the Ordovician-Silurian boundary reported (also on evidence from previous studies) to be about one metre higher. Indeed, the only significant changes in diversity and taxonomic composition in the studied sections occur lower down, in the Edenian, corresponding to progressive deepening and a shift in biofacies belts.

The most interesting aspect of this study actually lurks unheralded within the section on biostratigraphy.

The recognition of the persistence of three older offshore-onshore biofacies into the Late Ordovician, combined with the first-ever proposal of an accompanying tripartite trilobite zonation for rocks of this age, marks a major contribution. None of this is elaborated in the abstract or introduction, and warrants only a fleeting mention under purpose and scope. Regrettably, presentation of the biostratigraphic data is somewhat wanting, and one is left wondering about the accuracy of zonal boundaries and taxonomic ranges plotted on the three charts and summary text-figure. For example, if the ranges are correct as given in text-figure 5, there seems to be little basis for recognizing the *Ceraurus mackenziensis* Zone in Section AV-1, where the occurrence of this species lies entirely within the succeeding *Ampyxina pilatus* Zone (as proposed) and only one of its zonal associates, *Arcticeraurinella brevispina* (cited as *Ceraurinella* in the text) is present below. The first appearance of *A. brevispina* is plotted beneath the base of the *Ceraurus mackenziensis* Zone, which in turn appears to be drawn at the last occurrence of *Bathyurus teresoma*. In sections AV-4B and 98AV-4B (text-figures 3 and 4), however, *Bathyurus teresoma* ranges well up into the *Ceraurus mackenziensis* Zone. Thus the extent and utility of the new zone based upon *B. teresoma* is also rather difficult to assess. The first appearance of the eponymous species (the youngest known species of *Bathyurus*) is apparently a function of where the lowest sample was collected in one section (see text-figure 5), and how that translates into a lower zonal boundary coincident with the Chatfieldian-Edenian stadial boundary in text-figure 6 is a bit of a puzzle.

In addition to the anomalies mentioned above, there are numerous glitches and typographical errors scattered through the monograph. Most are simply minor annoyances, but a few organizational inconsistencies render some components difficult to use. In this latter category are the three appendices: the first two are a compilation of taxa recovered in separate sample collections made through Section AV-4B and these are

listed top down; the third lists material from Section AV-1, but from the bottom up. In all three appendices, sclerite abundances for taxa from each horizon aren't given in any consistent order, making comparisons between levels a tedious procedure.

Despite being plagued by editorial eccentricities and haunted by questions arising from some aspects of methodology and interpretation, *Palaeontographica Canadiana*, No. 21 remains a significant contribution to our knowledge of the splendid silicified trilobite faunas from the Mackenzie Mountains. One hopes that clarifying answers to the outstanding questions are at this very moment lying at the bottom of another bubbling cauldron of acid!