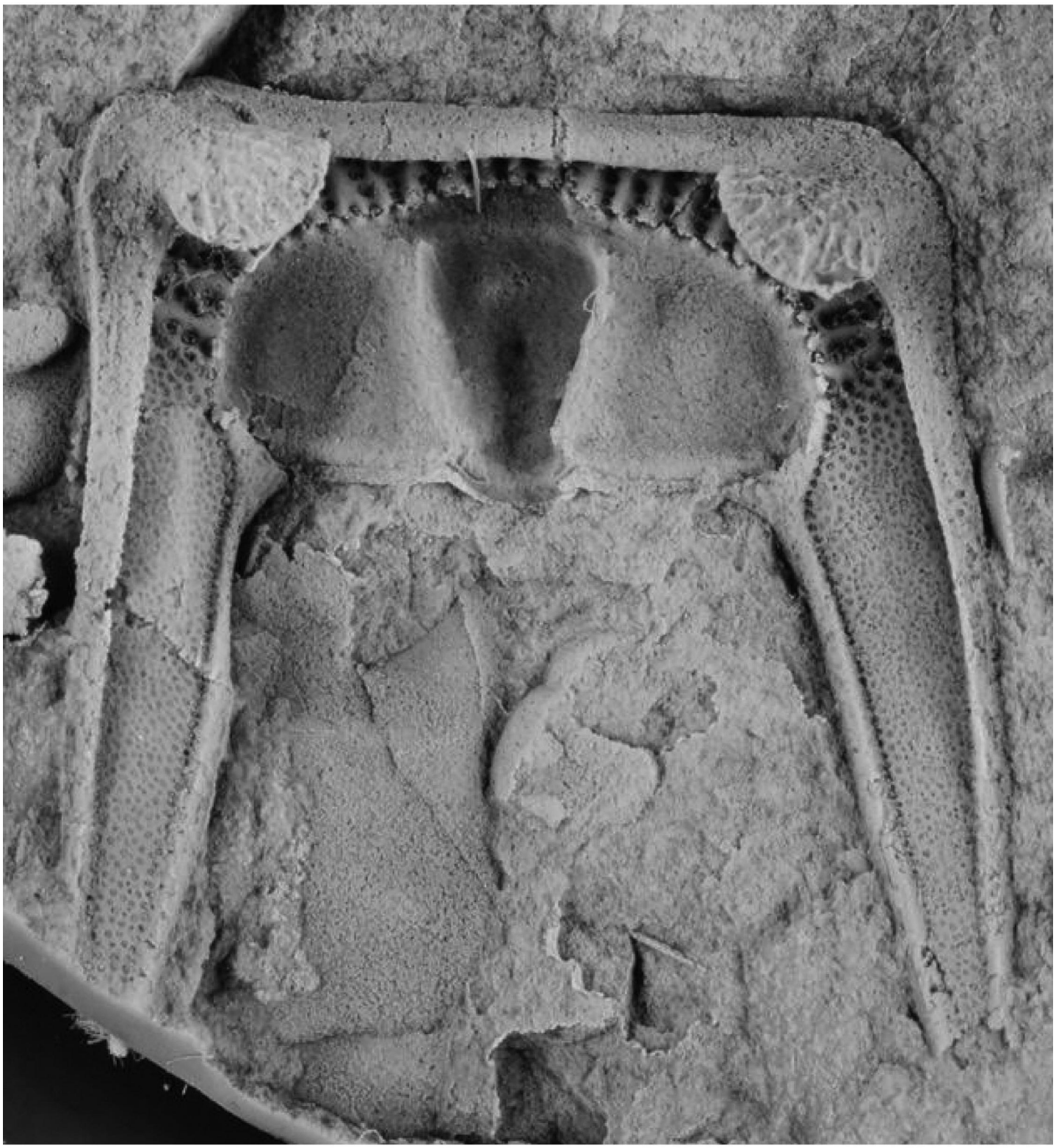
THE TRILOBITE PAPERS 26



An international newsletter for and by trilobite paleontologists
February, 2023

Dedicated to Rolf Ludvigsen

The Trilobite Papers Twenty-Six
February 2023

Editorial:

CONSTANTINOPLE—ISTANBUL

Or Nova Roma, Second Rome, Eastern Rome, Roma Constantinopolitana, Basileuousa, Megalopolis, the City, Miklagarðr, Miklagard, Miklagarth, Rūmiyyat al-Kubra, akht-e Rum, Tsargrad, and City of the Caesar. No matter what it has been called through time and by different people—it is essentially the same place.

All of this came to mind when I was constructing a graphic correlation of several middle and upper Cambrian sections of the Western United States using Peter Sadler's CONOP program (which he kindly provided to me and answered my questions). Why?

Well,

- is the first taxon location in a section(s) the
    - First Appearance Datum (FAD),
    - First Appearance (FA), or
    - First Occurrence (FO)?

- Is the last taxon location in a section(s) the
    - Last Appearance Datum (LAD),
    - Last Appearance (LA), or
    - Last Occurrence (LO)?

Like the city in Turkey, they're all about the same (at least all the firsts and all the lasts and sometimes both the first and lasts together). They all refer to a horizon in a stratigraphic section(s) where a taxon makes its presence known. I am sure there are some out there screaming in their head saying there are definitions to each term, but I don't care. The real problem is:

Did anyone actually believe that the first or last appearance (or occurrence) of a taxon in the fossil record were actually synchronous? We pretended that they were synchronous because resolution of the diachroneity was not possible (aka, yeah they showed up about the same time, plus or minus 500,000 to a million years) [overstatement!].

What we are really talking about is the timing of the evolution and extinction of a taxon. Perhaps we should use the terms:

ETEVT—Estimated Timing of the EVolution of a Taxon and

ETEXT—Estimated Timing of the EXtinction of a Taxon.

At least no one would to assume that we have accurately dated the evolution or extinction of a taxon given the environmental controls, migration, preservations, and sampling problems on the record of these events.

Fred Sundberg
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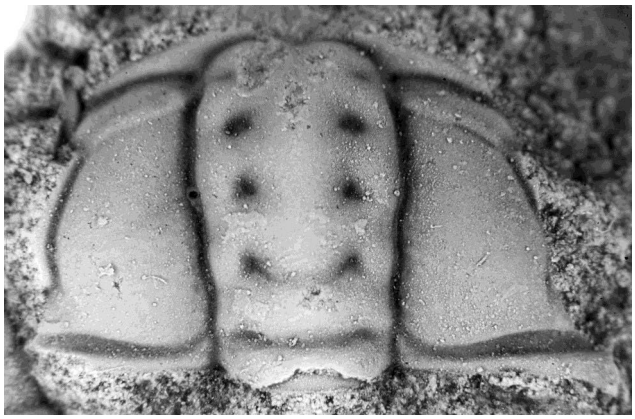


Smile—it is not all that bad!

Cover photo: ***Fantasticolithus isabelae*** Fortey and Gutiérrez-Marco, 2022 from the San Jose Formation, Ordovician, Peru. Latex cast of holotype cephalon, ventral view—Photo provided by Richard Fortey.

RESEARCH REPORTS

PER AHLBERG, Department of Geology, Lund University, Sölvegatan 12, SE-223 62 Lund, Sweden <per.ahlberg@geol.lu.se>

Cranidium of *Dellingia scanica* (Ahlberg & Bergström, 1978) from provisional Cambrian Stage 4 at Gislövshammar, Scania, Sweden. Photo Peter Cederström, Eslöv, Sweden.

In 1976, I started to work on ellipsocephalid trilobites from the traditional lower Cambrian of Scandinavia with the late Jan Bergström as supervisor, and in 1978 I published my first scientific paper on trilobites (ellipsocephalids), entitled 'Lower Cambrian ptychopariid trilobites from Scandinavia'. It was published as Volume 49 in Series Ca by the Geological Survey of Sweden (SGU). Since that time, I have been working on various topically and geographically wide-ranging research projects, and I could not envisage that I would return to studies on Cambrian ellipsocephalids from Scandinavia some 30–40 years later, largely as an Emeritus Professor. However, during the last 10 years or so, I have been working on a monograph on ellipsocephalid trilobites and their biostratigraphic significance together with Peter Cederström and Gerd Geyer. It has now finally been published in *Fossils and Strata* (see Publications below). Several genera and species from outside Scania and Sweden are also reviewed and partly revised. Regional and intercontinental correlations in the traditional 'lower-middle' Cambrian interval are also discussed.

During the past one or two years, I have continued to work on Cambrian and Ordovician trilobites and agnostoids, but my research has largely focussed on Cambrian and Ordovician biostratigraphy, carbon isotope chemostratigraphy, chronostratigraphy, geochronology, and sedimentary environments.

Publications in 2022:

Zhao, Z., Ahlberg, P., Thibault, N., Dahl, T. W., Schovsbo, N. H. & Nielsen, A. T., 2022: High-resolution carbon isotope chemostratigraphy of the middle Cambrian to lowermost Ordovician in southern Scandinavia: Implications for global correlation. *Global and Planetary Change 209*, 103751. DOI: org/10.1016/j.gloplacha.2022.103751

Rooney, A. D., Millikin, A. E. G. & Ahlberg, P., 2022: Re-Os geochronology for the Cambrian SPICE event: Insights into euxinia and enhanced continental weathering from radiogenic isotopes. *Geology 50*, 716–720. DOI: org/10.1130/G49833.1

Álvaro, J. J., Holmer, L. E., Shen, Y., Popov, L. E., Ghobadi Pour, M., Zhang, Z. F., Zhang, Z. L., Ahlberg, P., Bauert, H. & González-Acebrón, L., 2022: Submarine metalliferous carbonate mounds in the Cambrian of the Baltoscandian Basin induced by vent networks and water column stratification. *Scientific Reports 12:8475*. DOI: org/10.1038/s41598-022-12379-y

Cederström, P., Geyer, G., Ahlberg, P., Nilsson, C. H. & Ahlgren, J., 2022: Ellipsocephalid trilobites from Cambrian Series 2 and Stage 4, with emphasis on the taxonomy, morphological plasticity and biostratigraphic significance of ellipsocephalids from Scania, Sweden. *Fossils and Strata 67*, 1–131. DOI: 10.18261/9788215065779-2022

DOUG BOYCE

I have been the de facto Provincial Paleontologist for the Government of Newfoundland and Labrador, Canada since late June, 1984.

In preparation for my upcoming retirement, I am finalizing three reports for publication:

1. Maiolingian (Wuliuan—Delamaran) Trilobites from the Hawke Bay Formation (Labrador Group), Port Au Port Peninsula

(NTS 12B/06 – Cape St. George), western Newfoundland by W.D. Boyce and I. Knight

2. Miaolingian (Wuliuan—Delamaran) Trilobites of the Penguin Cove Formation, Goose Arm, Bay Of Islands (NTS 12H/04 – Pasadena), western Newfoundland — Paleontology and Biostratigraphy by W.D. Boyce and I. Knight

3. First Recognition of the Dyeran Stage (Waucoban Series)—Delamaran Stage (Lincolnian Series) Boundary in eastern North America (Chimney Arm, Canada Bay, western Newfoundland, Canada) by W.D. Boyce and I. Knight

RODOLFO GOZALO, Dept. Botánica y Geología, Universitat de Valencia, C/ Dr. Moliner 50, E-46100-Burjassot, SPAIN <rodolfo.gozalo@uv.es>

I am working with the PhD of Luis Collantes and Alexandre Sepulveda in the Marianian trilobites (Stage 3 and 4) in the Iberian Peninsula. Eladio and I go on working in the Ovetian trilobes of central Spain (Stage 3) and are working in the Middle Cambrian of the Iberian Chains and Cantabrian Mountains with Juan Chirivella.

Papers:

Collantes, L., Mayoral, E., Linán, E., Gozalo, R. & Pereira, S. 2022. The trilobite Serrodiscus Richter & Richter from Iberia, with systematic review of the genus and its international correlation through the Cambrian Series 2. Bulletin of Geosciences, 97 (3), 289-317. DOI: 10.3140/bull.geosci.1852

Sepúlveda, A., Liñán, E., Chirivella-Martorell, J. B., Gámez Vintaned, J. A. & Gozalo, R. 2022. Biostratigraphy of the Ribota and Huérmeda formations (Cambrian Series 2) in the Comarca del Aranda (Zaragoza province), Iberian Chains (NE Spain). Spanish Journal of Palaeontology, 37 (1), 101-122. DOI: 10.7203/sjp.24492

Abstracts:

Bernárdez, E.; Gozalo, R.; Liñán, E.; Chirivella Martorell, J.B. 2022. Los trilobites de la Serie Miaolingiense de Sela de Entorcisa (Zona Asturoccidental Leonesa; Norte de España). XXXVII Jornadas de Paleontología SEP - V Congreso Ibérico de Paleontología

Collantes, L.; Pereira, S.; Mayoral, E.; Gozalo, R. 2022. A new eodiscoid trilobite occurrence from the Marianian (Cambrian Series 2) of Spain. XX EJIP Cañaveral de León 2022, 19-22 de abril

Collantes, L.; Pereira, S.; Mayoral, E; Liñán, E. & Gozalo, R. 2022. The regional Marianian Stage (Cambrian Series 2) of the Ossa-Morena Zone, SW Iberia: Trilobite biostratigraphy and international correlation. XXXVII Jornadas de Paleontología SEP - V Congreso Ibérico de Paleontología

Gozalo, R.; Chirivella Martorell, J. B.; Collantes, L.; Dies Álvarez, M. E.; Gámez Vintaned, J. A.; Liñán, E.; Mayoral, E.; Sepúlveda, A. 2022. Trilobites of the Cambrian Stage 4 in Spain revisited. XX EJIP Cañaveral de León 2022, 19-22 de abril

Liñán, E.; Gozalo, R.; Collantes, L.; Mayoral, E. 2022. Trilobite biostratigraphy of the Marianian (Cambrian Series 2) from Sierra Norte de Sevilla: an overview. Ossa Morena and beyond: a tribute to Teodoro Palacios, 26th & 27th Januray 2022, Badajoz.

Sepúlveda, A.; Liñán, E.; Chirivella-Martorell, J. B.; Gámez-Vintaned, J. A. & Gozalo, R. 2022. Bioestratigrafía de las Formaciones Ribota y Huérmeda (Serie 2 del Cámbrico) en el yacimiento Jarque 2 (provincia de Zaragoza), Cadenas Ibéricas (NE España). XX EJIP Cañaveral de León 2022, 19-22 de abril

NIGEL HUGHES, Deptartmen of Earth and Planetary Sciences, University of California, Riverside, CA, USA <nigel.hughes@ucr.edu>

Work continues in both trilobite development and morphological variation, and in the stratigraphic and tectonic history of South and Southeast Asia. I presently have two graduate students in the lab – Shravya Srivastava (PhD) and Horus Balogh-Zanin (MS). Shravya's work, combined with that of former MS student Ernesto Vargas Perra is investigating the dikelocephlaids that I was unable to examine in detail in the 1990s. We are particularly interested in looking at evolutionary patterns in sequence stratigraphic context in the Upper Mississippi Valley. Horus is working on a collection of late Cambrian trilobite made from various localities in the southern part of the Shan State of Myanmar, as part of our NSF funded project and IGCP668 which is now wrapping up. I have numerous other collaborations in various states of completion. Undergraduate Kim Buenrostro is working on well preserved *Cruziania* from Pakistan.

Recent and in press papers, many of which concern trilobites at least in some part, include:

Hughes, N.C., Peng, S.-C., Harper, D.A.T., Myrow, P.M., Phạm Kim Ngân, Wernette, S.J. and Zhu, X.-J. 2022. Cambrian and earliest Ordovician fauna and geology of the Sông Đà and adjacent terranes in

Việt Nam (Vietnam). *Geological Magazine*, **159:**55-80. DOI: 10.1017/S0016756821000844

Zhu, X.-J., Hughes, N.C. and Zhou, Z.-Q. 2022 A *Glyptagnostus reticulatus* trilobite faunule from the Cambrian of the Northern Qilian Mountains, northwest China and its paleogeographical implications. *Journal of Paleontology,* 96(4):875-885*,* doi: 10.1017/jpa.2021.117

Fortey, R.A., Wernette, S.J. and Hughes N.C. 2022. Revision of F. R. C. Reed's Ordovician trilobite types from Myanmar (Burma) and western Yunnan Province, China. *Zootaxa* **5162(4):** 301-356, doi.org/10.11646/zootaxa.5162.4.1

Xiao, S.-H., Jiang, G.-J., Ye, Q., Ouyang, Q., Banerjee, D.M., Singh, B.P. Muscente, D., Zhou, C.-M. and Hughes, N.C. in press. Systematic paleontology, acritarch biostratigraphy, and δ13C chemostratigraphy of the early Ediacaran Krol A Formation, Lesser Himalaya, northern India. *Journal of Paleontology.* doi.org/10.1017/jpa.2022.7

Myrow, P.M., Hughes, N.C. and Singh, B.P. in press. Ordovician strata of the Indian subcontinent, *In* Servais, T., Harper, D.A.T., Lefebvre, B. & Percival, I.G. (eds). A Global Synthesis of the Ordovician System Part 2. *Geological Society of London Special Publication,* **533**

Xu, W., Hughes, N.C., Liu, L.-H., Zhang, W., and Liu, P.-H. in press. Paleogeographic reconstruction of the Paleozoic Lhasa terrane through detrital zircon mixing modeling. *Geophysical Research Letters* doi.org/10.1029/2022GL100160

Craddock, J.P., Paulsen, T.S., de Silva Schmitt, R., Johnston, S.T., Myrow, P.M. and Hughes, N.C. in press. Amalgamation of Gondwana: Calcite Twinning Strains from the early to late Paleozoic Ribiera, Ross, Kurgiakh, and Gondwanide Orogens. *In*: Hynes, A.J. and Murphy, J.B. (eds.) *The Consummate Geoscientist; a Celebration of the Career of Maarten de Wit*. Geological Society, London, Special Publication 531. doi.org/10.1144/SP531-2022-165

Van Iten, H., Hughes, N.C., John, D.L., Gaines, R.R. and Colbert, M.W. in press. Conulariid soft parts replicated in silica from the Scotch Grove Formation (lower Middle Silurian) of east-central Iowa. *Journal of Paleontology*.

Hou, J.-B., Hughes N.C. and Hopkins, M.J. in press. Gill grooming in middle Cambrian and Late Ordovician trilobites. *Geological Magazine*

NEAL M. HANDKAMER, Cicterra, Conicet-Universidad Nacional de Córdoba Argentina, Av. Velez Sarsfield, 1611, X5016GCA, Córdoba (Capital), Provencia de Córdoba, Argentina, neal.handkamer@usask.ca

Last year, I published a paper on the systematics, biostratigraphy, and paleoecology of the early and middle Cambrian trilobites from the eastern Mackenzie Mountains, Northwest Territories, Canada with my previous advisors Prof. Brian R. Pratt of the University of Saskatchewan and Dr. Robert B. MacNaughton of the Geological Survey of Canada. I am now in the process of writing up a manuscript with Brian on the growth and development of two endemic species from the Mackenzie Mountains, *Sahtuia carcajouensis* and *Mackenzieaspis parallelispinosa*. Both exhibit a style of paedomorphism that we interpret was produced from heterochronic changes, facilitated by the unique paleoecology present in that region during the middle Cambrian. Also, we, as well as Andrei Ichaso, Prof. Luis A. Buatois, and Prof. M. Gabriela Mángano of the University of Saskatchewan have another manuscript in review about the systematics and biostratigraphy of some middle Cambrian trilobites collected from helium cores of the Earlie Formation of southwestern Saskatchewan.

I moved to Córdoba, Argentina, in July 2022 to begin my Ph.D. project with Prof. N. Emilio Vaccari and Dr. Arnaud Bignon of la Universidad Nacional de Córdoba, which will encompass the family Raphiophoridae and attempt to contextualize the radiation of this group of trilobites within the Great Ordovician Biodiversification Event. This study will involve a systematic review and cladistic analysis of raphiophorids, as well as the description of a new species (and probably new genus) collected from la Formación Gualcamayo of the Precordillera of Provincia San Juan, Argentina. Later we plan to investigate the growth of raphiophorids using morphometric analysis to recognize any developmental modularity in this group.

Handkamer, N.M., Pratt, B.R., and MacNaughton, R.B., 2022, Biostratigraphy and paleoecology of the trilobite faunas from the Mount Clark and Mount Cap formations (early and middle Cambrian), eastern Mackenzie Mountains, northwestern Canada: Journal of Paleontology, v. 96, Memoir 89, p. 1–47.

JIM JAGO University of South Australia--STEM, Mawson Lakes, South Australia 5095, Australia <jim.jago@unisa.edu.au>

Jim Jago is continuing to work on the Cambrian trilobites of Tasmania, South Australia and New Zealand. Current projects include the Cambrian trilobites from the Cobb Valley, New Zealand collected by the late Roger Cooper. This project is being done with Patrick Smith and John Laurie. Another project is on a late Cambrian fauna from the south coast of Tasmania (with John Laurie and Kim Bis-

choff). Jim, Sun Xiaowen and Chris Bentley are in the process of studying the remaining undescribed trilobites from the Warburton Basin as well as producing a review of the Cambro-Ordovician faunas of the Warburton Basin.. A recent project (with Diego Garcia-Bellido, Nick Lemon, Jim Gehling and Richard Jenkins) has dealt with an enigmatic fossil from the early Cambrian Heatherdale Shale, south of Adelaide. Jim is involved in the study of the Big Gully biota, a Burgess Shale type fauna from Kangaroo Island. Workers on this project include Mike Lee, Jim Gehling, John Paterson, Greg Edgecombe, Diego Garcia-Bellido, Glenn Brock and Jim Jago.

JAGO, J.B., GEHLING, J.G., LEMON, N.M., JENKINS, R.J. F., & GARCIA-BELLIDO, D.C., (accepted for publication). A large enigmatic fossil from the early Cambrian (Series 2, Stage 3) Heatherdale Shale of South Australia. New Zealand Journal of Geology and Geophysics. DOI 10.1080/00288306.2022.2157846

JAGO, J.B. & BENTLEY, C.J., 2022. The stratigraphically lowest known Cambrian trilobites from the Dial Range Trough, north-west Tasmania and from western Tasmania. Alcheringa 46, 33-42. DOI 10.1080/03115518.2022.2043438.

JOHN LAURIE Australia
<john.r.laurie@gmail.com>

I now work mostly on Cambrian biostratigraphy and stratigraphy of the Georgina Basin, with two projects currently under way, one of which is with Craig Munns and John Paterson (both UNE), while the other is a lone affair on the Cambrian faunas from Hunt 1 well. Also recently submitted is a paper on the Miaolingian (Cambrian) agnostid and trilobite faunas from the northern part of the South Island in New Zealand (with Pat Smith, Jim Jago, John Simes and the late Roger Cooper) and another on the Furongian (Cambrian) agnostid and trilobite faunas from southernmost Tasmania (with Jim Jago and Kim Bischoff). Another couple of projects under way include a reassessment of the morphology and taxonomy of the pseudagnostids, a group that has been bouncing around between major agnostid lineages over the past couple of decades.

Smith, P.M., Laurie, J.R., Jago, J.B., Cooper, R.A. & Simes, J.E. (submitted). Miaolingian (Cambrian) agnostids and trilobites from the Cobb Valley area, South Island, New Zealand. *Australasian Palaeontological Memoirs*

BRIAN PRATT, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan S7N 5E2, Canada.
<brian.pratt@usask.ca>

Brian and his now-graduated MSc student, Neal Handkamer, along with Rob MacNaughton of the Geological Survey of Canada, published a Paleontological Society Memoir in 2022 on lower and middle Cambrian faunas from northwestern Canada, west of the Mackenzie River:

Handkamer, N.M., Pratt, B.R., and MacNaughton, R.B., 2022, Biostratigraphy and paleoecology of the trilobite faunas from the Mount Clark and Mount Cap formations (early and middle Cambrian), eastern Mackenzie Mountains, northwestern Canada: Journal of Paleontology, v. 96, Memoir 89, 47 p.

It was great to see this project completed after Brian and Rob made initial collections in 2011.

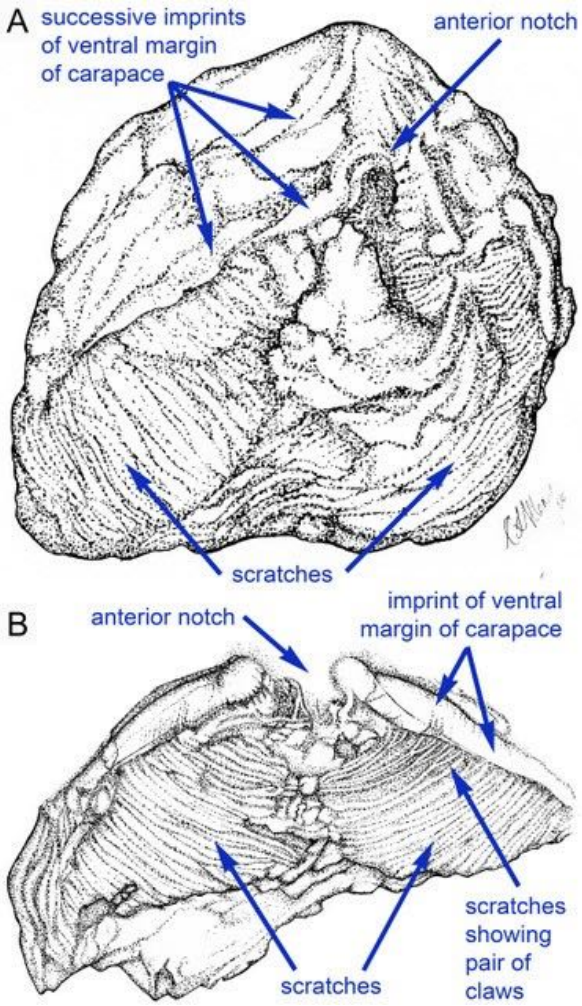
Sedimentology PhD student Andrei Ichazo discovered trilobites in newly drilled cores from helium wells in southwestern Saskatchewan, an area hitherto not explored for oil and gas. These are the first trilobites recovered from the province's subsurface, so exciting for correlation to the middle Cambrian in the Rocky Mountains far to the west. Neal and Andrei are the lead authors of manuscript submitted to Canadian Journal of Earth Sciences.

Brian also published:

Pratt, B.R., 2022, Lower Cambrian *Rusophycus* from Ellesmere Island, Arctic Canada: Ichnofossil of a predatory, non-trilobite arthropod: Palaios, v. 37, p. 165–184.

This was another project that was long in the works—Brian collected the Arctic specimens in 1993. They belong to *Rusophycus jenningsi* (Fenton and Fenton, 1937), first described from the southern Rocky Mountains in British Columbia. The type specimen has been lost but Brian found a substitute 20 years ago which he designated the neotype. This *Rusophycus* species was not made by a trilobite, and detail of the anterior portion of the carapace shows that

it was made by another, predatory arthropod form, and the scratch marks allow the ethology to be reconstructed. The standard paradigm about this and other 'trilobite' burrows such as *Cruziana* is discussed. Brian went out on a limb and erected two new ichnofamilies, so it will be interesting to see where the taxonomy goes.



SHRAVYA SRIVASTAVA, Department of Earth and Planetary Sciences, University of California, Riverside, CA-92507, USA. <ssriv008@ucr.edu>

Hi, I am Shravya Srivastava, a PhD candidate working in Hughes Trilobite Lab at University of California, Riverside. I am in my third year of a five-year PhD program. I joined this lab after working here in 2018 through a Indo-US Summer Research Fellowship called Satyendra Nath Bose Summer Fellowship and realizing that it is so fun that I get to tell the story of these long lost arthropods.

Me at University of Wisconsin Museum ecstatic about seeing *Walcottaspis* after years working on images of these very specimens.

A first step in my research has been to describe and analyze a lesser known late Cambrian dikelocephalid *Walcottaspis vanhornei* from the Upper Mississippi Valley of the North

Tony Runkel (Minnesota State Survey Geologist) and me sitting atop the Hokah section in Wisconsin where *Walcottaspis* is found abundant.

American craton interior. I have been learning some cool tools to extract morphological variation in fossils using geometric morphometric analysis. I have also undertaken phylogenetic analysis to explore evolutionary relationships among dikelocephalid trilobites, most species of which are found in other parts of North American craton in addition to the Upper Mississippi Valley. Towards the end of 2022, I submitted my work on *W. vanhornei* to the Journal of Paleontology which is under review now, which suggests that *Walcottaspis vanhornei* evolved through a punctuated equilibrium mode of evolution. Now I am expanding this work, looking at other dikelocephalid genera including *Osceolia* with a view towards integrating this with Nigel and Ernesto Vargas Perra's recent work on *Dikelocephalus.* The main objective of my PhD research project is to explore the nature of evolutionary innovations in nearshore marine settings such as Upper Mississippi Valley.

FRED SUNDBERG, Research Associate, Museum of Northern Arizona, Flagstaff, AZ <sundbergfred@gmail.com>

I am just about done working on middle-upper Cambrian trilobites (*Cedaria* to *Ellipsocephaloides* biozones) from the upper Noonan, and lower St. Charles formations (including the Worm Creek Member) of northern Utah with Hannah Cothren and Carol Dehler, University of Utah as a supplement to their work on the SPICE event (Cothren et al., 2022).

The main focus of my work is the Cambrian trilobites of the Grand Canyon. The plan is to focus on biostratigraphy, presence of disconformities, and revising the taxonomy of Resser (1945). At this point, other than collecting more material, I have also photographed most of Walcott and Ressers' type trilobite specimens from the Grand Canyon. **Note:** if you need copies of my photos of a Grand Canyon trilobite for research, let me know.

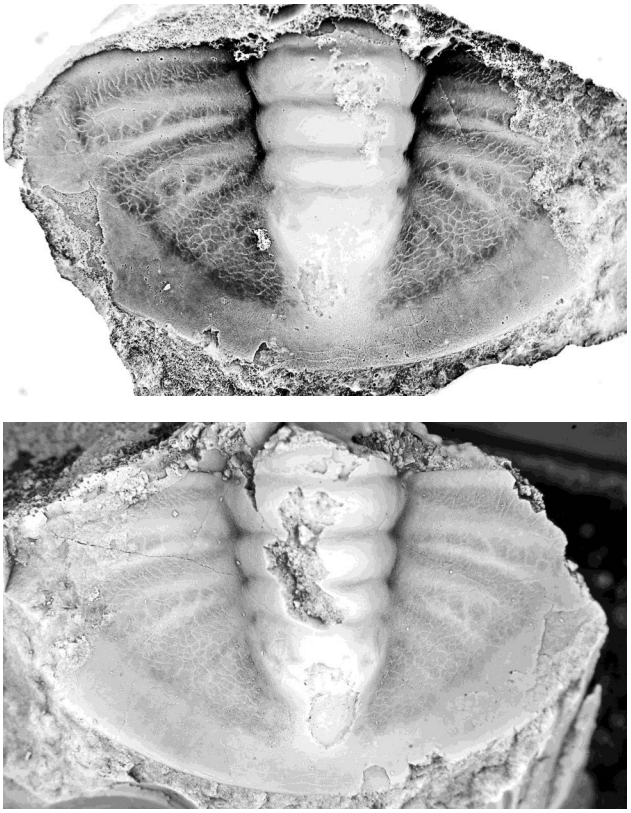
I have also been involved in identifying trilobites from the *Ehmaniella* Biozone from the Lodore Formation of Dinosaur National Monument with John Foster (also note John Taylor's work on the same fauna below).

Cothren, H.R., Farrell, T.P., Sundberg, F.A., Dehler, C.M., and Schmitz, M.D., 2022, Novel age constraints for the onset of the Steptoean Positive Isotopic Carbon Excursion (SPICE) and the late Cambrian time scale using high-precision U-Pb detrital zircon ages; Geology, https://doi.org/10.1130/G50434.1

Sundberg, F. A., and M. Webster. 2021. Corynexochine trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada. *Journal of Paleontology* **95** (6): 1241-1258.

Sundberg, F. A., and M. Webster. 2022. "Ptychoparioid" trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada. *Journal of Paleontology* **96** (4): 886-920.

Sundberg, F. A., M. Webster, and G. Geyer. 2022. Biostratigraphical significance of a new trilobite fauna from the Harkless Formation (upper Stage 4, Series 2, Cambrian), Nevada, USA. *Lethaia* **55** (3): 1-12.



Wilbernia cf. *W. pero* (Walcottt, 1890) from the *Ellipsocephaloides* Biozone, St. Charles Formation, Smithfield, Canyon, Utah. Upper photo is the external mold that has been color inverted and flipped horizontally using Photoshop. The lower photo is the dorsal surface of the actual specimen. Both were blackened and then whitened using the same methods. Note the differences in the expression of the dendritic pattern on the surface.

Trilobites from the Spence Shale of northern Utah. The other side is just as full. Photo provided by John Foster.

JOHN F. TAYLOR, Department of Geography, Geology, Environment and Planning, Indiana University of Pennsylvania, Indiana, PA 15705 jftaylor@iup.edu

The great thing about the relatively recent reactivation of The Trilobite Papers is that I once again get to enjoy reading about all the exciting work colleagues from around the world have accomplished each year. The worst thing about them coming back to life is that I have to admit in my own research reports how few of my projects have actually been completed! So it is with this year's report. The monstrous manuscript on *Lotagnostus*-dominated faunas from Nevada, which I said we were "*..very* close to completing.." in last year's report, is now EXTREMELY close to submission. Two separate (and much improved) manuscripts on *Ehmaniella* Zone faunas from the Lodore Formation in Dinosaur National Monument have received mostly favorable reviews, and revised versions have been submitted to both journals. Upon receiving word that my buddy John Laurie has agreed to come out of retirement to edit one more Australasian Palaeontological Memoir (Cambrian-Ordovician Studies VII), I promptly promised to contribute a manuscript on the Tremadocian (uppermost Stairsian and basal Jeffersonian) trilobite faunas from the El Paso Group in west Texas and New Mexico, which will be co-authored with James Loch, Paul Myrow, and Rob Ripperdan. I am also going to do my best to

deliver a second manuscript to that volume, describing a Cambrian Siberian fauna from the central Brooks Range in Alaska with my young colleague Justin Strauss. Justin and I are also keen on getting a manuscript assembled, sooner rather than later, on all the biostratigraphic, sedimentological, and chemostratigraphic data we've collected from the Jones Ridge Formation in easternmost Alaska. I have plenty to add to the treatment of the Jones /ridge trilobite faunas in the classic 1968 U.S.G.S. professional paper by Pete Palmer, including a new and apparently the youngest species of *Ptychopleurites* that occurs in what we interpret as a shelf-margin systems tract at the very top of the Ptychaspid Biomere. As the deadline for the Australian volume is September 1, it is possible that we can get a paper on the Jones Ridge (or one of the other projects mentioned in the last couple issues of the Trilobite Papers) out the door this fall. Stranger things have happened…although not often.

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A revised version of the "Léxico Estratigráfico de la Argentina. Volumen VI Cámbrico" was edited and submitted for publication in collaboration with Florencio G. Aceñolaza and Susana Esteban (Universidad Nacional de Tucumán). With Daniela Monti and Viviana Confalonieri (Universidad de Buenos Aires), a research article on the biogeographic histories of Hypermecaspididae and *Parabolinella* (Olenida; Furongian-Early Ordovician) is in review. New studies on middle Cambrian trilobites from the southern Argentine Precordillera are in progress.

Tortello, M.F. 2022. Cambrian trilobites from the *Glossopleura walcotti* Zone (Miaolingian Series, Wuliuan Stage) of Mendoza, western Argentina. Journal of Paleontology 96: 611-630.

Monti, D.S., Tortello, M.F. y Confalonieri, V.A. 2022. A phylogenetic approach to the study of the evolution of Hypermecaspididae (Olenida, Trilobita). Papers in Palaeontology 8(3): 15 p. doi: 10.1002/spp2.1433.

MARK WEBSTER, Department of the Geophysical Sciences, University of Chicago, 5734 South Ellis Avenue, Chicago, IL 60637 <mwebster@geosci.uchicago,edu>

Research progress continues. I finally got back into doing fieldwork during Summer 2022 after a long hiatus due to the pandemic, and I will continue my field campaigns this year. A backlog of Cambrian trilobite systematic and biostratigraphic projects is steadily being cleared. I continue to expand my study of the disparification of the glabella across the entire Trilobita, which is already yielding useful insight into the evolution of the shape of the glabella and how that evolution was influenced by developmental constraints (see GSA abstract). Students and collaborators give me the opportunity to work on things beyond trilobites, too.

Abbott, C., M. Webster, and K. Angielczyk. 2022. The importance of ontogeny and phylogeny in evaluating body size change in the fossil record: A case study of *Lystrosaurus* (Therapsida, Anomodontia) in the Karoo Basin, South Africa. *Geological Society of America, Abstracts with Programs* **54** (5). doi:10/1130/abs/2022AM-382767

Balaguera-Reina, S. A., M. Angulo-Bedoya, J. F. Moncada-Jimenez, M. Webster, I. J. Roberto, and F. J. Mazzotti. 2022. Update: Assessing the evolutionary trajectory of the *Apaporis caiman* (*Caiman crocodilus apaporiensis*, Medem 1955) via mitochondrial molecular markers. *Biological Journal of the Linnean Society*. (published online 2022)

Karbowski, G., E. Smith, A. Yu. Zhuravlev, M. Webster, and S. Pruss. 2022. Dead clade walking: Small archaeocyathan reef mounds in the lower Cambrian (upper Stage 4) Mule Spring Limestone, Split Mountain, Nevada. *Geological Society of America, Abstracts with Programs* **54** (5). doi: 10.1130/abs/2022AM-379051

Maloof, A. C., R. Manzuk, E. C. Geyman, A. Mehra, J. A. Kaandorp, M. Webster, S. Edmondon, B. Howes, and C. Hagen. 2022. From modern analogs to three dimensions: Lessons learned for interpreting the stratigraphic record of the Proterozoic-Phanerozoic transition. *Geological Society of America, Abstracts with Programs* **54** (5). doi: 10.1130/abs/2022AM-379218

Manzuk, R. A., A. C. Maloof, J. A. Kaandorp, and M. Webster. 2023. Branching archaeocyathids as ecosystem engineers during the Cambrian radiation. *Geobiology* **21**: 66-85.

Moore, J. L., S. M. Porter, M. Webster, and A. C. Maloof. 2021. Chancelloriid sclerites from the Dyeran-Delamaran ('Lower-Middle' Cambrian) boundary interval of the Pioche-Caliente region, Nevada, USA. *Papers In Palaeontology* **7** (1): 565-623.

Ng, R., and M. Webster. 2022. Ontogeny as an evolutionary constraint and source of neomorphism within the early Cambrian trilobite genus *Zacanthopsis*. *Geological Society of America, Abstracts with Programs* **54** (5). doi: 10.1130/abs/2022AM-381117

Sundberg, F. A., M. Webster, and G. Geyer. 2022. Bio-

stratigraphical significance of a new trilobite fauna from the Harkless Formation (upper Stage 4, Series 2, Cambrian), Nevada, USA. *Lethaia* **55** (3): 1-12.
Sundberg, F. A., and M. Webster. 2022. "Ptychoparioid" trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada. *Journal of Paleontology* **6** (4): 886-920.
Sundberg, F. A., and M. Webster. 2021. Corynexochine trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada. *Journal of Paleontology* **95** (6): 1241 -1258.
Webster, M. 2022. Assessing the role of developmental constraints in trilobite evolution. *Geological Society of America, Abstracts with Programs* **54** (5). doi:10/1130/abs/2022AM-381162

STEVE WESTROP, School of Geosciences and Oklahoma Museum of Natural History, University of Oklahoma
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I "retired" 18 months ago, after 23 years at the University of Oklahoma. Despite the time spent there, I had a ridiculous number of unfinished projects to complete, and "retirement" was simply a way of giving myself more time to write. I'm now doing most of my research from my home office in Ontario, with periodic treks to Oklahoma when I need to work directly with my research collections.

The Cambrian of Newfoundland has become a major focus again, and I'm continuing work on the Drumian–Jiangshanian (Marjuman and Steptoean) faunas of the Cow Group with former students Sandy Dengler and Jennifer Eoff. Ed Landing and I have much left to complete on the Middle Cambrian of Avalonia, particularly the Manuels River Formation. We are working with well-preserved specimens from carbonate nodules that retain original convexity (e.g., Westrop et al., 2018), and these are more informative than specimens flattened in shale described recently by Hildenbrand, Unger and colleagues. We also have some nodule faunas from the Jiangshanian and "Stage 10" in Nova Scotia, and some of the results are now appearing in print (e.g., Nguyen et al., 2022). Photography is in progress on the Lower Cambrian faunas of the Brigus Formation of the Avalon Peninsula, although it will likely be at least a couple of years before I can make significant progress on any manuscript.

There are a number of other projects moving forward slowly, including the faunas and carbon isotope stratigraphy of the Lion Mountain Member (Paibian) of the Riley Formation in central Texas (with former student Madison Armstrong, and with Mike Engel running isotopes in his lab at the University of Oklahoma); faunas and carbon isotope stratigraphy of the lower (Jiangshanian) Windfall Formation of Nevada (with former student Katie Welch, and Mike Engel); faunas and carbon isotope stratigraphy of the Paibian–Jiangshanian Dunderberg Formation and correlatives in Nevada and Utah (with former student Robert Mayer, current student Max Mehlman, and Mike Engel). The various units in Nevada and Utah include silicified faunas that Jonathan Adrain is taking the lead on. Finally, the Jiangshanian Honey Creek Formation of Oklahoma has yielded diverse faunas that I'm working on with former student Sean Blackwell. This is mostly at the photography stage.

There are a number of loose ends to tie up in the Upper Ordovician, mostly on the Bromide and Viola formations in Oklahoma, but it will be a while before I get to them.

Recent(ish) publications

Armstrong, M., Westrop, S.R., and Eoff, J.D., 2020, Systematics of a survivor: the Cambrian kingstoniid trilobite *Blountia* Walcott, 1916 across the Marjuman–Steptoean (Guzhangian–Paibian) extinction interval in Laurentian North America: Zootaxa, v. 4804, p. 1–79.
Nguyen, J.J., Westrop, S.R., and Landing, E., 2022, The Cambrian (Furongian) olenid trilobite *Peltura* from Avalonian Nova Scotia, Canada, with a review of some species from Baltica: Canadian Journal of Earth Sciences, v. 59, p. 463–477.
Landing, E., Keppie, D., Keppie, F., Geyer, G., and Westrop, S.R., 2021, Greater Avalonia—latest Ediacaran–Ordovician "peribaltic" terrane bounded by continental margin prisms ("Ganderia," Harlech Dome, Meguma): Review, tectonic implications, and paleogeography: Earth Science Reviews, v. 224, p. 1 –49.
Landing, E., Kröger, B., Westrop, S.R., and Geyer, G., 2023, Proposed Early Cambrian cephalopods are chimaeras, the oldest known cephalopods are 30 m.y. younger: Nature Communications Biology, doi.org/10.1038/s42003-022-04383-9.
Landing, E., Westrop, S.R., and Geyer, G., 2022, Trans-Avalonian green–black boundary (early Middle Cambrian): transform fault-driven epeirogeny and onset of 26 m.y. of shallow-marine, black mudstone in Avalonia (Rhode Island–Belgium) and Baltica: Canadian

Journal of Earth Sciences, v. 60, p. 1–39.
Westrop, S.R., and Dengler, A.A., 2022, A new Cambrian catillicephalid trilobite from the Shallow Bay Formation of western Newfoundland, Canada: Acta Palaeontologica Polonica, v. 67, p. 27–33.
Westrop, S.R., Landing, E., and Dengler, A.A., 2018, Pseudocryptic species of the Middle Cambrian trilobite *Eodiscus* Hartt, in Walcott, 1884, from Avalonian and Laurentian Newfoundland: Canadian Journal of Earth Sciences, v. 55, p. 997–1019.

Richard A. Fortey Commander of the British Empire

Richard A. Fortey has been awarded the honour of CBE (Commander of the British Empire) for his contribution to palaeontology and geology.

It is not often that scientists in these fields receive such attention. He looks forward to receiving this at Buckingham Palace later in the year.

Richard Fortey well deserves this award.

David L. Bruton

Postdoctoral Fellowship Available

The Denver Museum of Nature & Science (DMNS) invites applications for a Postdoctoral Fellow to help conduct research with curator James Hagadorn. This is a two-year term position with potential opportunity for extension. The successful candidate will be an outwardly focused earth scientist with a record of peer reviewed publications and fieldwork in paleontology and/or sedimentary geology. Ideal candidates will have experience that will help grow and complete existing DMNS projects focused on understanding deep-time environments and ecosystems, including those characterized by trilobites.

We seek an individual, especially from groups traditionally underrepresented in the earth sciences, who is not only interested in expanding their scholarly footprint but who is also interested in diversifying their outreach, collections and/or technical skills. For application information, please contact james.hagadorn@dmns.org.

Essential duties:

- Publishes peer-reviewed research.
- Conveys scientific results to the scientific and public communities.
- Collaborates with DMNS staff, community scientists, interns, and external partners to produce new scholarship, improve collections or databases, and conduct outreach.
- Contributes to Museum efforts to ignite community passion for science and nature.
- Other duties as assigned.

Minimum qualifications/requirements:

- Ph.D. in earth sciences or geological sciences by spring 2023.
- Field research experience in sedimentary rocks.
- Peer-reviewed publication record.
- Proof of COVID-19 vaccination or exemption.

Ideal candidate will have:

- Experience in some aspect of Cambrian, Devonian, Permian, or Cretaceous systems, a subfield of stratigraphy or sedimentology, or trilobite paleontology.
- Database, modeling or laboratory experience.
- Collections, museum or GIS experience.
- Public communication skills.
- Flexibility in adapting to new projects.
- Ability to work independently, including in hybrid multigenerational and multidisciplinary teams.
- Interest in developing science communication skills.
- Desire to participate in the museum's diversity, equity, access and inclusion initiatives, including encouraging marginalized groups to get involved in science.

DMNS Internships

Two paid trilobite-oriented summer internships at the Denver Museum of Nature & Science are available, and are open to current undergradu-

ates, graduate students, or recent graduates. The focus of the internships will be on the fossil collections of the late Stew Hollingsworth. Applications are due Feb 17, and information is at https://www.dmns.org/about/internships/

CAMBRO-ORDOVICIAN STUDIES VII: Request for papers

Back in 2004, the journal *Memoirs of the Australasian Association of Palaeontologists* and its replacement *Australasian Palaeontological Memoirs*, began a series on Cambro-Ordovician Studies and published six volumes in the series (see below). A seventh volume is going to be published, and will of course be Cambro-Ordovician Studies VII. This is a request for submissions to this latest volume in the series.

Manuscripts submitted to the *Australasian Palaeontological Memoirs* must be of suitable content for publication in such a palaeontological journal and all papers are peer reviewed. Publication is therefore conditional on the content of the paper being considered suitable for review and on passing the peer review process. If you wish to submit a paper, please e-mail the editor (address below) with a probable title and the names of the authors. These are not final and can be changed at any time up to submission. The date for submission of manuscripts is September 1st, 2023, with a likely publication date in the second half of 2024.

John Laurie, editor (john.r.laurie@gmail.com)

Laurie, J.R. (ed.), 2004. Cambro-Ordovician Studies I. *Memoirs of the Association of Australasian Palaeontologists 30*, 260p.

Paterson, J.R. & Laurie, J.R. (eds), 2006. Cambro-Ordovician Studies II. *Memoirs of the Association of Australasian Palaeontologists 32*, 422p.

Laurie, J.R., Brock, G.A. & Paterson, J.R. (eds), 2009. Cambro-Ordovician Studies III. *Memoirs of the Association of Australasian Palaeontologists 37*, 716p.

Laurie, J.R., Paterson, J.R. & Brock, G.A., 2011. Cambro-Ordovician Studies IV. *Memoirs of the Association of Australasian Palaeontologists 42*, 492p.

Laurie, J.R., Paterson, J.R. & Brock, G.A. (eds), 2014. Cambro-Ordovician Studies V. *Memoirs of the Association of Australasian Palaeontologists 45*, 419p.

Laurie, J.R., Percival, I.G., Jago, J.B., Paterson, J.R. & Brock, G.A. (eds), 2016. Cambro-Ordovician Studies VI. *Australasian Palaeontological Memoirs 49*, 514p.

TRILOBITE ACROSTIC POEM #1

The present is – a key,
Relatively speaking, to ...
Islands of
Lost time,
Or as Hutton
Best eulogized,
Incomprehensible in every
Terse moment of infinity ...
***E**t tu, Chronos?*

Christopher Collom
January, 2023

Trilobite Tears For People We Have Lost

J. Keith Ingham (1937-2022)

By Richard Fortey

Keith Ingham recently passed away at the age of 85 and will be missed by his many trilobite friends and colleagues. For almost 40 years he held the position of Curator and Senior Curator of Palaeontology at the Hunterian museum, University of Glasgow. He was not just a stratigrapher and palaeontologist. Within the Museum he was known for being able to take on almost any task to an extraordinary degree of perfection. This ubiquity ranged from re-assembling a Mesozoic 'ganoid' fish from what started as a bagful of disarticulated plates, through having an exhaustive (and occasionally exhausting) knowledge of Roman coinage, to re-mastering NASA images from the early robotic explorations of the Martian landscape and identifying potentially one of the best locations to explore for life on Mars as a result (Russell et al. 1999). He had an extraordinarily wide compass of expertise, and an indefatigable attention to detail.

Trilobites were, however, his palaeontological speciality, and the Ordovician was his stamping ground. Many of his colleagues recognized that he was a superb field mapper, and relished the kind of structural complexities that would deter lesser mortals. His thesis work was centred on the Cautley and Dent district, where the upper

Ordovician Ashgillian strata provided the global standard in the mid-twentieth century, and Keith published on the stratigraphy of these rocks and their trilobite faunas in a series of regularly cited papers (Ingham 1966; Ingham and Wright 1970). Although the term "Ashgillian" is no longer favoured for the chronostratigraphic name for the younger Ordovician, it is still very useful as a regional stage name for many regions –especially in Europe – and Keith's work did much to refine its understanding. Keith described the trilobites of the type Ashgillian in three parts of a Palaeontographical Society monograph (Ingham 1970-1977), work that is unlikely to be superseded.

Keith became particularly enthused by the Family Trinucleidae, and with colleagues provided a review of the group that remains one of the most magisterial of trilobite works (Hughes, Ingham and Addison 1975). They fostered a deeper understanding of the structure of the trinucleid fringe, and documented the importance of the girder (and pseudogirders) that go into its construction. They also managed to get photographs of many type species of genera, making comparisons across the family that much easier. The drawings in this paper were all Keith's, and reveal him as probably the best artist the trilobites ever had. His oblique ventral views of trinucleids are utterly convincing, and have never been surpassed. When he died he was trying out new computer-based drawings, and it is hoped that some of these will appear in a posthumous paper on *Ellipsotaphrus* and its relatives in the *Transactions of the Royal Society of Edinburgh*. Keith's reconstruction of *Marrolithus* appeared on early covers of *Palaeontology*, and has become adopted as a logo for the Palaeontological Association, and after several decades I wonder if the younger members of the Association know where it came from.

Following his establishment at the Hunterian museum Keith progressed on to Scottish Ordovician strata (taking in the Lake District on the way; Ingham and McNamara 1978), at a time when the topography and terranes of the margins of the Iapetus Ocean were being vigorously debated. He started to map and measure the famous coastal sections near Girvan that had yielded some of the later Ordovician trilobites described by Nicholson and Etheridge and F.R.C. Reed. It is doubtful whether any other Ordovician section has been mapped in comparable detail (Ingham 1992) and he continued to refine the particulars well beyond his 'retirement'. I recall him showing me remarkable sedimentary rocks laid down in and around what he interpreted as submarine canyons: these yielded a superb atheloptic assemblage of deep-water, blind and specialized pelagic trilobites that Keith could describe in every detail. When he did so his eyes popped with excitement, and his detailed accounts were enriched occasionally with a peal of manic laughter about some unusual feature that he had discovered. He joined forces with the 'professional amateur' Ronald P. Tripp, who had spent years collecting from small quarries dotted over the Ayrshire countryside. Ron Tripp had worked in finance for many years, but became an obsessive trilobite collector after suffering nervous troubles, and eventually leaving his paid job. He was an efficient 'finisher' of papers, whereas Keith was by nature a perfectionist who was reluctant to let anything go. However, they joined forces in a fine paper on an important fauna from the Doularg Formation that carries both their names (Ingham and Tripp 1991). Ron Tripp told me that he had to move in with Keith to ensure that the work was actually completed and submitted. A few years earlier Keith had contributed to a small, but important palaeontological paper that finally settled the question of the early Ordovician age and palaeogeographic position of a sliver of limestone caught up in the Highland Border Complex (Ingham, Curry and Williams 1988) - proving its "Laurentian" credentials. Such detailed studies in these classical areas where contributing to big questions.

Meanwhile, the international standard subdivision of the Ordovician was also under scrutiny, and I was charged with leading the revision of the correlation of strata within the British Isles. In the UK, correlation charts of successive geological periods were published as Special Reports of the Geological Society of London, and an older version headed by the renowned brachiopod specialist Alwyn Williams was due for revision. A team of us, including Keith, had been

trying to add a new precision to the old, widely used Ordovician subdivisions going back to Lapworth and his colleagues (Tremadoc, Arenig, Llanvirn, Llandeilo, Caradoc and Ashgill), although after the ruminations of the Subcommission on Ordovician Stratigraphy only the Tremadocian would eventually survive. It was a long process persuading Keith to come up with his latest definitive version of the correlation of the Ordovician rocks of the Midland Valley, but when he did it was so detailed that we had to convince the publishers that a 'pull out' correlation chart was needed, and so it eventually proved (Ingham 2000, Fig. 24). This was a summary of everything Keith had done in his detailed mapping, especially in the Girvan area. It was based on extensive trilobite collections that Keith had always intended to describe in the detail they deserved. Keith continued to work on his Girvan collections until shortly before he became ill and I can recall typically enthusiastic conversations with him about dionidids and cyclopygids, of which he had startlingly good material. Sadly, many of these trilobite species remain to be published, but his collections are available to future students and it is much to be hoped that his work will be completed by a successor.

Hughes, C. P., Ingham, J.K. and Addison, R. 1975. The morphology, classification and evolution of the trilobite Family Trinucleidae. Philosophical Transactions of the Royal Society of London, Series B, 272, 537-607.

Ingham J K. 1966 The Ordovician rocks of the Cautley and Dent districts of Westmoreland and Yorkshire. Proceedings of the Yorkshire Geological Society, 35, 455-505.

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Ingham, J.K. and Wright, A.D. 1970, A revised classification of the Ashgill Series. Lethaia 3, 233-242.

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Ingham, J.K. 2000. Scotland: the Midland Valley Terrane, 48-50 in Fortey, R.A. et al. A revised correlation of Ordovician rocks in the British Isles. Special Report of the Geological Society of London 24, 1-83.

Russell, M., Ingham, J. K., Zedef, V., Maktav, D., Sunar, F., Hall, A. & Fallick, A. E. 1999. Search for signs of ancient life on Mars: Expectations from hydromagnesite microbialites, Salda Lake, Turkey

A. R. "Pete" Palmer (1927-2022)

by Mark Webster

On October 24th, 2022 the trilobite community suffered a great loss with the passing of A. R. "Pete" Palmer at the age of 95. His deep love of paleontology (especially of, but certainly not restricted to, Cambrian trilobites!), stratigraphy, and field geology was evident in everything he did throughout six decades of active research.

Pete's professional career began in 1950 with the U.S. Geological Survey, where he spent 16 years working as the Cambrian Paleontologist-Stratigrapher. He then became a Professor of Geology at SUNY Stony Brook until, in 1980, he took on the role of Centennial Science Program Coordinator with the Geological Society of America, and was responsible for editing the monumental *Decade of North American Geology (DNAG)* project. In 1994 he retired from professional duties, but continued his Cambrian research as a "gentleman scientist" from his home in Boulder.

Pete was tireless in his work, and made monumental contributions to geology and paleontology throughout his life. He published more than 130 papers and monographs, naming more than 230 species and almost 50 genera of trilobites. He appreciated the importance of considering fossils within their geologic context, which allowed him to refine the stratigraphic zonation of the Cambrian System on Laurentia. He also developed and popularized the "biomere" concept of trilobite evolution and extinction, which spurred more than four decades of subsequent work as researchers sought to more fully understand the patterns and processes involved. Indeed, Pete was always eager to encourage re-

search and to see new methods applied so as to drive the science forward.

In 1981 Pete co-founded the Institute for Cambrian Studies, a non-profit organization which serves to promote the scientific study of the Cambrian System. He served as President of the ICS for 25 years, during which time he created and curated the internationally important ICS Research Library and Collections. The ICS visitor's logbook is testament to just how many of us—students, professionals, and amateurs alike—benefitted from Pete's expertise, enthusiasm, generosity, and hospitality by visiting his Boulder home.

As befitting his achievements and dedication to science, Pete was the recipient of numerous prestigious awards, including the Walcott Medal of the National Academy of Sciences, the Distinguished Service Award of the Geological Society of America, and the Paleontological Society Medal.

Pete will be remembered as a gentleman, scholar, and mentor who profoundly shaped our understanding of the Cambrian System. He leaves a lasting legacy in our discipline, and will be greatly missed.

A detailed obituary is planned for submission to the *Journal of Paleontology*.

Reminiscence of Pete Palmer by Ed Fowler

Like most students of the Cambrian in the Great Basin, I first knew A. R. (Pete) Palmer through geological literature. His authoritative reports on fossil Ids were ubiquitous in field reports of Cambrian strata in this region and beyond from the 50s and 60s. After I started myself finding unidentified Cambrian fossils, I ventured to contact Pete and found him to be as congenial, and as authoritative, as suggested by the style of the reports.

Later on, following up on Pete's 1979 paper on the Carrara Formation, Sarah and I had visited the Oak Spring Summit site near Caliente and found some promising material. As a result we agreed to meet Pete and Pat at the site. We pulled up to this location in 1988, took the short hike over to the fossil beds and found them already there. That first day our party made several novel finds and Pete instantly id'ed two unexpected elements of the Vermont fauna. This was the beginning of a wonderful period when we were privileged to accompany them on several field trips, mostly in the Pioche region. This included the discovery of the rich Ruin Wash fossil beds which Pete described in a landmark 1998 paper. This fieldwork in the area, begun by Pete's exploration of Oak Spring Summit in 1970, kicked off a period of investigation of the Pioche Shale by many geologists.

Once in Caliente when we pulled into the motel parking lot, we happened to strike up a conversation with a geologist working in this general area of the desert. He pulled me aside and asked who is this distinguished-seeming gentleman;

Pete talking to young paleontologists at Indian Springs Canyon during Laurentia '99 field trip.

when I answered, the awestruck reaction was a vivid demonstration of Pete's legendary status.

He was of course a quintessential field man, making many of the finds in the great period of Great Basin discovery in the 50s and 60s, such as the McGill Upper Cambrian section, the Miecklejohn Peak Ordovician reef, and numerous others. Perhaps his most outstanding discovery were the biomeres (and their remarkable boundaries) which now constitute the Lauren-

tian stages of the later Cambrian. The finding of these boundaries in all the various Basin ranges stands as a remarkable feat of fieldwork, like needles in a haystack when you consider the great thicknesses and the paucity of knowledge of these rocks at the time.

To me his works are outstanding for their clarity of thought, a quality which, along with their high standard of accuracy, will allow them to stand the test of time. These works are part of the remarkable postwar period of paleontology alongside Whittington, Rasetti and others.

Above all Pete was a wonderful man, with a spirit of pure exploration and discovery and always open to engage with all. His international ambassadorship of the Cambrian is something to be missed in these current times.

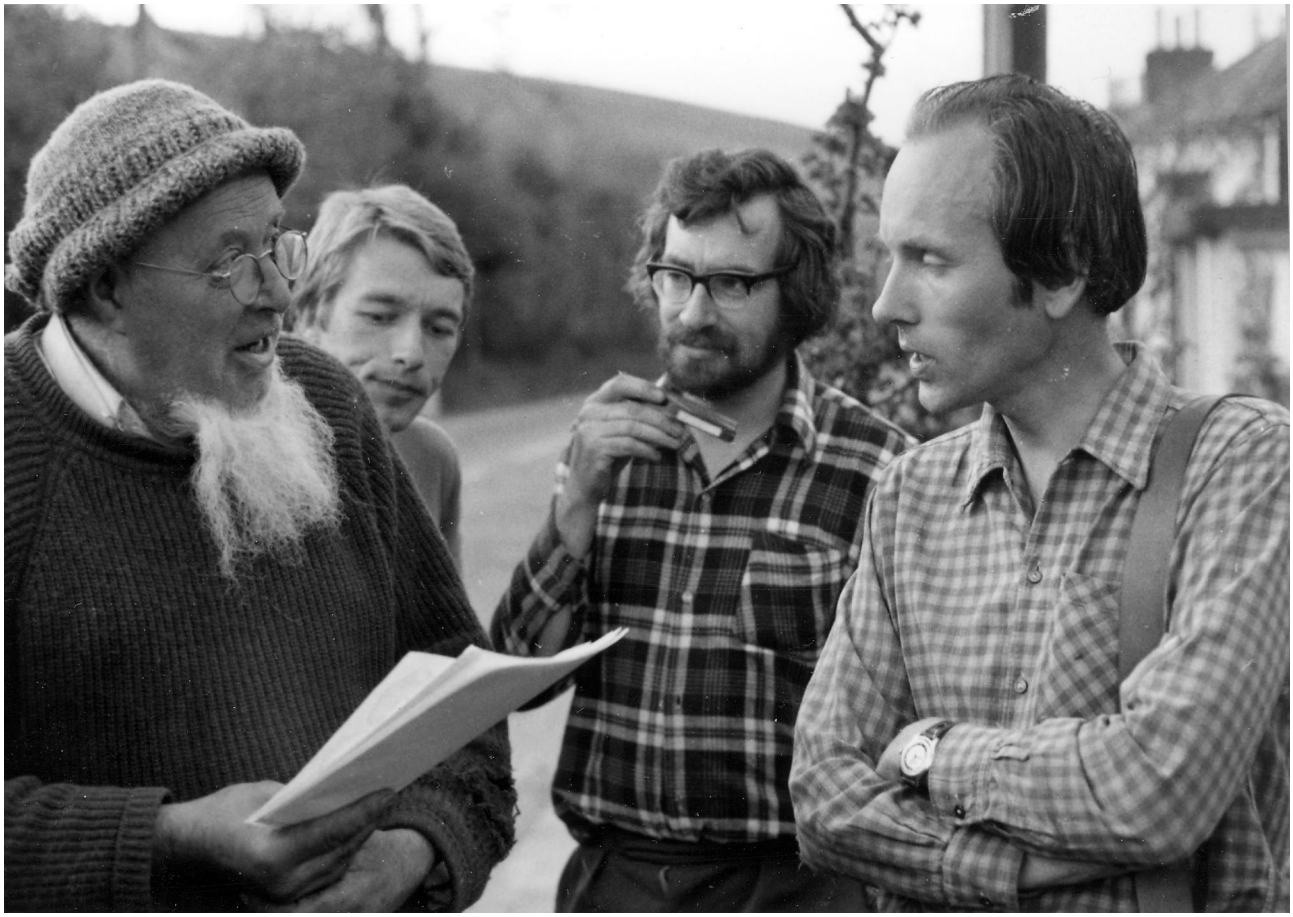
One last "near-miss" of meeting up with Pete in the field was in 2016 when I returned to the Pioche area after a hiatus of many years. Stopping at the Oak Springs Summit registry book (with its cover illustration faded after many years), I signed in and scanned for familiar names. Later I found out Pete had stopped by this spot the very next day, after a similar long hiatus.

"I the presence of eternity, the mountains are as transient as the clouds". So also a human lifespan and a geologic epoch. Long may his spirit linger over the desert ranges.

TRILOBITE ACROSTIC POEM #2

***T**rilobagnostus*, a.k.a.
***R**udagnostus*, lacking sight &
Instincts evolved by
Light ... from distant
Orb, too
Bright to look directly
Into, crawls slowly
Through ancient darkness, present
Everywhere.

Christopher Collom
January, 2023



Three trilobite researchers (Archie Lamont, Euan N. K. Clarkson and Jan Bergström) and Louis Liljedahl at Carlops close to Pentland Hills, Scotland. Photo Per Ahlberg 22 May 1977.

FIELD NOTES

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Work continues on the systematics of Devonian trilobites. I am hoping to complete another paper on phacopid trilobites with Jens Koppka this year. Several projects involving lower Emsian trilobites from western Europe with Peter Müller are taking shape. Gerry Kloc and I have published a paper on asteropygines including a systematic revision of Hollardops (van Viersen &; Kloc, 2022). In Asteropyginae, the relationship between the pygidium size excluding the pleural spines and the length of these spines is often inversely proportional and total pygidial dimensions similar to those of the cephalon. Complementary evidence from the ventral morphology of Hollardops demonstrates that the lateral cephalic doublure coincides with the lateral border. We proposed a 'dual mode of coaptation', encompassing a locked state of pseudomegalaspid type (Fig. 1E, F) and a retracted state that allowed water to pass internally and antennae to protrude through slits between the pygidial spines (Fig. 1G, H).

The additions of peripheric spines to the pygidium to create a 'breathing device' offer a potentially novel perspective on the rise and evolution of Asteropyginae within Acastidae. Dalmanitids on the other hand, often developed cephalic crenulations to enable a respiratory function (see Fig. 1L of *Phalangocephalus* redrawn after Campbell, 1977 and interpreted as a retracted state of cephalon during enrolment, added to by a derived locked state Fig. 1K (new)). The spiny, comparatively small pygidium of the dalmanitid *Erbenochile* (Fig. 1O, P) is deemed a breathing device and a convergence on Asteropyginae. Different putative breathing devices have been described in the literature which evolved, independently, in various trilobite lineages. We suspect that this may have been a widely distributed feature in derived members of the class.

Viersen, A.P. van & Kloc, G.J. 2022. Functional morphology, coaptation and palaeoecology of *Hollardops* (Trilobita, Acastidae), with descriptions of new species and two new genera from the Devonian of Morocco. Geologica Belgica, 25: 99-144. https://doi.org/10.20341/gb.2022.005 [open access]

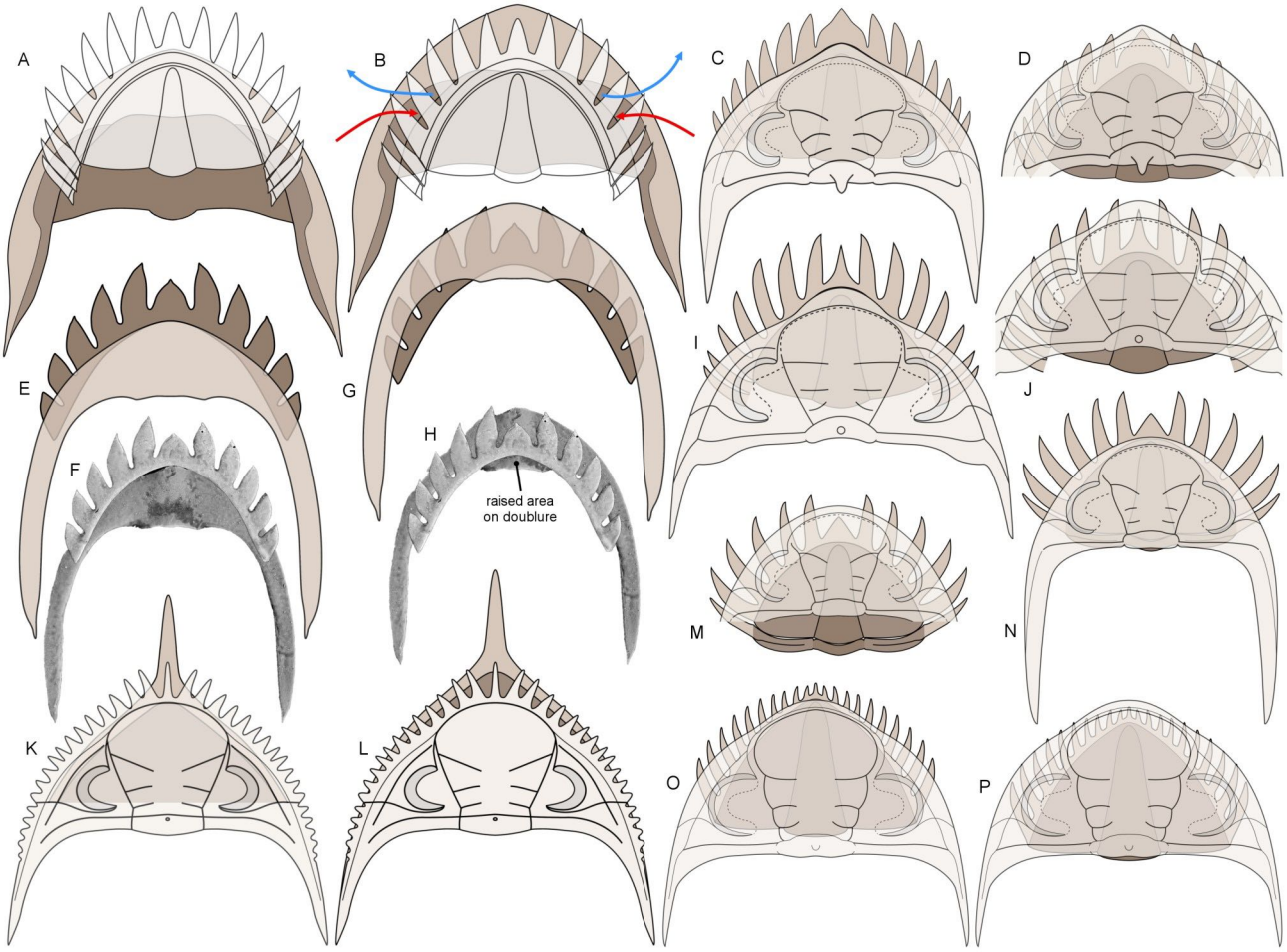
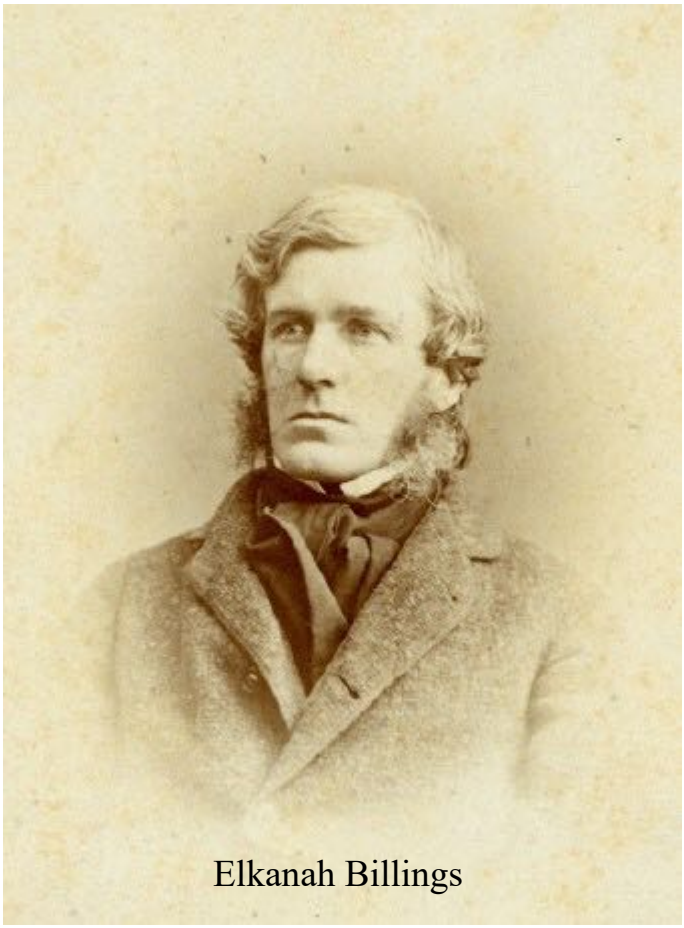


Fig. 1. A, B – *Bellacartwrightia* sp.; C, D – *Platykardiapyge maderensis* (Morzadec, 2001); E-H – *Hollardops burtandmimiae* (Lieberman & Kloc, 1997); I, J – *Delocare bensaidi* (Morzadec, 2001); K, L – *Phalangocephalus dentatus* (Barrett, 1876); M, N – *Asteropyge filoxenia* van Viersen et al., 2019; O, P – *Erbenochile issoumourensis* Chatterton & Gibb, 2010. Retracted states: B, D, G, H, J, L, M, P; remainder are locked states.

Revisiting Billlings (1865): Fieldwork on the west coast of Newfoundland in the late 1970s

By Richard Fortey

Elkanah Billings (1820-1876) was a pioneer in the description and naming of trilobites from Canada. Collections made from then remote areas were brought to him for description and assessment. He laid the foundations of the Paleozic stratigraphy for a large part of what we now regard as the Laurentian paleocontinent, and identified more than a thousand taxa in the process. Although his drawings were rather small, and the trilobites he named often based upon a single cranidium or pygidium, he was an accurate illustrator and wrote precise descriptions. However, it was clear after his death that his Ordovician species needed revision, and that would not be feasible without new collections.



Elkanah Billings

At the time Billings was working, Newfoundland was truly remote, with large parts of the island only accessible by sea. Billings was supplied by a collector called Richardson, who took samples from places that could be safely reached by boat. Extensive outcrops of Ordovician strata were exposed all along the 200 km west coast of the Great Northern Peninsula, comprising a varied series of formations yielding plentiful fossils in many sites. Richardson brought back collections from the peninsula of Cow Head, and nearby Table Head, as well as further north around the remote settlement of Port au Choix. The whole area has figured prominently in the interpetation of the evolution of the geological history of what is now the northern hemisphere, but at the time of Richardson's visits every fact was a new one. Many of the trilobite discoveries received Billings' attention in a classic 1865 publication of the Geological Survey of Canada, the type specimens from which are stored in the national collections in Ottawa.

Although Percy Raymond had added some additional species, the thorough re-examination of the old localities had to wait until almost the middle of the twentieth century, when Cecil H. Kindle began to study the Ordovician faunas of "the Rock" (as Newfoundland is known to natives). By the mid fifties he had joined forces with my old professor, the great Harry Whittington, and in 1958 they pubished a revision of the rock succession on the Cow Head Peninusula. The 'boulder beds' that puncuated the succession yielded many trilobites, in blocks derived from shelf sites and allochthonously emplaced. The largest of these – a huge limestone boulder at Lower Head – had many interesting articulated species and became Whittington's first major monograph on the area (Whtttington 1963) that bore testimony to the variety of trilobites close to the base of the Middle Ordovician. Away from the boulder beds, Whittington described a very rich trilobite fauna from the Middle Ordovician Table Head Formation, one of the most lavishly illustrated monographs at the time (Whittington 1965). I had just joined the Cambridge geology department (UK) by then, and was soon to regard this work as the model to follow. However, Harry Whittington did not go

on to work on the faunas that underlay these riches, possibly because they were comparatively fragmentary, or, more likely, because he was more preoccupied with the discovery of spectacular silicified trilobites from the Edinburg Limestone and correlatives. It was difficult enough to reach Cow Head (boats were still in use) but getting further north to see the older strata was even more of a challenge.

This is where I come into the story. As a student in 1967 I was fortunate enough to be part of an expedition that discovered very fossiliferous Lower to Middle Ordovician strata on the Arctic island of Spitsbergen, part of the Svalbard archipelago. These trilobites became my PhD thesis and subsquently my own entry into the world of monographs – I was very much aware of Whittington's impeccable model. I told the story of these discoveries in the first chapter of my 1997 book 'Life: an unauthorised biography'. The similarities to Newfoundland did not take long to recognise, especially in the upper Formation (the Valhallfonna Formation), and writing two large papers on these trilobites published in 1974 and 1975 fully occupied my time when I got a job at the Natural History Museum in London (a third part followed in 1980). However, there was another trilobite fauna (actually, several) beneath those of the Valhallfonna Formation. It did not take me long to recognise that these fossil faunas from the Kirtonryggen Formation were similar to those from the strata underlying Harry Whittington's in western Newfoundland – with original descriptions by Elkanah Billings.

I could scarcely start naming new species from Spitsbergen if Billings had already described them from Newfoundland. I would have to put my trilobites to one side until some revision of the old Billings' species had happened – furthermore, they included the type species of genera like *Bathyurellus* and *Petigurus* that had been widely recorded. The exacting Whittington example demanded that these should have properly assigned sclerites before proceeding further! I needed to get to the limestone bluffs of the St George Group north of Cow Head to make new collections and begin the long process of preparation of specimens.

A twist of fate helped me. Memorial University is in St John's on the eastern side of "the Rock". In 1977 it was a vigorous centre for research as the island's geology proved important in deciphering the history of the ancient Iapetus Ocean. A conodont worker – Lars Fahraeus – was due sabbatical leave, and the then head of department, David Skevington, asked me if I would be interested in filling in as a visiting professor for a year. So I became the Howley Visiting Professor just after my 30 th birthday. I had recently got married, so my wife Jackie and I embarked on the adventure with a mixture of trepidation and relish. Within a few days we had arrived at the foot of the Great Northern Peninsula, and sought out Billings's trilobites. This did indeed prove an adventure, as they were just putting in a new and modern road due to go all the way north to St Anthony, but at this stage it was rather like negotiating a First World War battlefield. Somehow, we made it through. We were able to admire the splendid scenery along the Peninsula, and I was later to discover that we were blessed with extraordinarily good weather (in subsequent years I was repeatedly soaked). The Ordovician rocks cropped out alongside the sea: inland outcrops were scattered, emerging from a tundra-like sphagnum bog. It was pretty clear where Richardson would have collected his specimens. We put up in Mrs Billard's Guest House at Port au Choix. Our hostess was a charming, old fashioned, motherly type, and fed us well – particularly in the cake department. We learned that the celebrated and eccentric nautiloid specialist Rousseau H. Flower had been a previous guest: we were evidently not the first to make our way here.

The geology was pretty simple, basically a shallow dipping, well-bedded limestone succession. The St George Group had been subdivided by now into several formations, and the one that concerned me was called the Catoche Formation. Having honed my 'eye' in Svalbard I was soon able to work out that the productive trilobite layers were scattered shelly lags though the succession, and realised the wisdom of not trying to secure good crack-out in the field, but to collect samples for later breaking up and preparation. Packed in order, these collections

were to occupy much of my non-teaching time back in St John's. However, it was pretty obvious that we had collected all the sclerites of *Petigurus* - the largest, and most coarsely tuberculate bathyurid trilobite. The type species of *Bathyurellus* was there, too, and it did not take long to recognise the appropriate 'heads" to go along with the "tails". Even more exciting was the recovery of a pelagic trilobite *Carolinites*, which had been the subject of a detailed study in my Spitsbergen monographs and seemed useful for long distance correlation. I probably drove my colleagues in St John's mad with the incessant buzzing of my vibrotool. Most of the trilobites separated from the matrix without too much trouble and were well preserved in full relief carrying details of surface sculpture. There was, however, not a single articulated specimen among them.

The fauna was not particularly diverse (20 taxa) but was the typical bathyurid biofacies dominated by the eponymous family. Harry Whittington dubbed the platform North American faunas of this kind the "bathyurid province." I was right to study Billings' species before embarking on the Kirtonryggen Formation in Svalbard because some of the species were surely identical. Over the ensuing years I picked up similar faunas elsewhere, in Greenland and NW Scotland, so these trilobites were biostratigraphically useful. I described the Catoche faunas in a GSC paper published in 1979. Meanwhile, a young Doug Boyce was taking up a job with the Newfoundland Department of Mines, and extended the range of the faunas to other sites and earlier stratigraphic levels.

I wish I could report that I immediately got down to those Svalbard faunas, but by then I wanted a change of topic, and the trilobites got 'put in a drawer' for many years. But all was not lost. After I 'retired' I was determined to finish of the account of the Svalbard Ordovician trilobites, and the collections were taken out (with additonal material stored in Oslo) and preparation began again. The monograph of the trilobites of the Kirtonryggen formation by myself and David Bruton finally appeared in *Fossils and Strata* in 2013, more than forty years after their initial discovery. One of the other lessons I learned from Harry Whittington was to finish what you had started – even if it takes nearly a lifetime to do so.

EL TRILOBITE y LA MEDUSA – UN AMOR PLANCTÓNICO

En los suburbios del arrecife de coral
Vivía un trilobite endémico y marginal
De amplias librígenas y espina genal
Con pronunciado lóbulo palpebral

De condición humilde y familia proletaria
De corto biocrón y sutura proparia
Sin tener un rol protagónico
Era sólo un carroñero y bentónico

Todos los días al atardecer y después de la marea
Salía con la manada en su rutinaria tarea
Removiendo el bentos en busca de algún bocado
Entre lirios y anémonas vivía despreocupado

Pero aquella tarde y al momento de la oración
Entre luces y reflejos tuvo una gran visión
De aparición espontánea y casi mágica
Percibió la silueta de una criatura pelágica

Una medusa gelatinosa, grácil y danzante
Vestida con velos y tentáculos ondulantes
Con espasmódicos movimientos delicados
Enigmática y cautivante ante sus ojos extasiados

El hipostoma le temblaba y le alteraba el cranidio
Le vibraban los somitos y le exaltaba el pigidio
Y sin poder controlar su cuerpo celomado
De aquella figura angelical se había enamorado

Todos los días al finalizar la faena
Se ocultaba rápido entre el limo y la arena
Sólo para verla pasar y suspirar de pena
Soportando tanto amor como una condena

Pero un día tempestuoso y casual
Se desató una tormenta tropical
Y en su furia turbulenta accidental
Impactó a la colonia arrecifal

Ante aquel dantesco escenario
El trilobite se refugió entre los cnidarios
Pero tanto detrito en suspensión
Arrastró a la medusa hasta el fondo de un cañón

Al ver a su amada ilusión sepultada en un abismo
Acudió en su ayuda con gran heroísmo
Y en un desesperado intento de salvación
Al tocar sus tentáculos recibió una mortal poción

El veneno lo invadió en un momento
Un insoportable ardor recorrió su tegumento

Paralizando en un instante su sistema sensorial
Inmovilizando sus apéndices y su visión holocroidal

Y así, pensando que tanto dolor agónico
Lo causaba su amor planctónico
Mirando a su amada feliz le sonreía
Convencido que de amor se moría

Osvaldo Bordonaro

Namuropyge, the optically most spectacular trilobite in the late Paleozoic (Mississippian, Carboniferous) of the Rhenish Massif, Germany

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The genus *Namuropyge* stands out from the German late Paleozoic trilobites due to the spines on its carapace compared to the morphologically rather undifferentiated other proetid trilobites. In Germany, *Namuropyge* is only known with four species in the Rhenish Massif east of the Rhine, which are herein briefly presented.

In recent faunas common forms dominating in the composition of a biocoenosis are accompanied by rare species, which, even under favorable conditions, are only found after a long search and then often only in single specimens. This also applies to the trilobites of the Erdbachian and Aprathian (Mississippian, formerly Lower Carboniferous) in the Kulm facies in the Rhenish Massif east of the Rhine. Archegoninae (Order Proetida, Family Phillipsiidae) dominate in these faunas, which are often rich in individuals in the Bergisches Land, Sauerland and Lahn-Dill area. Rare elements include *Namuropyge* Richter and Richter, 1939 (Proetida, Brachymetopidae). Historically, this can be seen from the fact that the genus was initially only based on a single pygidium of its type species, *N. demaneti* Richter and Richter from Belgium. For Germany, it then took another 41 years until the first evidence could be provided with *N. nemetona*, again a single find. Eight years later, a (disarticulated) dorsal carapace was found here – the only one to date (Fig. 1).

The systematics of *Namuropyge* conveyed by Hahn and Hahn (1996) was partly rather insufficient due to the material. Hitherto only Müller *et al*. (2021) were able to differentiate more clearly with new finds from the Rhenish Massif, which were relatively rich for the first time. Originally there were two subgenera, *N.* (*Namuropyge*) and *N.* (*Tilsleya*) Hahn and Hahn, and several "evolutionary branches". The latter have been converted into subgenera, *N.* (*Cuyapyge*) Müller *et al*. and *N.* (*Engelimorrisia*) Müller *et al*. And *Coignouina* Reed as a subgenus of *Namuropyge* has been virtually revived.

The species lists provided for these subgenera by Müller *et al*. are supplemented as follows:

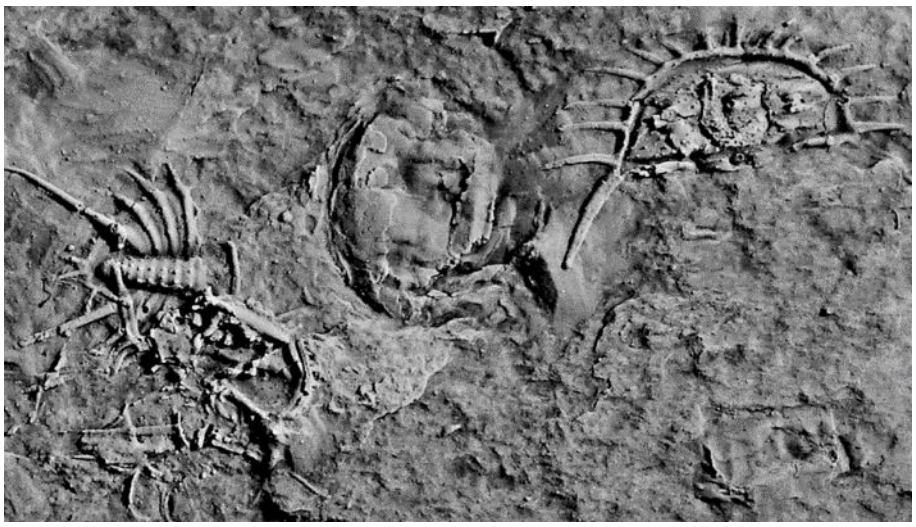

Fig. 1. *Namuropyge* (*Namuropyge*) *muelleri*, holotype (cephalon top right) and disarticulated carapace (bottom left), silicone mold from sediment cast mainly of the dorsal sides. Whether parts of this assemblage originally belonged to this cephalon cannot be clarified. Length of cephalon without spines: 2,5 mm.

Weiner *et al*. (2021: Fig. 5) reported an isolated "librigene" from the Visean of Moravia (Czechia), which they tentatively assigned to *Namuropyge*. This would be their first photographically documented evidence for Czechia. If it is indeed this genus, the subgenus would not be determinable, since important characteristics for the classification are missing. Alternatively, however, an assignment to *Spinimetopus* Hahn and Hahn (Brachymetopidae) would be possible. So what remains for the time being is the first reliable record of Brachymetopidae in Czechia.

Only one of these subgenera is known in Germany, namely with the following species, the updated and commented profiles of which we reproduce herein.

The four German namuropygines

Namuropyge (*Namuropyge*) *nemetona* Hahn *et al*., 1980: Holotype: Cephalon, sediment casts, T.K. 1a–b (Ruhr Museum, Essen; artificial casts: SMF 36211a–b, Senckenberg Research Institute and Natural History Museum, Frankfurt am Main), Hahn *et al*. (1980: Pl. 1, fig. 4a–b); Müller *et al*. (2021: Pl. 1, fig. 2); herein: Fig. 3.7. – Type locality (no longer accessible): Construction site on Steinberger Weg, Düsselerhöhe south of Aprath, TK 25 sheet 4708 Wuppertal-Elberfeld, Herzkamp Syncline, Bergisches Land, North Rhine-Westphalia. – Type horizon: *Geigibole thomasi* bed of an informal trilobite biochronology directly overlaying the *grimmeri* Bed (cf. Thomas and Zimmerle 1992: Around bed 4; Rathmann and Amler 1992: Fig. 2), Bromberg Formation, Medebach Group. – Current finds (originally hypotypes, all from excavations in the Aprath and Velbert areas that are no longer accessible): Figs 3.3–6, 8, fig. 5.3 herein. – In addition to Müller *et al*. (2021) the formation affiliation of the type horizon is offered herein.

Namuropyge (*Namuropyge*) *muelleri* Hahn and Hahn, 1988: Holotype: Cephalon, sediment casts, SMF 42512a–b (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main; artificial casts SMF 42512a.1–b.1), Hahn and Hahn (1988: Pl. 1, fig. 1.1, Pl. 2, fig. 4–5); Müller (1997: 23, figure above); Müller *et al*. (2021: Pl. 1, fig. 2); herein: Fig. 1, Fig. 2.1–2. – Type locality: Old quarry at Homberg hill immediately southwest of Erdbach, TK 25 sheet 5315 Herborn, Bicken-Ense Nappe, Dill area, Hesse. – Type horizon: Siliceous transition layers between the *Entogonites grimmeri* and *Goniatites crenistria* Zones of the ammonoid biochronology (Korn 2003, 2006; Korn and Kaufmann 2009), Bromberg Formation, Medebach Group. – Paratype: Fig. 5.1 herein. – New finds: None. – In addition to Müller *et al*. (2021) the formation affiliation of the type horizon is offered herein.

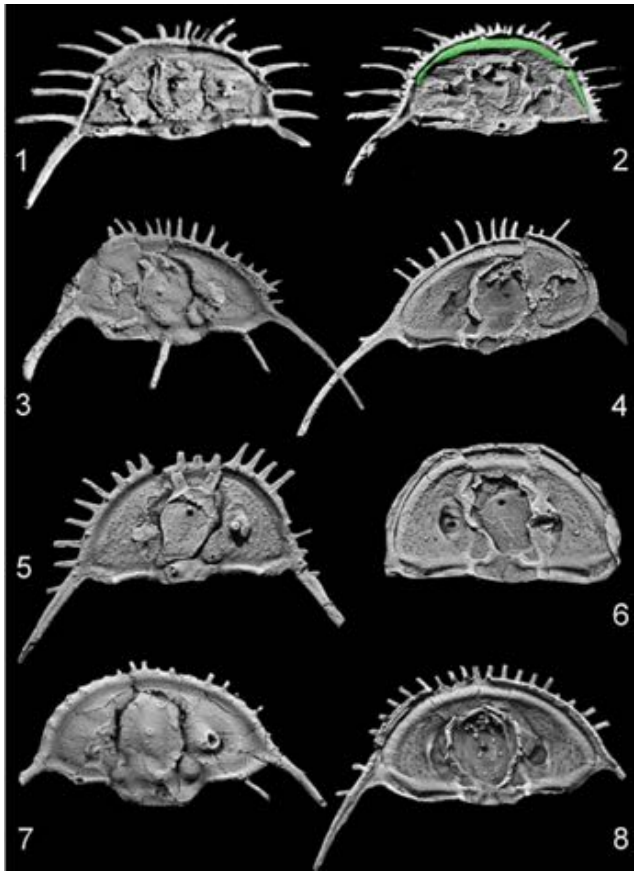

Fig. 2. Cephala. **1–2. *N.* (*N.*) *muelleri***, holotype, green: rostral plate, length without spines: 2,5 mm. **3–8. *N.* (*N.*) *nemetona***, 3–4: Each 3.8 mm, Aprath; 5–6 (strongly flattened): Each 4,5 mm, Velbert; 7. Holotype, 4,4 mm. 8. The bulge parallel to and slightly posterior to the anterior border of the cephalon is not the rostral plate but the "inverted" anterior border furrow, 3,2 mm, Velbert. All silicone molds from sediment casts of the dorsal and/or ventral sides.

Notes: In previous drawings of the dorsal view of the cephalon, some aspects have been intentionally suppressed. Above all, it is the coarser elements of the sculpture that seem to be missing. In fact, they are present on the anterior border as sharp knots where the long marginal

Fig. 3. Gypsum model (top left, bottom, 105 mm long) designed by Werner Mathesius and plastic model (60 mm) by Tomáš Viktorýn as attempts to reconstruct *Namuropyge* (*Namuropyge*) *muelleri*. Although the antennae and walking legs are derived from other trilobite finds, their depiction here should only be interpreted as artistic license.

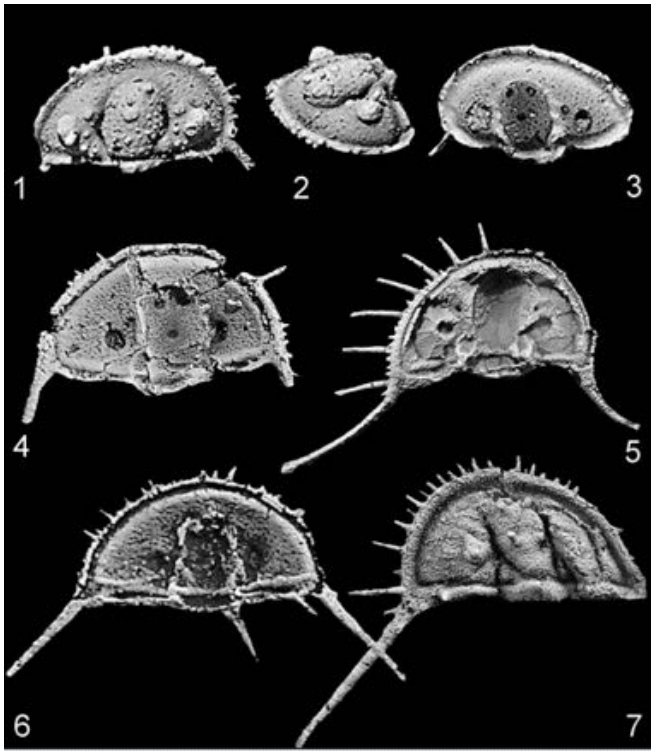

Fig. 4. Cephala. **1-5. *N.* (*N.*) *ulrichi***, 1–3. holotype, length without spines: 1,9 mm; 4. 2,8 mm; 5. 5,5 mm, all from Aprath. **6–7. *N.* (*N.*) *alfredi***, 6. 1,4 mm; 7. Holotype, 3,3 mm, Velbert. All silicone molds from sediment casts of the dorsal and/or ventral sides.

spines merge with the anterior border, and finer sculpture is present on inner parts of the cephalon (Fig. 6). A very similar sculpture is found in *N.* (*N.*) *nemetona*. Although the two species agree well in other respects, the absence of short "secondary" spines along the anterior margin of the cephalon in the latter clearly distinguishes them. The rostral plate of the subgenus is only known from *N.* (*N.*) *muelleri*. Although it was recorded as such in the first description of the species, it was not so clearly recognizable. This is improved with our Fig. 3.2. The shape of this rostral plate is the main reason why *Namuropyge* is not to be equated with the often very similar Siluro-Devonian genus *Cyphaspis* Burmeister and why it has mostly been assigned to the Brachymetopidae since Hahn and Hahn (1996).

The unusual morphology of *N.* (*N.*) *muelleri* inspired two attempts at reconstruction, reproduced here in Fig. 2.

Namuropyge (*Namuropyge*) *ulrichi* Müller *et al.*, 2021: Holotype: Cephalon, sediment casts, SMF 97193a–b (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main), Müller *et al.* (2021: Pl. 3, fig. 4a–c); herein: Fig. 4.1–3. – Type locality (no longer accessible): Kohleiche site northeast of Aprath, TK 25 sheet 4708 Wuppertal-Elberfeld, Herzkamp Syncline, Bergisches Land, North Rhine-Westphalia (Thomas and Zimmerle 1992). – Type horizon: Leached siliceous limestone maximum 5 m below the *Entogonites grimmeri* Bed (bed 2 of Thomas and Zimmerle 1992), upper Hillershausen Formation, Drewer Group. – Paratypes: Fig. 4.4–5 herein. – The pygidium of this species is unknown. In addition to Müller *et al.* (2021) the formation affiliation of the type horizon layer is offered herein.

Namuropyge (*Namuropyge*) *alfredi* Müller *et al.*, 2021: Holotype: Cephalon, sediment casts, SMF 97186a–b (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main), Müller *et al.* (2021: Pl. 4, fig. 1a–b);

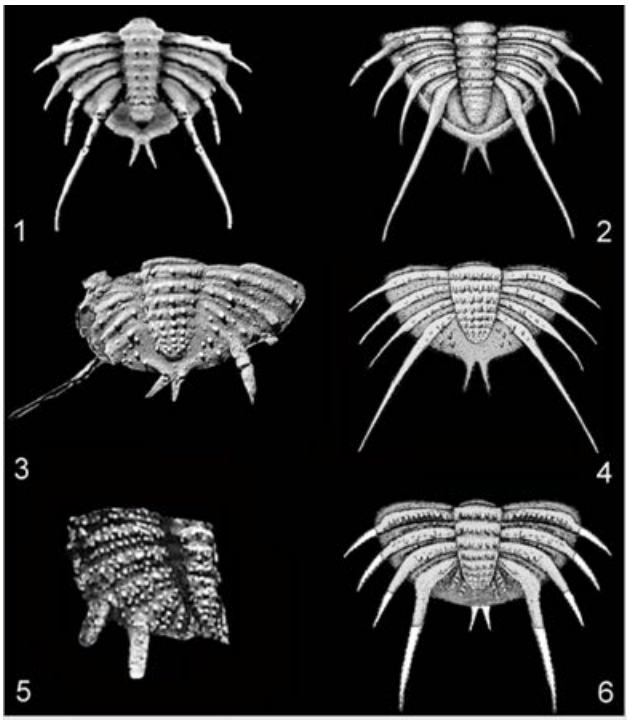

Fig. 5. Pygidia. **1–2. *N.* (*N.*) *muelleri***, right half supplemented by mirroring the left, length without marginal appendages: 2,1 mm. **3–4. *N.* (*N.*) *nemetona***, 3. Sediment cast of the ventral side, 1,9 mm, construction site near Röttgen near Velbert. **5–6. *N.* (*N.*) *alfredi***, 1,4 mm, Velbert. 6. Completed by mirroring, dashed lines: Morphology suspected. #1 and #5 are silicone molds from sediment casts of the dorsal sides. Drawings: #2 updated after Hahn and Hahn (1988); #4 and #6: P. Müller.

herein: Fig. 4.7. – Type locality (no longer accessible): Construction site on Von-Behring Street, Velbert, TK 25 sheet 4608 Velbert, Velbert Anticline, Bergisches Land, North Rhine-Westphalia. – Type horizon: Brownish slates, Bromberg Formation(?), Medebach Group. – Paratype: Fig. 5.5 herein. – In addition to Müller *et al*. (2021) the possible formation affiliation of the type horizon is offered herein.

Stratigraphic aspects

In addition to the above, Fig. 6 shows the occurrences in a larger stratigraphic context. The abbreviations cu I–III used here are no longer up-to-date, but facilitate comparisons with the older literature. In contrast, the modern ammonoid biochronology (Korn 2003, 2006; Korn and Kaufmann 2009) cannot be transferred with certainty to most occurrences. Likewise, this chronology of the Kulm facies (open marine) is not directly applicable to the international conodont zonation (Kohlenkalk facies, shallow marine).

Apparently all species of the subgenus occur in a geologically very small time interval. According to the ammonoid biochronology, this stretches from the *Entogonites nasutus*/*Entogonites grimmeri* boundary to the *Goniatites crenistria* Zone, i.e. from the late Erdbachian (cu IIδ) to the late Aprathian (cu IIIα_{2-3}) or from the upper Hillershausen Formation far into the Bromberg Formation (around the Lower/Upper Visean boundary). Thus finds of *Namuropyge* (*Namuropyge*) from new outcrops in this geographical area can definitely be evaluated as stratigraphic clues.

Paleobiogeographic aspects

Nothing is known about the origin of the German namuropygines, which seem to appear suddenly. Considering Paleo-Belgium and Paleo-Spain as possible resources (see Fig. 6) would be pure speculation given the still very poor material situation. Worth mentioning in this context is a massing of transgression events occurring in quick succession towards the end of the Visean, such as the so-called "late Asbian transgression" in cu IIIα_{1-2}, which reached its maximum at the cu III$\alpha_{2/3}$ boundary (Herbig 1998). Such sea level rises have often resulted in an increased geographical distribution of marine organisms. In this case, there could well be a connection with the occurrence of *N*. (*N*.) *muelleri* and *N*. (*N*.) *nemetona*, which occur around this maximum.

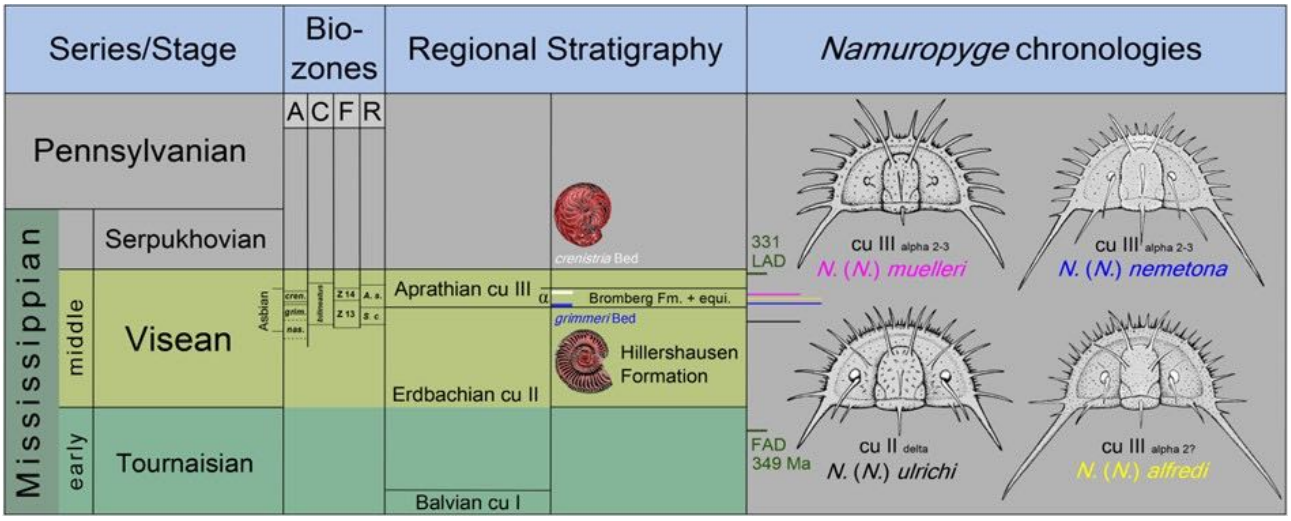

Fig. 6. Regional chronologies of the German *Namuropyge* within the European Carboniferous chronology of the nominate subgenus. FAD (first appearance date of the subgenus, either by *N*. (*N*.) *brevicauda* Gandl in Spain or by *N*. (*N*.) *bricta* Hahn *et al*. in Belgium in late Tournaisian respectively), LAD (last appearance date, by *N*. (*N*.) *demaneti* in the latest Aprathian of Belgium). Whether *N*. (*N*.) *muelleri* is actually somewhat geologically younger than *N*. (*N*.) *nemetona* remains uncertain. Columns one to three based on Korn (2003, 2006), Korn and Kaufmann (2009), Won and Zeo (2010), Herbig (2016), Aretz *et al*. (2020). A (ammonoids: *nasutus*, *grimmeri*, *crenistria*), C (conodonts), F (foraminifera: Zones 13 and 14), R (radiolarians: *Scharfenbergia concentrica*, *Albaillella spinosa*). These as well as the two absolute times cannot be shown directly for any species. Therefore, they are only to be taken as a suggestion, including the resulting lifetime of the subgenus of 18 million years. Drawings: P. Müller.

However, the corresponding lithological investigations are complex and can no longer be carried out on most of the German deposits because they are no longer accessible.

Acknowledgements

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Observations on the Silurian trilobite *Spathacalymene nasuta*

by Don Bissett, Dry Dredgers, Norton Shores, Michigan

Forty-plus years of collecting the Silurian Massie Shale in southeast Indiana has taught me, repeatedly, that complete articulated exoskeletons of *Spathacalymene nasuta* (Tillman, 1960) are indeed rare. Yet the many hours in the field by me and other collectors have yielded enough information and samples to draw some tentative conclusions.

The locality is a commercial rock and lime quarry in Ripley County. The ~3-foot thick Massie Shale (which includes a limestone cap rock) is sandwiched between the thick overlying Laurel Limestone and the underlying Osgood, Lewisburg, and Brassfield Limestones. The Massie is scrap to the quarry, and is dumped in jumbled heaps on spoil piles. Those piles are where most of the productive trilobite collecting occurs.

While some *S. nasuta* can be found in the shale itself and in the limestone cap rock, the majority of the trilobites reside in hard reef-like bryozoan bioherms that occur sporadically in the Massie.

In particular, they occur in hard shale seams in the bioherms.

The trilobites are most often found prone and ventrally exposed (Figure 1). For this one, the underside of the cephalon was apparent on the surface, and cross sections of the thorax were exposed in the matrix cracks. On the opposite side of the matrix, no trace of the trilobite was evident. After prep, though, it is clear that the entire exoskeleton is present and articulated (Figure 2).

The trilobites range in length from ~¼ inch to slightly over 4 inches. Usually they occur as single isolated specimens, though a few are multiples. As for enrolled specimens, they account for less than 10% of the collected trilobites. The high ratio of prone to enrolled suggests rapid burial, such that the trilobites did not have time to enroll before being smothered.

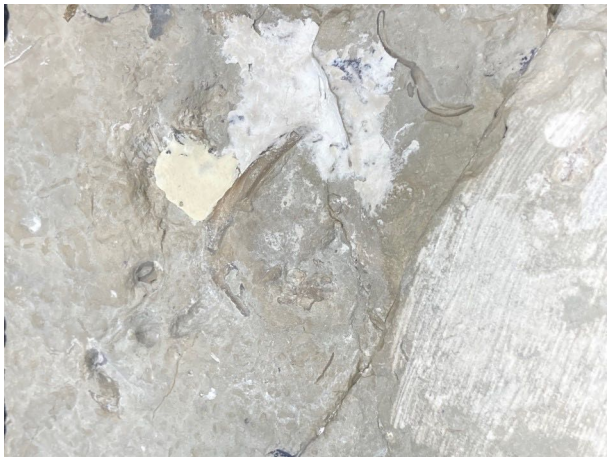

Figure 1. Underside of articulated trilobite "cheeks." Note that the rock was glued and patched to stabilize the cracks.

There have been occasions in the quarry when the Massie Shale is exposed for a brief period before being excavated, hauled away, and dumped. And on rare occasions, digging the exposed formation has produced trilobites. This *in situ* collecting revealed that the trilobites are usually buried dorsal side up. So the ventral posture of the trilobites on the spoil piles appears to be simply how the rock fractured (beneath the trilobites), not how they were buried and died.

A prominent feature of *S. nasuta*, of course, is the "snout," as it's commonly called. What was its function? I am not aware of any definitive answer. But a lot of energy was expended in producing the snout, and in reproducing it with each molting of the exoskeleton as the trilobite grew. So the function must have been important, such as in mating encounters or for stirring up seafloor sediment for feeding.

Figure 2. *Spathacalymene nasuta* from Figure 1 after prep by Ben Cooper. Trilobite is 2 1/8 inches long.

As rare as *S. nasuta* is in the Massie Shale, it is far more common than the other genera. Among those are *Calymene*, *Bumastus*, *Dalmanites*, a lichid, and the extremely elusive *Staurocephalus*. The *Calymene* occur with the *Spathacalymene*, though very few of the former have been found. As for the remainder, too few of them have been found to draw any conclusions, except that complete articulated exoskeletons are very rare. And since none have been studied from the Massie, no species names have been officially applied.

Acknowledgement: Thank you to the Wanstrath family for permitting collecting in their quarry.

UPPER CAMBRIAN TRILOBITES FROM MEXICO

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Knowledge of upper Cambrian trilobites in Mexico is limited. They are restricted to the states of Oaxaca (southern Mexico) and Sonora (northwestern Mexico) and have been the subject of few systematic and taxonomic studies. In the state of Oaxaca, the upper Cambrian trilobites come from the Yudachica Member of the Tiñú Formation (Furongian, Stage 10), and were described by Robison and Pantoja-Alor (1968). In Sonora, there are only four localities that contain upper Cambrian trilobites: El Tule, Arivechi, Mesteñas and Los Ajos (the latter is the subject of this note).

El Tule was studied by González-León (1986), where the Bolsa and Abrigo formations are documented, the latter containing trilobites from the *Crepicephalus* Zone. Subsequently, Sundberg and Cuen-Romero (2021), studied the upper Cambrian trilobites of the Tule and Mesteñas, where they documented the trilobites *Crepicephalus* sp., *Tricrepicephalus texanus*, *Llanoaspis modesta*? *Coosella perplexa*, *Coosia ariston* and *Coosia* sp., confirming the presence of *Crepicephalus* Zone at both localities, and also correlating the faunas with those of the Texas Riley Formation described by Palmer (1954).

The Cambrian of the Arivechi area was studied by Almazán-Vázquez (1989), and subsequently by Cuen-Romero et al. (2019). At this locality the upper Cambrian Milpillas Formation is exposed, containing trilobites such as *Aphelotoxon* sp., *Elvinia* sp., *Homagnostus* sp., *Pseudoagnostus* sp., and *Pterocephalia* sp., therefore, being assigned to the *Elvinia* Zone (Almazán-Vázquez, 1989; Cuen-Romero et al., 2018).

Sierra Los Ajos is located approximately 30 km east of the city of Cananea, northern Sonora. The area was studied by Page et al. (2010), who document the Bolsa and Abrigo formations. For the Abrigo Formation they mention the presence of the trilobites *Cheilocaphalus* sp., *Coosina* sp., *Crepicephalus* sp. and *Tricrepicephalus* sp.

In the present investigation carried out in the Sierra de los Ajos, the presence of *Cedaria eurycheilos*?, representative of the *Cedaria* Zone, was documented. In addition to *Tricrepicephalus coria*, *Coosia ariston*, *Crepicephalus* sp.,

Figure 1. Poorly preserved cranidium of *Tricrepicephalus coria* and a trilobite pigidium from the Sierra Los Ajos, Sonora.

Llanoaspis modesta, *Llanoaspis* sp., among others, representative of the *Crepicephalus* Zone.

This research is important because it represents the fourth known locality with upper Cambrian trilobites for Sonora, with faunas representative of an inner marine shelf. This also allows for intra- and interspecific correlations and affinities with North American craton faunas from Texas and New Mexico.

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TRILOBITE ACROSTIC POEM #3

Tremadoc, nestled amid
Rugged Welsh crags, home to
Itinerant T.E.
Lawrence, of Arabia ... and
Ordovician time – captured in
Black rock, avec fossils
Isn't what it appears
To be; a village emergent from
Exoskeleton moulting.

Christopher Collom
January, 2023

THE GIFT
by John Laurie

A couple of days ago, someone asked me what was the best Christmas present I ever received. It got me thinking about all the stuff I had been given over the years: diecast Matchbox and Dinky cars, plastic kits of aircraft and ships, a Hornby Dublo train set and envelopes of money, and the occasional book. Nothing in that list really stood out until I thought of the one book that may have changed my life.

Like most inquisitive kids, I read a fair bit, and like many kids under the age of ten, I was fascinated with dinosaurs and knew the names of lots of them. I still occasionally see kids as young as 5, who can tell their parents the names of dozens of dinosaurs. From the age of about 6 onwards, I had a series of large format, thin (each had 48 pages) paperbacks of the How and Why Wonder Books which were an American series produced from 1960 onwards. These were turned out in large numbers on many topics and were designed to teach children about science and history. I can remember the few volumes I had; they were: Dinosaurs; Rocks and Minerals; and Primitive Man.

Some time later, I also obtained a little pocket book entitled 'Fossils: a guide to prehistoric life' which I read and reread so much that it had to be repaired with much sticky tape. It was published in 1962, the year I turned 8. In addition to dinosaurs, it listed and illustrated all sorts of invertebrate fossils such as trilobites, brachiopods, gastropods, ammonites, corals and sundry others. It was written by Frank Rhodes, a famous American palaeontologist, and illustrated with coloured drawings by Raymond Perlman. Rhodes only died a couple of years ago and was a former president of Cornell University in the United States.

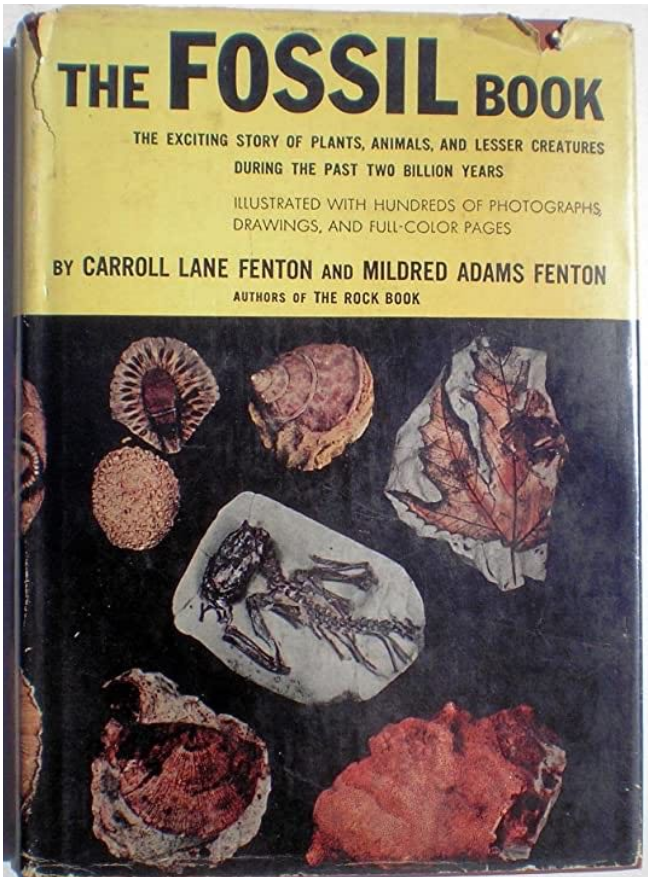
Despite all the groundwork being laid by the books listed above, the book that changed my life and set me on the road to becoming a professional palaeontologist was another American book. My parents owned a small 'ladies' wear' shop which they operated from the late 1950s until they retired in 1989, and every season they would travel to Sydney and go around the cloth-

John Laurie (1964—about the time he received The Fossil Book) in a school uniform and a school rosette ready to travel to the Snowy Mountains with his primary school. It was the first time he had ever seen snow.

ing manufacturers buying clothing to sell in their shop. I would accompany them as I was too young to be left on my own. While we were in Sydney we'd do a bit of other shopping as well. On one of these trips we went to a bookshop and I wandered around until I saw a massive tome entitled 'The Fossil Book: a record of prehistoric life' by Carrol Lane Fenton and Mildred Adams Fenton. I grabbed it and opened it up and was amazed at the huge number of illustrations, and the amount of detail explaining each group of fossils. It made such an impact on me that I can still remember this event as if it was only a few weeks ago, when it was in fact well over 50 years ago. The book was expensive and I had to put it back on the shelf as we left the bookshop to go back home. The Fentons were a husband and wife team who, although they both had degrees in geology, seemed to make most of their living from publishing popular science books, mostly on geology and palaeontology.

Some weeks later, my parents asked me what I wanted for Christmas and I told them. Christmas day arrived and there it was. Of course, I was overjoyed, and spent much of the next year poring over the book. This book still sits on a bookshelf in what passes for my professional library, still with its dustcover, and enveloped in a repurposed ladies' wear plastic bag with which my mother covered all my school text-books.

One of the other books that set me off was entitled 'The Geology of the Hunter Valley' by Beryl Nashar. At the time this book was bought for me (1964-1965) when I was about 10 or 11, I had no idea that Beryl Nashar would turn out to be the head of the geology department at the university where I did my undergraduate degree in geology. This book was pivotal for me because, although it was about general geology of the region in which I lived, there was a short section listing some fossil localities, many of which were Carboniferous in age, and which were replete with brachiopods, a few bivalves and corals and occasional trilobites. I used to coerce my parents into going for picnics, of which they were very fond, at or near some of these localities. Have you ever been for a picnic



in a disused quarry? It is not quite the site one chooses for a picnic except to placate an enthusiastic fossil-hunting child.

While I will never know what my life would have been like if I had never seen this book by the Fentons, I suspect it would have been much the same, as I was a driven person. Despite that, it was still the best Christmas gift I ever received, and the only one from my childhood I still have. The fact that I did obtain a copy is, of course, solely down to my parents who enthusiastically supported my desire to be a palaeontologist. Considering that my father left school at 14 to start work in a hardware store and my mother at 15 to work in a drapers, it seems odd that I became a professional scientist. It may have been the fact that they both were denied education by attitudes and circumstances that they realised its value. Whatever it was, I am eternally grateful.

A personal note, I too was strongly influenced by ***The Fossil Book*** as a teenager. My dad and mom had taken my two brothers and I on several trips to look fossils, mining, minerals, archaeological sites, etc. This picture is of my brother Tom (standing) and myself (in blue) looking for Cambrian trilobites in the Marble Mountains, California, on one such trip in 1969 (age 15 years).—Fred Sundberg

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