THE TRILOBITE PAPERS 25

An international newsletter for and by trilobite paleontologists
February, 2022

Dedicated to Rolf Ludvigsen

The Trilobite Papers Twenty-Five
February 2022

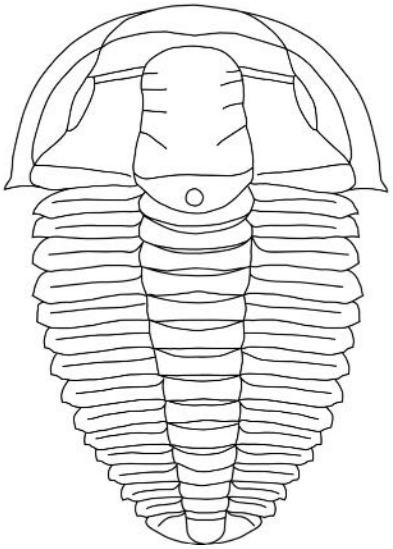
Editorial:

SHIFT IN PARADIGM

History has a strong role in paleontology—and not just in the geologic sense. We are commonly bound to previous works in both nomenclature and models and some of these can be incredibly frustrating to deal with. I have in the past discuss the frustration of dealing with poorly described taxa or taxa described on poorly preserved specimens especially, but not limited to, Charles Elmer Resser (e.g., Sundberg, 2007). Christina Lochman-Balk, Franco Rasetti, Allison (Pete) Palmer, Richard (Dick) Robison, and many others have tried to make sense of this taxonomic mess.

It is time to try something different. In a recent paper, Mark Webster and I (Sundberg and Webster, in press) have proposed to just drop the old taxonomic names that are based on poorly described/illustrated/preserved specimens (e.g., *Eoptychoparia*) and define new genera/species based on several specimens that represent different parts of the exoskeleton (not just the cranidium) and preferably articulated specimens at different growth stages. Oh yes, this definitely runs the risk of having our new genera/species synonymized with older named taxa; but these historically older taxa cannot be fully characterized at present and until someone goes out and collect topotype specimens, it is unlikely that they will be characterized soon.

It is just names, why should we care? These older names carry a lot of baggage making it difficult to determine the phylogeny of these (mainly early to middle Cambrian) trilobites. One study (Sundberg, 2004) illustrates that species defined on cranidia of these poorly defined taxa (*Onchocephalus*) are unstable in their position in a cladogram where as taxa known from more complete specimens or have unique cranidial morphology are much more stable within the cladogram.



Reconstruction of the type species of a new genus and species of "ptychoparioid" trilobites from the Harkless Formation, Nevada (mid Dyeran).

Sundberg, F.A., 2004, Cladistic analysis of the Early–Middle Cambrian kochaspid trilobites (Ptychopariida): Journal of Paleontology, v. 78, p. 920–940.

Sundberg, F.A., 2007, Nightmare on Resser Street, *in* Landing, E., Milukic, D.G., and Kluessendorf, J., eds., Fabulous Fossils—300 Years of Worldwide Research on Trilobites: New York State Museum Bulletin 507, p. 213–224.

Sundberg, F.A., and Webster, M., in press, "Ptychoparioid" trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada: Journal of Paleontology.

Fred Sundberg
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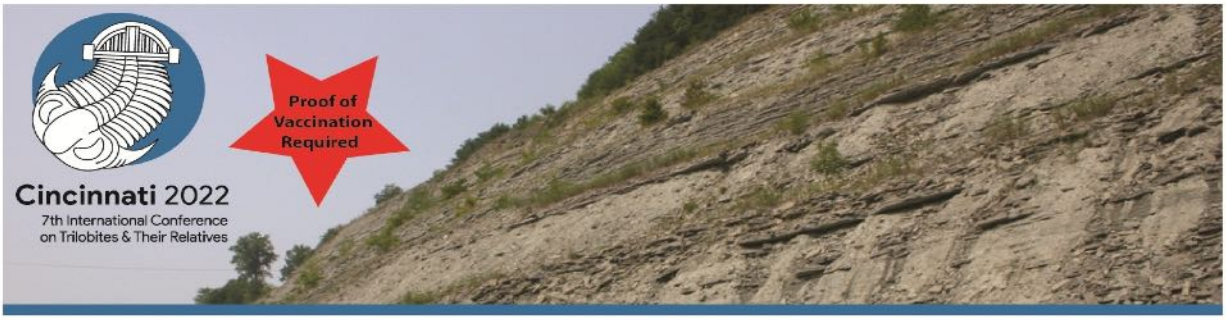
Cover photo: *Flexicalymene meeki* (Foerste, 1910), Ordovician, Corryville Member, Richwood, Kentucky. 2.5 inches (61mm) long. Photo by Don Bissett.

7TH INTERNATIONAL CONFERENCE ON TRILOBITES & THEIR RELATIVES

JULY 14TH—JULY 19TH, 2022
CINCINNATI, OHIO, USA



July 14th - July 18th, 2022

The Organizing Committee is pleased to announce that the 7th International Conference on Trilobites & Their Relatives will be held next year in Cincinnati, Ohio, U.S.A.

The goals of the conference are to present and discuss recent progress in studies on all aspects of trilobites and their relatives (e.g., morphology, evolution, phylogeny, ecology, development, and geography).

Schedule of Events:

Pre-conference Field Trip: July 10th - July 14th
Trilobite paleobiology in its stratigraphic context: the late Cambrian of the Upper Mississippi Valley

Meeting July 14-18th
Sunday July 17th – intra-conference field trip to the Cincinnatian Series

Post-conference Field Trip: Tuesday July 19th - Friday July 22nd
Ordovician - Devonian Trilobites of the Niagara Region

Session Topics:

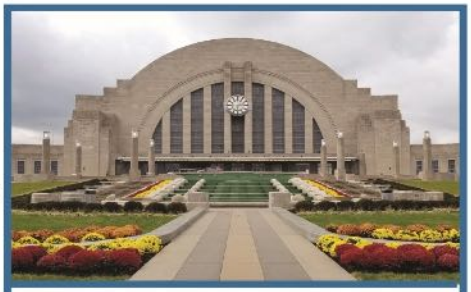
Phylogeny and Macroevolution
Paleo-Evo-Devo and Functional Morphology
Exceptional Preservation
Trilobites and Environments: synecology to paleogeography
Systematics and Biostratigraphy

Please check out the website for additional details on registration fees and deadlines!

https://www.cincymuseum.org/7th-international-conference-on-trilobites-and-their-relatives/

Organizing Committee:
Brenda Hunda, Cincinnati Museum Center **bhunda@cincymuseum.org**
Nigel Hughes, University of California, Riverside **nigel.hughes@ucr.edu**
Mark Webster, University of Chicago, **mwebster@geosci.uchicago.edu**

WE HOPE TO SEE YOU IN CINCINNATI!



The meeting will be held at Cincinnati Union Terminal. One of the last great American train stations, built between 1929-1933, Union Terminal is a Cincinnati icon. The building is one of the most widely regarded examples of the art deco style and has the largest half-dome in the western hemisphere.It is currently home to three museums, an OMNIMAX® Theater and the Cincinnati History Library and Archives.

Conference Highlights:

- Joint session with IGCP668-735.
- Special Issue publication in the *Journal of Paleontology*
- In-person meeting with virtual streaming so all can attend!
- Intra-conference field trip into the world-famous Upper Ordovician Cincinnatian Series.
- Conference banquet to be held in the beautiful rotunda of Cincinnati Union Terminal.

RESEARCH REPORTS

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As an emeritus professor, I still have my office at the Department of Geology, Lund University, and try to be there regularly working on various research projects. During the past years, I have continued to work on Cambrian and Ordovician trilobites and stratigraphy, and to a large extent also on graptolites, graptolite stratigraphy and carbon isotope chemostratigraphy. My recent work on Cambrian trilobites has largely focussed on: 1) upper 'lower' Cambrian (Cambrian Stage 4) ellipsocephalid trilobites from various parts of Scandinavia; 2) Miaolingian trilobites and agnostoids from the island of Öland, southeastern Sweden; and 3) Furongian olenid trilobites and agnostoids from Sweden. The study on ellipsocephalid trilobites is in collaboration with Peter Cederström, Eslöv, Sweden, and Gerd Geyer, Würzburg, Germany, and it has been going on for almost a decade. It is based primarily on material from the Gislöv Formation in Scania, southern Sweden. The ellipsocephalids from this thin formation will be described in great detail and are partly based on material that allows characterisation of ontogenetic developments. 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 will be discussed. A comprehensive paper was submitted to *Fossils and Strata* in early 2021 and it will be published later during this year (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* in proof).

Zhu, M. Y., Babcock, L. E., Peng, S. C. & Ahlberg, P., 2021: Reply to 'Uppermost Cambrian carbon chemostratigraphy: the HERB and undocumented TOCE events are not synonymous'. *Geological Magazine 158*, 1323–1326. DOI: org/10.1017/S0016756820001120

Maletz. J. & Ahlberg, P., 2021: Dapingian to lower Darriwilian (Middle Ordovician) graptolite biostratigraphy and correlation of the Krapperup drill core, Scania, Sweden. *GFF 143*, 16–39. DOI: org/10.1080/11035897.2020.1822439

Ahlberg, P., Lundberg, F., Calner, M., Lehnert, O., Dahlqvist, P. & Joachimski, M. M., 2021: Miaolingian (Cambrian) trilobite biostratigraphy and carbon isotope chemostratigraphy in the Tingskullen drill core, Öland, Sweden. *Estonian Journal of Earth Sciences 70*, 18–35. DOI: org/10.3176/earth.2021.03

Harper, D. A. T., Stouge, S., Christansen, J. L., Topper, T. P., Alwmark, C., Richoz, S. & Ahlberg, P., 2021: Early Cambrian brachiopod-dominated shell concentrations from North-East Greenland: Environmental and taphonomic implications. *Global and Planetary Change 204*, 103560. DOI: org/10.1016/j.gloplacha.2021.103560

Maletz. J. & Ahlberg, P., 2021: Upper Darriwilian (Middle Ordovician) graptolite biostratigraphy and correlation of the Krapperup drill core, Scania, Sweden. *GFF*. DOI: org /10.1080/11035897.2021.1936156

Naum, M. E., Sjöberg, C., Håkansson, H., Lindskog, A., Eriksson, M. E. & Ahlberg, P., 2021: Kilian Stobæus and his fossil collections: science, aesthetics, and emotions. *In* M. E. Naum, J. Linaa & S. Escribano-Ruiz (eds.): *Material Exchanges in Me-*

Per Ahlberg in Morocco, 2013. Photo by Fred Sundberg

dieval and Early Modern Europe – Archaeological Perspectives, 235–256. Brepols, Turnhout, Belgium. 264 pp. ISBN: 978-2-503-59399-9

DOUG BOYCE

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

Additionally, I am trying to complete the following proposed 2022 Current Research report: 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.

My next project will be a complete description of late Dyeran to late Delamaran trilobites of Chimney Arm, Canada Bay, western Newfoundland.

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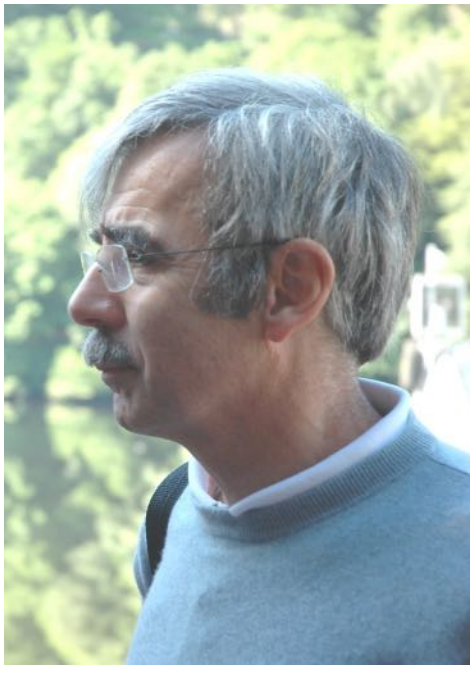
We all know that science does not pay at all, and trilobites are among the hypostasis, or dead stock of what a modern citizen wants to know. My guess is that the number of people providing a research report in this issue without being paid for trilobite research (the gentlemen researchers and retired war horses) will be greater than that of the ones making a living on this. For me it was time to take this into precise account, and take a retirement. Although I might spend less time on trilobites in future, it does not mean that this is a farewell message.

The year 2021 was not a particularly successful for my trilobite research, but it generated a few publications in which Cambrian trilobites play a role, at least to some degree (see list below). I have a number of ongoing projects which as by-product successively generate topics to be studied so that these appear to be endless. Among those are the ongoing research on the taxonomy of solenopleurids in general; the biostratigraphy and taxonomy of trilobites from the *Ornamentaspis frequens* through *Badulesia tenera* zones in Morocco; a monograph of the trilobites from the Wildenstein Member of the Tannenknock Formation in the Franconian Forest, Germany; a revision of the *Bailiella* group; and trilobite assemblages from the late Wuliuan and early Drumian from the Franconian Forest, Germany.



Gerd Geyer in Czech Republic, 2009. Photo by Fred Sundberg

Landing, E., Schmitz, M. D., Geyer, G., Trayler R.B. & Bowring, S.A. 2021. Precise early Cambrian U–Pb zircon dates bracket the oldest trilobites and archaeocyaths in Moroccan West Gondwana. Geological Magazine, 158 (2): 219–238, https://doi.org/10.1017/S0016756820000369.

Geyer, G. & Landing, E. 2021. The Souss lagerstätte of the Anti-Atlas, Morocco: discovery of the first Cambrian fossil lagerstätte from Africa. Scientific Reports, 11, no. 3107, https://doi.org/10.1038/s41598-021-82546-0.

De Baets, K., Budil, P., Fatka, O. & Geyer, G. 2021. Trilobites as Hosts for Parasites: From Paleopathologies to Etiologies. In: K. De Baets & J. W. Huntley (eds.): The Evolution and Fossil Record of Parasitism, Topics in Geobiology, 50: 173–201. https://doi.org/10.1007/978-3-030-52233-9_6.

Eichhorn, R. & Geyer, G. 2021. Zu Stein geworden. 50 Fossilien und ihre Geschichten. 296 pp., München (Bayerisches Landesamt für Umwelt).

Landing, E., Keppie, J.D., Keppie, D.F., Geyer, G. & Westrop, S.D. 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, 224, 103863, 49 pp.

Geyer, G., Landing, E. & Żylińska, A. 2021. A new look at *Eccaparadoxides* (Cambrian, Trilobita) and its biostratigraphic significance. PalZ, 42 S., https://doi.org/10.1007/s12542-021-00580-9.

Cederström, P., Geyer, G., Ahlberg, P., Nilsson, C. A. & Ahlgren, J., in press. Ellipsocephalid trilobites from Cambrian Series 2 and Stage 4 in Scania, Sweden: taxonomy, morphological plasticity and biostratigraphic significance. Fossils & Strata.

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

Nigel Hughes (USA) continues to co-lead IGCP668, Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics, which has close ties with IGCP653 and 735. Along with Paul Myrow and Birendra Singh he has been writing the chapter for the new Ordovician volume associated with these IGCP projects, and has been working with Richard Fortey and Shelly Wernette on FRC Reed's type material of Ordovician trilobites from the northern part of Shan State, Burma, and from Baoshan, China, that were originally described in the early part of the last century. Shelly's papers on the Thai and Burmese late Cambrian faunas are coming into press and a major monograph on the Thai fauna is in revision. Nigel was also the lead author on a paper that discussed late Cambrian and early Ordovician trilobites, brachiopods and the detrital zircon spectra from sandstones of those ages from the Sông Đà terrane of Việt Nam. Other relevant work is that with former PhD student Jin-bo Hou and Melanie Hopkins on the exopods of *Triarthrus eatoni,* and a paper making suggestions for standardizing descriptions of articulated trilobite ontogeny. Work with Tao Dai, Xingliang Zhang, Shanchi Peng and Giuseppe Fuscu on the ontogeny of the early Cambrian *Oryctocarella duyunensis* has shown the first case of determinate growth in trilobites. Other trilobite work in press is that on a fauna from the northern Qilian belt with Xuejian Zhu and Zhiqiang Zhou.

Dai, T., Hughes, N.C., Zhang, X.-L., and Peng, S.-C. 2021. Development of the early Cambrian orycto-cephalid trilobite *Oryctocarella duyunensis* from western Hunan, China. *Journal of Paleontology* **95 (4),** 777-792. DOI: 10.1017/jpa.2020.111

Nigel Hughes in Spain, 2008. Photo by Fred Sundberg

Dai, T., Hughes N.C., Zhang, X.-L. and Fusco, G. 2021. Absolute axial growth and trunk segmentation in the early Cambrian trilobite *Oryctocarella duyunensis*. *Paleobiology*. **47(3)**, 517-532. DOI: 10.1017/pab.2020.63

Hou, J.-B., Hughes N.C. & Hopkins, M.J. 2021 The trilobite upper limb branch is a well-developed gill. *Science Advances* **7 (14)** doi:10.1126/sciadv.abe7377

Hughes, N.C., Adrain, J.M., Holmes, J.D., Hong, P.S., Hopkins, M.J., Hou, J.-B., Minelli, A., Peng, J., Park, T.-Y.S., Paterson, J.R., Webster, M., Zhang, X.-G., Zhang, X.-L., & Fusco, G. 2021. Articulated trilobite ontogeny: suggestions for a methodological standard. *Journal of Paleontology* **95(2)**: 298-304. doi:10.1017/jpa.2020.96

Hughes, N.C., Peng, S.-C., Harper, D.A.T., Myrow, P.M., Phạm Kim Ngân, Wernette, S.J. & Zhu, X.-J. 2022. Cambrian and earliest Ordovician fauna and geology of the Sông Đà and adjacent terranes in Việt Nam (Vietnam). *Geological Magazine*. DOI: 10.1017/S0016756821000844

Wernette, S.J., Hughes, N.C., Myrow, P.M. and Sardsud, A. 2000 *Satunarcus*, a new late Cambrian trilobite genus from southernmost Thailand and a re-evaluation of the subfamily Mansuyiinae Hupé, 1955. *Journal of Paleontology* **94(5)**:867-880. https://doi.org/10.1017/jpa.2020.23

Wernette, S.J., Hughes, N.C., Myrow, P.M. and Sardsud, A. 2020. The Furongian (late Cambrian) trilobite *Thailandium*'s endemicity reassessed along with a new species of *Prosaukia* from Ko Tarutao, Thailand. *Thai Geosciences Journal* **1(1)**:63-82. https://doi.org/10.13356/tgj.2020.6

Wernette, S.J., Hughes, N.C., Myrow, P.M. and Aye Ko Aung, 2021. The first systematic description of Cambrian fossils from Myanmar: Late Furongian trilobites from the southern part of the Shan State and the early Palaeozoic palaeogeographical affinities of Sibumasu. *Journal of Asian Earth Sciences* **214** 104775. doi.org/10.1016/j.jseaes.2021.104775

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 Antarctica. 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 Bischoff). Jim and Chris Bentley are in the process of completing the study of a small middle Cambrian fauna from the Isandula Road area of the Dial Range Trough, northwest Tasmania. This is the stratigraphically lowest known trilobite fauna in the area. Jim is involved in the study of the Big Gully biota, a Burgess Shale type fauna from Kangaroo Island. Workers on this project include John Paterson, Jim Gehling, Mike Lee, Greg Edgecombe, Diego Garcia-Bellido, Glenn Brock and Jim Jago. Other projects include the stratigraphy and sedimentology of the Kanmantoo Group (with Justin Gum, Andy Burtt and Peter Haines) and the history of geology (with Barry Cooper).

The papers listed below are those published since the previous edition of The Trilobite Papers. The five papers from 2020 in the *Australian Journal of Earth Sciences* volume 67 are part of the process of applying for World Heritage status for the Flinders Ranges, South Australia. This application is largely based on the unique geology and palaeontology of the region.

SUN, X.W., BENTLEY, C.J. & JAGO, J.B.,2021. A Guzhangian (late middle Cambrian) fauna from the Gidgealpa 1 drillhole, Warburton Basin, South Australia. *Alcheringa*, *45*, 289-298. DOI. 10.1080/03115518.2021.1962974

HALL, P.A., McKIRDY, D.M., HALVERSON, G.P., JAGO, J.B. & COLLINS, A.S., 2021. Biogeochemical status of the Palaeo-Pacific Ocean: clues from the early Cambrian of South Australia. *Australian Journal of Earth Sciences*, *68*, 968-991. DOI:10.1080/08120099.2021.1890639

JAGO, J.B., BENTLEY, C.J., PATERSON, J.R., HOLMES, J.D., LIN, T.R. & SUN, X.W., 2021. The stratigraphic significance of early Cambrian (Series 2, Stage 4) trilobites from the Smith Bay Shale near Freestone Creek, Kangaroo Island. *Australian Journal of Earth Sciences, 68*, 204-212. doi:10.1080/08120099.2020.1749882

HOLMES, J.D., PATERSON, J.R., JAGO, J.B. & GARCIA-BELLIDO, D.C., 2021. Ontogeny of the trilobite *Redlichia* from the lower Cambrian (Series 2, Stage 4) Ramsay Limestone of South Australia. *Geological Magazine*,*158*, 1209-1223. doi.10.1017/S0016756820001259

JAGO, J.B., GEHLING, J.G., BETTS, M.J., BROCK, G.A., DALGARNO, C.R., GARCIA-BELLIDO, D.C., HASLETT, P.W., JACQUET, S.M., KRUSE, P.D., LANGSFORD, N., MOUNT, T.J. & PATERSON, J.R., 2020. The Cambrian System in the Arrowie Basin, Flinders Ranges, South Australia. *Australian Journal of Earth Sciences, 67, 923-948.*

doi:10.1080/08120099.2018.1525431
LANGSFORD, N., RAIMONDO, T. & JAGO, J., 2020. Red crust: evidence for an early Paleozoic oceanic anoxic event. *Australian Journal of Earth Sciences, 67, 995-1001.* doi:10.1080/08120099.2018.1563827
MOUNT, T.J., JAGO, J.B., LANGSFORD, N.R. & DALGARNO, C.R., 2020. Geological setting of the Moorowie Formation, lower Cambrian Hawker Group, Mt. Chambers Gorge, eastern Flinders Ranges, South Australia. *Australian Journal of Earth Sciences, 67, 949-980.* doi:10.1080/08120099.2019.1586771
REID, L., HOLMES, J., PAYNE, J., GARCIA-BELLIDO, D. & JAGO, J. 2020. Taxa, turnover and taphofacies: a preliminary analysis of facies-assemblage relationships in the Ediacara Member (Flinders Ranges, South Australia). *Australian Journal of Earth Sciences, 67,* 905-914. doi. 10.1080/08120099.2018.1488767
JAGO, J.B. & KRUSE, P.D. Significance of the middle Cambrian (Wuliuan) trilobite *Pagetia* from Yorke Peninsula, South Australia. *Australian Journal of Earth Sciences, 67,* 1003-1008. doi: 10.1080/08120099.2019.1643405
BENTLEY, C.J., JAGO, J.B. & CORBETT, K.D., 2020. Late Cambrian (Iverian, Jiangshanian) fossils from the Professor Range area, western Tasmania. *Alcheringa*, 44, 203-216. doi:10.1080/03115518.2020.1725833
REID, L.M., PAYNE, J.R., GARCIA-BELLIDO, D.C. & JAGO, J.B., 2020. The Ediacara Member, South Australia: Lithofacies and palaeoenvironments of the Ediacara biota. *Gondwana Research*, 80, 321-334. doi.org/10.1016/j.gr.2019.09.017
BETTS, M.J., CLAYBOURN, T.M., BROCK, G.A., JAGO, J.B., SKOVSTED, C.B., & PATERSON, J.R., 2019. Early Cambrian shelly fossils from the White Point Conglomerate, Kangaroo Island, South Australia. *Acta Palaeontologica Polonica, 64,* 489-522. doi:https://doi.org/10.4202/app.00586.2018
JAGO, J.B., BENTLEY, C.J., LAURIE, J.R. & CORBETT, K.D. 2019. Some middle and late Cambrian trilobites and brachiopods from the Adamsfield Trough, Tasmania. *Alcheringa,* 43, 1-17. doi 10.1080/03115518.2018.1480801
JAGO, J.B., BENTLEY, C.J. & COOPER, R.A., 2018. Cambrian biostratigraphy of the Bowers back-arc basin, Northern Victoria Land, Antarctica – a review. *Palaeoworld*, 28, 276-288. Doi.org/10.1016/j.palwor.2018.12.002
COOPER, B.J. & JAGO, J.B., 2018. Robert Bedford (1874-1951), the Kyancutta Museum, and a unique contribution to international geology. *Earth Sciences History, 37,* 416-443. doi: 10.17704/1944-6178-37.2.416

PETER A. JELL, School of Earth and Environmental Sciences, University of Queensland, St Lucia, QLD 4072, and Queensland Museum, PO Box 3300, South Brisbane, QLD 4101, Australia (amjell@bigpond.com)

Current trilobite research, in cooperation with Patrick Smith of the Australian Museum, Sydney, is focused on Cambrian and early Ordovician faunas of the Gnalta Syncline just north of the Mootwingee National Park. The Cambrian faunas of this area were discovered during the 1960s by company geologists, who brought the fossils to the attention of A.A. Öpik. Bevan Warris mapped the area and discussed the fossils in his 1967 PhD thesis; Michael Leu also mapped the area and dealt with an element of the fauna in his 1982 MSc thesis. I visited the area in the company of Laurie Sherwin and John Shergold in 1969 and with various other parties on numerous occasions since. Several trilobite species representing several time intervals have been described or reviewed by Öpik, Shergold, Jago, Paterson, and myself. We intend drawing together all that has been made known to date with a good deal of yet unpublished palaeontological work in a series of papers dealing with separate faunas.

Papers published during 2021 each include trilobite work although two of them are more focused on associated fauna or geology:

Jell P.A. & Sprinkle, J. 2021. Revision of Whitehouse's eocrinoids *Peridionites* and *Cymbionites*, with description of the associated fauna including two new echinoderm genera, lower Middle Cambrian Thorntonia Limestone, northwestern Queensland. *Alcheringa: An Australasian Journal of Palaeontology* 45, 1-55. DOI: 10.1080/03115518.2021.1913512
Jell, P.A. 2021. A new species of *Modocia* (Trilobita: Ptychoparioidea) in the late middle Cambrian (Guzhangian: Miaolingian) Devoncourt Limestone, Northwestern Queensland. *Proceedings of the Royal Society of Queensland* 129, 3–13. https://doi.org/10.53060/ prsq.2021.1
Jell, P. A. 2021. Addendum: A new species of *Modocia* (Trilobita: Ptychoparioidea) in the late middle Cambrian (Guzhangian: Miaolingian) Devoncourt Limestone, Northwestern Queensland. *Proceedings of the Royal Society of Queensland* 129, 15, 16. https://doi.org/10.53060/prsq.2021.1.a
Jell, P.A., Percival, I.G., & Cook, A.G. 2021. Ordovician fauna in a small fault block on the Yarrol Fault, south of Calliope, central Queensland. *Proceedings of the Royal Society of Queensland 129*, 17–35. https://doi.org/10.53060/prsq.2021.4

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I now work mostly on Cambrian biostratigraphy and stratigraphy of the Georgina Basin, but has also been involved in a paper on the trilobites from the Darriwilian of the Amadeus Basin, central Australia (with Pat Smith, Australian Museum). Current projects well advanced are on the biostratigraphy of the early Cambrian Thorntonia Limestone from the Georgina Basin (with Craig Munns, University of New England); and on middle Cambrian trilobites and agnostids from the northern South Island of New Zealand (with Jim Jago, University of South Australia, the late Roger Cooper, IGNS, and Pat Smith). A couple of other projects have moved little in the last few years and include one on Late Cambrian trilobite faunas from southernmost Tasmania (with Jim Jago and Kim Bischoff) and another on the middle Cambrian biostratigraphy in Hunt 1 well in the Georgina Basin.

Smith, P.M. & Laurie, J.R., 2021. Trilobites from the mid-Darriwilian (Middle Ordovician) of the Amadeus Basin, central Australia. *Alcheringa* **45(2)**, 140-177.

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Briefly, I have been working over the last several years on reconnaissance collections that J.F. Taylor and I recovered from the Windfall Formation in Nevada. We recovered an agnostoid-olenid coquina that is rich in *Lotagnostus* and which bears on the ongoing discussions on that taxon's systematics. For more detail, please refer to John's report.

I have a sabbatical request pending for the Fall of 2022 for time to begin the study of an interesting bathyurid-dominated fauna from the McKelligon Formation at Cookes Peak, New Mexico. This fauna succeeds an *Aulacoparia*-dominated fauna in the José Member of the Hitt Canyon Formation whose affinities appear similar to Stairsian faunas from the Ibex region, Utah. The bathyurids in the McKelligon, however, have greater affinity to the Jeffersonian Stage faunas of Texas, Oklahoma, Pennsylvania, and Newfoundland. This reinforces the endemic nature of trilobite faunas of the mid-Tremadocian in Laurentia.

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Neal Handkamer finished his MSc co-supervised by me and Rob MacNaughton of the Geological Survey of Canada, Calgary. Neal worked on faunas spanning the *Olenellus* through *Glossopleura* zones in the Mount Clark and Mount Cap formations on the eastern side of the Mackenzie Mountains, using material he collected and augmented with samples I had collected in 2010. A memoir of The Paleontological Society is in press. Cores from newly drilled helium wells are yielding the first trilobites from the Saskatchewan subsurface and Neal is working on these before his next move, to Córdoba, Argentina. The sole biostratigraphic tie-point was a well from which we recovered linguliformean brachiopods (Robson et al., 2003). This winter I plan to finish describing material from the *Olenellus* Zone and the basal middle Cambrian I collected from Victoria Island, western Arctic Islands, as well as middle Cambrian material from western Argentina in collaboration with Osvaldo Bordonaro. I just submitted a manuscript on *Rusophycus* from the *Olenellus* Zone, based mostly on specimens I collected on

Brian Pratt in Spain, 2008. Photo by Fred Sundberg

Ellesmere Island in 1993. The tracemaker was not a trilobite. I would like to draw trilobite fans to my recent paper on a certain kind of wrinkle structure often termed kinneyia. It can occur associated with trilobite-bearing layers. I argue that it is not from surface microbial biomats which has been the reigning explanation for nearly 25 years.

Pratt, B.R., 2021. Kinneyia-type wrinkle structures on sandstone beds: Not microbially induced but deformation features caused by synsedimentary earthquakes: Palaios, v. 36, p. 313–325.

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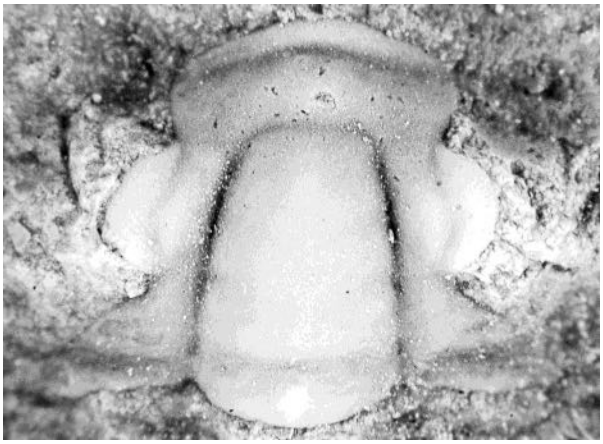
I have continued work on several different trilobite fronts. Mark Webster and I have finished the taxonomy of the Dyeran non-olenellid trilobites from the Harkless Formation in Nevada (Sundberg and Webster, 2021, in press) and are now working with Gerd Geyer on the significance of this fauna to international correlation (manuscript submitted). I have also been working on middle-upper Cambrian trilobites (*Cedaria* to *Elvinia* biozones) from the upper Noonan, and lower St. Charles formations (including the Worm Creek Member) of northern Utah to supplement Hannah Cothren and Carol Dehler's, University of Utah, work on the SPICE event.



Tumicephalus depressus Palmer, 1965, from the Noonan Formation (*Asphelaspis* Biozone), Worm Creek ,Utah. Length 3.4mm.

The main focus of my work now is the Cambrian trilobites of the Grand Canyon. The vast majority of the Tonto Group does not contain trilobite body fossils, but with some intensive searching, several localities have been found. The plan is to focus on biostratigraphy, presence of disconformities, and revising the taxonomy of Resser (1945). This project is directed by Karl Karlstrom (Univ. of New Mexico) and James Hagadorn (Denver Museum of Natural History) and involves many other scientist.

Glyphaspis vulsa Resser, 1945, from the Peach Springs Member (*Ehmaniella* Biozone), Muav Formation, Grand Canyon, Arizona. Cranidial length 4.9mm, pygidial length 2.3mm.

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

Sundberg, F.A., and Webster, M., in press, "Ptychoparioid" trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2, Stage 4), Clayton Ridge, Nevada: Journal of Paleontology.

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For a more complete account of the projects/ faunas that vie for my attention each day, see my research report in The Trilobite Papers 20, because *all* those projects are still ongoing! Description of Furongian *Lotagnostus*-dominated faunas from the Windfall Formation in Nevada with Jim Loch has consumed most of the time I've been able to free up from family commitments over the last couple years. We are *very* close to completing a manuscript on those faunas in which we describe four new species of *Lotagnostus*, as well as new species of *Neoagnostus* and *Bienvillia.* We had hoped that information gleaned from the Windfall faunas would refine correlation between deep-water deposits that contain *Lotagnostus* and age-equivalent strata in the extensive shallower-water successions of Laurentian North America, confirming the utility of the lowest occurrence of *Lotagnostus americanus* for defining the base of the uppermost Cambrian stage (Stage 10) proposed by Peng and Babcock (2005). Instead, our data strongly support the counterargument (Westrop et al., 2011; Westrop and Landing, 2016) that too broad a species concept has been applied by advocates of that horizon (Peng et al., 2014, 2015) and, in fact, the name should be restricted to material from the type area. We go one step farther in the paper we're preparing, concluding that *Lotagnostus americanus* should be restricted to the holotype. Moreover, *Lotagnostus* was more restricted environmentally than agnostoid species that have served well for defining global stage boundaries lower in the Cambrian, such as *Glyptagnostus reticulatus* and *Lejopyge laevigata*. Those species co-occur with endemic Laurentian taxa in faunas recovered from upper slope and deeper shelf deposits, and their lowest occurrences can be correlated with precision into the platform biostratigraphy. [I'm quite fond of *G. reticulatus,* because it was among the very few macrofossils recovered from an exceptionally thick succession of ribbon carbonates deposited in the Richardson Trough, and allowed me to provide a fairly precise placement for the base of the Furongian near the base of our measured section in a multidisciplinary stratigraphic study of the Road River Group in the northern Yukon (Strauss et al., 2020)]. In contrast, the scarcity or absence of *Lotagnostus* from shallower water faunas limits the precision with which a boundary based on the lowest occurrence of one of its species can be correlated into the Furongian biostratigraphy of Laurentia. The resulting imprecision, on the order of tens if not hundreds of meters in thick carbonate platform successions, poses a serious problem for Laurentian biostratigraphers.

To preserve my sanity (what is left of it anyway), I occasionally set the Windfall material aside and resume work on other faunas. I recently completed processing and photography of taxa present in a Cambrian fauna from Mt. Snowden in the Brooks Range of Alaska that Pete Palmer recognized as Siberian in aspect in the 1980s. Additional specimens recovered by processing material borrowed from the Institute of Cambrian Studies and the Smithsonian add to the list of uniquely Siberian genera, and confirm an exotic origin for that piece of North America. Conversely, trilobites I extracted last year from a carbonate grainflow in the Dauphin Formation in eastern Pennsylvania include such Laurentian endemics as *Idiomesus intermedius* and *Glaberaspis vescula.* They confirm that those carbonates, re-interpreted (Ganis et al., 2001) as part of a very large olistolith that slid into the Taconic foreland basin during deposition of the Martinsburg Formation in the Ordovician, originated as Laurentian slope deposits, rather than in some more distant location in the Theic Ocean. The work on the Dauphin fauna from the carbonates of the old Hamburg klippe also prompted me to resume work on age-equivalent (late Sunwaptan) faunas I collected decades ago from similar limestone-shale rhythmites in the Gorge Formation in Vermont and the Frederick Formation in Maryland.

The faunas that I am most anxious to return to are those recovered from the lower Paleozoic portion of the Bouvette Formation in the Ogilvie Mountains in the Yukon collected by my Dartmouth College colleague Justin Strauss and his students. The collections from the Ordovician part of the formation include complete, articulated skeletons of a new species of *Hypodicranotus* that is younger than the widespread Middle Ordovician species *H. striatulus.* But even more exciting are the Cambrian faunas from carbonate clasts in debris flow conglomerates low in the formation, which represent a broad range of ages from traditional lower Cambrian (Series 2) to Furongian. The good preservation, and high diversity of the clast faunas are similar to those of the Levis Formation and Cow Head Group in the northern Appalachians, and more than a few new species in need of description are present, a few in such intriguing genera as *Perissopyge* and *Loganopeltoides.* To see the nice preservation and wide range of morphology, take a look at the collage (Figure 13) I contributed for a preliminary report on the project published in Yukon Exploration and Geology 2018 (Busch et al., 2019), which can be downloaded from my Researchgate account. And feel free to offer any suggestions as to the identity of taxa left in open nomenclature (as Mark Webster kindly did, pointing me to *Perissopyge* as the likely genus for what is labeled Genus species indet. 241A and 241B in Figure 13). That kind of support from fellow trilobitologists is always welcome, whether it's finding the proper genus for a peculiar beast like *Perissopyge* or resolving species in such conservative genera as *Elrathiella,* which Fred Sundberg assisted me in sorting out in an *Ehmaniella* Zone fauna from the Lodore Formation in Dinosaur National Monument. Paul Myrow is working on revising a manuscript submitted to the GSA Bulletin that includes my treatment of that fauna after a bare-knuckled (but fair) review. So many faunas, so little time!!

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I continue working with both Cambrian trilobites from Mendoza (southern Precordillera, western Argentina) and Tremadocian faunas from Salta and Jujuy (Cordillera Oriental, northwestern Argentina). A comprehensive revision of the trilobites from the *Glossopleura walcotti* Zone (Wuliuan) of Mendoza has been published by Journal of Paleontology. In collaboration

with Daniela Monti and Viviana Confalonieri (Universidad de Buenos Aires), a cladistic analysis of the Ordovician Family Hypermecaspididae was performed. With Susana Esteban (Universidad Nacional de Tucumán) and María del Huerto Benítez (Fundación Miguel Lillo), a study on the sedimentology and paleoenvironment of the middle part of the Santa Rosita Formation containing trilobites from the lower to middle Tremadocian *Kainella meridionalis*, *K. teiichii* and *Bienvillia tetragonalis* Zones has been published by Serie Correlación Geológica.

Tortello, M.F. 2021, Cambrian trilobites from the *Glossopleura walcotti* Zone (Miaolingian Series, Wuliuan Stage) of Mendoza, western Argentina. Journal of Paleontology, doi: 10.1017/jpa.2021.116

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My work on the systematics of Devonian trilobites from Europe and North Africa continues. Fieldwork coordinated by the Musée national d'histoire naturelle de Luxembourg in the Emsian of Luxemburg has yielded an interesting trilobite fauna that requires study. A research article on the taxonomy and functional morphology of asteropygine trilobites from the Emsian of Morocco is underway. Other, long-term projects involve systematics of proetids, odontopleurids and phacopids.

Recent publications:

Viersen, A.P. van, 2021. Systematics of Devonian trochurine trilobites (Lichidae). Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen, 300: 175-187.

Viersen, A.P. van, 2021. Type and other species of *Gerastos* and allied genera (Trilobita, Proetinae) from the Siluro-Devonian. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen, 299: 185-217.

Viersen, A.P. van & Koppka, J., 2021. Type and other species of Phacopidae (Trilobita) from the Devonian of the Ardenno-Rhenish Mountains. Mainzer geowissenschaftlichen Mitteilungen, 49: 25-66.

Viersen, A.P. van & Lerouge, F. 2021. *Timsaloproetus alissae* sp. nov. (Trilobita: Proetidae) from the Lower Devonian of southern Morocco. PalZ (Paläontologische Zeitschrift), 85: 223-230.

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Research progress continues. The pandemic-induced limit on doing fieldwork has allowed me to start clearing a backlog of systematic and biostratigraphic projects that had been piling up. I also launched into a new project studying disparification of the glabella across the entire Trilobita. Data collection for that project is ongoing, but preliminary findings are interesting (see GSA abstract, below): this study is yielding useful insight into the evolution of the shape of the glabella, and how that evolution was influenced by developmental constraints.

Hughes, N. C., J. M. Adrain, J. D. Holmes, P. S. Hong, M. J. Hopkins, J.-b. Hou, A. Minelli, J. Peng, .T.-Y. Park, J. R. Paterson, J. Peng, M. Webster, X.-G. Zhang, X.-L. Zhang, and G. Fusco. 2021. Articulated trilobite ontogeny: suggestions for a methodological standard. *Journal of Paleontology* **95** (2): 298-304.

Sundberg, F. A., and M. Webster. In Press. "Ptychoparioid" trilobites of the Harkless Formation and Mule Spring Limestone (Cambrian Series 2,

Mark Webster in Spain, 2008. Photo by Fred Sundberg

Stage 4), Clayton Ridge, Nevada. *Journal of Paleontology*.
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. 2021. Ontogeny as a constraint in the evolution of the trilobite glabella. *Geological Society of America, Abstracts with Programs* **53** (6). doi: 10.1130/abs/2021AM-368396

Trilobite-Intensive Collections Management Internship

The Denver Museum of Nature & Science has funding for an internship focused on integrating specimens donated by the late Stew Hollingsworth into the Museum's collections, and making them available to the community for research, education, and outreach. The Hollingsworth Collection is dominated by Cambrian trilobites from Nevada, but also includes other invertebrate, plant, and trace fossils. The specimens need rehousing, organization, and databasing. Internship includes a modest stipend, free bus/rail pass, and opportunities to gain museum experience while diversifying your professional network. Internship duration ranges from 12 to 26 weeks, with a start date in early summer 2022. Internships are available to postgraduate students as well as currently enrolled students.

For more information, please contact Nicole Neu-Yagle (Nicole.Neu-Yagle@dmns.org) or James Hagadorn (jwhagadorn@dmns.org).

FIELD NOTES

The Potential Fossil Evidence of Trilobite Ecdysis

By Perry J. Damiani and Maria Damiani

Ecdysis is the molting of the cuticle of many invertebrates of the clade ecdysozoa. The physical process of ecdysis in trilobites can only be theorized given our observations of the present day arthropod kingdom. Certain field observations of articulated and partial articulated specimens may lead one to believe that the specimen is either a fossil of the original arthropod or a simple exuviae.

The process of ecdysis involves apolysis or the separation of the old exoskeleton from the underlying epidermal cells (Figure 1). The cuticle histology is inclusive of the epicuticle (most exterior), the exocuticle and endocuticle underneath making up the procuticle. The epidermis lies below the cuticle and has a series of glands that produce a hormonal substance called ecdysone. A separation of the cuticle and the epidermis occurs with the variance of hydration of the arthropod. For most organisms, a resting period precludes a stage of preparation during which the secretion of ecdysone is produced and secreted into this separation during the loosening of the undersurface of the cuticle. This hormone remains inactive while the epidermal sublayer produces another procuticle and epicuticle. The enzyme is then activated and the dissolution of the original endocuticle and exocuticle occur. This leaves a thinned epicuticle which is much easier to molt.

The ventral morphological surface of trilobites exemplifies a simple doublure which extends laterally and anteriorly circumnavigating the cephalon. Anteriorly, this anatomic characteristic blends into the rostral plate separated by a suture and thus the hypostome positioned posterior to this anatomic location.

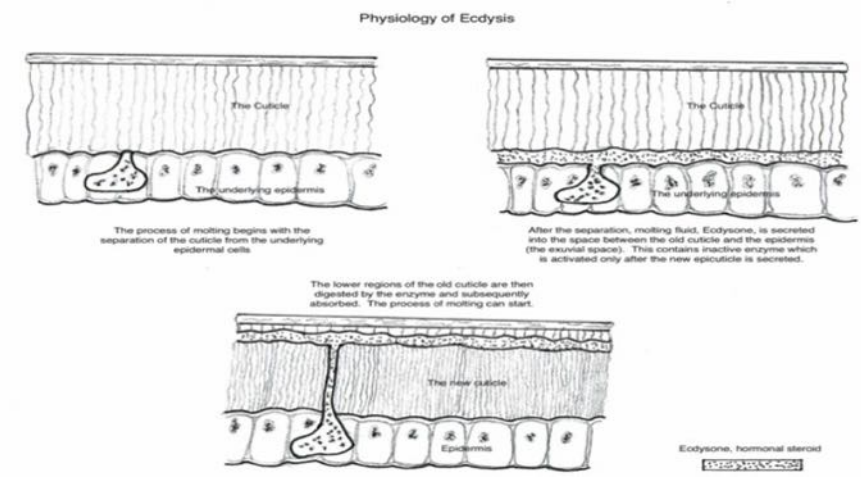

Figure 1. Figure 1. The physiological steps to ecdysis[1]

Horseshoe crabs exhibit a very similar anatomy. A doublure type morphology is accentuated on the ventral cephalon which continues anteriorly into a widened characterization medially. Ecdysis of the cephalothorax begins at the intersection of the lateral edge of the doublure at the greatest curvature of the cephalon superiorly. This produces a complete separation of the doublure and thus the crustacean crawls out of the cuticle leaving the doublure often times inferior and posterior to the anterior border of the cephalon.

Figure 2. Lower *Fallotaspisis* sp., Cl= 15.3mm, F2 Biozone (informal), Montenegro Member, Campito Formation. Note the impression of the rostral plate and doublure is located posterior to the anterior border and rotated to the left.

This finding can also be exemplified in trilobites. Complete or semi complete specimens will often times show the rostral plate in a posterior position as compared to the anterior border. The visibility of the rostral plate in a specimen may also be indicative of a thinned cuticle, thus allowing one to observe this anatomic feature (Figure 2 and 3).

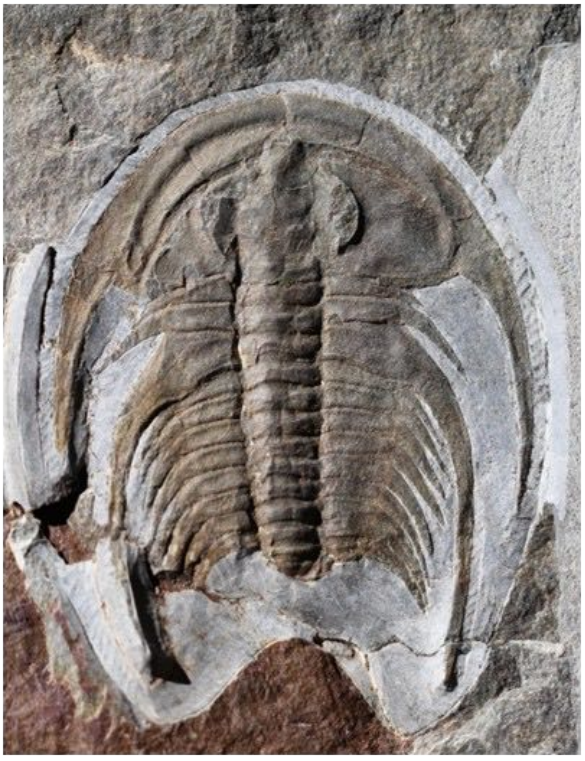

Figure 3. Upper *Fallotaspis* sp., CL=17mm F4 Biozone (informal), Montenegro Member, Campito Formation. The impression of the rostral plate and doublure is located posterior to the anterior border and rotated to the right.

A second observation of ecdysis may also be consistent with the physical thickness of the cuticle. A few Cambrian trilobite localities demonstrate multiple colorations to the deposited biomass. Occasionally, the partial or disarticulated specimens will show a lighter coloration than other complete specimens within the same bed-

Figure 4.” *Elliptocephala* “and *Lochmanolenellus* plate. Upper Poleta Formation, Esmeralda County, Nevada. Specimens within this bedding produced complete articulation with a purple patina. Note the partial articulated specimen in the upper left corner demonstrates a light yellow patina.

Figure 5. *Hemirhodon amplipyge*, CL=38mm Marjum Formation, Marjum Pass, Utah. Note the partial specimen to the right demonstrates a much lighter coloration than the complete articulated specimen.

ding. These lighter colorations can be theorized as being consistent with a thinner cuticle and thus an example of an exuviae (Figure 4and 5).

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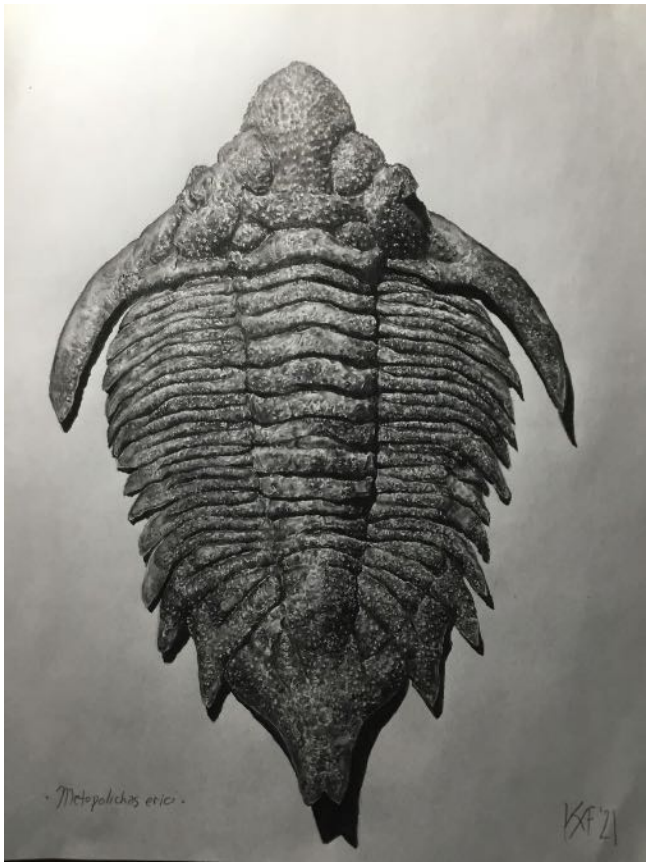
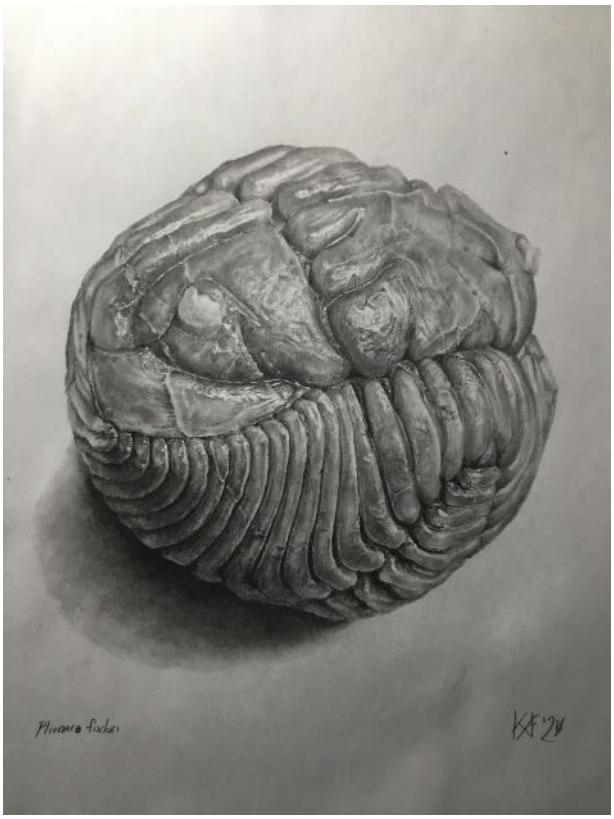
Trilo-art

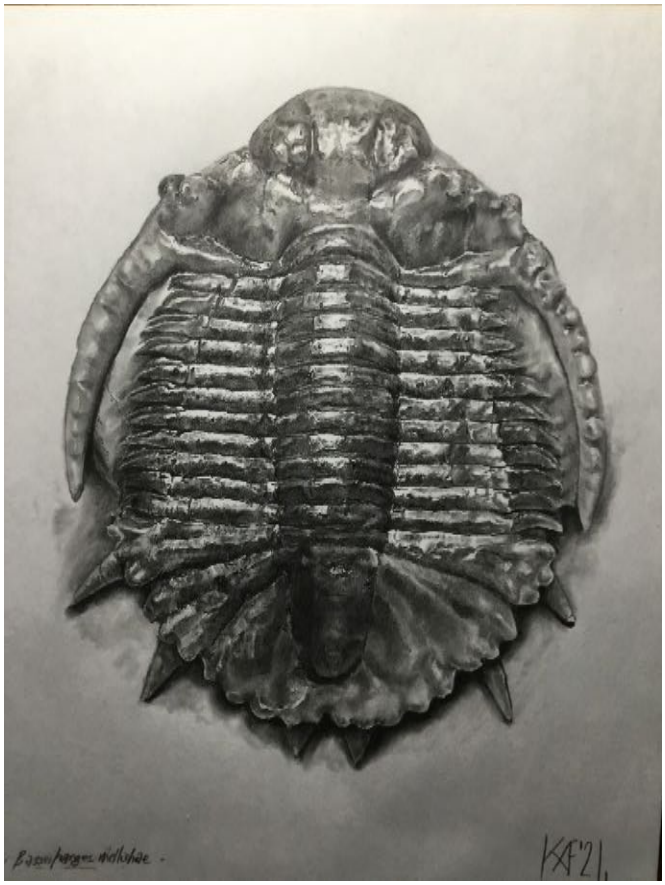
By Kane Faucher



Metopolichas erici (Warburg, 1939)



*Pliomera fischeri (*Eichwald 1825)



Basselarges mellishae Corbacho and López-Soriano, 2013

TRILOBITE APPENDAGES PRESERVED AS SILICA REPLACEMENTS

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John Shergold (1980, BMR Bulletin 186) described *Iveria iverensis* from his locality K204, just southeast of Chatsworth Station in western Queensland. He illustrated (pl. 13, figs 1-6) the dorsal exoskeleton of three articulated specimens with librigenae in place. Such preservation indicates that these are exoskeletons of trilobites that died rather than exoskeletons discarded during moulting. In the faunal list for K204 he also listed "eocrinoid aff. *Macrocystella* sp. undet."

By the mid1980s I had become interested in Palaeozoic echinoderms and recognizing their poor record in the Late Cambrian I determined to make known the taxon listed by Shergold. The echinoderm fauna turned out to be one of the more diverse known from the Upper Cambrian (Smith & Jell 1990, Mem. Qd Mus. 28, 715-778).

While etching the K204 limestones to liberate the echinoderms, I found the two trilobite specimens (illustrated herein) etched more clearly from the ventral side, and refer them to *Iveria iverensis*, with high probability though not certainty, because all the dorsal features are not evident on either specimen. The size, nature of the cephalic doublure, dorsal features, as far as can be discerned on the fully liberated cephalon, and matching hypostomes taken with the lack of an alternative among trilobites known from K204 suggest the probable identification.

These two specimens provide the first report of trilobite appendages or parts thereof being preserved as silica replacements. Trilobite appendages, though reasonably rare, are becoming more widely known and several different modes of preservation are already known. In the Cambrian Burgess Shale, trilobite appendages are replaced by clay minerals of the illite group and in the Chenjiang fauna a variety of iron oxides replace trilobite appendages, several occurrences of pyrite replacements of trilobite appendages have been documented from USA and Germany and the Upper Cambrian of Sweden has yielded fine trilobite appendages preserved as phosphatic replacements — all are detailed in the 1997 Treatise volume. Many occurrences of silicified trilobite dorsal exoskeletons, ventral doublures, rostral plates and hypostomes have been documented. Some have been shown with the silicified hypostome near life position (Many good examples in the ontogeny section of the 1997 Treatise). However, I have been unable to find any report of silicified appendages of trilobites.

The fully liberated, damaged cephalon (Figure 1) with fragments of a couple of anterior segments has a very coarsely silicified and thus unclear dorsal surface. In ventral view the hypostome remains in place although collapsed

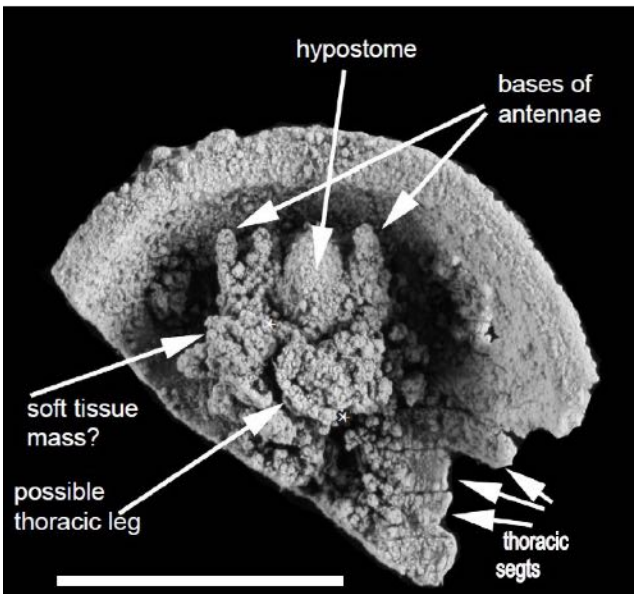


Figure 1. *Iveria iverensis* Shergold, 1980, QMF60372, from locality K204, Upper Cambrian (Iverian), Chatsworth Limestone. Ventral view of incomplete, coarsely silicified (probably beekite) cephalon and partial thorax. Doublure complete and with faint comarginal terrace lines, not showing any facial suture. Possible thoracic leg indicated by labeled arrow and * at each end.

into the vault of the cephalon. This is natural in trilobites with the hypostome separated from the doublure by a soft, flexible membrane. Emerging immediately right of the hypostome is a single projection (arrowed) that can be interpreted as the base of an antenna while on the left of the hypostome are apparently two projections; the more abaxial of these is of the same dimension as the projection right of the hypostome and I interpret it as the base of an antenna making a pair of antennae that is characteristic for trilobites. The mass of material just left of the hypostome is interpreted as parts of the soft bodily tissue slightly dislodged and preserved up against the hypostome and dislodging the left antenna some distance laterally. In support of this interpretation I point out a Z-shaped structure (* at each end and arrowed) that is almost certainly a thoracic appendage.

The articulated but damaged exoskeleton (Figure 2) is only partly etched from the matrix; I stopped at this stage because etching over one night had allowed the leg of the anterior thoracic segment on the left-hand side to be fully liberated and the silica washed away; the groove in which it rested remains on the matrix. Antennae are not evident as in Figure 1 although the base may be evident on the left of the hypostome where a circular structure is evident just behind the anterior wing. Robust plate-like structures, left and right per segment, bordering the food groove are interpreted as coxae. The junction, in the dorsal exoskeleton, between cranidial rear and first thoracic segment is clear on the right of the specimen and allows for the identification of three coxae (i.e. appendages) beneath the cephalon. The sagittal food groove is quite deep but is somewhat concealed in the vicinity of the mouth by silicification that may have replaced gut contents expelled orally upon death and/or compaction. On the left side two partially etched appendages appear to be quite fine structures but details are not discernible.

As far as I am aware this is the first report of trilobite appendages being preserved as silica

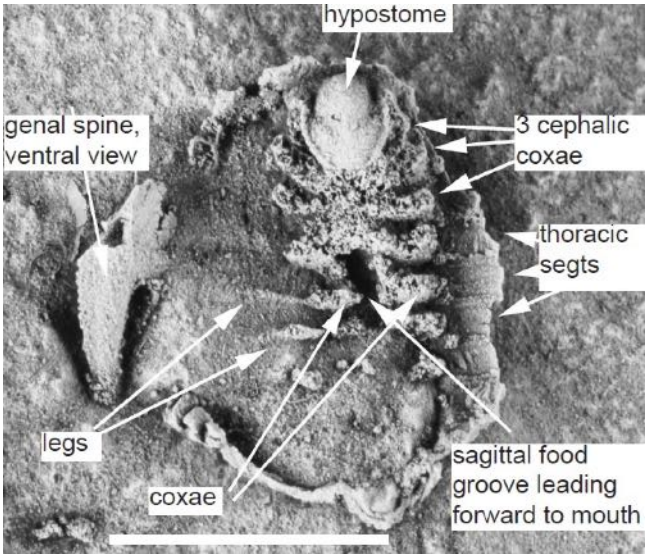


Figure 2. *Iveria iverensis* Shergold, 1980, QMF60373 same locality and age as 60372 (Fig. 1). Ventral view of silicified animal, now incomplete due to damage during diagenesis and/or acid etching showing silicified replacement of coxae on both sides of the sagittal food groove.

replacements and also the first report of appendages being fossilized in a Cambrian ptychoparioid trilobite. These specimens make only a minor contribution to understanding trilobite appendage morphology because of the coarse silicification concealing detail. Rather, I tender this note to show that, given the right circumstances of burial and diagenesis, we may yet find detailed ventral structure of those trilobites in which the hypostome is not adjacent to the doublure (*i.e.* libristomates).

Giant *Flexicalymene meeki* from the Ordovician of the Cincinnati Arch

by Don Bissett, Dry Dredgers, Norton Shores, Michigan

The Ordovician strata of the Cincinnati Arch (Southwest Ohio, Northern Kentucky, and Southeast Indiana) are well known for their abundance of well-preserved invertebrate fossils, such as the trilobite *Flexicalymene meeki* (Foerste, 1910). Not so long ago, a prone specimen of 2 inches in length was considered large for the species. That all changed a few years ago when the noted trilobite collector Dan Cooper

found a site that yielded prone *F. meeki* that were well over 2 inches long.

The locality was a warehouse construction site near Richwood, Kentucky. The overlying strata had been removed and used as fill on which to build a warehouse across the street. That left an exposure of thin-bedded limestone and shale about the size of a football field.

The exposure appeared to have weathered for an extended period of time. The surface was littered with internal molds of cephalopods (e.g., *Orthoceras*), but no trilobites were evident. Convinced there would be trilobites, Dan returned often to the exposure, scouring the surface and the exposed perimeter, and doing small test digs into the heavily weathered shale. Yet he still did not find any trilobites. That is, until one trip when a large prone specimen was found lying near the perimeter of the shale ledge. It appeared to have weathered out of the shale intact, which is unusual for prone Cincinnatian specimens – they generally tend to crumble when exposed for any length of time.

Dan started digging more extensively. Over several trips, he found a few additional specimens. All were prone and intact, with little adhering shale. And all were big – each over 2 inches. See an example of a field-collected specimen in Figure 1. These trilobites were the largest Cincinnatian *Flexicalymene* he'd ever seen.

Dan invited me to join him at the site. Also invited were local professional paleontologists and other knowledgeable avocational collectors.

The digging involved shoveling away a few inches of thin-bedded fractured limestone cap rock to exposed a shale layer. From there, digging involved a narrow-bladed putty knife to flip through the crumbly shale, removing a couple square inches of matrix with each flip of the knife. The majority of the trilobites were found only a couple inches below the limestone cap rock. Most of them were prone, intact, and ventral side up. Speculation is that the trilobites died suddenly, perhaps in some smothering event. They died so quickly that they could not even enroll. Then decomposition gases likely built up inside the exoskeletons, followed by the gases escaping and flipping the trilobites upside down.

Figure 1. Field-collected *Flexicalymene meeki*, Ordovician, Corryville Member, Richwood, Kentucky.

The distribution of trilobites was not uniform across the exposure. And the density of trilobites was low – an average day of collecting yielded one or two specimens. The majority of them were found widely spaced in one large area. Outside of that zone, little to nothing was found. And typically when a trilobite was found, another was nearby, leading to the speculation that perhaps they may have been a mating pair.

Occasionally, specimens broke in two when exposed or pleural tips fell off. In those cases, the shale in the area was gathered to screen for missing parts. One approach to this was to soak the shale in water to disperse it, air dry the solid residue, and sort the residue for the missing

Figure 2. Prone Richwood *F. meeki* (2.5 inches long). Prepared by Ben Cooper. Also see cover picture.

parts. Other than pieces of *Flexicalymene*, only a few tiny gastropods, pelecypods (internal molds), and small fragments of bryozoan were found. That was it.

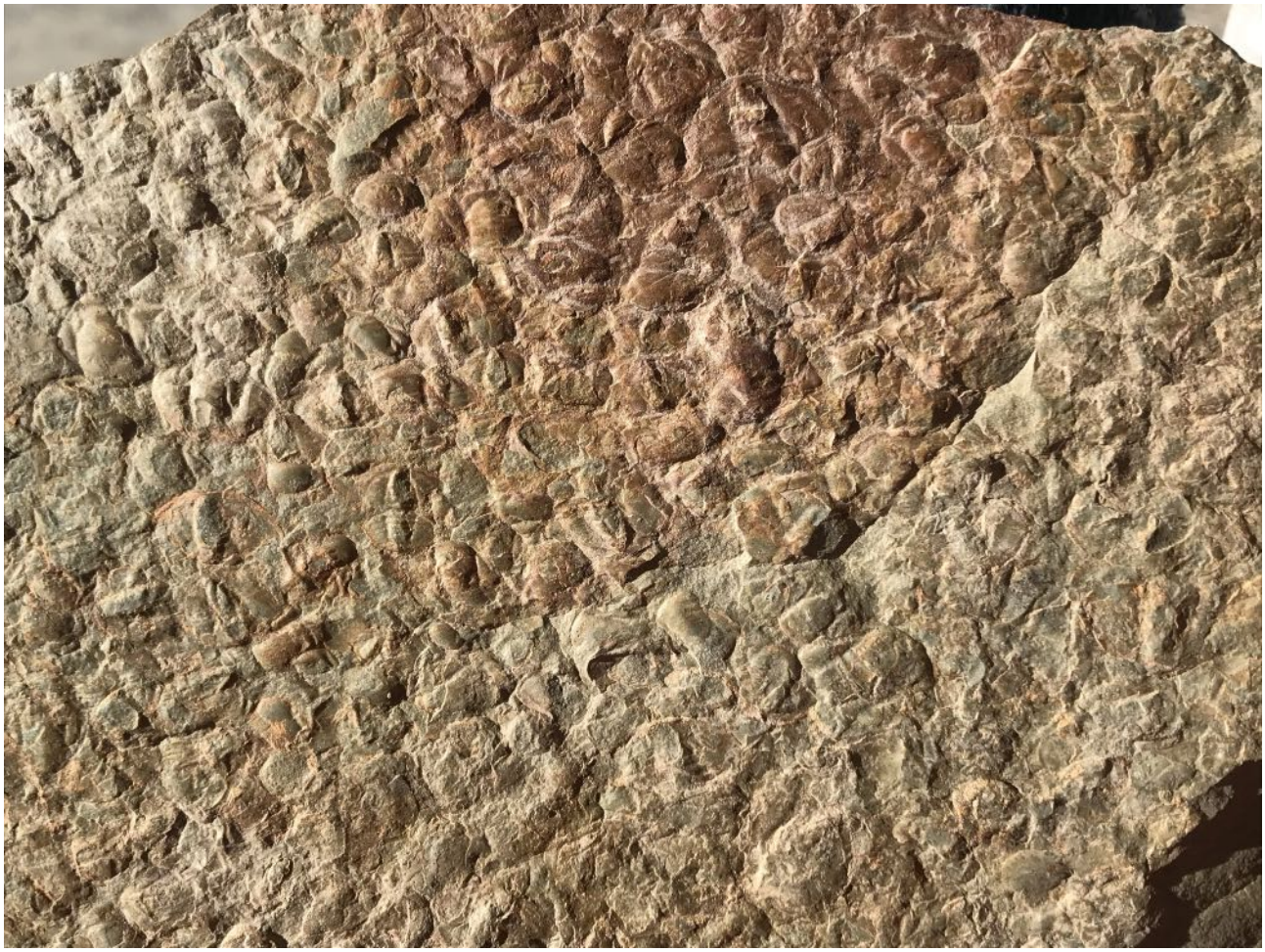
Most of the trilobite exoskeletons found were complete (e.g., no missing "free cheeks"), and almost all of them were over 2 inches in length. See a prepared example in Figure 2. Since the trilobites had no supporting matrix, prepped specimens were mounted on the thin limestone cap rock for stability. A few specimens were found partially enrolled and lying on their sides. See a prepared example in Figure 3.

Since the locality was a construction site, Dan and I had limited time to complete the dig before the shale would disappear under a warehouse. We did mark off several meter-square areas for digging, collected data on any trilobite found (depth below limestone cap, length of trilobite, compass orientation, photograph *in situ*), and made the specimens and data available to local professional paleontologists.

We also dug deeper into the shale (to a depth of approximately 6 inches) and found an occasional trilobite: not quite as large, oriented dorsal side up, and usually partially enrolled. But with the limited time available, we could not complete any more detailed survey at that lower level in the shale. And I will add that on my last ten trips to the site, I found only one small specimen, suggesting we had perhaps exhausted the available trilobites.

In the brief time we could collect this exposure (it now resides under a warehouse), approximately 100 trilobites were found. The largest was 2.75 inches. Only two were less than 2 inches in length. With the near absence of small *Flexi*, this area may not have been where the trilobites lived. So perhaps it was indeed where the adults came to mate.

Figure 3. Partially enrolled Richwood *F. meeki*. Prepared by Ben Cooper.



Glossopleura producta cranidia and pygidia from the Ophir Formation in the Oquirrh Mountains of Tooele Co., Utah. Photo by John Foster.

A new locality of trilobites in Sonora: El Sahuaral area

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In Mexico, Cambrian studies have increased significantly in recent years, mainly those focused on the central and eastern region of the state of Sonora, highlighting the presence of stratigraphic sequences of marine facies from the lower to middle Cambrian (Cuen-Romero et al., 2018; 2019; Noriega-Ruiz et al., 2020; 2021).

In the El Sahuaral hill, located in the central part of the state of Sonora, Cambrian rocks, Series 2 – Miaolingian, are exposed, and have been assigned to the Proveedora, Buelna, Cerro Prieto, El Gavilán and El Tren formations (Noriega-Ruiz et al., 2020), and have been correlated with the Cambrian rocks of the Caborca area described by Cooper et al. (1952).

Stratigraphy of the El Sahuaral area

The Proveedora Formation is made up, from base to the top, by a fine- to coarse-grained quartz sandstone, white in color with red oxidation stains. The unit, 216 m thick, outcrops massively on the top of El Sahuaral hill as thick fractured beds. The lower contact is not observed, while the upper contact is concordant with the Buelna Formation. This unit has abun-

dant ichnofossils characteristic of an intertidal-subtidal coastal zone environment. Noriega-Ruiz et al. (2021), established the distribution of the faunal guilds for the Proveedora Formation, indicating that *Skolithos* isp. occupies more than 66% of the sampled ecospace. This corresponds to an association of benthic-filtering organisms of low diversity, and dominated by abundant structures that include vertical tubes, indicating sandy and coastline environments (Bromley, 1996). The Buelna Formation is composed of sandy limestone with hyolithid fragments, followed by limestone with oncolitic algae. The unit outcrops on the El Sahuaral hill with a thickness of 64 m. The lower and upper contacts are concordant with the Proveedora and Cerro Prieto formations, respectively (Noriega-Ruiz et al., 2020). This unit is considered a shallow marine environment, particularly a tropical carbonate platform with carbonates predominating, and the high abundance of epifaunal-sessile primary producer organisms such as *Girvanella* sp. indicating shallow marine environments with subtidal and reef conditions (Noriega-Ruiz et al., 2021). The Cerro Prieto Formation consists of a cliff-forming dolomitized oolitic limestone. The lower and upper contacts are concordant with the Buelna and El Gavilán Formations, respectively. Regarding the depositional environment, the Cerro Prieto Formation is considered an intertidal to shallow marine shelf environment, based on the presence of oolites that are related to high tidal activity, dominated by primary-epifaunal consumers such as *Amecephalus arrojosensis*; however, it is possible that these organisms have been displaced by high energy currents, as evidenced by the poor preservation in the specimens (Noriega-Ruiz et al., 2020; 2021). The El Gavilán Formation is composed at its base by layers of red shale with the presence of reticular sponges, chancellorids, brachiopods, hyolithids, trilobites, and echinoderms (Beresi et al., 2019; Buitrón-Sánchez et al., 2021; Noriega-Ruiz et al., 2021). The lower contact is concordant with the Cerro Prieto Formation and the upper contact is unconformable with Miocene rhyolites and andesites. The El Gavilán Formation is considered to have been deposited in an open platform (intermediate) environment, based on the abundant trilobites such as *Elrathina* sp. which corresponds to the most abundant genus present, and agnostids, being abundant *Quadragnostus depressa* and *Euagnostus interstrictus*, the latter are considered pelagic due to the facies where they are found, although they suggest a change of facies towards a deeper environment (Noriega-Ruiz et al., 2021).

Trilobites of the El Sahuaral area

In Sonora, more than 30 families, 61 genera and 84 species have been documented for Cambrian trilobite faunas (Cuen-Romero et al., 2018). The Family Oryctocephalidae is is constituted by 3 genera and 3 species located in the vicinities of the towns of San José de Gracia and Mazatán (Vega-Granillo, 1996; Cuen-Romero et al., 2016). Recently, the genus *Tonkinella* has been identified in the localities of San José de Gracia (El Sahuaral area), which is one of the trilobite taxa that appeared at the beginning of the middle Cambrian that has a wide distribution around the world, like India, North America, Korea, Siberia, China and Argentina (Gonzalo et al., 2003). So far, the well-preserved trilobite material found in the El Sahuaral area comes from the El Gavilán Formation; where trilobites such as *Quadragnostus depressa*, *Oryctocephalus* sp., *Oryctocephalites burgessensis*, *Tonkinella valida* and ?*Elrathina antiqua* are representative of the *Altiocculus* Subzone, upper part of the *Ehmaniella* Zone (Sundberg, 1994). Associated with trilobites are abundant acrotretid brachiopods such as: *Acrothele* sp. and *Linnarssonia rara*, as well as scarce individuals of scleritomes such as *Chancelloria eros, Allonia tintinopsis* and *Archiasterella* sp., and hyolithids such as *Hyolithes sonora* and *Haplophrentis reesei*. In this sequence, 40% of the sampled ecospace is occupied by the trilobites *Elrathina* sp. and *Quadragnostus depressa*, which makes them the most abundant trilobites within the area (Noriega-Ruiz et al., 2021) (Fig. 1).

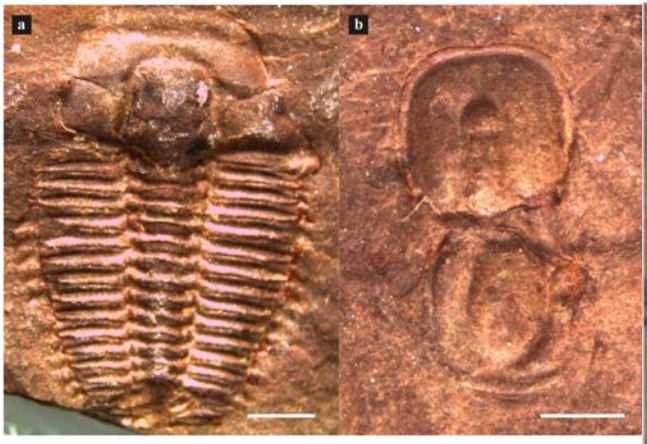

Figure 1. Most abundant polymerid and agnostids trilobites from the El Gavilán Formation in the El Sahuaral area. a) *Elrathina* sp. b) cf. *Quadragnostus* sp. Scale line = 1mm.

Another of the abundant agnostic trilobites identified in the El Sahuaral area is *Euagnostus interstrictus*, which was described and illustrated for the first time for the Cambrian in Mexico by Cuen-Romero et al. (2020). Specimens of this studied material were compared with *Euagnostus interstrictus* from the Cambrian of the Wheeler Shale, exposed in the House Range, Utah, USA (Palmer, 1954), establishing similarities and morphological differences, along with other similarities and differences to other Australian specimens from the Pacific Oil and Gas Baldwin 1 well region, Georgina Basin Northern Territory of Australia (Laurie, 2006) and differences with other Danish specimens from the Alum Shale Formation, Bornholm, Denmark (Weidner and Nielsen, 2014). In addition, in the El Gavilán Formation of the El Sahuaral area, trilobites corresponding to the Family Oryctocephalidae have been identified, in order of abundance: *Tonkinella valida, Oryctocephalus* sp., *Oryctocephalites burgessensis, Oryctocephalus reynoldsi* and *Tonkinella flabelliformis*, (Noriega-Ruiz et al., 2020; 2021) (Fig. 2). Furthermore, the *Ehmaniella* Zone has been recognized in the State of Sonora by Vega-Granillo (1996) in Rancho Sobechi area, near the town of Mazatán, based on the trilobites *Quadragnostus depressa* (= *Peronopsis fallax*), *Tomagnostus* sp., *Tonkinella valida* and *Syspacephalus* sp., that were later assigned to the *Altiocculus* Subzone by Cuen-Romero et al.

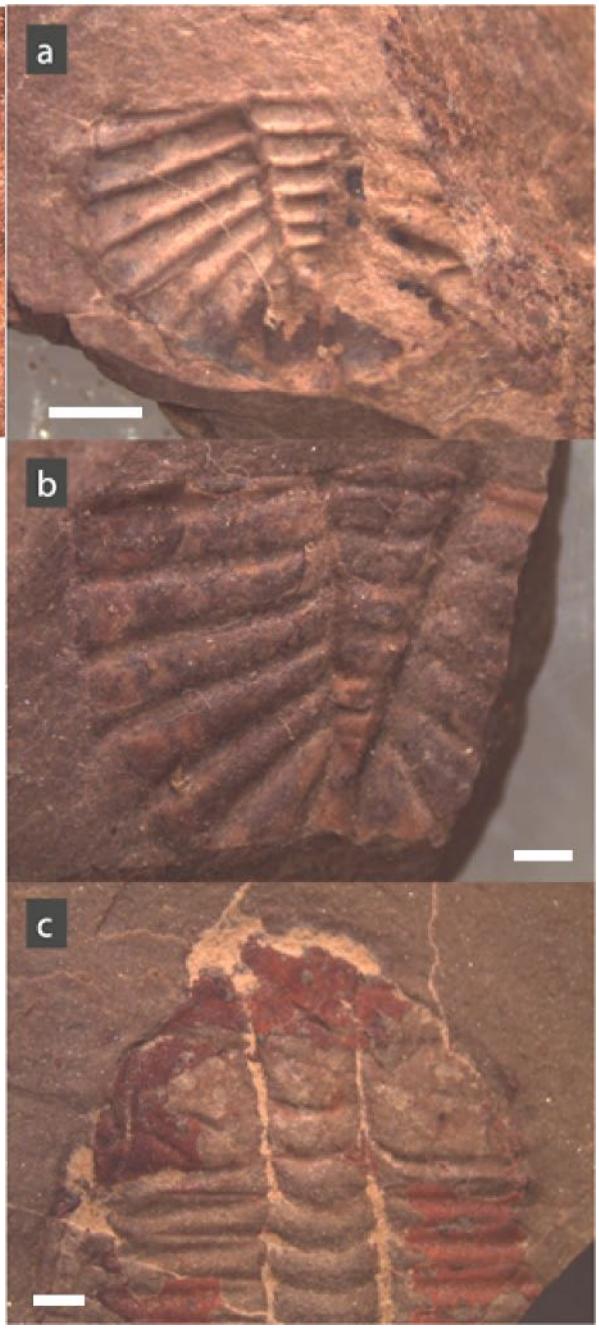

Figure 2. a) and b) disarticulated pygidia of the genus *Tonkinella*; c) cephalon and part of the thorax of the genus *Tonkinella*. Scale line = 1mm.

(2018). The presence of *Tonkinella valida* in the El Sahuaral area represents the second record of the *Ehmaniella* Zone for the Cambrian of Mexico (Fig. 3). Also, *Tonkinella valida* has been documented for the Trailer Limestone and Swasey Limestone of Utah, as well as the Pole Canyon Limestone of Nevada, in association with other middle Cambrian trilobites (Sundberg, 1994).

Figure 3. External mold of *Tonkinella vaida*. Scale line = 1mm.

Figure 4. A complete exoskeleton of *Tonkinella* sp. Scale line = 1mm.

The Family Oryctocephalidae is an important group during the middle Cambrian, due to its wide geographical distribution and short chronostratigraphic range, being useful as an index fossil (*Oryctocephalus indicus*). In Sonora, the presence of oryctocephalids (Figs. 4 and 5) has been documented in association with abundant agnostids (Fig. 6) and isolated sclerites of *Chancelloria eros*, which confers the sequence to an external shelf marine environment (Robison, 1976).

Figure 5. External mold of *Oryctocephalites burgessensis*. Scale line = 1mm.

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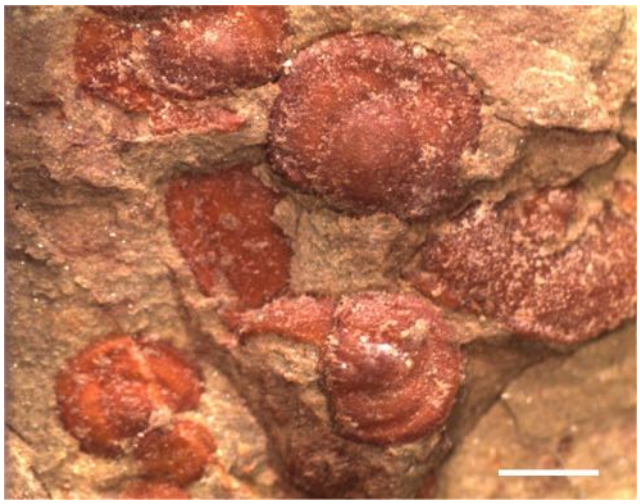

Figura 6. Presence of agnostids in El Sahuaral area.

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Rhenops Richter & Richter ventrally (Asteropyginae, Phacopina)

Martin Basse (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main, Germany)

Rhenops in the Early Devonian Hunsrück Slate

The lower Emsian Hunsrück Slate Conservation Lagerstätte in western Germany is famous for its arthropods sometimes having ventral appendages and soft bodies preserved. No other German site compares to that. Among the trilobites, asteropygines, especially *Rhenops*, though by no means common belong to the "well" known faunal elements, some of which having the ventral side of the carapace better investigated than the dorsal one, what is very unusual indeed. Some ventral aspects of *Rhenops* are well understood meanwhile due to the classical works of e.g. Lehmann (1934) and Bergström & Brassel (1984), who intensively investigated antennae and limbs as shown in *Rhenops* sp. herein (Fig. 1). Since this figure does not bear information additional to or different from those studies, except that the antennae are better preserved than anywhere else, new descriptions and discussions are not necessary. In contrast to this, other ventral parts, as the cephalic doublure and the hypostome, which are rather well preserved in the new specimen, were hitherto largely unknown.

Hunsrückian *Rhenops* taxonomy

Species determination of *Rhenops* from the Hunsrück Slate is problematic. *Rhenops limbatus* is the only *Rhenops* species having its type horizon in the Hunsrück Slate. It is known only from a pygidium never figured, and thus it is only vaguely defined (*nomen dubium*). There is probably at least one further species in the slate,

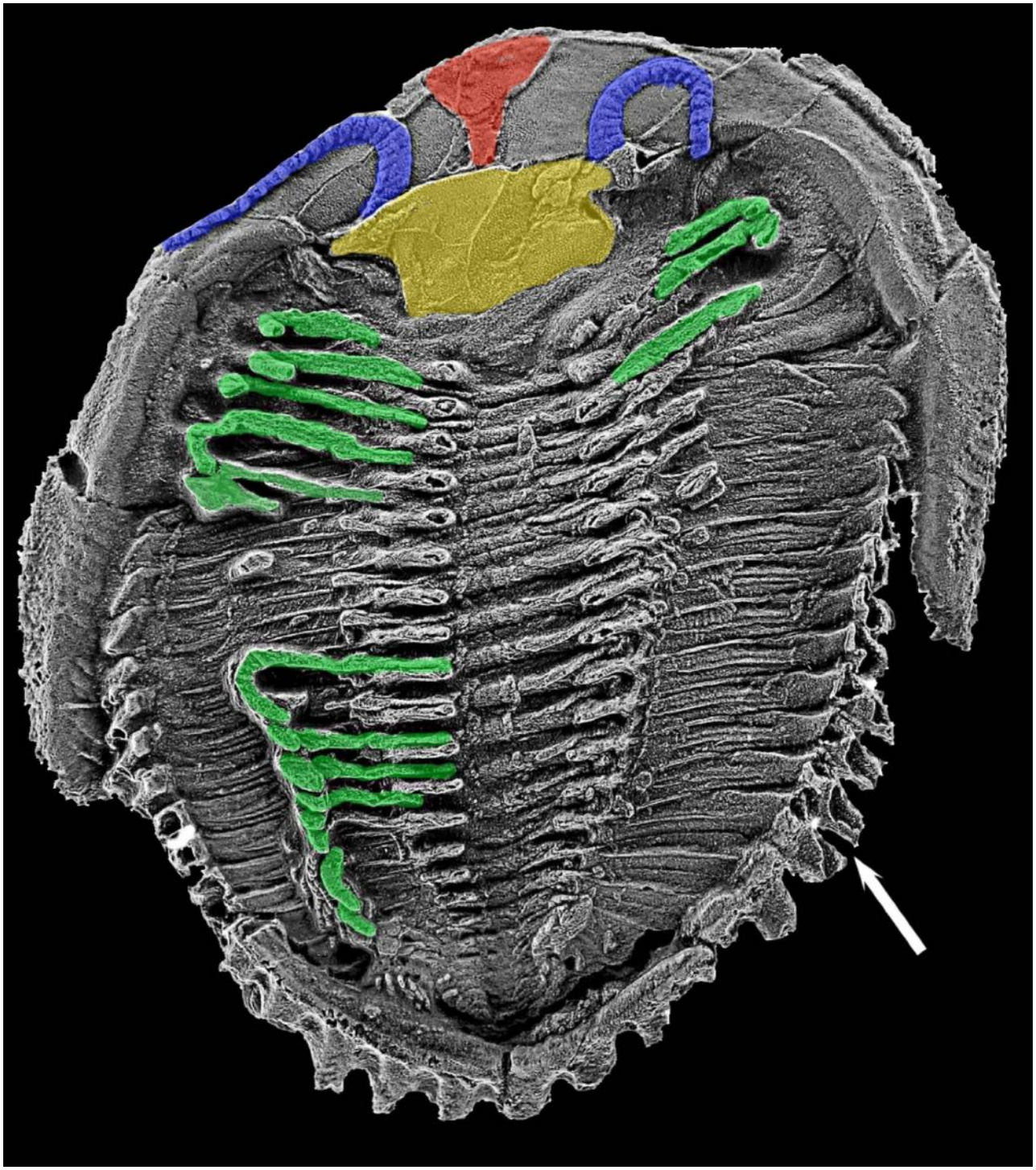

Figure 1. Ventral view of *Rhenops* sp. from "Bundenbach", Hunsrück region, Rhenish Massif, western Germany, Hunsrück Slate, lower Emsian, Early Devonian. MgO whitened cast SMF 88195 (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main) (original specimen in private collection). Total sagittal length: 42 mm. Red: Rostral plate. Yellow: Incompletely preserved conterminant hypostome nearly in situ. Blue: Antennae. Green: Two cephalic, eight thoracic and one pygidial limbs (walking legs). Arrow pointing to thorax/pygidium boundary. All photographs by the author.

due to differences found in the segmentation of several pygidia not yet published. Rhenish early Emsian *Rhenops anserinus* (Richter & Richter) and *Rhenops*? *index* (Richter & Richter) come from completely different biofacies and lithofacies. Their occasionally propagated occurrence in the Hunsrück Slate is rather doubtful. "*Rhenops anserinus*", or "*Rh*. cf. *anserinus*", as suggested by some authors for Hunsrück finds having knots on axial segments mesially surely do not match because such knots are absent in typical *Rh*. *anserinus*. That is why Basse (2003:

Pl. 10, figs 157–158) named related finds *Rh*. sp. n. H. In *Rh*.? *index* those knots are present, but this species is only documented by pygidia. Summed up, all *Rhenops* from the Hunsrück Slate should be treated in open nomenclature until a revision based on well-preserved specimen is available.

There is no systematic value at all for ventral features as figured herein. Those finds can only be assigned generically. The length of the librigenal spines – they are about as long as the cephalon – and the equally short, often clumsy-looking lateral spines of the pygidium are indicative. Consequently, *Rhenops* sp. figured herein does not contribute to this assignment problem. The real meaning of the find lies elsewhere.

Trilobite rostral plates

The rostral plate is a median part of the cephalic doublure. It is surrounded in front and laterally by facial sutures, which operate as predetermined breaking points during molting. Its posterior margin is connected directly or, via organic matter that has not been preserved in fossils, indirectly with the hypostome. Because of this rather "loose" connection, rostral plates are also found isolated.

In general, little is known about rostral plates. For the German Paleozoic, on 30 figures have been published, although the potential is far greater. Preservation of the rostral plate *in situ* requires at least an articulated cephalon. And it is at least potentially present in any complete carapace. There are a lot of them locally in Germany. If nevertheless so little is known about rostral plates, it is also because even professional paleontologists usually only expose the dorsal side of a carapace preparatively. Actually incomprehensible, because the ventral side is much more interesting because it appears to be more functional due to its closer connection to the inner organization.

Once the carapace has been dissolved during the fossilization process, only sediment casts remain. Here the rostral plate is usually covered by sediment filling the space between the anterior border and the doublure of the cranidium, which one does not necessarily want to remove for reasons of optical attractiveness. The Hunsrück Slate with its manifestations of soft bodies and little mineralized parts of the shield is a godsend regarding the relevant ventral views. Because here one was forced to make appropriate preparations if one did not just want to see these structures in the X-ray image. Despite this, hardly any ventral views of cephalic doublures are documented from here, what is due either to preservational matters or to the little enlightening photographic documentation.

***Rhenops* rostral plate!**

After all, in the German Devonian the rostral plate is known from all occurring trilobite families with the following exceptions: Harpetidae, Acastidae (Asteropyginae and others) and Phacopidae. This corresponds largely to other finds worldwide, which indicate that no differentiated rostral plates are present in these groups for functional reasons. Here the plates are melted indistinguishably in the doublures, since the facial suture has lost its original functional meaning. This can be shown convincingly for the ventrally well-studied Harpetidae and Phacopidae. With asteropygines, however, the situation is not so clear. In fact, only the new find from the Hunsrück Slate and a cephalon from the Middle Devonian of the Eifel have recently been published (Fig. 2). Despite this unsatisfactory situation, which was even worse more than half a century ago, Struve (1959: 461) diagnosed the Phacopina Struve, which include the Asteropyginae, as follows: "Cephalon (...) without rostral plate (...)".

The find in Fig. 1 allows the first safe identification of a differentiated rostral plate in a taxon of the Phacopina. This formulation takes into account that Lehmann (1934: Fig. 2), i.e. before Struve, showed a structure in his reconstruction

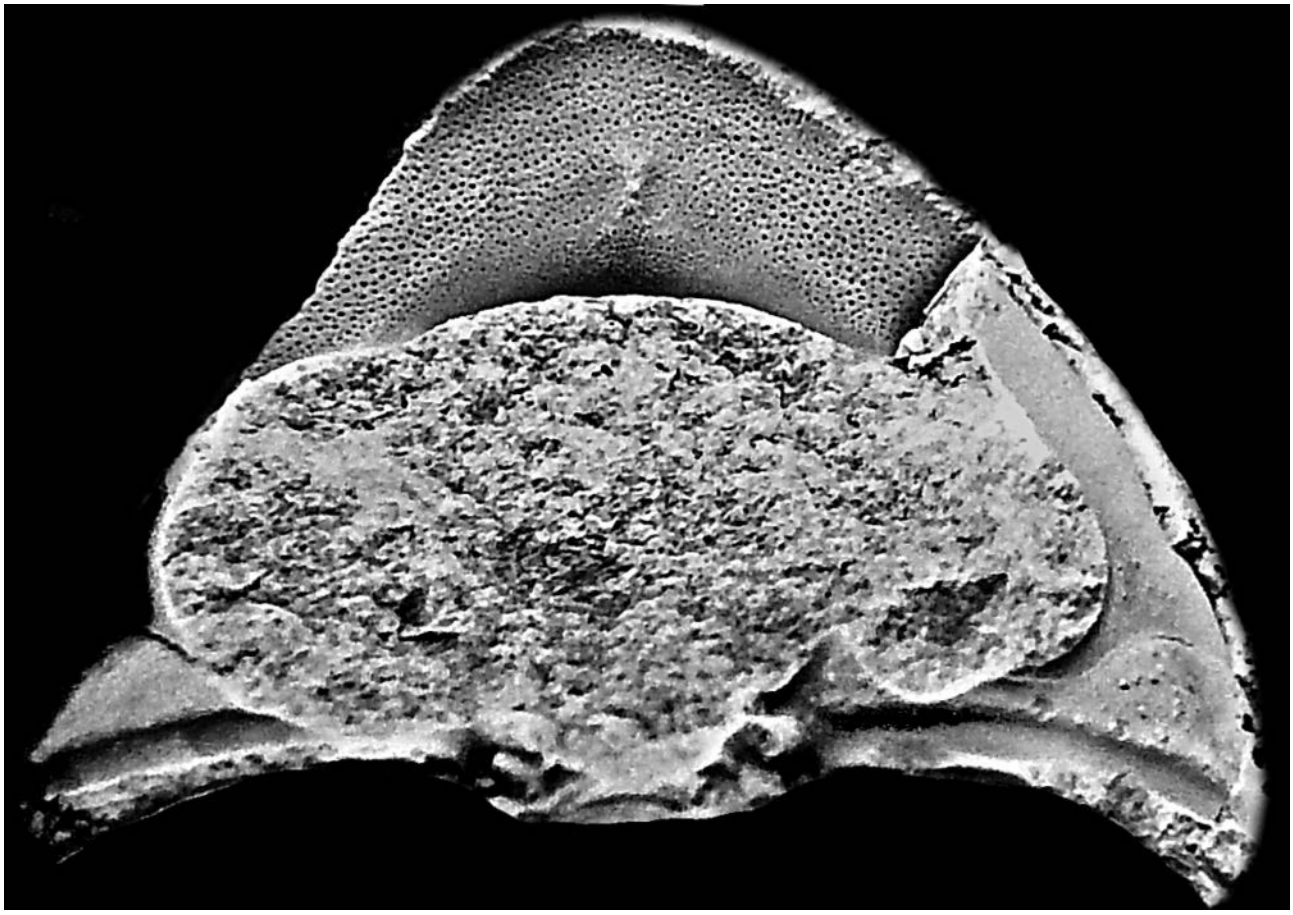

Figure 2. *Asteropyge comes* Basse from the Eifelian (Middle Devonian) of the Eifel Synclines, Rhenish Massif, western Germany. External natural mold of doublure showing no trace of any kind of rostral plate. MgO whitened cephalon of incomplete carapace SMF 79428 (Senckenberg Research Institute and Natural History Museum, Frankfurt am Main). Sagittal length of doublure: 4,5 mm.

drawing based on an X-ray image for a *Rhenops* from the Hunsrück Slate – Broili's much-cited *Asteropyge* – which could be a rostral plate due to its outline and position. However, it is unusually wide and neither Lehmann nor later authors, who even reproduced this drawing, commented it. So that find is initially the only published evidence.

For the reasons mentioned, the significance of this rostral plate for the systematics is largely unclear. It is now only certain that asteropygines can have a differentiated rostral plate. In *Rhenops* sp. it is funnel-shaped. Comparable structures are known from Homalonotinae (suborder Calymenina). The presence of a rostral plate in *Rhenops* suggests a potential functionality of the facial suture. This may coincide with the fact that appearingly natural cranidia of asteropygines are known, albeit rarely (e.g. Basse 2003: Figs 214, 242, 251, 353, 413), which means that the cephalon may have completely disarticulated during molting.

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Trilobite Tears
For People We Have Lost

Frank Nikolaisen (1940-2021)

By David L. Bruton

Frank Nikolaisen died alone at home in Oslo on September 20th 2021, aged 81. At a very early age he became interested in the natural sciences and chose Vestheim School, one of two schools in Oslo where this was possible. He later studied geology at the University and became immediately fascinated with the rocks and fossils of the Oslo Region. He became a regular visitor at the University Palaeontological Museum, Tøyen and was invited to join Gunnar Henningsmoen on an expedition to Digermulen in the far north of the country and later Frank became the senior author of two joint papers on the Cambrian trilobites collected Nikolaisen & Henningsmoen (1985, 1990). Frank had a keen eye for detail which he revealed by careful use of the vibrotool. I first met Frank in 1963 when I visited the Palaeontological Museum and later we became close friends especially after I took over Henningsmoen's position in 1967. When I started lecturing, Frank became my mentor and scientific assistant and introduced me to the localities and fossils of the Oslo Region. In the field he also had a rich knowledge of the flowers, animals and birds. Ornithology was his big hobby in later years and he travelled world- wide to study rare birds. Frank published three important papers on Ordovicain trilobites from the Oslo Region between 1961 and 1965. In 1971 he joined Gunnar Henningsmoen, Richard Fortey, myself and others for an expedition to Ny Friesland, Spitsbergen. In 1973 he assisted me with the organisation of the 1st International trilobite meeting held in Oslo. After this, Frank left us for other activities in private business but returned to publish two important works on the Remopleurididae in 1983 and 1991. In 2017 Frank was present at the 6th International Trilobite meeting held I Tallinn, Estonia and we met often at meetings of the Norwegian Geological Society in Oslo. In his years at Tøyen, Frank met many visiting guest researchers who, since his death, have written their appreciation for his help and friendship. Interestingly all remember well his style of dress of flowered shirts with large collars. Frank retained his "Elvis-style" from his schooldays to the end. At his funeral, the service ended with Frank Sinatra's "My Way". Frank Nikolaisen's life was always his way.

Frank Nikolaisen. Photo by Karl Bruton 2019

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In memory of Yuriy Ya. Shabanov (02/10/1936 - 01/28/2022)

By Tatyana Pegel

On January 28, 2022, Yuriy Ya. Shabanov, a well-known researcher of Cambrian trilobites and stratigraphy of Siberia, died in Novosibirsk, Russia.

Yu.Ya. Shabanov was born on February 10, 1936 in a Siberian village in the Altai Territory. After graduating from the Faculty of Geology and Geography of Tomsk State University in 1959, he became an employee of the recently organized Siberian Research Institute of Geology, Geophysics and Mineral Resources (SNIIGGiMS) in Novosibirsk. Here he began and ended his career as a paleontologist and stratigrapher, which he followed to the end of his days.

In 1961, at SNIIGGiMS, a direction was organized to study the stratigraphy of the platform regions of Siberia under the leadership of Vladimir E. Savitsky. Here complex studies of stratigraphy, paleontology, lithology, geochemistry were carried out, aimed at reconstructing the history of the geological development of the Upper Precambrian and Lower Paleozoic sedimentary basins of Siberia in connection with the clarification of the prospects for their oil and gas potential. From among the young specialists, a group of researchers was created, which included Yuriy Shabanov, who later became one of the favorite students of V.E. Savitsky. The main direction of his research was stratigraphy and trilobites of the Cambrian of the Siberian Platform. Under the guidance of his teacher, he prepared a dissertation "Biostratigraphy of Domanik-type deposits of the Cambrian in the northeast of the Siberian Platform". His creative legacy includes articles and monographs on the stratigraphy and trilobites of the type and reference sections of the Lower and Middle Cambrian located on the territory of the Siberian Platform. As a member of the International Working Group, he took an active part in the discussion of the position of the traditional boundary of the Lower and Middle Cambrian and in the preparation of a proposal to establish a new Molodian stage in the Global Scale of the Cambrian system with the stratotype of the Kuonamka Formation section on the Molodo river in the northeast of the Siberian Platform.

Yu.Ya. Shabanov for many years headed the Cambrian section of the Siberian Regional Interdepartmental Stratigraphic Commission, established at SNIIGGiMS. Under his leadership, regional stratigraphic charts of the Cambrian of the Siberian Platform were created. He was a member of the Commission on the Cambrian system of the Interdepartmental Stratigraphic Committee of the Russian Federation, a member of the All-Russian Paleontological Society, a member of the International Subcommision on Cambrian Stratigraphy, a member of the International Working Group on the boundary of the Lower and Middle Cambrian.

Yuriy Ya. Shabanov (2008) at the Kuonamka Formation section on the Molodo river in the northeast of the Siberian Platform. Photo by Fred Sundberg.

Anyone who knew him would certainly note not only the depth and breadth of his knowledge and willingness to share it, but also his kindness, humor, and openness to communication.

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NEW BOOKS

Illustrations of Cambrian Stratigraphy and Index Fossils of China – Trilobites

by PENG Shanchi and dedicated to the memory of his late wife, LEI Shu, published in 2021 by Zhejiang University Press in 571 pages, with 230 of them taken up by photographic plates.

The Cambrian trilobites of China are very very many and have attracted a great deal of study over nearly 150 years. The first phase included numerous small papers and culminated in Walcott's large well illustrated 1913 monograph. During the 1920s and 1930s Y.C. Sun, T. Kobayashi, and R. Endo all described enormous trilo-

Peng Shanchi and his late wife, Lei Shu, at the Knotty Pine, Caliente, Nevada, 2011. Photo by Fred Sundberg.

bite faunas. The next phase, in the post-WWII period, was led by Lu Yanhao and Zhang Wentang. This was followed by the publication of regional atlases of fossil faunas with an enormous proliferation of new trilobite genera/species described. This led into the modern era, which has witnessed many students of the group publishing widely on an ever increasing array of Cambrian taxa.

Bringing this enormous field together in a single book was achieved by Lu Yanhao and others in 1965 but the extent is now enormously increased. Just to list the fauna would be a huge task. Illustrations in early Chinese publications were often of inferior quality, a situation that Zhang & Jell (1987) tried to improve for early described faunas held outside China but quality has been continually improved to the present day. PENG Shanchi has, in this new book, has not only collated Chinese Cambrian trilobite knowledge but also provided 230 plates of some of the finest trilobite illustrations of all time. In many cases he has provided images of multiple individuals where original treatments figured only one specimen. He has re-photographed many specimens to provide much clearer understanding of individual species. The volume contains an extensive stratigraphic and biostratigraphic introduction that allow all illustrated taxa to be set into country-wide and international contexts.

Although the text is entirely in Chinese, those unfamiliar with that language are able to easily relate species to tabulations in the introduction and thus to the rest of the world. I have noticed one or two minor hiccups but they do not detract from the incredibly useful compendium that will no doubt become the premier source of Chinese Cambrian trilobite information for a long time to come.

Anyone interested in the study of trilobites will eventually be forced to study this outstanding volume that I find it impossible to recommend too highly.

By Peter Jell

Following are three examples of plates from Peng 2021


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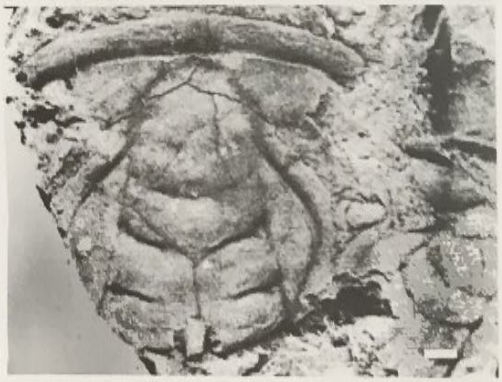
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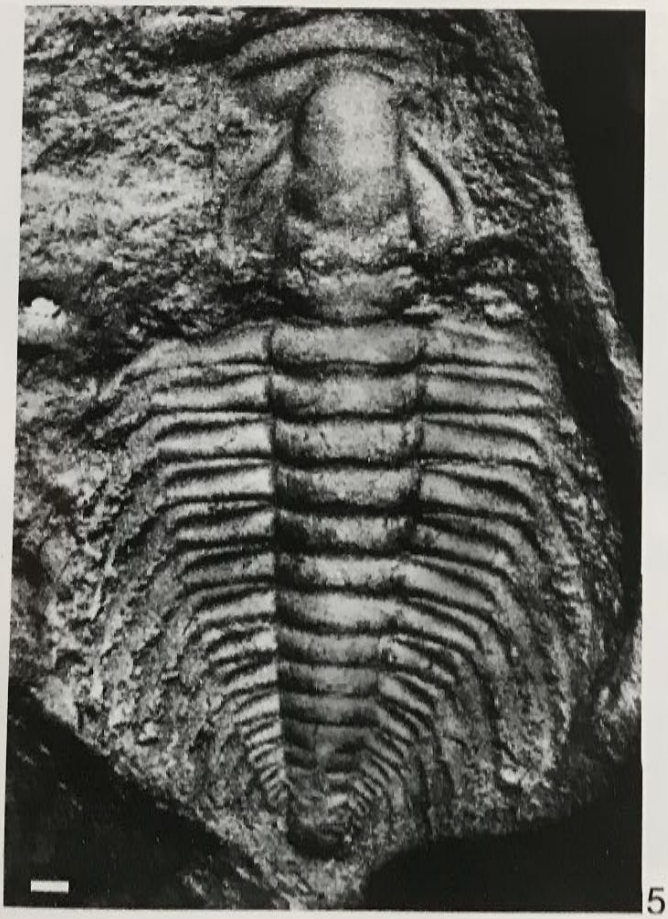
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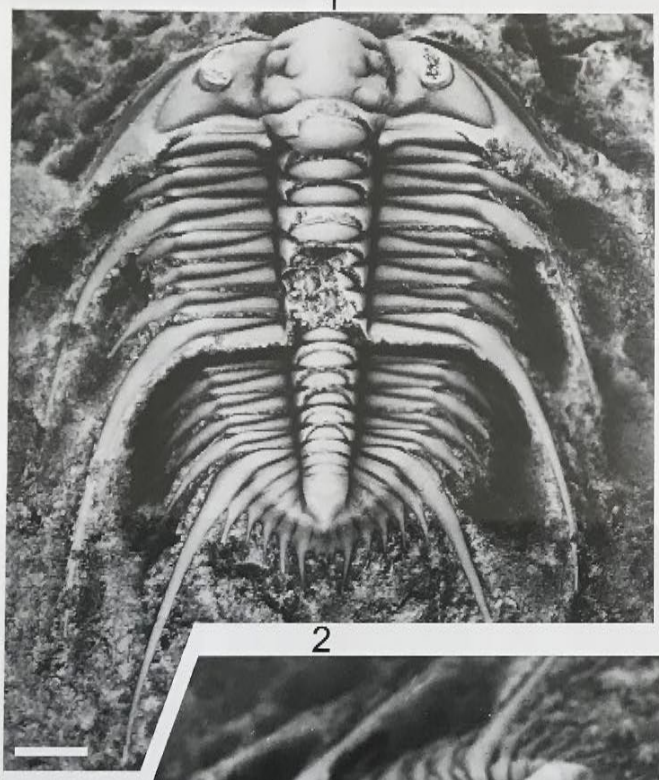
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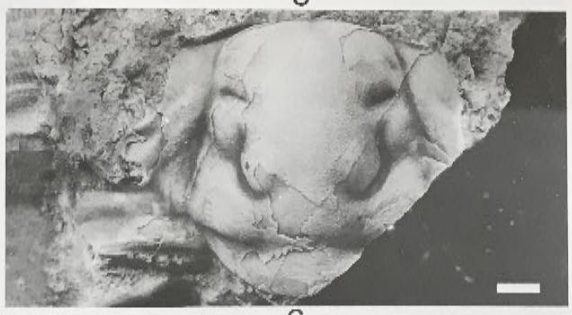
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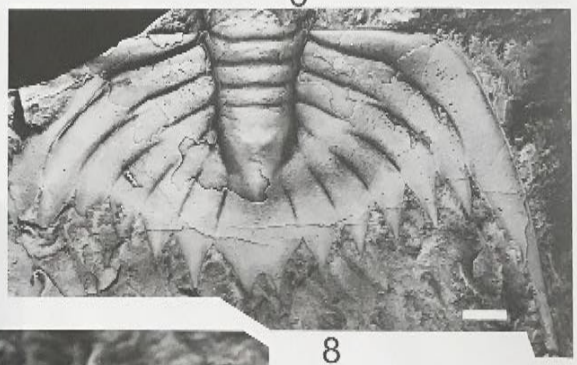
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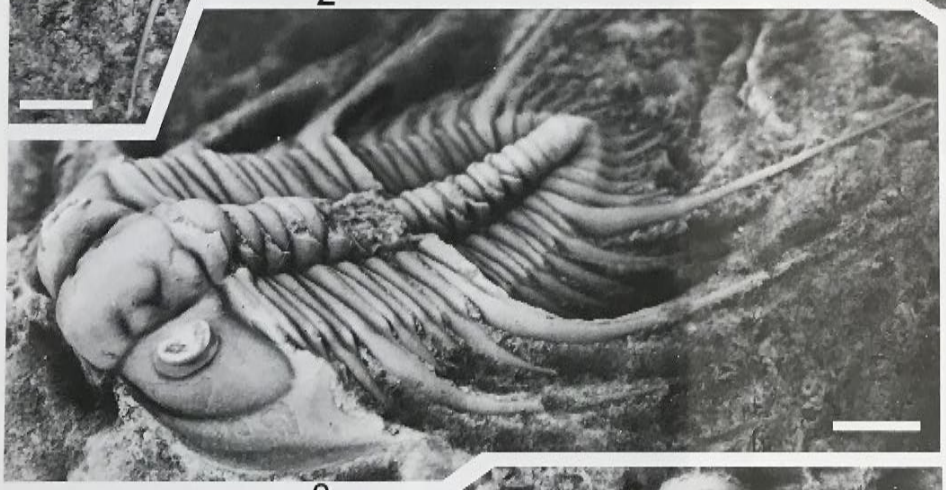
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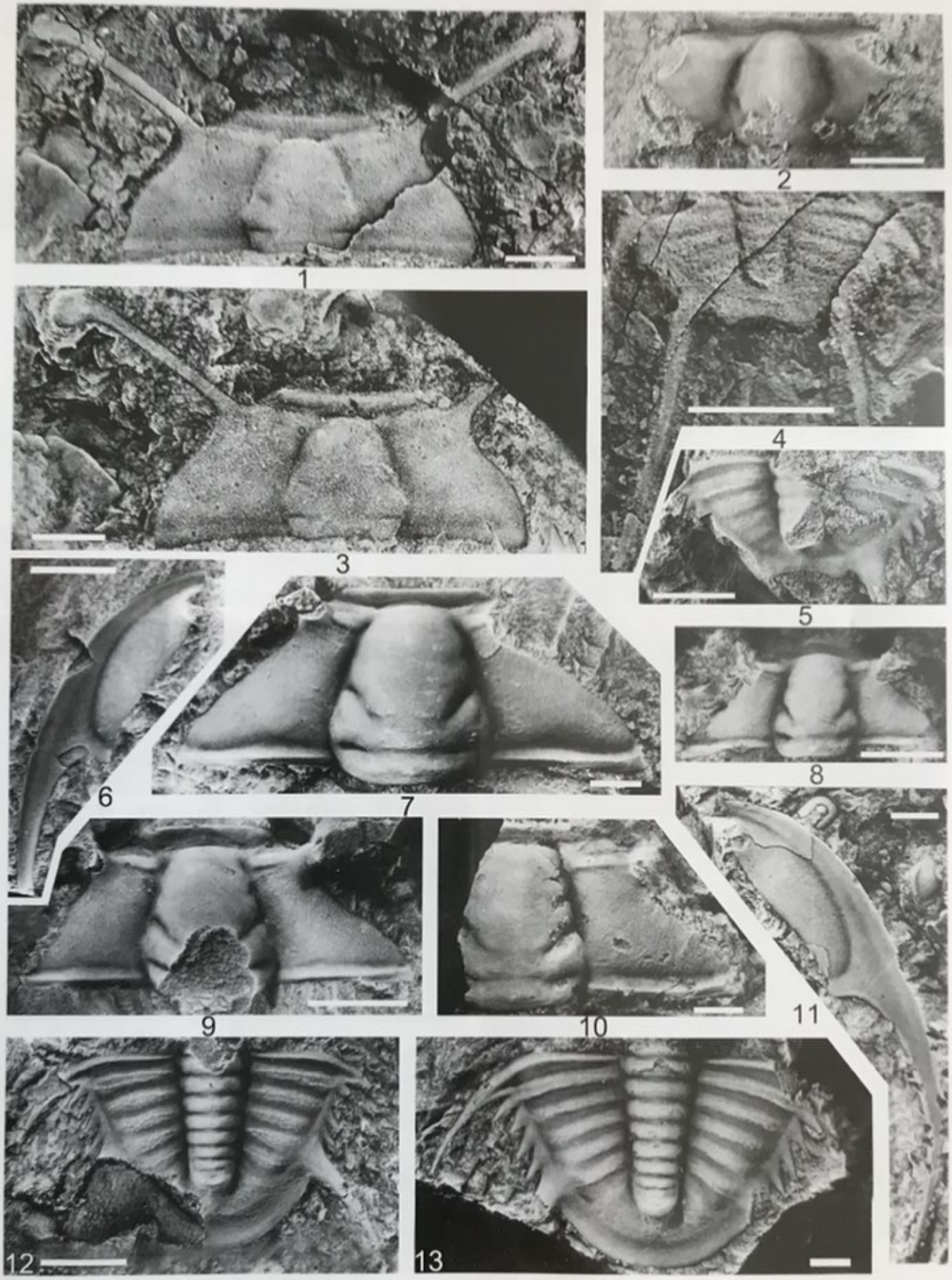
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