

ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
INTERNATIONAL COMMISSION ON STRATIGRAPHY

Number 40 (for 2022)

Edited by Bertrand Lefebvre



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Cover photo

The Uuga Cliff on Pakri Peninsula, NW Estonia, is one of the classic Ordovician sections along the Baltic Klint, a 1200-km-long escarpment running from Lake Ladoga, across north Estonia, to the island of Öland in Sweden. In the photograph, Tremadocian-Floian glauconite-rich sandstones grade into cool-water carbonates of Dapingian and Darriwilian age, rich in various fossils. The section will be visited during the ISOS-14 in July 2023. Photo: Olle Hints, 2022.

(<https://geoloogia.info/en/photo/183774>).

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CHAIRMAN'S MESSAGE

This is my third Chairman's Message as chair of the Ordovician Subcommission to introduce this issue of Ordovician News. Thanks, again, to Bertrand Lefebvre, the secretary of the Subcommission, to compile the newsletter, and to Ian Percival, former secretary (2008-2020) to continue helping us, bringing all the news of the Ordovician together.

Our term as officers of the Subcommission started in 2020, right in the middle of the COVID-outbreak. Now, the pandemic is (hopefully) (almost) over, and we start meeting again on site, not just online, as we did a few times, including for the last (virtual) meetings of IGCP 653 (Copenhagen 2020, Lille 2021). With IGCP 735 now running, a number of Ordovician researchers came together in Marrakesh in October 2022. IGCP 735 also organized two sessions at the 6th International Palaeontological Congress in Khon Kaen, Thailand, November 2022. You can find reports of these meetings in the newsletter. So, we meet again!

This is the Newsletter compiling all your data from 2022. Thanks for sending all your information (and please, continue doing so!). It is important to see what Ordovician workers are doing around the world. The Newsletter also includes a number of meeting announcements for the year 2023. This year 2023 is indeed a major year for the Ordovician Subcommission, because it is the year when the “Olympic Games” of the Ordovician take place again: the 14th ISOS is taking place at Tallinn, Estonia. Many of us will be there. Please, see the announcement of the Estonian congress in this newsletter.

Just before that, the other “Olympic Games” of stratigraphy are taking place: STRATI2023 is organized by “us”, i.e., by some members of the executive of the Ordovician Subcommission. This meeting will bring over 250 scientists together just before the 14th ISOS (with a joint field excursion in Estonia).

Sadly, we have in this issue some contributions in the memory of Ordovician workers, who recently passed away. Many thanks for the authors of these lines.

Please, continue to send your contributions (to the secretary Bertrand Lefebvre) and do not forget to send also relevant information to your webmaster Alycia Stigall.

Best regards,
Thomas Servais

ANNUAL REPORT OF ORDOVICIAN SUBCOMMISSION FOR 2022

1. TITLE OF CONSTITUENT BODY Subcommission on Ordovician Stratigraphy (SOS)

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2. OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY

The Subcommission promotes international cooperation on all aspects of Ordovician geology, specifically stratigraphy. Its global network involves academia, government institutions and industry.

Specific objectives are:

- a. To delimit and subdivide the Ordovician System (and Period) as a part of the overall ICS mission to elaborate the standard global stratigraphic scale. This work aims to establish boundaries (GSSPs and ASSPs), correlation of major subdivisions (Stages and Series)

globally and regionally, and to periodically review the effectiveness and utility of these decisions.

- b. To promote regular international meetings on all aspects of Ordovician geology, especially those devoted to clarifying stratigraphic procedures, nomenclature and methods for use in establishing a unified global time scale and to prepare correlation charts with explanatory notes (the main phase of this latter task is now completed).
- c. To encourage, promote, and support research on all aspects of Ordovician geology worldwide and to provide outlets, including an annual newsletter (*Ordovician News*), international meetings, and a web page, for promoting discussions and reporting results of this research.
- d. To encourage, promote, and support interdisciplinary research on the Ordovician global Earth system, addressing topics that require high-resolution, global correlation.
- e. The ultimate goal of the Subcommission is to provide a high-resolution geological time scale that will be a critical foundation for interdisciplinary research on the global Earth system during the Ordovician Period. The work is broadly based and must include specialists in palaeontology, all subdisciplines of stratigraphy (bio-, litho-, chemo-, and magneto-), sedimentology, geochemistry, and tectonics. With a large network including active participants from more than 25 countries, the Subcommission thus involves much of the global geological community.

3. ORGANISATION - interface with other international projects / groups

Since mid-2020, the Subcommission on Ordovician Stratigraphy (SOS) comprises an Executive (Chair, Vice-Chair and Secretary), plus 17 other Voting Members (and >300 Corresponding Members). Since 2021, the Subcommission Executive includes, for the first time, a female member, appointed by the Chair, as Internet Officer.

The Subcommission includes a broad national representation and coverage of key fossil groups as well as specialists in interdisciplinary fields such as geochemistry, sequence stratigraphy and sedimentology.

The Subcommission on Ordovician Stratigraphy closely cooperates with the IGCP 735 project “Rocks ‘n’ ROL (Filling knowledge gaps in the Early Palaeozoic Biodiversification” (2021–2025). The co-leaders of IGCP 735 include four Voting Members of the SOS. The second Annual Meeting of IGCP 735 was held in Marrakesh, Morocco, in coordination and collaboration with the Ordovician Subcommission.

4. NATIONAL/REGIONAL/GLOBAL SUPPORT FROM SOURCES OTHER THAN IUGS

Other than time allowed by employers of the Executive and Voting Members to carry out their duties and attend conferences, the Subcommission receives no support from sources other than IUGS.

5. CHIEF ACCOMPLISHMENTS IN 2022

- The official inauguration of the second Auxiliary Boundary Stratigraphic Section and Point (ASSP) for the base of the Ordovician System in the Dayangcha section (Northern China), originally scheduled for May 2020, was postponed first to May 2021, and is currently postponed again to a later date, possibly in 2023 (as the pandemic situation remains unresolved, the organization of the meeting in 2023 is unlikely, and no budget has been foreseen)
- In accordance with ICS Rules, the Voting Members of SOS were replaced in 2020, and the Voting Membership voted to select a new Executive and Voting Members for the term 2020–2024. The Voting Membership was increased to 20. During the covid pandemic, online meetings are organized. The second online business meeting was organized in late March 2022 with most Voting Members attending.
- Following the final meeting of the International Geoscience Programme (IGCP) 653 ‘The onset of the Great Ordovician Biodiversification Event’ and kickoff meeting of the IGCP 735 “Rocks n’ ROL (Filling knowledge gaps in the Early Palaeozoic Biodiversification” organized jointly as a videoconference congress in Lille (France) on September 13th-16th 2021, two thematic volumes were scheduled, for publication in *Palaeogeography Palaeoclimatology Palaeoecology* and in *Geobios*. Both special issues are focused on the Ordovician radiations, and are co-guest-edited by current and former executive officers of the Subcommission. During 2022, numerous contributions were submitted to these two volumes, which will be published in 2023.
- A major accomplishment during 2022 is the online publication in two volumes of the *Geological Society Special Publication* series on a global Ordovician synthesis. Launched by the Ordovician Subcommission in 2021, manuscripts for all chapters have been submitted between January and November 2022. The printed publication is scheduled for Summer 2023.
- The second Annual Meeting of the International Geoscience Programme (IGCP) 735 “Rocks ‘n’ ROL (Filling knowledge gaps in the Early Palaeozoic Biodiversification” took place as a successful in person congress, October 19th–20th 2022, with about 50 participants, with the Ordovician subcommission being a co-organising body. The excursion to the Central Anti-Atlas (October, 21st–24th 2022) coincided with the 3rd National Conference on Moroccan Geological Heritage, in Zagora.
- *Ordovician News* 39 (for 2021) was published in March 2022 and is available from the SOS webpage (<http://ordovician.stratigraphy.org/>).
- The SOS webpage changed its host, and is now managed as a separate page of the webpage of the ICS (<http://stratigraphy.org/>).

6. SUMMARY OF EXPENDITURE IN 2022

(all figures in USD, totals rounded due to exchange rates)

- a) T. Servais' (Chair) expenses (transport by car, accommodation & food: US\$ 730) in meeting B. Lefebvre (Secretary) at Lyon University, France, May 9–11, 2022, to discuss Subcommission duties and the *Geobios* special issue (organization).
- b) T. Servais (Chair) expenses (transport by train, accommodation & food: US\$ 750) and B. Lefebvre (Secretary) expenses (transport by train, accommodation & food: US\$ 750) to participate to editorial meeting with D.A.T. Harper (former Chair) and I.G. Percival (former Secretary) at the Geological Society of London, UK, May 23–24.
- c) T. Servais' (Chair) expenses (transport train, accommodation & food: US\$ 750) in meeting B. Lefebvre (Secretary) at Lyon University, France, September 5–8, 2022, to discuss Subcommission duties and *Geobios* special issue (meeting editor-in-chief).
- d) T. Servais (Chair) expenses (transport flight, accommodation & food: US\$ 1000), B. Lefebvre (Secretary) expenses (transport flight, accommodation & food: US\$ 1200) and A. Stigall's (Internet Officer) expenses (transport flight, train, accommodation & food: US\$ 1200) to attend the 2nd Annual Meeting of IGCP 735 at Marrakesh University, Morocco, October 19 – 20, 2022.

7. SUMMARY OF INCOME IN 2022

Same as next item (ICS was the sole source of income)

8. BUDGET RECEIVED FROM ICS IN 2022

USD 6500

9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2023)

- After previous meetings in Lisbon, Portugal (2013), Graz, Austria (2015), and Milan, Italy (2019), Thomas Servais (Chair) will be organizing the fourth international congress on stratigraphy (Strati 2023) under the auspices of the International Commission on Stratigraphy (ICS). Strati 2023 will take place in Lille, France (July 11–13, 2023). The field excursion to the Ordovician of Estonia (July 15–18, 2023) is co-organized with ISOS 14 (see below). The Ordovician Subcommission has scheduled both a business meeting and a scientific session at Strati 2023.
- Support of the joint ISOS 14 and 3rd Annual Meeting of IGCP 735 to be held in Tallinn, Estonia (July 19–21, 2023), including field excursions to the Ordovician of Estonia (July 15–18, 2023) and Sweden (July 23–26, 2023).
- Data will be gathered for *Ordovician News* 40 (to be published in March 2023).

10. KEY OBJECTIVES AND WORK PLAN FOR THE PERIOD 2020–2024

For further advancement and increased precision in correlation we need to focus on regional stratigraphy, regional scales and regional chronostratigraphic schemes. We recognise that many biotic, chemical and physical changes are not always synchronous, and that local

and regional signals may vary from trends evident in global compilations. This is especially true for the Ordovician, where strong provincialism can mask biostratigraphic-based correlation. Ordovician regional stratigraphy and geology will therefore be the main goal for the period 2020-2024.

- To compile and publish an updated review on Ordovician regional stratigraphy and geology: *A Global Synthesis of the Ordovician System*. Special attention is paid to precise correlation of the Ordovician depositional sequences and sea-level curves as well as stable isotope and regional biodiversity curves. This project was launched in 2021, and manuscripts were submitted in 2022. Two volumes (*Geological Society of London, Special Publications* 532 & 533), each of ~600-800 pages, were compiled during 2022 and will be published in 2023. The realisation of this publication, originally initiated over ten years ago, fulfils the major objective of the Subcommission (2020-2024). The presentation of the volumes is scheduled at ISOS14 in Tallinn, July 2023.
- To better correlate Ordovician depositional sequences throughout the World.
- To design and execute a program of radiogenic dating of key Ordovician horizons (using Pb-Pb isotopes and CA-IDTIMS dating of zircons).
- The Ordovician website will be updated including development of a database for GSSPs and ASSPs.

11. BUDGET AND ICS COMPONENT REQUESTED FOR 2023 (all figures in USD)

1. Support for B. Lefebvre (Secretary) to attend Strati 2023 in Lille, France, July 2023: **\$1200**
2. Support for A. Stigall (Internet Officer) to attend Strati 2023 in Lille, France, July 2023: **\$1500**
3. Support for T. Servais (Chair) to attend ISOS14 and IGCP 735 Annual Meeting in Tallinn, Estonia, July 2023: **\$1200**
4. Support for B. Lefebvre (Secretary) to attend ISOS14 and IGCP 735 Annual Meeting in Tallinn, Estonia, July 2023: **\$1200**
5. Support for A. Stigall (Internet Officer) to attend ISOS14 and IGCP 735 Annual Meeting in Tallinn, Estonia, July 2023: **\$1500**
6. Support for T. Servais (Chair) to SOS business meeting in Lyon, France, September 2023: **\$800**

As in previous years it is envisaged that officers will supplement any aid from the ICS with their own research funds. We have not quantified this support.

TOTAL 2023 BUDGET: 7400 USD

REQUESTED FROM ICS: 7400 USD

Potential funding sources outside IUGS: None.

Subcommission officers are mainly supported by their research projects for most of their activities.

APPENDIX – Current Executive Officers and Voting Members (2020–2024) & contact details

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NEWS AND VIEWS

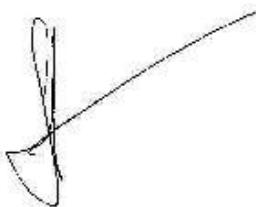


To the leaders of all IUGS committees, commissions, and activities,

The International Union of Geological Science (IUGS) has published its statement in reaction to the invasion of Ukraine by the Russian Federation. Our statement requires that active involvement of scientists from Russian institutions in IUGS groups and activities should cease until further notice. This includes withdrawing the offer to host the International Geological Congress in St. Petersburg, Russia in 2028.

The scientific community in Russia provides highly valuable contributions to the commissions and publications of IUGS. We note that an impressive number of Russian scientists have distanced themselves from their government's decision and we are proud of their courage. Our actions at this time are not personally directed towards our colleagues, but we must firmly oppose the aggressive actions of the Russian government.

This statement was agreed by the IUGS executive in Paris, France on the 18th March 2022.



Professor John Ludden CBE, FRSE, MSA, RAS

President of IUGS

Anticosti Island: a decision in 2023 for its inscription on the UNESCO World Heritage List

Anticosti Island is recognized worldwide for its remarkable record of the first mass extinction of life in the oceans at the end of the Ordovician and the slow recovery of marine life in the early Silurian. An important step was taken towards the recognition of Anticosti Island as a UNESCO World Heritage Site with the submission of a 2,500-page nomination document in January 2022. The specialists of the International Union for Conservation of Nature visited the island in September 2022 to carry out an evaluation. A final decision will be made by UNESCO in September 2023. The International Commission on Stratigraphy and the sub-commissions on Ordovician and Silurian stratigraphy support the nomination of Anticosti Island to the UNESCO World Heritage List as a unique stratigraphic and paleontological site of global significance. No site covering this important period of the Earth history is currently inscribed on the UNESCO World Heritage List. The Anticosti nomination is the result of an important collaborative effort between all levels of government, First Nations, the scientific community, the local population, and many civil society actors. A new research program, with a budget of \$1.4 million over five years, will support projects on various aspects of Anticosti natural heritage, including the stratigraphy and paleontology of the first mass extinction of life at the end of the Ordovician period. This program, which will be in place by May 2023, will cover the salaries of postdoctoral fellows affiliated with universities in Quebec and the costs of conducting field research.

André Desrochers

PROPOSITION D'INSCRIPTION SUR LA LISTE DU PATRIMOINE MONDIAL
QUÉBEC, CANADA



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 in which six volumes have been published (see below). A seventh volume is now planned, 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 this series of *Australasian Palaeontological Memoirs* must be of relevance to Cambrian and/or Ordovician palaeontology. They are not restricted in content to the Australasian region. Systematic studies are welcome. All contributions are peer reviewed and their acceptance is therefore conditional on the content of the manuscript being considered suitable for review and being of appropriate scientific standard. Please adhere to the format of papers published previously in the series (these are readily available on ResearchGate and similar sites). If you wish to submit a manuscript, please e-mail the editor (address below) with its title and the names of the authors. These can be changed at any time up to submission. Deadline 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.

REPORT OF RECENT CONFERENCES

IGCP 735 Second Annual Meeting, Marrakesh, Morocco

19–23 October 2022



Very nice Moroccan weather greeted the 2nd Annual Meeting of the IGCP 735, which was the first in-person edition of the project IGCP 735. This meeting was organised by the Cadi Ayyad University, Marrakesh and hosted in the newly built “Cité de l’Innovation”.



View of the conference venue.

*First row, Khadija El Hariri, organiser of the meeting and field excursion.
(Photograph: Organising committee 2nd A.M. IGCP 735)*

A few words of thanks and presentation of the event introduced the meeting, prior to starting the scientific sessions. Firstly, **Khadija El Hariri**, organiser of the meeting, thanked both the sponsors and the participants. **Bliad Bougadir**, Vice-President of the Cadi Ayyad University, and on behalf of **Moulay El Hassan Hbid**, President of the Cadi Ayyad University, welcomed all the participants and insisted on the importance of the protection and the promotion of the geological and palaeontological heritage of Morocco. **David Harper** (President of the ICS - *International Commission on Stratigraphy*) emphasised the importance and relevance of the IGCP 735 Project, which involves the entire community of researchers and non-professionals working together on the UNESCO mission of protecting and promoting the nations' heritage. **Thomas Servais** (President of SOS – *Subcommission on Ordovician Stratigraphy*) presented the importance of the Fezouata site (elected one of the 100 first sites of the World's Geological Heritage by the IUGS – *International Union of Geological Sciences*) and paid particular attention to the importance of the work that has been produced on the study of the Ordovician. To conclude, **Bertrand Lefebvre** (co-leader of the IGCP 735 Project) thanked warmly the organisers of the meeting.



Group photograph of the delegates at the end of the meeting.
 (Photograph: Organising committee 2nd A.M. IGCP 735)

Over thirty-five participants, representing 17 nations made this meeting a success. Over these two days, a total of 4 keynote lectures and 18 talks were given at the programme.

Day 1. First session. The first keynote speaker, **Javier Ortega-Hernández** has presented his research on the importance of the preservation of the nervous system of the ctenophores and arthropods, in particular, and its evolution during the Palaeozoic. **Abdelfattah Azizi** followed and started the 'regular' talks with the description of microbially induced sedimentary structures in the late Ediacaran-early Cambrian of Morocco. These indicate that the extinction of the Ediacaran biota represents an abrupt evolutionary event linked to environmental changes rather than a gradual reduction of favourable taphonomic conditions. The geological

heritage potential of Zaouit Ouzdine (Moroccan Anti-Atlas) was presented by **Saïd Belkacim**, who also insisted on the importance of working in close relationship with the local population for the preservation of the sites and their sustainability. A Small Shelly Fossils assemblage from the Cambrian of the High Atlas (Morocco) was then described by **Asmaa El Bakhouch**, that enabled to see, in a new light, patterns of biodiversification during the ‘Cambrian Explosion’. The morning session concluded with **Javier Ortega-Hernández** and a presentation on the advantages of CT scans to understand some Early Cambrian fossil organisms from China.



Alycia Stigall, first keynote speaker of the second day of the meeting.
(Photograph: Yves Candela)

Day 1. Second session. The second keynote speaker was **David Harper** who presented a synthesis of his work on Upper Ordovician brachiopod faunas around the Iapetus Ocean, compared with coeval faunas from Morocco. Although the latter are endemic, peri-Iapetus brachiopod faunas are cosmopolitan, emphasising the importance of high diversity regions in biodiversification processes. **Yves Candela** shared his preliminary results on the study of brachiopod faunas from the Fezouata Shale, highlighting their palaeogeographical importance, and also importance in the biodiversification of the group in the Lower Ordovician along the Gondwana margin. In the next talk, **Michał Mergl** presented rich and taxonomically diversified linguliform brachiopod faunas from the Lower Ordovician of the Prague Basin, which could constitute the “Paradise” for brachiopods. **Rosemary Rogal** talked about her study on brachiopod shells protegulum, taking dalmanellid brachiopods from North America as examples. An unusual brachiopod association comprising strophomenates and tube-shaped phosphatic fossils was presented by **Colin Sproat**. This association played a role in the evolution of shallow water marine communities that developed during the Ordovician. **Alycia Stigall** then closed this series of talks on Ordovician brachiopods with her research on factors that influenced the diversification of brachiopods during the Lower and Middle Ordovician of Oklahoma in the USA. **Rutt Hints** closed the afternoon session and the first

day of talks with her study on phosphorite trace elements in the Baltic palaeo-basin during the Lower Ordovician.

Following a warm acknowledgement of the day's speakers, the meeting of the IGCP 735 project summarised its activities past and future. The 9th International Brachiopod Congress (IBC) that was scheduled for 2023 in Berlin, and now definitively cancelled, will be held in Canada in **June 23-28**, 2024. It will be organised by **Brock University, St. Catharines**. The main theme will be "**Brachiopods: Sentinels of the Phanerozoic**". More information to follow: website <www.9th-IBC/CIB 2024.ca> and e-mail address: 9brachiopodcong@brocku.ca. Both volumes on the Ordovician of the World (*A Global Synthesis on the Ordovician System*) – not published yet, but in an advanced stage of preparation – were foreshadowed by David Harper and Thomas Servais.

Day 2. First session. Third keynote speaker, **Alycia Stigall** presented a synthesis on the current knowledge regarding palaeobiogeography during the Ordovician, highlighting new methods that enable a more robust analytical approach. **Olle Hints** studied the isotopic composition of Ordovician conodonts from the Eastern Baltic Region, as an important archive for ocean temperature curves and its use to resolve problems of palaeoecology and palaeobasins development. **Wallace Leatham** discussed the effect of the Ordovician biodiversification on carbonate deposits, characterised by micrite-depleted carbonates. For the next presentation, the schedule had to be altered (B. Schmitz had to cancel his participation on health grounds): **Allison Daley** presented some of the research activities of her laboratory in Lausanne on the Fezouata Lagerstätte. After this last talk of the session, **Olle Hints** introduced the 3rd Annual Meeting of the IGCP 735 (in conjunction with the 14th Meeting of the ISOS) that will take place in Tallinn (Estonia) between the 19th and the 21st July 2023. More information available on the meeting's website <isos14.org>

Day 2. Second session. Fourth and last keynote speaker, **Thomas Servais** gave an overview of the Great Ordovician Biodiversification of terrestrial plants and concluded that these have not been affected by the End Ordovician mass extinction. **Sofia Pereira** presented a talk on the palaeogeographical position of Belgium, during the Ordovician, on the basis of trilobite data. **Sofia Pereira** then read, on his behalf, the presentation prepared by Juan Carlos Gutiérrez-Marco (absent due to health problems) on Ordovician trilobite faunas from Tunisia and Libya. **Christophe Dupichaud** presented the three morphotypes of solutan echinoderms in the Fezouata Shale. These correspond to a transitional assemblage between Cambrian solutan faunas and those from the Ordovician. A strong affinity with other peri-Gondwanan assemblages was noted. **Javier Ortega-Hernández** presented, in his absence, **Karma Nanglu**'s talk on the discovery of an aggregation of *Rhabdopleura*-like pterobranchs in the Fezouata Shale. To close the meeting, **Jared Richards** presented the typicity of the Fezouata Biota.

This meeting ended with the traditional gala dinner (chez Ali).



Group photograph during the field excursion – Lower Ordovician Fezouata Shale Lagerstätte (Photograph: Organising committee 2nd A.M. IGCP 735).

The following morning, most of the participants to the IGCP 735 meeting met at the entrance of the Cité de l’Innovation and this group split into three minibuses, and made their way to Zagora, Drâa-Tafillalet Region, in the south-east of the Kingdom. This trip made the most of the itinerary to halt at geologically interesting stops. First stop, at the Assanfou Inn in Tizi n’Tichka revealed the lower Cambrian-middle Cambrian transition characterised by the presence of the calcareous horizon of the “Brèche à Micmacca”. This horizon is very fossiliferous and has yielded trilobites, acrotretoid and rhynchonelliform brachiopods, helcionelloids, hyoliths and many groups of echinoderms, and chancellorids. A few kilometers further we passed the Tizi n’Tichka (2260 m) – pasture pass in Tamazight language.



Brèche à Micmacca (Cambrian), Assanfou.
(Photograph: Organizing committee 2nd A.M. IGCP 735).

Our second stop was there, and we were able to observe the transition between the middle Cambrian (“Schistes with *Paradoxides*”) and the Lower Ordovician (upper part of the Fezouata Shale – Floian). The transition is marked by an unconformity and the absence of both the Tabanite Sandstone that characterise the top of the middle Cambrian, and the lower part of the Fezouata Shale (Tremadocian). The third stop (Amane n’Tourhart) was located about 25 km passed Ouarzazate. We stopped to observe a remarkable site with Ediacaran stromatolitic limestones. The rest of the journey to Zagora (130 km) was undertaken without stopping.



Ediacaran stromatolites, Amane n’Tourhart.
(Photographs: Khadija El Hariri [left], Yves Candela [right])

The following day, the 3rd Edition of the National Day of Geological Heritage of Morocco, under the theme “African Geoparks” took place at the “Maison de la Culture” in Zagora. The organisation of this event in Zagora was chosen in honour of Zezouata, which site at Jbel Tizagzaouine, was chosen among one of the 100 Geological Heritage Sites designated by the IUGS. Local authorities, scientists and civil society contributed to the success of this day of talks and discussions. Emphasis was made on the importance of the rich and diverse heritage of the Zagora area. The day concluded with a Gala Dinner (bivouac) organised by the Regional Council of Zagora, with a “Star Party” hosted by the Atlas Dark Sky Foundation.



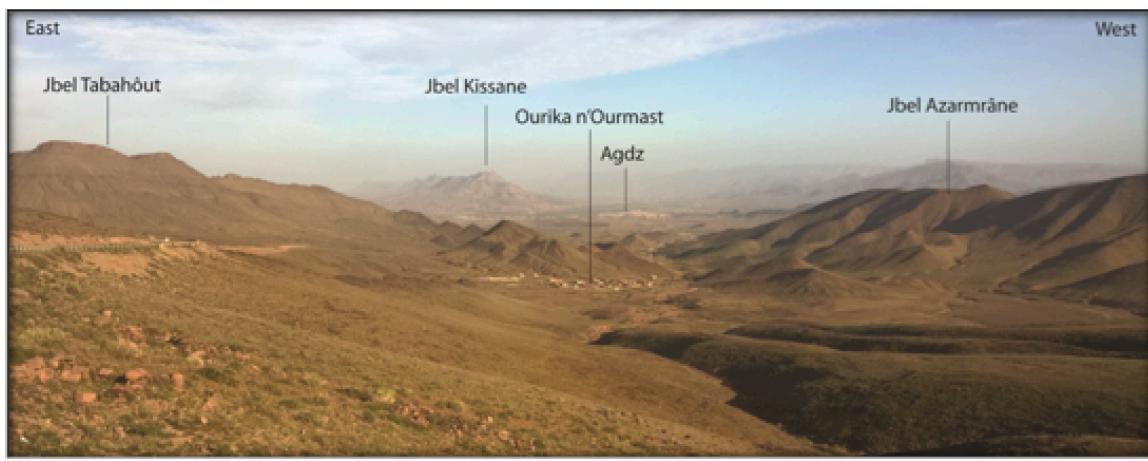
Star party and dinner near Zagora (Photographs: Khadija El Hariri)

During the second day of the excursion, we drove about 25 km NNE of Zagora to observe the End Ordovician (Hirnantian) glacial activity and its impact on the landscape morphology. In the afternoon, after going back to Zagora, we concluded our trip to the NNW, towards Beni Zoli and Bou Izargane, then north towards Jbel Tizagzaouine. Our destination was this site of the Fezouata Shale, where most of participants to this trip have never been before. After a couple of hours on site, the sun set was ushering us back to Zagora.



Sunset on the Ternata Plain, North of Zagora (Photograph: Yves Candela)

The following day, return journey to Marrakesh. On the way we stopped to admire the panorama, west of Jbel Kissane encompassing the lower Cambrian to the Middle and Upper Ordovician of the First Bani Formation.



Panoramic view with Cambrian and Ordovician exposures, W of Agdz.
(Photograph: Abderrahmane Soulaimani).

Yves Candela, Bertrand Lefebvre & Khadija El Hariri

6th International Palaeontological Congress, Khon Kaen, Thailand

7–11 November 2022



After previous successful editions in Australia (Sydney, 2002), China (Beijing, 2006), the UK (London, 2010), Argentina (Mendoza, 2014), and France (Paris, 2018), the 6th International Palaeontological Congress was organized in Khon Kaen, Thailand. IPCs are the official meetings of the International Palaeontological Association (IPA), and the major events for palaeontologists from different countries, disciplines, generations to meet and discuss. The 6th edition included 5 days of indoor sessions in Khon Kaen (Thailand) and several field excursions in Thailand and neighbouring countries.

Over 400 participants from 40 countries gathered in Khon Kaen for the 6th International Palaeontological Congress. During a full week of indoor sessions over 350 presentations (keynotes, talks, and posters) organized into 34 scientific thematic sessions were proposed. The IGCP 735 organized two scientific sessions. The first one (session 27), which was dedicated to "*Recent advances on metazoan diversifications from Early Palaeozoic Lagerstätten*", included 1 keynote, 16 talks and 8 poster presentations. The second one (session 28) was co-organized with IGCP 668, and it was entitled "*Freedom to breath: integrating the evolution of animals and their environments during the Early Palaeozoic*". This session comprised 1 keynote, 19 talks and 4 posters.



Group photograph (Organizing committee, IPC6).



IGCP 735 Session

Recent advances on metazoan diversifications from Early Palaeozoic Lagerstätten

The IGCP 735 session during the IPC6 in Khon Kaen Thailand included numerous talks on Cambrian and Ordovician Lagerstätten. Sarah M. Jacquet gave a keynote on helpful new imaging and microanalyses techniques when investigating Lagerstätten. The session included talks on (1) ontogenetic factors controlling preservation, (2) recent advances from the Cambrian Sirius Passet (Northern Greenland), (3) the depositional environment of the Cambrian Chengjiang Biota (China), (4) trace fossils in Burgess Shale-style Lagerstätten, (5) a new Cambrian polyp, (6) a new medusoid from the Cambrian Burgess Shale (Canada), (7) a mid-Cambrian tunicate, (8) the timing of panarthropod divergence, (9) the oldest hurdiid radiodont from the Cambrian of China, (10) the ventral morphology of arthropods from the Chengjiang Biota, (11) revisiting the evolution of Conciliterga, (12) the functional diversity and structure of Cambrian ecosystems, (13) Arthropods from the Ordovician Fezouata Biota (Morocco), (14) Radiodonts from the Ordovician Fezouata Biota, and (15) community assembly in the Fezouata Biota. Numerous scientific discussions happened during the questions part. The session ran smoothly, with particular attention to diversity and inclusion.

Farid Saleh



Orla Bath Enright giving a talk on ontogenetic factors controlling preservation
(Photograph: F. Saleh).

CONFERENCE ANNOUNCEMENTS



4th Palaeontological Virtual Congress

8–22 May, 2023

Website: <http://palaeovc.org/>

Description: The increasing use of virtual platforms to communicate science encouraged us to create the 1st Palaeontological Virtual Congress in December 2018, followed by the second edition in May 2020, and the third edition in December 2021. The three initial editions were a success, so we are glad to present the fourth edition of the Palaeontological Virtual Congress. Our purpose is to spread, worldwide, the most recent scientific advances in palaeontology in a fast, easy and economical way.

Our initiative was pioneering in palaeontology, being the first exclusively virtually developed conference in our field. In these challenging times, online platforms have gained great relevance and are key to keep up the drive for science communication among peers and enthusiasts. This year we did not want to miss the opportunity of offering you this platform so you can share your amazing research with the world, either by oral communications or slides presentations.

Even when online meetings are the norm, our main aim is still the same: to give international projection to the palaeontological research carried out by groups with limited economic resources, as well as to promote the participation of palaeontologists from developing countries around the world. And this is reflected in our low-cost registration fees. In order to reach out as widely as possible to researchers with fewer resources, this year, as in the previous edition, we have created a social fund for participants from low and lower-middle income countries listed as such by The World Bank.

Additionally, to increase the range and diversity of nationalities and areas of expertise, this year we are renewing the figure of ambassadors, for those participants who wish to advertise us among their colleagues in their country and/or specialty. We also continue with the Discord server with multiple text and voice channels so you can give and receive feedback to and from your peers. We all miss seeing each other as we used to in conventional meetings, here you will be able to develop your networking skills and talk to other.

In this new edition we are going to present a new website design, and we are also developing an APP so you can enjoy the congress comfortably from your favourite mobile or tablet, the 1st PVC Photography Contest, and the 1st PVC Palaeoart Contest... and many more surprises!

The 4th Palaeontological Virtual Congress combines the benefits of traditional meetings (i.e., providing a forum for discussion, including guest lectures, and the production of an abstract book, among other features) with the advantages of online platforms, which allow a

wider reach around the world. We would love to have you here sharing your research, engaging in exciting discussions, and enjoying other peers' works.

Organising Committee: Vicente D. Crespo, María Ríos Ibañez, Fernando Antonio Martín Arnal, Penélope Cruzado-Caballero, Alba Sánchez García, Javier González-Dionis, Rosalía Guerrero-Arenas, Evangelos Vlachos and Arturo Gamonal.

Important dates:

- Deadline for virtual field trips proposals: April 15th, 2023
- Deadline for abstract submission: March 22nd, 2023
- Deadline for regular registration: No limit
- Deadline for submitting the images to the contests: April 1st, 2023



***Filling Gaps in Ordovician Palaeontology
(IGCP 735 session at PVC4)***

Description: Our understanding of the pattern and tempo of the initial diversification of metazoans in Early Palaeozoic times is more challenged than ever, with raising questions about the accuracy and completeness of the current sets of available palaeontological data and environmental proxies. This session, organized by the UNESCO/IGCP 735 “Rocks and the Rise of Ordovician Life” (Rocks n’ROL) primarily aims at filling the numerous knowledge gaps related to various aspects of the Ordovician diversification: obviously, data gaps within the period from the preceding Cambrian explosion to the post-Hirnantian Silurian recovery do exist, but also major regional biases in knowledge/data during the Ordovician itself, e.g. from Africa, South America, the Near and Middle East, southeastern Asia, Siberia. This session is not restricted to talks on palaeo(bio)geographic and stratigraphic gaps, but it also welcomes all presentations contributing to enhance knowledge on less investigated or poorly known aspects of Early Palaeozoic diversifications related to e.g. taphonomic gaps, reef communities, trace fossils, and the early colonization of continental environments by plants and animals.

Organisers: Yves Candela, Khadija El Hariri, Mansoureh Ghobadi Pour, Bertrand Lefebvre, Elena Raevskaya, Oive Tinn, Beatriz Waisfeld and Wang Wenhui.



4th International Congress on Stratigraphy

strati 2023

11th -13th July 2023, Lille, France

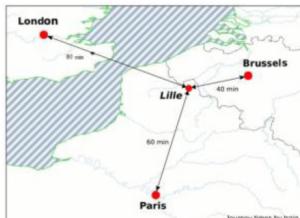
Following the 1st congress in Lisbon (Portugal) in 2013, and additional congresses organized in Graz (Austria) in 2015 and Milan (Italy) in 2019, the 4th International Congress on Stratigraphy STRATI 2023 will be held in Lille, France, 11th-13th July 2023.

Venue: The indoor sessions with keynote talks and regular lectures (partly scheduled online) will take place in the new Congress Centre of Lille University ‘Lilliad’ on the Campus of the *Cité Scientifique* (Science Campus) at Villeneuve d’Ascq (15 minutes by metro from Lille city centre). They are scheduled from Tuesday, July 11th to Thursday, July 13th 2023. Plenary and parallel sessions will take place, with numerous workshops and business meetings in smaller rooms available to all subcommissions of the ICS.

Location: Lille, capital of the French Flanders, is located in the northernmost part of France. It is very convenient to travel to one of the major international airports in Paris (France), Brussels (Belgium), or London (UK). High speed train connections are regular and very practical, with very short travel times to Lille. Hotels and restaurants are available in all price categories, mostly in walking distance from the metro and train stations.



Palais des Beaux Arts



90 minutes from London
60 minutes from Paris
45 minutes from Brussels



Lille ‘Place Général de Gaulle’

Congress Website: <https://strati2023.sciencesconf.org>

Language: English will be the official language of the meeting and the field trips.

Scientific sessions: General scientific themes will be mostly organized as plenary sessions, but parallel sessions will also be scheduled, as well as poster sessions. The following scientific sessions have been proposed covering a wide range of stratigraphic topics. For more detailed information visit the congress website: <https://strati2023.sciencesconf.org>

Subcommission Sessions:

- SC1: Time-scale calibration
- SC2: The Anthropocene: stratigraphical concepts and evidence
- SC3: Developments in Quaternary chronostratigraphy

- SC4: SNS Neogene stratigraphy and palaeoceanography
- SC5: Advances in Paleogene research
- SC6: Integrated stratigraphy and GSSPs of the Cretaceous System
- SC7: Cretaceous palaeoceanography, palaeogeography, biota, climate change and critical events
- SC8: The Jurassic: events, correlation and timescale
- SC9: Triassic integrated stratigraphy, GSSPs, and extreme climatic, environmental and biotic events
- SC10: Correlation of glacial events and extinctions: the Permian and beyond
- SC11: Stratigraphy of the Carboniferous world
- SC12: Devonian palaeoenvironments and time
- SC13: New stratigraphic insights into the Silurian story
- SC14: Ordovician: correlation of events
- SC15: Cambrian stratigraphy, palaeontology and depositional dynamics
- SC16: Tonian to Cryogenian stratigraphy, palaeobiology and Earth system change
- SC17: The Early Precambrian: a chronology of invisible time
- General Sessions:
- GP1: Advances in cyclostratigraphy – reconstructing geological time, palaeoclimate, and the Solar and Earth-Moon systems
- GP2: From rock to time: evolutionary lineages and the calibration of the Chronostratigraphic Scale
- GP3: Quantitative stratigraphic analysis using databases
- GP4: Palynology as a tool in multidisciplinary research: advances and applications (Aramco – CIMP sponsored session)
- GP5: Integrated stratigraphy: methods and concepts
- GP6: Ecostratigraphy *vs.* biostratigraphy *vs.* sequence stratigraphy
- GP7: Miscellaneous session

Depending on the number of oral presentations proposed, it is possible that the session organizers and the organizing committee may request poster presentations instead of oral presentations. For abstract submission, please, visit the congress Website:

<https://strati2023.sciencesconf.org>

Plenary lectures: The program of the plenary lectures will be available on the congress website in May 2023. The following key-notes are scheduled:

- Laia Alegret (Zaragoza, Spain): Global events of the Paleogene
- Lucia Angiolini (Milano, Italy): Carboniferous-Permian environments and climate
- Steven Holland (Athens, GA, USA): Stratigraphic palaeobiology
- Michael Joachimski (Erlangen, Germany): Chemostratigraphy
- Jacques Laskar (Paris, France): Astronomy and stratigraphy
- Christopher Scotese (Evanston, IL, USA): Phanerozoic geography and climate

Workshops and group meetings: Two workshops are scheduled, and participation is free, but registration is mandatory for those who want participating (space limited).

- WS1: OneStratigraphy Database and Constrained Optimization (CONOP) analysis
- WS2: Radio-isotopic dating

Group meetings are possible, with smaller rooms available for all ICS subcommissions (and other groups) that wish to organize their official business meetings. Please, contact the organizers to book a room.

Social activities and conference dinner: Social activities include the icebreaker party and reception on Monday July 10th, as well as a visit to the Natural History Museum Lille.

The conference dinner will be organized on Wednesday, July 12th, at the Hermitage Gantois, an ancient hospice (a former charitable almshouse) of the late 15th Century, located in the city centre of Lille, in walking distance from the railway station. The reception and dinner will take place in the “Salle des Hospices” the historical main caring room.



Musée d'Histoire Naturelle



Salle des Hospices



Hospice Gantois

Excursion: Several pre- and post-conference excursions and one-day field trips are scheduled to take place before and after the indoor meeting:

- Pre-congress excursion 1: Wednesday July 5th to Sunday July 9th 2023

British Classics: Hutton's Unconformity, Palaeozoic of Northumberland & Jurassic of the Yorkshire Coast, UK.

- Pre-congress excursion 2: Thursday July 6th to Saturday July 8th 2023

Classic Mesozoic (Cretaceous) successions of the Vocontian Basin (SE France), containing several GSSPs.

- One-day field trip to Upper Jurassic of the French ‘caps’ (opposite the cliffs of Dover): Monday, July 10th
- One-day field trip to the ‘Tertiary’ of Flanders, Belgium, Ypresian and Rupelian (Paleogene): Friday, July 14th
- Post-congress excursion 3: Friday July 14th to Sunday July 16th 2023

Belgian Classics: Devonian-Carboniferous of southern Belgium and northern France.

- Post-congress excursion 4: Saturday July 15th to Tuesday July 18th, 2023

Ordovician of Estonia (pre-conference excursion of the International Symposium of the Ordovician System in Tallinn, Estonia)



Cretaceous cliffs of the Cap Blanc Nez – *Côte d'Opale*



Devonian type section of Givet, Meuse Valley

Registration fees: Attention, due to limited space and for security reasons, the congress is limited to 300 participants (and the conference dinner to 180). Workshops are free, but with limited numbers of participants.

Excursions are scheduled with a minimum and a maximum number of participants.

- **Conference Registration**

Full registration ca 380 € (early) ca 450 € (late) ca 520 € (on site)

Reduced (students, etc.) ca 200 € (early) ca 250 € (late)

Registration includes congress documents, morning and afternoon coffee breaks and lunches, ice-breaker party and social events.

- **Conference Dinner:** Hermitage Gantois Hospice (Wednesday July 12th): 85 €.

- **Excursions:** Costs include all accommodation and restaurants (as specified), field guide and transport from and to meeting point (travel to Newcastle, Lyon and Tallinn is not included).

- Pre-excursion 1: British Classics ca 580 € (5 days), from and to Newcastle, UK

- Pre-excursion 2: Cretaceous of France ca 450 € (3 days), from and to Lyon, France

- One-day field trip: Upper Jurassic coast ca 95 € (1 day), from and to Lille, France

- One-day field trip: Belgian Paleogene ca 120 € (1 day), from and to Lille, France

- Post-excursion 1: Belgian Classics ca 550 € (3 days), from and to Lille, France

- Post-excursion 2: Ordovician of Estonia ca 300 € (4 days), from and to Tallinn, Estonia

Important dates

- July 2022: 1st Circular issued
- September 30th 2022: Deadline for proposals of sessions and workshops
- December 2022: 2nd Circular issued
- February 28th, 2023: Abstract submission and registration deadline
- May 1st 2023: Distribution of Final Circular with Programme

The third circular will be distributed in May 2023 and will provide information about the conference programme and scientific sessions

From rock to time: evolutionary lineages and the calibration of the Chronostratigraphic Scale (General Plenary Session)

Description: The Chronostratigraphic Scale has been under construction for more than 200 years. By the integration of multidisciplinary high-resolution studies, and the correlation of pervasive markers, the chart has evolved through times aiming to follow a global process of standardization. However, what we see is the result of different subcommissions specifically focused on the different systems of the Phanerozoic. As such, specialists of definite temporal frames hardly go beyond their time slice. The proposed session aims to bring together apparently unrelated diverse lines of investigation on diverse fossil groups of different time frames in order to define, discuss, combine and compare through a long time slice the potential of evolutionary lineages in the fine tuning of the Chronostratigraphic Scale. The general session title is intended to be broadly interpreted by researchers on evolutionary biology, biostratigraphy and chronostratigraphy to contribute to an integrated understanding of the geological time. Our intention is to publish a collection of papers resulting from the proposed session as a special issue of a peer-reviewed journal with a high impact factor. We hope that such a high-profile session will culminate by uniting researchers with various backgrounds and that the resultant publication will provide the necessary impetus to continue or embark on new research and to encourage future collaborations among colleagues.

Organisers: Annalisa Ferretti, Marco Balini and Thomas Servais.

14th International Symposium on the Ordovician System

July 15–26, 2023; Estonia and Sweden

in conjunction with
The 3rd Annual Meeting of IGCP 735 and
STRATI-2023 Ordovician Excursion



Second Circular

The 14th International Symposium on the Ordovician System will take place in Tallinn, Estonia, with field trips in Estonia and Sweden. ISOS-14 marks the return of the major event for all friends of the Ordovician System to Baltica after 41 years. Welcome to Estonia and Sweden in July 2023!

Tõnu Meidla and Olle Hints
on behalf of the organisers



Schedule and deadlines

April 1, 2023	Deadline for short papers and abstracts Deadline for paying the regular conference fee
June 2023	Distribution of the Third Circular
July 14, 2023	Arrival in Tallinn (for pre-conference excursion)
July 15-18, 2023	Pre-conference excursion: Ordovician of Estonia
July 18, 2023	Registration and Ice Breaker in Tallinn
July 19-21, 2023	Scientific sessions, Conference Dinner
July 22, 2023	Travel from Tallinn to Stockholm for the Post-Conference Excursion
July 23-26, 2023	Post-conference excursion: Ordovician in Sweden
July 27, 2023	Departures from Stockholm



**TAL
TECH**



REPUBLIC OF ESTONIA
GEOLOGICAL SURVEY



About Estonia

Estonia is located in northern Europe between Finland, Russia, Latvia and Sweden. With an area of 45,000 km² and a population of ca 1.3 million, it is one of the smallest countries in Europe. The official language is Estonian, a Fenno-Ugric language spoken by 1.1 million people. Estonia is a member of the European Union, the Eurozone, NATO, the OECD, and the Schengen Visa Area.

Estonia is renowned for its economic and social freedom, sound education system, high level of digitisation and government e-services. The capital of Estonia is Tallinn, famous for its UNESCO World Heritage medieval old town. Tartu, the second largest city in the country, is best known for its university, established in 1632. Find out more at: <https://estonia.ee>, <https://www.visitestonia.com>.

Travel options

Tallinn can be reached from many European cities by direct flights or via nearby larger airports, particularly Helsinki, Stockholm and Riga. From Scandinavia and Central Europe, Estonia is also reachable by car or bus. For details, please consult: <https://www.visitestonia.com/en/travel-here-around/travel-to-estonia>

Please check if you need a visa for Schengen Area and contact the organisers in advance should you need an official invitation.

Conference venue

The scientific sessions will take place at the Astra Building of Tallinn University, located in Tallinn City Centre (address: Narva mnt 29), within walking distance from the historical Old Town, various hotels, restaurants, and the Baltic Sea.

Accommodation

Conference participants are responsible for arranging accommodation for the entire period of stay, including the pre-conference excursion. A special price is offered for the participants in a few hotels close to the conference venue (5-10 min walk) until April, depending on availability:

- (1) Hestia Hotel Seaport, book with promo code "ISOS-14" on [this link](#).
- (2) Hestia Hotel Europa, book with promo code "ISOS-14" on [this link](#).
- (3) Tallink City, book at <https://hotelbooking.tallink.com> and use promo code "ISOS-14".
- (4) Nordic Hotel Forum, book at the hotel website with event code "ISOS-14".

Additionally, budget accommodation is available in Academic Hostel. The special price for a twin room is €38 (no breakfast included). Please use the keyword "ISOS-14" during the booking via their website before April 1st, 2023. Note that the hostel is ca 30 min by public transport from the conference venue. However, it is located within the Tallinn Technical University (TalTech) campus, and during the pre-conference field trip, the bus will stop near the hostel.

Various other hotels and other types of accommodation in Tallinn are available on booking systems (such as <https://booking.com>), with the price range from €50 to above €250 per night.

Registration fees

Regular Conference Fee Covers abstract volume, ice breaker, coffee-breaks and lunches. To be paid until April 1, 2023.	EUR 400
Student Fee To be paid until April 1, 2023.	EUR 250
Late Conference Fee If paid after April 1, 2023.	EUR 550
Conference Dinner	EUR 75
Pre-conference excursion: Ordovician of Estonia (July 15-18, 2023) Includes guidebook, transportation, field lunches (accommodation in Tallinn should be booked by participants separately). The number of places is limited.	EUR 300
Post-conference excursion: Ordovician of Sweden (July 23-26, 2023) Includes guidebook, lunches, and accommodation. The number of places is limited. Late price (if paid after April 1, 2023)	EUR 600 EUR 700

For registration and payment, visit conference website: <https://isos14.org>

Payment options

Credit card payments are preferred, the details are available at the conference website: <https://isos14.org>.

An invoice for bank transfer can be provided upon request. Please indicate the keyword "ISOS14" and the names of participant(s) in the payment description, and ensure that the payment will be without charges to the beneficiary.

Cancellation

Refunds of 50% of the conference and excursion fees will be paid if the cancellation is received before July 1, 2023. No refunds are possible after this date. In case of unlikely cancellation or postponing the meeting due to global health or security crisis, the fees will be returned.

Support

Limited support to young researchers from the IGCP 735 will be possible; please contact the conference secretary for further details. Note that only participants with presentations will be considered for support.

On-site Registration and Icebreaker

Registration desk will be opened at the conference venue (Astra Building of Tallinn University, Narva mnt 29, Tallinn) in the afternoon of July 18, 2023. Icebreaker will take place in the same location.

Conference dinner and spouse activities

The conference dinner will take place on July 20, 2023, in Tallinn City Center. Note that the Conference Dinner is not included in the registration fee.

Spouse activities will be organised for the period of scientific sessions if there is interest. Please indicate your interest in the registration form.

Short papers and abstracts

The conference volume will be published in the *Estonian Journal of Earth Sciences*, a Scopus-indexed Open Access journal. Participants are invited to submit short papers (4 printed pages) on any aspect of the Ordovician System worldwide. The manuscripts will be

peer-reviewed and, upon recommendation, published as regular 'Short Communication' papers of the journal. All short papers will receive a DOI identifier, become openly accessible at the journal website according to Creative Commons Attribution (CC BY) licence. They will be indexed in Scopus, Web of Science, Google Scholar and other services.

Please prepare your manuscript using the 'short paper template' that is available on the conference website: <https://isos14.org/Presentations.html>. NB! No article processing fees apply to the conference volume contributions and colour images are printed free of charge.

Alternatively, participants may submit abstracts (1 printed page), but note that these will not be indexed in SCOPUS and other citation databases as publications. No illustrations, references and acknowledgements are allowed in abstracts. Use the 'abstract template' file to prepare your abstract: <https://isos14.org/Presentations.html>

Short papers and abstracts should be sent by email to isos14@ut.ee by April 1, 2023.

Presentations

Regular oral presentations are limited to 15+5 minutes, and keynote talks to 35+5 minutes. Slides should be prepared in MS PowerPoint (.ppt, .pptx) or pdf formats and delivered to the organisers during on-site registration.

Posters will be displayed during the entire conference and presented during the poster session. Please prepare your poster in A0 format, preferably in portrait orientation. It is possible to print your poster in Tallinn and deliver it to the conference venue by the organisers. Printing usually costs ca EUR 20, depending on speed and paper type. Please contact the printing office at TalTech campus for further information and orders: akadeemia@koopia.ee.

Excursions

The conference will be preceded by an excursion in Estonia introducing classic Ordovician successions in the eastern Baltic region and a post-conference field trip in Sweden.

Please note that the number of places is limited on both excursions. The places are reserved in the order of registration and kept only if the fee is paid before April 1, 2023. The pre-conference excursion is also an official excursion of the STRATI-2023 Conference.

Pre-conference excursion: Ordovician of Estonia (July 15-18)

The 4-days excursion will focus on the Ordovician succession of northern and central Estonia. The fee EUR 300 includes travel, lunches and excursion guidebook. Please note that participants are responsible for arranging accommodation for the entire period of the excursion in Tallinn. The maximum number of participants is limited to 60.

The stops to be visited include coastal cliffs exposing uppermost Cambrian to Upper Ordovician siliciclastics and limestones, and active quarries and opencast mines for limestone and oil shale. Additionally, selected drill cores from central and southern Estonia piercing the entire Ordovician sequence will be shown at the Geological Survey's core study facility.

More information and map of the sites is available at <https://isos14.org/Excursions.html>

Schedule in brief (some sightseeing and cultural stops to be added):

Day 1 (Saturday, July 15)

- Pakerort Cliff, Pakri Peninsula (mid-Cambrian to Early Ordovician siliciclastics)
- Uuga Cliff, Pakri Peninsula (Floian to Darriwilian sandstones and limestones)
- Madise escarpment (Sandbian marly limestones)
- Põõsaspea Cliff (Sandbian limestones, Kinnekulle K-bentonite)

Day 2 (Sunday, July 16)

- Harku Quarry (Darriwilian limestones)
- Vasalemma Quarry (topmost Sanbian limestones with organic buildups)
- Sutlema Quarry (Katian lime-mudstones)
- Reinu Quarry (latest Katian to earliest Rhuddanian limestones)



Reinu Quarry (Hirnantian reefs).

Day 3 (Monday, July 17)

- Kunda clay quarry (Terreneuvian clay)
- Kunda-Aru quarry (Darriwilian limestones)
- Põhja-Kiviõli opencast mine (Sandbian limestones and kukersite oil-shale)
- Ontika-Valaste Cliff (Mid-Cambrian to Early Ordovician siliciclastics)

Day 4 (Tuesday, July 18)

- Ordovician drill cores at the Arbavere research centre (Full Ordovician succession from subsurface sections in central and southern Estonia)
- Nõmmeveski riverbank outcrop (Tremadocian to Darriwilian siliciclastics and carbonates)
- Jägala waterfall (Tremadocian to Darriwilian siliciclastics and carbonates)
- Iru outcrop (Tremadocian sandstones with shelly phosphorite)

Post-conference excursion: Ordovician in Sweden (July 23-26)

The 4-days excursion will focus on the Ordovician successions of Västergötland (southwest Sweden) and the Siljan district (central Sweden). The preliminary costs are **EUR 600** (includes bus travel, four field lunches, three dinners, and accommodation for three days during the field excursion) and **EUR 700** for late registrations after 1st April.

The excursion will start from Uppsala. Please note that participants are responsible for arranging accommodation for the night before the excursion (22 to 23 July) and the day/days following the excursion (26 July onwards). A variety of hotels and other types of accommodation are available in Uppsala at <https://booking.com> with a price range from EUR 50 to EUR 200 per night.

The maximum number of participants is now limited to 18. NOTE! At the moment too few participants have indicated interest for the post-conference excursion to be feasible. A final decision regarding the realisation of the field trip will be made after 1 April. Details on payment and final schedule will be given at that stage if the excursion will still be arranged.

Schedule in brief

Day 1 & 2 (Sunday, July 23 and Monday, July 24)

Uppsala to Västergötland. Stops at Mt Kinnekulle with the condensed Middle Ordovician limestone succession, and the Hirnantian at Mt Billingen. Overnight at Skara and Filipstad.

Day 3 & 4 (Tuesday, July 25 and Wednesday, July 26)

Stops at the Kårgärde and Fjäcka localities which have several of the Swedish Ordovician type sections units. Several quarries with Boda Limestone carbonate mounds will be visited. Overnight at Siljansnäs, return to Uppsala Wednesday afternoon.

Visit geological collections

In Estonia

Large collections of Baltic Ordovician fossils and rocks are kept at the Department of Geology of Tallinn University of Technology, at the Estonian Museum of Natural History and at the Natural History Museum, University of Tartu (in Tartu, 180 km south of Tallinn). Participants of the conference are welcome to arrive earlier or leave later, in order to study these collections. Please contact the corresponding curators at your earliest convenience, but no later than May 1, 2023, to ensure the availability of the material. Data on many collection specimens, samples, localities etc have been digitised and made accessible online in the national geoscience data portal: <https://geoloogia.info>. Contact:

- Ursula Toom, Department of Geology, Tallinn University of Technology (ursula.toom@taltech.ee)
- Mare Isakar, Natural History Museum, Tartu University (mare.isakar@ut.ee)
- Karin Truuver, Estonian Museum of Natural History (karin.truuver@loodusmuuseum.ee)

In Sweden

The main collections of Swedish Palaeozoic fossils and rocks are kept at the Museum of Evolution at Uppsala University, the Swedish Geological Survey (also in Uppsala) and the Swedish Museum of Natural History in Stockholm. Participants of the conference are welcome to study these collections. Please contact the corresponding curators at your earliest convenience, but no later than May 1, 2023, to ensure the availability of the material. Contact:

- Jan Ove R. Ebbestad, Museum of Evolution, Uppsala University (jan-ove.ebbestad@em.uu.se)
- Linda Wickström, Geological Survey of Sweden (Linda.Wickstrom@sgu.se)
- Jonas Hagström, Swedish Museum of Natural History, Stockholm (jonas.hagstrom@nrm.se)

Scientific committee

- David A. T. Harper (Durham University)
- Lars Holmer (Uppsala University)
- Petr Kraft (Charles University)
- Thomas Servais (CNRS-Université de Lille)
- Zhan Renbin (Nanjing Institute of Geology and Palaeontology)

Organising committee

- Tõnu Meidla, chairman (University of Tartu)
- Olle Hints, vice chair (Tallinn University of Technology)
- Oive Tinn, secretary (University of Tartu)
- Leho Ainsaar (University of Tartu)
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- **Jan Ove Ebbestad** (post-conference excursion): jan-ove.ebbestad@em.uu.se

<https://isos14.org>

11th European Conference on Echinoderms (ECE11)
Lyon, France
16–20 October 2023

Website: <https://ece11.univ-lyon1.fr/en/pages/ece-11-2023-home>

Description: After previous successful editions in Brussels (Belgium, 1979 and 1989), Lecce (Italy, 1991), London (UK, 1995), Milano (Italy, 1998), Banyuls (France, 2001), Göttingen (Germany, 2010), Portsmouth (UK, 2014), Sopot (Poland, 2016) and Moscow (Russia, 2019), we are very pleased to invite you to the 11th European Conference on Echinoderms (ECE11), which will be held in Lyon (France) next autumn. This meeting will be the first 'in person' echinoderm meeting after an almost four-year hiatus due to the covid pandemics, and we look forward to seeing you all again!

Chairs of the Organising and Scientific Committees: Bertrand Lefebvre and Thomas Saucède

Important dates:

- **March 10th, 2023:** Deadline for suggestions for workshops and scientific sessions - Second Circular - Opening of abstract submission - Opening of pre-registrations.
- **March 31st, 2023:** Opening of registrations for conference and excursions.
- **May 15th, 2023:** Deadline for abstract submission.
- **June 15th, 2023:** Decisions on abstracts - Deadline for registration to pre- and mid-conference excursions.
- **June 30th, 2023:** Third Circular, with full-program of conference and excursions.
- **July 15th, 2023:** Deadline for early-bird registrations.
- **March 31st, 2024:** Deadline for submission of manuscripts to the proceedings volume in *Cahiers de Biologie Marine*.

Provisional Schedule

- **Pre-conference excursion to Villefranche-sur-Mer marine station:** October 11th–15th, 2023
- **Registration, icebreaker:** October 16th, 2023
- **Indoor scientific sessions:** October 16th–17th and 19th–20th, 2023
- **Mid-conference excursion in Ardèche (la Voulte Lagerstätte):** October 18th, 2023
- **Gala Dinner:** October 19th, 2023



IN MEMORIAM

Claude BABIN (1934–2022)

Born in Saint-Nazaire (29 April 1934), Claude Babin, emeritus professor in palaeontology passed away on the 23rd April 2022 in Lyon. He devoted most of his life to the study of Palaeozoic molluscs. His systematic work on Ordovician bivalves from different areas (e.g. Argentina, Bolivia, France, Morocco, Spain) represents a milestone for the study of this group, for example the description of the earliest Ordovician bivalves from the Montagne Noire. His contribution to our knowledge of the bivalve diversification during the Ordovician was truly pioneering and provided a strong basis for future studies. Claude Babin was one of the leading authorities on Ordovician bivalves in the second half of the 20th and the beginning of the 21st century.

After studying at and graduating from the University of Rennes, where he also passed his *agrégation* (teaching diploma) in 1959, he began his career as a natural sciences teacher in a secondary school in Poitiers, in west-central France (1956), then in Morlaix, in Brittany (1957) at the *Tristan Corbière* High School. In 1959, at the start of the school year, a branch of the University of Rennes was created in Brest, that enabled Claude Babin to teach the first courses in geology. The following year, he was transferred to *Kerichen* High School in Brest, saving him precious time by cutting the journeys between Morlaix and Brest. He was then able to dedicate more time to the preparation of his geology courses, in particular using the material he collected from the Palaeozoic outcrops in the surrounding areas (*Rade de Brest*, Crozon Peninsula). In September 1961, Claude Babin is, at last, employed by the *Collège Scientifique Universitaire* (CSU), as a teaching assistant in geology, where in addition to his teaching, he was able to begin his research on Palaeozoic molluscs from the Armorican Massif in preparation for his PhD, which he will be awarded in 1965.

In Brest, the palaeontology of the Palaeozoic developed steadily around and with Claude Babin, thanks to the successive recruitments of Yves Plusquellec (1962; Devonian corals), Michel Mélou (1967; Ordovician brachiopods) and then Jean Le Menn (1968; Devonian crinoids). In 1966, the CSU became the Brest Science Faculty (Faculté des Sciences de Brest), and in 1971 the University of Western Brittany (Université de Bretagne Occidentale – UBO). In this context, promoted to Lecturer (1967) and then to Professor (1972), Claude Babin became the Head of the CNRS team RCP 240 “Stratigraphy and Palaeontology of the Palaeozoic” in Brest (1970–1976), then President of the UBO (1982–1987). The years 1960–1980 mark the golden age of the palaeontology of the Palaeozoic in Brest, with in particular, the organisation, by Claude Babin, of the 1st International Congress on the Ordovician and the Silurian in September 1971. Pursuing his research on Palaeozoic molluscs as well as on the Armorican biostratigraphy, Claude Babin was a member, from 1972 to 1989, of the International Subcommission on Silurian Stratigraphy. In 1979, he founded the French



Palaeontological Association (*Association Paléontologique Française – APF*), becoming its first president (1979–1981), before being elected vice-president of the International Paleontological Association (IPA) from 1984 to 1990.

Appointed at the University Claude Bernard – Lyon 1 in 1989, he was Head of Geology, then called URA 11 “*Paléontologie stratigraphique et Paléoécologie*” at the CNRS (1990–1993) and became President of the French Geological Society (*Société Géologique de France – SGF*) in 1991. He retired in 1995 and has published many books on the history of palaeontology and the Armorican geology.

Bertrand Lefebvre, Yves Candela & Marika Polechová

Selected publications (in chronological order)

- BABIN, C. 1966. *Mollusques Bivalves et Céphalopodes du Paléozoïque armoricain. Etude systématique ; essai sur la phylogénie des Bivalves; esquisse paléoécologique*. Thèse, Imprimerie Commerciale et Administrative, Brest, 471 pp.
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Michael Gwyn BASSETT (1943–2023)



Michael Bassett in the field observing Middle Ordovician exposures at the Lynna River, eastern Ingria, 2004.

It is with deep sadness and sorrow that we inform you of the passing of Professor Michael Gwyn Bassett on Sunday 15th January 2023, following a long illness. He would have been 80 years old on 31st March 2023.

Professor Bassett was born in the town of Barry, South Wales and was educated locally. He went on to study at the University of Wales, where he graduated with a BSc Honours degree. He continued his education at University College, Swansea where he gained his PhD for the monographic study on the Silurian (Wenlock) stratigraphy and brachiopods of Wales and the Welsh Borderland in 1968.

Shortly before that, in October 1967, he joined the National Museum of Wales in Cardiff. He worked there for the next 40 years, firstly as the Assistant Keeper of Geology and subsequently as the Senior Keeper and Head of the Geology Department, until his retirement in 2008. For a number of years he was an Honorary Professor and Lecturer at Cardiff University and also spent extended research stays abroad, in particular at the Natural History Museum, Oslo, and in Sweden, working on Gotland and at Uppsala University and the Swedish Museum of Natural History.

He also served as the Secretary General and First Vice Chairman of the International Commission on Stratigraphy, IUGS. At that time, he made significant contributions to the development of the International Geochronological Scale and, especially, subdivision of the Silurian System. He also was deeply involved in development of the Ordovician chronostratigraphy and the organisation of the early Ordovician meetings and symposia.

Professor Bassett was amongst the brightest researchers of his generation, working mainly on the palaeontology and stratigraphy of the Lower Palaeozoic. He was widely known as an outstanding expert on Palaeozoic brachiopods, biostratigraphy and facies developments worldwide, but particularly in the U.K. and Scandinavia. He also made important contributions to the study of brachiopod palaeobiology, especially their early ontogeny and phylogeny.

During his long scientific career, Professor Bassett received a number of awards and recognitions related to his research. In particular, he was awarded an Honorary Doctorate from Uppsala University in 2000 and in December 2006 he was appointed for two years as the President of The Palaeontological Association, one of the world's leading societies in palaeontological studies. In 2006 he received the prestigious Edward D'Ewes Fitzgerald Coke Medal by the Geological Society of London.

During his time as Keeper of Geology, he significantly raised the profile of the National Museum of Wales as an internationally recognised research centre, creating strong research links, not only in North American and European countries, but also with Argentina, China and developing countries such as Kazakhstan, Iran and Uzbekistan. He also played a key role as the organiser of a number of highly successful exhibitions, such as the ground-breaking 'Dinosaurs from China' (1986-1987), 'Mammoths and the Ice Age' (1991-1992), and 'Flight' (2001). The highly popular, award-winning 'Evolution of Wales' exhibition is his long-lasting legacy.

Following retirement, Professor Bassett actively continued his research, dedicated to such topics as geotourism highlights of Gotland, description of a new group of the Late Ordovician Silurian chileide brachiopods, biogeography of the Ordovician linguliforms and craniiforms, taxonomy and early ontogeny of the Silurian craniide brachiopods from Gotland. The last paper authorised by him was published in 2017. It was dedicated to the early ontogeny of the Silurian brachiopod *Coolinia*.

He was a true giant within his field. He now lives in our memory as a bright scientist and a great friend.

We send our deepest condolences to his family and friends.

Lars E. Holmer, Leonid Popov and Mansoureh Ghobadi Pour

L.R.M. “Robin” COCKS (1938–2023)



Robin Cocks was arguably the world’s most distinguished student of brachiopods, and his death on February 5 deprives the scientific world of a lifetime of expertise and scholarship. During his many years at the Natural History Museum, he rose to become Keeper of Palaeontology (1986-1998), but never lost his enthusiasm for science – indeed, he was still working on new papers a few weeks before he died. It seems unlikely that his equal will be seen again.

Robin was of the generation that was young during WW2. After a gruelling time in a preparatory school he was educated at Felstead School. He was obliged to do National Service in the years that followed. He served his time in Malaysia, with the Royal Artillery, where the fierce sun took its toll on his typically English fair complexion

(this may be implicated in the skin cancers he suffered from later in life). Oxford followed, and after gaining a first-class honours degree in geology he completed a DPhil (1965) on Silurian rocks and faunas supervised by Stuart McKerrow, who later became a friend and colleague. When he was appointed in the same year to the British Museum (Natural History) (as it was then) as Scientific Officer, Howard Brunton was also taken on to the staff. Apparently, they were such outstanding candidates that *both* were employed, which seems unimaginable today. Brunton was assigned the Upper Palaeozoic brachiopods and Cocks the Lower Palaeozoic. Robin was promoted to Senior Scientific Officer and then Principal Scientific Officer as his career progressed, and Ellis Owen completed the brachiopod ‘team’ with his expertise in Mesozoic species. It is sad to reflect that the brachiopods once had three full time specialists in the “BM” (as it was known) where now there are none.

From his appointment onwards a steady stream of systematic papers on brachiopods were published from Robin’s hand that continued until last year. By the mid 1990s he had become an expert on Ordovician as Silurian brachiopods, and eventually claimed to have named a new genus for every letter of the alphabet. His compass extended globally, from a secure base in the Silurian (Llandovery) of Britain, to a series of papers on the Ordovician of Kazakhstan with his long-time collaborator, Leonid Popov. Such monographs may not be the height of fashion, but they will endure. His pioneering research also involved studies of brachiopod-dominated biofacies, including the seminal paper on the composition and structure of Lower Silurian marine communities published jointly with Ziegler and Bambach in 1968. Robin’s long-term research collaborator also included Rong Jiayu, and together they investigated both strophomenide morphology and taxonomy, as well as the global palaeobiogeography and biodiversity patterns in brachiopods during the Early Silurian recovery period after the Late Ordovician mass extinction. At the same time, Robin was always anxious to describe himself as a geologist, and he enjoyed sorting out the stratigraphy of the Silurian rocks in Britain. He and McKerrow spent summers in

Newfoundland attempting to apply the relatively new science of plate tectonics to the complex geology of that island, where the story of the vanished ocean Iapetus is preserved. Robin later became a central figure in the debate about exactly where to draw the boundary between the Silurian and Devonian Periods. A definitive volume of papers of the ‘BM Bulletin’ edited by Robin in 1990 helped secure the international retention of the British names of the standard chronostratigraphic Silurian subdivisions.

A recurring theme in Robin’s research became the reconstruction of ancient geography when it became clear that continental distributions were very different in the Palaeozoic from those at the present day. This research burgeoned in the 80s and 90s in conjunction with the present writer, since brachiopods and trilobites taken together allowed new insights into the ‘signatures’ of ancient continents and their margins. After Robin reached the mandatory retirement age in 1998 he continued this theme, particularly with Professor Trond Torsvik in Norway, whose computer modeling permitted a more sophisticated treatment of ancient geography. Many new continental reconstructions were published during the first decade of the 21st century. The collaboration was summarized in a book published in 2017 by Cambridge University Press that has already become indispensable to palaeontologists and tectonic geologists around the world.

During Robin’s time as Keeper of Palaeontology in the Natural History Museum he maintained a generally light touch, preferring to let his best scientists pursue their own line of research without his intervention, so long as they produced the ‘goods’, mostly in the form of published papers. Judging by external recognition it could be said that the Palaeontology Department at that time was at the zenith of its reputation, for example, having two Fellows of the Royal Society (later three) elected from the staff, which was previously unequalled. As an administrator, Robin liked to get the official stuff out of the way quickly – so that he could return to his beloved brachiopods. This businesslike approach sometimes resembled brusqueness, and his deputies the ammonite specialists H. G. Owen or M. K. Howarth occasionally had to tactfully intercede. Despite his administrative burden Robin somehow managed to make huge contributions to the Brachiopoda for the *Treatise on Invertebrate Paleontology* – at that time edited by the forceful Sir Alwyn Williams. This was a testament to his organizational skills as well as his scholarly command and extraordinary memory. Over many years he had gathered specimens of the type species of brachiopod genera that came together in this definitive summary, which is likely to remain current for the foreseeable future.

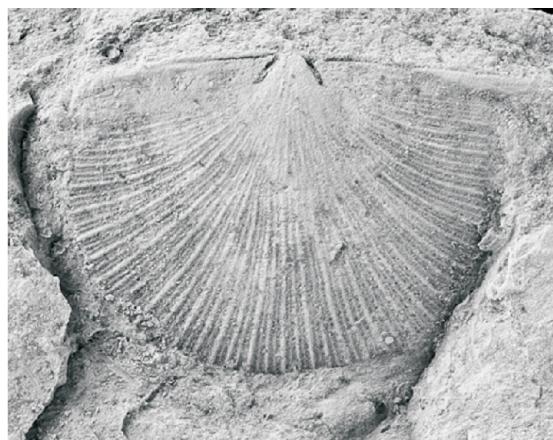
Robin Cocks served many academic societies and international committees. On the palaeontological front he is the only person who has been president of *all* the appropriate British learned societies. He was president of the Palaeontological Association (1986-1988), a group with which he was concerned from its early days, and helped towards its current status as the leading organization of its kind in Europe. He was president of the Palaeontographical Society (1994-1998), which published several of his major papers on brachiopods. The pinnacle of his service to the geological community was arguably as president of the Geological Society of London (1998-2000), where he had previously been responsible for important decisions on the independent future of its publishing arm that made a vital contribution to the survival of the Society. Finally, he presided over the Geologist’s Association (2004-2006). On the international level he was a voting member of Silurian Subcommission of the IUGS for many years, and was a Commissioner of the International Commission on Zoological Nomenclature for two decades (1982-2002).



Robin had to cope with health problems that might have deterred a lesser soul. He had successful treatment for a facial cancer in 1984, but the radiotherapy from the procedure inadvertently ‘killed’ his jawbone, and in 2006 he was given an operation to replace it with an artificial substitute. Unfortunately, the nerves serving to enervate one side of his face were irretrievably damaged during the operation, paralyzing this area. Many secondary problems arose from this unfortunate accident, not least with voice projection, all of which he ignored with great courage. To his friends, he seemed indestructible during his ‘retirement’ years, when he did not allow any health impediment to interfere with his research: if anything, the brachiopods and palaeogeography served to keep him going.

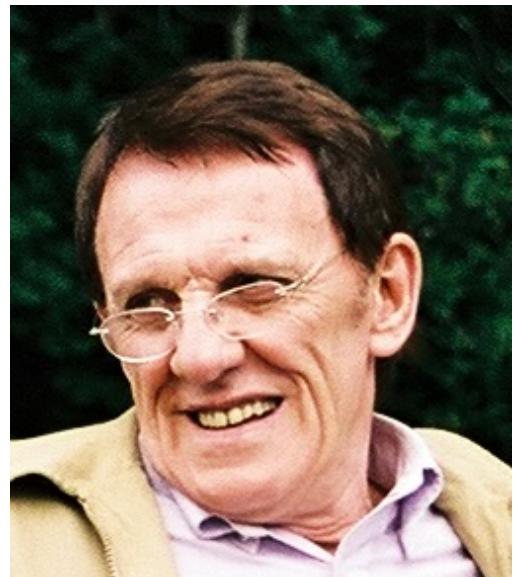
Robin’s contribution to science was recognized by the Geological Society by the award of their Coke Medal in 1995, the Dumont Medal of *Geologica Belgica* in 2003, and the Lapworth Medal of the Palaeontological Association in 2010. He was awarded an OBE in 1999. Away from his work, he was a devoted family man. He is survived by his wife Elaine (née Sturdy) whom he married in 1963, his three children and eight grandchildren.

Richard A. Fortey, Lars Holmer and Leonid Popov



Keith INGHAM (1937–2022)

Keith Ingham was a multi-talented Ordovician stratigrapher and trilobite palaeontologist whose scientific rigour and attention to detail were an inspiration to all who knew him. He played a major role in British Upper Ordovician stratigraphy. His detailed mapping at Dob's Linn was fundamental to the work leading to the site becoming the Ordovician-Silurian boundary stratotype and his excellent trilobite systematic works included matchless drawings and reconstructions; his drawing of the trinucleid *Marrolithus favus* for the logo of the 1974 Ordovician Symposium became the very familiar logo for the Palaeontological Association. He was awarded the Geological Society of Glasgow's Thomas Neville George Memorial Medal in 2004 for excellence in palaeontology and stratigraphy.



(Image courtesy of Helje Pärnaste)

Born near Burnley in North West England, Keith obtained his BSc at the University of Hull in 1959 and his PhD there in 1962. He then joined the University of Glasgow, taking up a joint appointment between the Hunterian Museum and the Department of Geology. He remained at Glasgow for his entire career, retiring in 1998 and continuing to be active in research and the curation of his extensive collections in the Hunterian Museum until ill health took its toll, some 18 months before his death in May 2022.

Keith's PhD study was on the Upper Ordovician succession in the Howgill Fells in northern England (the type area for what is now termed the Ashgill Regional Stage). His work there and, subsequently, in the Welsh Borderlands and in Scotland reflects his unrivalled mapping skills in areas of poor exposure and / or structural complexity. His enormous patience and focus enabled him to find and collect fossils even at very unpromising localities. Together, these field skills enabled him to produce detailed (and accurate) geological maps and to unravel the structural and stratigraphical histories of the historically key areas in which he worked. Keith was a member of the Ordovician-Silurian Boundary Working Group and his detailed mapping at Dob's Linn, including aerial photos and mosaics of field photographs, provided the framework for his PhD student Henry Williams (co-supervised by Barrie Rickards) to produce accurate range charts and detailed descriptions of the Upper Ordovician graptolite faunas, thus facilitating the eventual approval of the locality for the international Ordovician-Silurian boundary stratotype.

Keith made a significant contribution to British Ordovician stratigraphy and its wider correlation. He had a very clear view of the distinctions between litho-, bio- and chronostratigraphy that enabled him to tease apart the historical nomenclature applied to the succession in an area, update it in more rigorous terms (but retaining established terms where feasible) and to correlate it accordingly. He recognized a series of mappable shelly assemblage biozones in the middle and upper parts of the fairly monotonous mudstone succession in the Howgill Fells and, with Tony Wright, subsequently grouped the lowest seven of these into what they defined as the Cautleyan and Rawtheyan stages, above the

previously defined Pusgillian Stage that they ‘moved’ from the top of the Caradoc to form the lower stage of the Ashgill. His considerable knowledge of British Ordovician (especially Upper Ordovician) successions and his wider experience of the Ordovician in North America and China is reflected in his being the only contributor common to both the 1972 and 2000 Geological Society of London volumes on the correlation of Ordovician rocks in the British Isles led by Alwyn Williams and Richard Fortey respectively. In the period between the two he played an important role in the team revising and formalizing the British Ordovician chronostratigraphical scheme led by Richard Fortey. His contributions to the 2000 correlation volume included a masterly revision of the lithostratigraphy of the famous Ordovician successions at Girvan in South West Scotland.



Keith Ingham, detailed map in hand, on the foreshore of his beloved Girvan
(Photo courtesy of Thijs Vandenbroucke).

As a palaeontologist, Keith Ingham’s clear descriptions of Ordovician trilobites resulted from his eye for detail, the ability to make succinct comparisons between taxa and to produce drawings and photographs of the highest quality. Naturally a talented artist, the techniques he used to draw superb trilobite reconstructions evolved as the ‘technology’ advanced, through different methods of shading line-drawings to computer-based drawing techniques. He described Ordovician trilobites from all the areas in which he mapped and his 1975 collaboration with Chris Hughes and Bob Addison in a global review of the then 230 recognised species of the quintessentially Ordovician group of trilobites, the Trinucleidae, was a tour de force. It included an analysis of the distribution and evolution of the Family using a series of global palaeogeographical maps; an early use of such maps and an indication of Keith’s growing interest in trilobite palaeobiogeography. That interest related in particular to the Laurentian affinities of many of the Scottish Ordovician trilobite faunas. At Girvan, this was sparked by a collaboration with Rube Ross and was developed further in collaboration with Ron Tripp with whom he also interpreted differences between

some of the faunas there in terms their development at different sea floor depths. In 1986, as part of a major effort to elucidate the controversial history of the rocks at the Scottish Highland Boundary, Keith along with Gordon Curry and Alwyn Williams described a demonstrably Laurentian silicified fauna, extracted from 7.5 tonnes of the Lower Ordovician Ordovician Dounans Limestone. Trilobites comprised about three quarters of the recovered specimens and many were illustrated by Keith's customary accurate reconstructions in addition to the photographs of the individual sclerites.

The importance of palaeogeography and palaeobiogeography in Keith's work, was also manifest in his joint editorship of, and contributions in, the *Atlas of Palaeogeography and Lithofacies* published by the Geological Society of London in 1992. His considerable artistic skills were also very much to the fore and included his editorial responsibility for all the artwork including over a hundred colour maps showing the changing geography of what is now Britain and Ireland from the mid-Proterozoic to the present day.

Beyond trilobites, Keith Ingham had an extensive knowledge of other fossil groups including graptolites, Jurassic marine vertebrates and even hominins. His deep interests outside geology included Roman coins, astronomy and photography. He made digital compilations of images of the surface of Mars and even contributed to a paper identifying potential sites that might provide evidence of ancient life on Mars. He was an inspirational teacher and a frequent leader of conference and Society field excursions to Dob's Linn and his beloved Girvan.

Keith Ingham's attention to detail was evident in all that he did and his perfectionism meant that he found it very difficult to finish writing a paper. Many of his works only saw the light of day through the dogged persistence of co-authors and even subterfuge; one co-worker would insert a few factual errors into a 'final draft' for Keith to check before imminent submission. Keith would spot errors instantly and certainly could not risk letting them go uncorrected so, spurred into action, he would revise the manuscript with far greater urgency than would normally be the case. Keith's perfectionism has meant that some major works on which he expended a great deal of effort were sadly left unfinished, though colleagues are already trying to at least partly rectify this. The quality and scientific rigour of Keith Ingham's published work, his generosity with his knowledge and his encouragement of the work of others are parts of his lasting legacy. He is sorely missed.

Alan Owen, Glasgow (Scotland, UK)

Yu-nan NI (1938–2022)



Dr. Ni Yu-nan passed away on May 24, 2022, due to an abdominal infection and multiple organ failure, after long suffering from the consequences of a cerebral stroke more than ten years ago. She studied palaeontology in Nanjing University, and after graduation she entered Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, to start her scientific career in early 1967, where she focused on graptolite research and Ordovician-Silurian stratigraphy. She was a friendly colleague and an easy scientist to get along with. She retired in 1998.

Among her most important publications of studies in graptolites and stratigraphy are: (1) a series of papers on the Ordovician and Silurian stratigraphy and graptolite faunas from Tibet and western Yunnan Province, in cooperation with Prof. Mu Enzhi, in which she was able to establish for the first time the complete graptolite sequence for these regions. (2) graptolites and stratigraphy of the Ordovician Ningkuo, Hulo and Wufeng formations in South China, well represented by her master degree monograph “Early and Middle Ordovician graptolites from Wuning, northwestern Jiangxi, China”, and her excellent studies in the microstructures and taxonomy of *Xiphograptus*, *Pseudisograptus*, *Apiograptus* and *Glossograptus*. (3) She was among the leaders of a petroleum-oriented project on the Ordovician System of Tarim in 1990s, by which she led as first author several papers and chapters on the integrative stratigraphy of the Ordovician in Tarim and a correlation with other regions.

As palaeontologists, we will value highly her input in the description of Ordovician to Devonian graptolite faunas, that showed her understanding of the importance of the taxonomy and biostratigraphy of these faunas. She even established a number of Ordovician (*Protabroograptus*, *Wuninograptus*), Silurian (*Lituograptus*) and Devonian (*Neomonograptus*) graptolite genera and quite a number of species that improve our understanding of graptolite diversity and biostratigraphy.

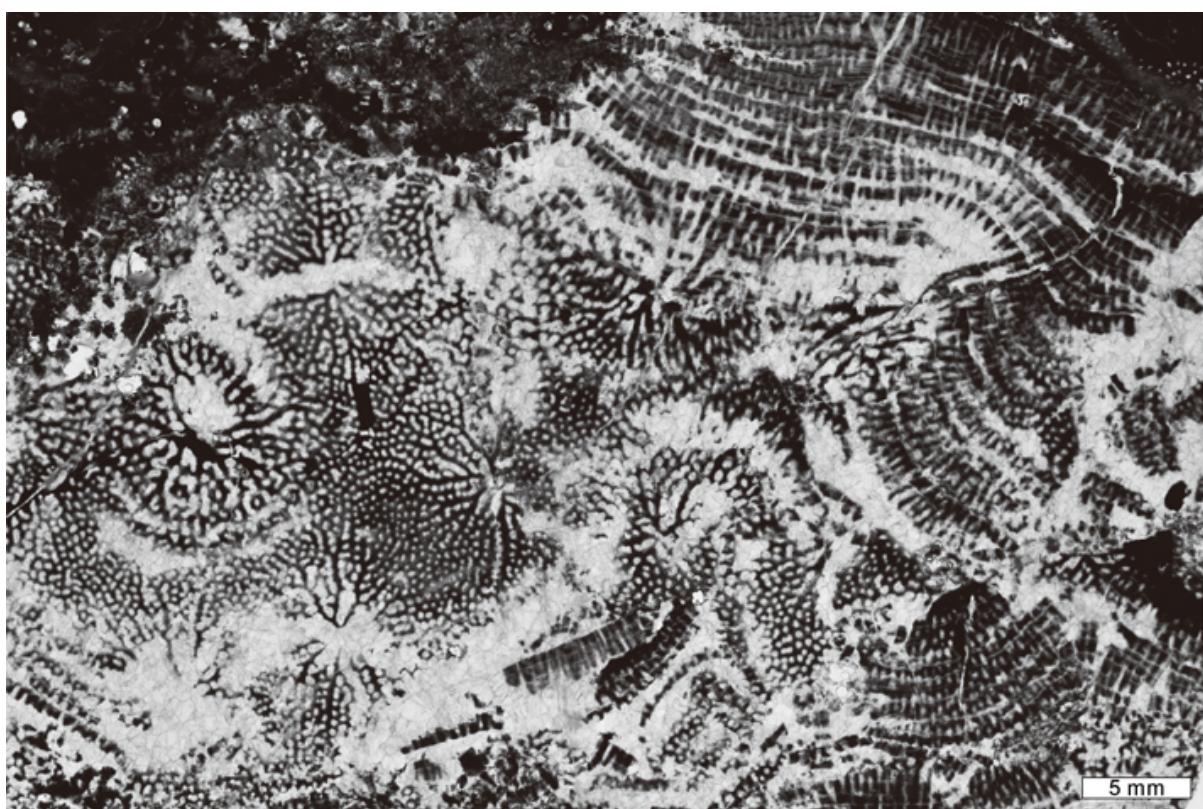
Yuandong Zhang (Nanjing, China) & Jörg Maletz (Berlin, Germany)

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*Section photograph of a Middle Ordovician stromatoporoid (*Labechiella mingshankouensis*) from the Machiakou Formation of North China
(courtesy of Juwan JEON).*

Elżbieta PORĘBSKA (1951–2022)



Dr. Elżbieta Porębska passed away on July 20, 2022, after a long battle with incurable disease. She was a Doctor of Geological Sciences and a retired Senior Lecturer at the Institute of Geological Sciences of the Jagiellonian University in Kraków, Poland. Elżbieta was a researcher with an enormous knowledge and scientific inquisitiveness. She was an outstanding specialist in graptolite paleontology and stratigraphy. Elżbieta was a brilliant lecturer and teacher deeply involved in the education of a large number of students at the Institute of Geological Sciences of the Jagiellonian University. She was a cheerful friend with extraordinary warmth and empathy.

Elżbieta started her scientific career with an important work on the late Silurian to early Devonian graptolites and their biostratigraphic

differentiation in the Bardo Mountains (Sudetes) of Poland (Porębska, 1984), for which she is well known in the graptolite community. The Bardo Mountains remained one of the main focus points of her research that was not restricted to graptolites, but also covered different aspects of sedimentology, chronostratigraphy and chemostratigraphy. Together with her colleagues, she documented the details of the famous *Lundgreni* Extinction Event in the Silurian of the East European Craton in Poland (Porębska et al., 2004) with its dramatic near extinction and re-appearance of the planktic graptolites. Regrettably, the prolonged illness prevented Elżbieta from bringing several of her research projects to a publication end.

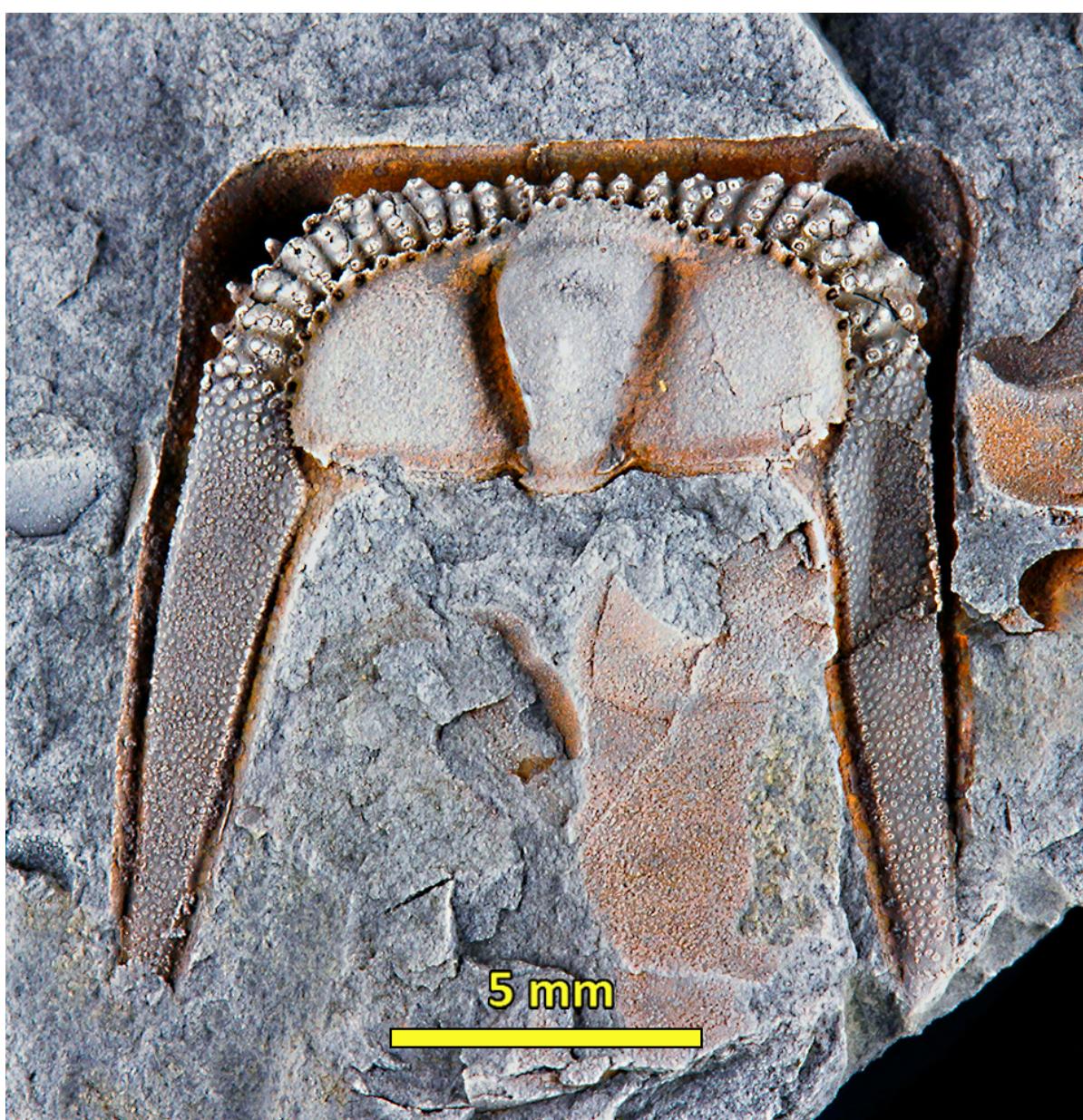
We cherish the memory of Elżbieta Porębska as a distinguished research personality and a cheerful friend.

Anna Kozłowska (Warszawa) and Jörg Maletz (Berlin)

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Fantasticolithus isabelae Fortey and Gutiérrez-Marco, 2022. Cephalic shield of an extraordinary trinucleid trilobite from Floian beds of the San José Formation in the Apurímac river valley, Cordillera Oriental of Peru (courtesy of Juan Carlos Gutiérrez-Marco).

ORDOVICIAN RESEARCH REPORTS & CONTACTS

Jonathan AITCHISON (Australia) continues working on taxonomy and biostratigraphy of Paleozoic radiolarians with an emphasis on those of Cambrian and Ordovician ages. Together with his students, Siyumi PERERA and Jaini SHENG he has been working on material from Newfoundland (Canada), Gansu (China), NSW (Australia) and north Queensland (Australia). Much of this work has involved microCT examination of matrix-free specimens to determine their internal structure and try to better understand the early evolution of radiolarians. Most excitingly recent work on latest Ordovician material from the Sichuan Basin (China) has used the Australian Synchrotron's new MicroCT beamline to look inside micro-cores at radiolarians that are still embedded in their surrounding matrix. The preliminary results are amazing!

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Guillermo L. ALBANESI (Argentina) works on the Lower Paleozoic conodont faunas of South America. Several projects from the Precordillera and northwestern Argentina continue with G. ORTEGA, former PhD students and a number of colleagues. PhD plans are developed by G.M. DELLA COSTA, F.E. LOPEZ, and E.K. RUEDA under his direction. He also follows the supervision of M.J. MANGO as a CONICET young researcher. His research programs include conodont biostratigraphy, paleoenvironments, paleothermometry and evolution from carbonate and siliciclastic sequences of the Ordovician System of Argentina.

He is Professor of Paleontology and Director of the Center for Applied Geological Research (CIGEA) of the Facultad de Ciencias Exactas, Físicas y Naturales (FCEFyN) at the Universidad Nacional de Córdoba (UNC), Argentina, which includes a micropaleontology laboratory specially equipped for the preparation of conodonts. The office is located at CIGEA (FCEFyN, UNC), and the conodont collections at the Museum of Paleontology (FCEFyN, UNC).

The year 2022 was his first year as Chief of the Pander Society (international society of conodont workers: https://dxy.cug.edu.cn/dxyen/THE_PANDER_SOCIETY/Executive.htm) editing the newsletter and promoting the international meetings of the society, such as the main periodic symposium held in Wuhan, China, in June, and a European annual meeting held in Utrecht, The Netherlands.

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Martina AUBRECHTOVÁ (Czech Republic) is a postdoctoral researcher at the Czech Academy of Sciences and the Charles University Prague. In cooperation with Dieter KORN (Museum für Naturkunde Berlin), she continues her studies on Ordovician coiled cephalopods from Baltoscandia and erratics in Germany and Poland, with a current focus on the systematics and ontogeny of representatives of the order Tarphyceratida. Together with Vojtěch TUREK (National Museum Prague), she investigates rare specimens of trocholid and actinoceratid cephalopods from the Bohemian Ordovician using micro-CT scanning.

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Gabriella BAGNOLI (Italy) continues studies on taxonomy and biostratigraphy of Cambrian and Ordovician conodonts from Sweden, Newfoundland (Canada), China and Korea.

Gabriella Bagnoli

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Chris BARNES (Canada) is slowly continuing his conodont paleontology / stratigraphy / isotope geochemistry research. The main projects being: a) Ordovician conodonts and paleotemperature record for tracking the Argentine Precordillera across Iapetus Ocean (with Guillermo ALBANESI (CONICET, Cordoba), Julie TROTTER (UWA) and colleagues; b) Ordovician and Silurian conodont biostratigraphy, bioevents, eustasy and thermal maturation, mainly for Laurentia; c) Late Ordovician organic black shales and conodont paleoecology, northern Hudson Bay, Nunavut (with Shunxin ZHANG).

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Juan L. BENEDETTO (Argentina) is continuing studies on taxonomy, phylogeny and biogeography of Ordovician brachiopods from the Central Andean and Famatina basins of NW Argentina. Jointly with Fernando LAVIÉ, he published the first lingulate faunas from the Famatina Range. He also continued to work on brachiopod faunas across the Hirnantian/Rhuddanian boundary in the Precordillera basin (Cuyania terrane) in order to shed light on the end-Ordovician extinction in temperate to cold waters of Gondwana. Together with Diego MUÑOZ and Arnaud BIGNON, he finished a work on the ontogeny and paleoecology of the plectorthoid brachiopod *Tarfaya purmamarcaensis* by using geometric morphometric methods (submitted and accepted for publication in *Geobios*).

Together with B. WAISFELD and other researchers from Brazil and Chile, he wrote the chapter *The Ordovician of Southern South America* published in the second volume of the book “A Global Synthesis of the Ordovician System” edited by T. SERVAIS, D.A.T. HARPER, B. LEFEBVRE and I.G. PERCIVAL (*Geological Society, London, Special Publication* 533).

Juan L. Benedetto

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Matilde Sylvia BERESI (Argentina) reports that research continues on Ordovician stratigraphy and faunas, mainly sponges from the Argentine Precordillera and Sonora, Mexico. In particular, she collaborated with F. CUEN, R. MONREAL and B. BUITRÓN-SÁNCHEZ and other colleagues on the chapter Ordovician rocks and biotas from Mexico. This chapter forms part of the volume *A global Synthesis of the Ordovician System* (Part 2), of the *Geological Society of London, Special Publications*.

PhD student, Jessica C. GOMEZ (CONICET- UNSJ), finished her doctoral thesis in Geological Sciences at the University of San Juan, Argentina, in November 2022, supervised by Dr Matilde BERESI (IANIGLA-CONICET-Mendoza) and Dr Silvio PERALTA, (CIGEOBIO-INGEO, CONICET-San Juan).

An Ordovician project involved an integrated study on high-resolution stratigraphy, biostratigraphy and palaeoenvironmental, palaeoclimatic, and palaeogeographic implications in the Ordovician-Silurian Transition (OST) deposits in central and eastern Precordillera of San Juan Province, western Argentina together with Dr S. PERALTA, Dr Jessica GOMEZ and other colleagues of the Institute of Geology (INGEO), San Juan University. A paper on Hirnantian sponge spicules from strata of the Eastern Precordillera in collaboration with Dr Jessica GOMEZ is in review.

A new project focuses on palaeoecological changes of the Early-Middle Ordovician faunas of a sedimentary sequence in central Sonora. This study will be carried on in collaboration with colleagues of the Geology Department of Sonora University. She is also working on Cambrian faunas (chancelloriids) from carbonate sequences in eastern Sonora.

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Carlton E. BRETT (USA). The following three topics occupied much of his research effort in the past year and form the major research programs for the next two to three years.

A) *Late Ordovician Cincinnati Stratigraphy and Paleoecology: Tennessee-Ohio-Indiana-Kentucky* — In ongoing research, Carlton and colleagues are extending this framework into the Nashville Dome in Tennessee, southern Ontario, Canada and New York State. Research with former student, Tim PATON, in spring 2022 resulted in further documentation of new road cut sections east of Nashville that provide important insights into the sequence stratigraphy and provides a number of markers that can be traced into the

Cincinnati Arch. His present PhD student Ian FORSYTHE (who completed a MS Degree with Dr. Alycia STIGALL in 2022) intends to do further isotopic studies to document temperature changes in both areas, and he will be working with Dr. Anne Christine DASILVA (University Liège, Belgium) to develop time series of geochemistry and gamma ray with the intent to develop an astrochronology to refine the resolution of the upper Katian-Richmondian local Stage. This work will form the basis of PhD study on paleoecology by Ian FORSYTHE. They are also planning to submit a collaborative project with Dr. Alycia STIGALL (University of Tennessee, Knoxville, TN) on regional paleoecology and biogeography of a coordinated immigration: the Richmondian Invasion in the Nashville and Cincinnati Basins.

Collaborative research with graduate students Ian FORSYTHE, Cole FARNAM, and Dr. Pat McLAUGHLIN, of Illinois Geological Survey, at present aims to improve correlations and examine patterns of sea level, climate and faunal change during the late Ordovician in eastern North America. In 2023, they are attempting to synthesize several years of collective study. With his students and Cameron SCHWALBACH, Glenn STORRS of the Cincinnati Museum, and independent stratigrapher and technical report specialist Kyle HARTSHORN, they are pulling together a total of eight chapters for a new book on Cincinnati Arch stratigraphy and paleontology to be published by Cincinnati Museum. They are hoping to have this book completed in time for the opening of the new Paleozoic Hall at the Cincinnati Museum in fall 2023.

B) *Research on Ordovician-Silurian Boundary Sequence and Chemostratigraphy* — With graduate student Cole FARNAM, he is studying the Ordovician-Silurian boundary transition in eastern North America. They are studying the uppermost Cincinnatian (upper Katian) strata (Whitewater and Elkhorn formations) and have completed important new field study that further refined sea level, climatic and faunal changes that immediately preceded the great crash in biodiversity associated with latest Ordovician Hirnantian climate change and mass extinction.

In 2022, they were alerted to an undescribed section in Indiana by an outstanding amateur collector, Lincoln SHOEMAKER; their studies of the fauna and carbon isotopes show that this is a unique lentil of shale and limestone, probably equivalent to the Centerville Member in Ohio and is Hirnantian in age. This is the only fossiliferous Hirnantian section in the US east of the Mississippi River and its rich fossil assemblages, including corals, brachiopods, articulated crinoids, and trilobites, are under study. Dr. Jin JISUO (University of Western Ontario) is describing the brachiopods and Dr. Robert ELIAS (University of Manitoba) is studying the rugose corals. This exceptionally well-preserved fossil assemblage, no doubt, includes several undescribed taxa and provides an important window into faunas that existed in eastern Laurentia in the immediate aftermath of the great Late Ordovician extinctions. The faunal assemblage is completely different from immediately underlying Cincinnatian (uppermost Katian) and similar to the Silurian faunas, which persist upward for some 5 million years. This is one of the most unique occurrences that Carlton has studied in this area and will form a major component of the PhD dissertation of Cole FARNAM in his final year of PhD studies. This assemblage will provide important insights into the post-extinction recovery in this critical interval.

Chris WAID of the Ohio Geological Survey and Carlton have continued to extend Upper Ordovician and Silurian correlations through the Ohio subsurface into New York, Ontario and other adjacent regions. They jointly presented a core-outcrop workshop for the Geological Society of America North-central/Southeastern section meeting in Cincinnati, April 2022.

C) *Ordovician-Silurian Echinoderm Faunas and Paleoecology* — Dr. James THOMKA (SUNY at Plattsburgh) and Carlton are continuing study of the paleoecology and organism

interactions involving pelmatozoan (stalked) echinoderms. They continue to work on using crinoid stems to better assess the biodiversity and relative abundance of crinoid populations (using the weight [mass] of disarticulated columns of distinct species sorted from bulk collections). They are also working on manuscripts dealing with evolution of parasitic interactions in Ordovician to Silurian “cystoids”; the oldest definite parasitic interactions in the fossil record.

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Jana BRUTHANSOVÁ (Czech Republic) continued her work on Ordovician conulariids in 2022. She focused with Heyo VAN ITEN (USA) on conulariid monospecific mass accumulations. As curator of Palaeozoic invertebrate collections at the National Museum in Prague, she curated and cared the fossil collections, did intensive field works mainly on the Ordovician outcrops and operated micro-CT devices in museum. She is also working on taphonomic and palaeoecologic topics with Petr KRAFT (Czech Republic) and Ondřej ZICHA (Czech Republic).

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Yves CANDELA (Scotland) is continuing the study of Ordovician and Silurian brachiopods from Belgium in collaboration with Bernard MOTTEQUIN (Royal Belgian Institute of Natural Sciences -RBINS, Brussels) and David HARPER (Durham University, UK), thanks to the EU-funded SYNTHESYS+ program. Following the two papers published in 2021 and 2022 (see previous *Ordovician News*), a new paper on Middle and Upper Ordovician brachiopods from the Brabant Massif has been submitted and is awaiting publication. A new SYNTHESYS visit to the RBINS, is scheduled for March 2023. Work is continuing with David HARPER and Michal MERGL (University of West Bohemia, Pilsen) on the study of Lower Ordovician brachiopod faunas of the Fezouata Lagerstätte (Morocco) [preliminary results presented at the 2nd annual meeting of the IGCP735 in Marrakesh]. The manuscript (co-authored with Consuelo SENDINO (NHM London)) on Scottish machaeridians from the Sandbian is awaiting publication. Projects started with Juan Carlos GUTIÉRREZ-MARCO (Institute of Geosciences, Madrid) on Ordovician brachiopods from Spain are still on-going.

Yves has also been working on Silurian brachiopods with Bing HUANG and Di CHEN: one paper has already been published on *Yidurella* (in *Palaeoworld*) and a second paper on evolutionary trends in trimerellid brachiopods is awaiting publication.

Yves is vice-president of the Palaeontographical Society, editor of the Earth and Environmental Science Transactions of the Royal Society of Edinburgh (EESTRSE) and editor of the Scottish Journal of Geology.

As curator of invertebrate palaeobiology at the National Museum of Scotland, most of Yves' time is dedicated to the curation and care of the invertebrate palaeontology collection, as well as welcoming research visitors.

IGCP project 735 "Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification" led by Bertrand LEFEBVRE (France) and also comprising Mansoureh GHOBADI POUR (Iran), Khadija EL HARIRI (Morocco), Beatriz WAISFELD (Argentina), Oive TINN (Estonia), Wenhui WANG (China), Elena RAEVSKAYA (Russia) and Yves is in its third year now and has attracted so far 205 colleagues representing 42 countries. If you are interested in joining this project, please check our website: <https://rocksnrol.wordpress.com/> or drop us a line directly. Do not forget to send us a line when a paper acknowledging the project is published; we will add it on our website to our list of papers. The website also lists future meetings in which IGCP735 is organising or involved. The successful 2nd annual meeting (first meeting in person), organised by Khadija EL HARIRI took place at the Caddi Ayyad University in Marrakesh last October (see website for report). The 3rd annual meeting will take place in Tallinn (Estonia) in July 2023 (details on the website).

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-

Marcelo G. CARRERA (Argentina) is actively working on the evolutionary history of Paleozoic sponges and bryozoans (taxonomy, paleoecology and paleobiogeographic significance). In particular, he is currently studying new findings related to Lower Ordovician reefs from western Argentina. Besides, an important collection of Middle Ordovician bryozoans from the Argentine Precordillera has been published. This last study is part of a major project carried out together with Dr Andrej ERNST regarding the remarkably diverse bryozoan fauna from the Ordovician of western Argentina.

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Ravi Shankar CHAUBEY (India) finished his Ph.D in 2020 at the Department of Geology, Panjab University, India on "*Integrated litho-bio-chrono-sequence stratigraphy and facies analysis of the Sanugba Group, Spiti Himalaya, India*". In 2019, he published warm water Dasycladaceae algae *Mastopora* and *Cyclocrinites* (Chaubey et al., 2019, *Estonian Journal of Earth Sciences*), and recently the litho-microfacies analysis and sequence stratigraphic studies (Chaubey et al., 2023) of the Ordovician-Silurian Takche Formation of the Spiti region. With other colleagues, he contributed to the record of Ordovician successions in Lesser Himalaya (Singh et al., 2019) and in reconstructing high-resolution chemo-stratigraphy ($\delta^{13}\text{C}_{\text{carb}}$ & $\delta^{18}\text{O}$) and event stratigraphy of the Takche (Pin) Formation (Myrow et al., 2018).

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Xu CHEN (China). In the recent five years, he was working with China National Petroleum Corporation (PetroChina), SINOPEC, and China Geological Survey, organized a shale gas biostratigraphic research group devoted to studying the Ordovician to Silurian shale gas-bearing strata in the Yangtze region. More than 50 drilled wells and nearly 10 important outcrop sections in the Yangtze region have been investigated. The group submitted timely consulting reports to various research departments of the petroleum companies. Three training courses were held, field instruction was provided, and both sets of workshops received positive feedback. Based on these field and laboratory research, they summarized the shale gas intervals in the black shales of the Wufeng and Lungmachi formations in the Yangtze region. They concluded that the sweet intervals are from *Dicellograptus complexus* Biozone (WF2) to *Demirastrites triangulatus* Biozone (LM6), particularly between LM1 (*persculptus* Biozone)–LM5 (*cyphus* Biozone). The distribution of K-bentonite layers above and below these “sweet spot” horizons, and the impact of volcanic eruptions (represented by K-bentonite beds) on the organic matter enrichment in adjacent paleo-sea areas are also discussed. In order to combine the framework of graptolite biostratigraphy with shale gas exploration, the relationship between gamma-ray logging response and graptolite biozonation is explained. He has submitted their main result in two reference books: *Latest Ordovician to Early Silurian Shale Gas Strata of the Yangtze Region, China* (Chinese version and English version), which was published by Zhejiang University Press and Springer separately in 2021 and 2022.

In the coming years, two palaeontology books will be published: *A restudy of the graptolites of the Wufeng Formation* and *Early Silurian graptolites of the Lungmachi Formation of the Yangtze region*. Graptolites are all from the shale gas bearing black shales.

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John COPE (United Kingdom) is now a Research Associate at the University of Bristol. A paper jointly with Jan Ove EBBESTAD describing the tergomyan fauna from the early Floian of Carmarthenshire, South Wales is currently under review. This will complete the description of the molluscan fauna from the single locality in the Llangynog Inlier that is the earliest example of Sepkoski's 'Modern fauna' and where molluscs comprise 71.5% of the fauna. This will complement the earlier description of the bivalves (Cope 1996), the cephalopods (Evans 2005) and the gastropods (Ebbestad & Cope 2021).

John Cope

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Helena COUTO (Portugal) is working on the study of Paleozoic stratigraphy, paleontology and on associated gold and antimony mineralizations in Dúrico-Beirã area (North Portugal). These studies aim at contributing to a better knowledge of the Paleozoic stratigraphy and paleontology of the Valongo Anticline and to define prospecting guides for gold and antimony deposits.

Helena Couto

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G. Susana DE LA PUENTE (Argentina) is continuing to work on chitinozoans and stratigraphy of Paleozoic basins from Argentina, including the Central Andean Basin and Precordillera. Submitted a publication on Ordovician chitinozoans (under revision). Also working on projects focusing on palynology and stratigraphy of Patagonia and Tandilia regions, in collaboration with paleontologists and sedimentologists. Advised three undergraduate students during 2022, and started with three new students. Finally, closely involved with the creation of the Doctorate in Geosciences (Doctorado en Geociencias) at the National University of Comahue.

G. Susana de la Puente

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André DESROCHERS (Canada) is working on the Upper Ordovician to Lower Silurian strata of Anticosti Island in Eastern Canada. His research program focuses on high-resolution stratigraphic studies integrating carbonate sedimentology, sequence stratigraphy, biostratigraphy, and chemostratigraphy. A number of collaborative projects are in progress including i) testing global anoxia an alternative cause for the Hirnantian mass extinction (with Julie DE WEIRDT, Thijs VANDENBROUCKE and others); ii) stratigraphy and timing of the End Ordovician mass extinction (with Joshua ZIMMT, Steve HOLLAND and Seth FINNEGAN); iii) sedimentology and paleoecology of Telychian encrinites (with Bill AUSICH, Selina COLE, and David WRIGHT); iv) paleoecology of giant Aulacerid stromatoporoids with Geneviève RIOPEL and Rachel WOOD); and v) carbonate-associated phosphate (CAP) as a proxy for reconstructing Hirnantian ocean phosphate levels (with Matthew DODD).

André Desrochers

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Jan Ove R. EBESTAD (Sweden) continues working on Ordovician gastropods and other molluscs from Baltica, Avalonia, Laurentia and peri-Gondwana settings. Collaboration with a number of colleagues lead by Arne T. NIELSEN resulted in a revised regional stage classification for the Ordovician of Scandinavia. New data on the northernmost findings in Sweden of a small fauna of brachiopods and conodonts was published together with Michael STRENG, Jan Audun RASMUSSEN and Thomas WEIDNER. New data on the curious mollusc *Jinonicella* from Belarus and Ukraine was published in collaboration with Alexander GUBANOV, Sofia BAKAYEVA and Olga BOGOLEPOVA. A further study on Lower Ordovician molluscs from South Wales with John COPE has been submitted. Work on the Wahlenberg (1818) type catalogue continued during 2022, in collaboration with Vivianne BERG-MADSEN (Uppsala).

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Cole EDWARDS (USA) continues to work on Ordovician stable and radiogenic isotope stratigraphy. Collaborations with Matt SALTZMAN (The Ohio State University) continue, along with his Ph.D. students (Christopher CONWELL, Datu ADIATMA, and Teresa AVILA), on conodont biostratigraphy and radiogenic isotope chemostratigraphy of the Middle–Late Ordovician, some of which has been published last year by Conwell et al. in the journal *Geology*. A new study on coupling molybdenum and uranium concentrations and isotopes with previously published stable isotope data came out late 2022/early 2023 with co-authors Xinze LU and Brian KENDALL (University of Waterloo, Ontario) show that there is minimal evidence for global euxinia during an early Ordovician mass extinction. Collaborative work with Sarah CARMICHAEL (Appalachian State University), Phoebe COHEN (Williams), Diana BOYER (Winthrop University), and Xiao-Ming LIU (University of North Carolina Chapel Hill) continue to build on our work on studying “best practices” for identifying periods of anoxia during the Late Devonian in relation to causes for mass extinctions.

Cole Edwards

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Robert ELIAS (Canada), with Dong-Jin LEE and Brian PRATT, concluded their studies of coral-like fossils from the Lower Ordovician of western Newfoundland. The latest paper (in *Journal of Paleontology*) places the new genus *Reptamsassia* together with *Amsassia* in the new family Amsassiaceae, considered to be a distinct group of calcareous algae. The two new species of *Reptamsassia* formed the earliest known symbiotic intergrowths of macroscopic modular organisms.

Robert is currently studying corals in latest Ordovician faunas from southern Ontario (with Roger HEWITT) and the Cincinnati Arch region (with Carlton BRETT and Cole FARNAM).

Robert Elias

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Andrej ERNST (Germany) has concentrated his studies on bryozoan faunas from the Ordovician of Baltoscandia (expired DFG project ER 278/10-1, 2018-2020). The material from this project contains mainly Katian bryozoans from localities in Estonia, Norway, and Sweden. Evaluation of the studied material shows enormous bryozoan diversity there. Noteworthy is often the huge discrepancy in colony size: in the same strata large species are found (20-25 cm in height), together with numerous bryozoan fragments less than 1 mm in size. Significant part of the Ordovician research is devoted to the bryozoan fauna from the kukersite, which is poorly known despite some earlier publications. Andrej ERNST collaborates with Björn KRÖGER on diversity changes of bryozoans, with Hans Arne NAKREM on bryozoan taxonomy, and with Olev VENN, Ursula TOOM, and Mark WILSON on ichnofossils interacting with bryozoans. Additional research was made on Ordovician bryozoan faunas from China (Ma et al. 2022a, b).

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Frank R. ETTENSOHN (USA) continues his work with Chinese colleagues from Yunnan University and Chengdu University of Technology in understanding the nature of Upper Ordovician platform carbonates on the Yangtze Platform of south China. He also continues his work on the Upper Ordovician Lexington Limestone, and with a grant from the U.S. Geological Survey, is working with a student and colleagues from the Kentucky Geological Survey on the three-dimensional mapping of facies in the unit. It is their hope to use 3-D mapping to further understand likely structural control on facies development throughout the unit.

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David EVANS (UK), having recently retired, he has nearly completed a monograph of the Sandbian and Katian cephalopod faunas of England and Wales. He is preparing sections for a revision of part K of the *Treatise on Invertebrate Paleontology*; currently the Ordovician Order Cyrtocerinida with Marcela CICHOWOLSKI.

David Evans

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Xiang FANG (China), an Associate Researcher in NIGPAS, Nanjing, is still working on the Early Palaeozoic cephalopods and relative stratigraphy. Currently, his research interest is focused on the Early Palaeozoic cephalopods in China and other tropical Gondwanan regions, especially on their palaeobiological and macroevolutionary patterns.

Xiang Fang

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Oldřich FATKA (Czech Republic) continues his research on Cambrian and Ordovician trilobites together with Petr BUDIL. In cooperation with Jakub VODIČKA, Lucy MUIR and Joe BOTTING we are working on Middle/Late Ordovician chitinozoans. We have just finished writing a contribution on a new Late Ordovician echinoderm Lagerstätte in the Prague Basin.

Oldřich Fatka

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Annalisa FERRETTI (Italy) continues her work on Ordovician conodont faunas from Europe and elsewhere, in cooperation with Stig BERGSTRÖM, Peter KÖNIGSHOF, Ulf LINNEMANN, Giles MILLER and Hans Peter SCHÖNLAUB.

The conodont fauna of the reference succession of the regional British Llandeilian Stage of the Llanvirn Series, described in a classical study by Rhodes in 1953 using single element (form) taxonomy, has been reviewed, and additional taxonomic details on the marker genera *Amorphognathus* and *Eoplacognathus* have been provided (Ferretti & Bergström, 2022). Well-preserved ferruginous laminated structures were described within the Upper Ordovician of the Cellon section in the Carnic Alps, Austria to suggest a biomediated genesis (Ferretti et al., in press). Co-authored papers have reviewed the Ordovician of southeastern Europe (Ferretti et al., 2022) and Sardinia, Italy (Loi et al., 2022).

Finally, Annalisa FERRETTI has co-chaired with Guillermo ALBANESI the Session “Beyond biostratigraphy: Conodont matters in evolving planetary scenarios” at the 5th International Conodont Symposium “ICOS 5” held in Wuhan, China (June 24th–27th, 2022).

The Thematic Issue “Beyond biostratigraphy: Conodont matters in evolving planetary scenarios”, to be published in *Marine Micropaleontology*, will collect related studies, including several Ordovician ones.

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Barry FORDHAM (Australia) hopes to get back to a small collection of Ordovician conodonts one day ...

Barry G. Fordham

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Richard FORTEY (UK). The revision of Reed's Burmese Ordovician trilobites completes a long standing project, published at last. Two other works on peculiar, or really extraordinary, Ordovician trilobites were also published. A series of papers on Moroccan trilobites was completed with the description of unusual soft part morphology. There remains a final paper on the Ordovician of the Sultanate of Oman which will bring that research project to a close after several decades. He will also finish a paper for publication left by the late Keith INGHAM on remarkable Girvan (Scotland) pelagic trilobites, which it is hoped will stimulate others to work on collections in the Hunterian Museum, Glasgow, left there by Keith after a lifetime's collecting. After more than 50 years of scientific publishing it is probably time to consider retiring.

Richard A. Fortey

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Mansoureh GHOBADI POUR (Iran) is currently working on the Early Ordovician trilobites from North Tien Shan, Kazakhstan, and Late Ordovician trilobites from Kitan Natural Reserve, Uzbekistan. At the same time, she is completing a book on the Ordovician of Iran (in Farsi).

Mansoureh Ghobadi Pour

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Daniel GOLDMAN (USA) retired in May of 2022. He continues to work on projects involving graptolite and conodont biostratigraphy. With Steve LESLIE, LIANG Yan, and Stig BERGSTRÖM, Dan co-authored the chapter on Ordovician biostratigraphy for the new Global Ordovician Synthesis volumes. He also worked with Blanca A. TORO and NEXXYS C. HERRERA SÁNCHEZ on a project that used CONOP to examine the distribution and biodiversity of Lower and Middle Ordovician graptolites in the Central Andean Basin. This work was recently published in Palaeogeography, Palaeoclimatology, Palaeoecology. Dan is also working with Steve LESLIE on the integrated graptolite and conodont biostratigraphy from the Phi Kappa Formation in the Trail Creek region of central Idaho (USA). Finally, Dan co-edited a book on Latest Ordovician and Early Silurian shale gas in the Yangtze Region of China with CHEN Xu and WANG Hongyan.

Daniel Goldman

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Jessica Carolina GÓMEZ (Argentina) received her Ph.D in Geological Sciences in November 2022 with the title “High-resolution stratigraphy of the Ordovician-Silurian Transition, in the San Juan Precordillera, Argentina” supervised by Dr. Silvio PERALTA (CIGEOBIOINGEO, CONICET-San Juan), and Dr. Matilde BERESI (IANIGLA-CONICET-Mendoza). She is currently in the last year of a scholarship at the National Council of Scientific and Technical Research of Argentina with the project “Biofacies and paleoenvironment in the Hirnantian-Rhuddanian boundary of the Argentine Precordillera: characterization of the Hirnantian glacimarine event”

The doctoral thesis work provided new data of the Ordovician-Silurian Transition (OST) deposits, in the basal strata of the La Chilca Formation and correlatives, Central Precordillera, and in the Don Braulio Formation, Eastern Precordillera. The main results focus on the recording of diagnostic deposits such as transgressive lag, phosphate lag, upwelling and ironstones, the recognition of Transitional Benthic Faunas (TBF) and their relationship with the *M. persculptus* Zone in the Precordillera, and the determination, for the first time, of an association of Hirnantian palynomorphs (with Dr. Mercedes DI PASCUO, CONICET- ENTRE RÍOS-UADER). Analysis and correlation of the isotopic curves of $\delta^{13}\text{C}_{\text{org}}$ and $\delta^{15}\text{N}$ in the Eastern Precordillera (with Dr. Alcides SIAL, NEG-LABISE) with the GSSPs of the Hirnantian and Rhuddanian was carried out to tentatively establish the stratigraphic position of the OST, due to the absence of diagnostic fossils. The bio-litho-chemostratigraphy analysis allowed us to propose a tecto-sedimentary model in the W-E direction, and a palinspathic reconstruction model for the Central and Eastern Precordillera.

She participated in the project “High-resolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128, Dr. Silvio PERALTA)”. The results were published at the 21st Argentine Geological Congress and in the Geological Correlation Series Journal.

Jessica Carolina Gómez

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Tom GUENSBURG (USA). Rich MOOI and Nico MONGIORDINO KOCH joined Tom during 2022, in preparing a new paper in which a new origin for the crinoid calyx plating is proposed. This research combined information from Tremadocian, Lower Ordovician, protocrinoids, and Lower Cambrian pentaradial echinoderms. Protocrinoid calyces show remarkable transitional morphology linking the Cambrian echinoderms to more derived camerata, disparid, and cladids crinoids that are so familiar to those of us working with Middle Ordovician and younger rocks. This work also supports crinoid origin from outside blastozoans (eocrinoids, ‘cystoids’), the group long thought by many to contain the crinoid ancestor. A phylogenetic analysis accompanies the conclusion reached in the new paper. This work has been accepted for publication and should appear in the *Journal of Paleontology* early in 2023. Further studies of new early Ordovician crinoids from the Great basin will follow. In addition, Rich and Tom have been investigating a remarkable new echinoid with spiral ambulacra from the Late Ordovician Bromide Formation of Oklahoma.

Tom Guensburg

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Juan Carlos GUTIÉRREZ-MARCO (Spain) is involved in future papers in collaboration with Jörg MALETZ and Blanca A. TORO (graptolites from several peri-Gondwanan countries), Lucy MUIR (colonial hydroids), Diego GARCÍA-BELLIDO (discovery of the first Ordovician Emucariid arthropod), Björn KRÖGER (Lower Ordovician cephalopods from Peru), Beatriz WAISFELD, Emilio VACCARI and Franco TORTELLO (Peruvian trilobites), Jorge COLMENAR (Peruvian brachiopods), John MALINKY (Spanish hyoliths), Samuel ZAMORA (Spanish echinoderms) and Sara ROMERO, Isabel RÁBANO and Sofia PEREIRA (trilobites from various localities of Morocco and SW Europe), among others.

Juan Carlos Gutiérrez-Marco

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David A.T. HARPER (Scotland). Research continues, on a range of Ordovician brachiopod and other faunas. A manuscript was published in the *Irish Journal of Earth Sciences* with Robin COCKS on the brachiopod fauna of the Portrane Limestone (Ireland); this paper essentially completes publication of DH’s PhD supervisor, Tony WRIGHT’s own PhD thesis; it is part of a special issue to celebrate the life of Dr Matthew PARKES, DH’s

first PhD student who died suddenly in 2020. A paper with JIN Jisuo and Robert BLODGETT on the *Tcherskidium* brachiopod fauna from the Arctic has been published and a more extensive and focussed study on the pentamerides from North Greenland with JIN Jisuo, Peter SHEEHAN and Christian RASMUSSEN is near completion. Collaboration continues with Yves CANDELA and Michal MERGL investigating the Lower Ordovician brachiopod fauna of the Fezouata Lagerstätte (Morocco); a more general, short paper (Saleh *et al.*) was published on the significance of new and existing localities in the region. Together with Bernard MOTTEQUIN and Thomas SERVAIS, Upper Ordovician brachiopods from Belgium are under study and DH has contributed to a monograph on the highest Ordovician and lower Silurian geology of the Condroz Inlier, Belgium (Mortier *et al.*). After many years in the making, description of the Middle Ordovician brachiopod from SE Ireland (with Denis BATES) has been submitted including a discussion of Dapingian brachiopod diversity. Investigation of the phylogeny of plectambonitoid brachiopods (with Yves CANDELA and ZHEN Guo) continues. A similar study is planned for the orthide brachiopods. Various studies with Thomas SERVAIS and others continue on the Great Ordovician Biodiversification Event and the putative Furongian Gap. Editorial work on and contributions to, two special Geological Society publications on the Global Ordovician has occupied a significant amount of time over the last year but both parts will be available in book form (see references) at the Ordovician Symposium in Tallinn in July of this year. DH was involved in chapters on South Africa, the UK and Ireland, Greenland, Scandinavia, palaeobiogeography and the history of the system. Finally DH has co-edited a semi-popular science book, with Ole SEBERG on ‘The Origin of All Things’. A number of the 28 chapters include Ordovician topics.

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Susana HEREDIA (Argentina) is working on biostratigraphy and taxonomy of Ordovician conodonts. Susana, Juan Pablo MILANA and Daniel POIRÉ are conducting a new project on Paleozoic Biostratigraphy and Clay deposits as paleoclimate indicators granted by FONCYT (Argentina): conodont biostratigraphy and clay minerals (Agencia de Promoción Científica y Tecnológica). Also are matter of interest the following topics: Ordovician conodonts from Argentine Puna, Cordillera Oriental, Famatina and Precordillera, and clastic sedimentology of La Chilca Formation. Susana collaborates in several subjects and projects with Ana MESTRE, Josefina CARLOROSI, Blanca TORO, Guillermo ACEÑOLAZA, Juan Carlos GUTIÉRREZ-MARCO, Hadi JAHANGIR, Estefania ASURMENDI, Eduardo TORO and Juan Pablo MILANA. Several manuscripts are in review from the Ordovician from the Villicum Sierra.

Dr. Carlo CORRADINI is collaborating (2014-2023) with the Micropaleontology Lab on developing Silurian-Devonian conodonts from the Central Precordillera.

Two graduate students obtained their PhD degrees during 2022. Dr. María José GÓMEZ on Silurian - Lower Devonian conodonts from the Precordillera and Florencia MORENO on Lower-Middle Ordovician conodonts, biostratigraphy and sedimentology of the San Juan Formation.

Dr. Susana Heredia

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Olle HINTS (Estonia) is continuing studies on Ordovician–Silurian microfossils, geochemistry and Baltic regional geology and stratigraphy. In collaboration with Jaak NÖLVAK and Yan LIANG, he is studying chitinozoans and other organic-walled microfossils from Baltoscandia and elsewhere, focusing on taxonomy, biostratigraphy, biogeography and palaeoecology. Papers were published on Early and Middle Ordovician chitinozoan taxonomy and biostratigraphy from Baltica. In collaboration with Petra TONAROVÁ and Mats E. ERIKSSON, Olle is studying Palaeozoic scolecodonts to provide new insights into the taxonomy, paleobiogeography and diversification history of jaw-bearing polychaetes. At present, the Ordovician collections from the Himalayas, Prague Basin and Baltoscandia are being examined.

Olle is involved in studies on geochemistry and chemostratigraphy together with Peep MÄNNIK, Tõnu MEIDLÄ, Leho AINSAAR, Aivo LEPLAND and numerous other colleagues across the world. A new national project on Ordovician climate history started in 2023, targeting regional paleotemperature trends and biotic turnovers. New paired carbon isotope records were collected from the Ordovician of Latvia and Lithuania, and a manuscript on these data is in press. Together with Peep MÄNNIK, Alicja WUDARSKA, Michael WIEDENBECK and other colleagues, work started on oxygen isotope records from Baltic Ordovician based on SIMS analysis of conodont apatite. The first results were presented at the IGCP 735 Annual Meeting in Marrakech in 2022, and manuscripts are in progress. Olle is also involved in collaborative studies of clumped isotope records and Boron isotopes, with intriguing results expected in coming years.

Olle is responsible for developing the national geological collection and related e-services as part of Estonia's research infrastructure (various data are accessible at <https://geocollections.info>). He is also Editor-in-Chief of the *Estonian Journal of Earth Sciences*, an open-access journal seeking contributions on Ordovician geology and fossils.

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Lars HOLMER (Sweden) is mainly continuing his joint work with J.J. ALVARO, L. POPOV, and P. AHLBERG investigating the distribution of Cambro-Ordovician glendonites and associated possible hydrothermal deposits and phosphorites in Baltoscandia, and seeking support from the Swedish Geological Survey and Swedish Research Council.

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Juwon JEON (South Korea) is currently preparing his dissertation under the supervision of Profs. Yuandong ZHANG and Kun LIANG. He is also working with Ursula TOOM on some Late Ordovician stromatoporoid from China and Kazakhstan.

Juwon Jeon

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Xiuchun JING (China) continues working on the Ordovician conodonts from North China and Tarim, and also on the integration of the conodont biostratigraphy and the carbon isotope chemostratigraphy. He published a paper in *Palaeo-3* with co-authors from Petro China and CUGB. Biostratigraphically-controlled Darriwilian carbon isotope excursions (LDNICE and MDICE) from North China were confirmed for the first time in this paper. Implications for climate change of the Darriwilian excursions are explored based on materials from North China and Tarim.

Xiuchun Jing

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Petr KRAFT (Czech Republic) continues his studies of graptolites and fossil associations in some localities and areas of the Prague Basin.

Petr Kraft

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Lukáš LAIBL (Czechia) continues to work on the morphology, evolution, and development of various euarthropods from the Cambrian and Ordovician strata worldwide, mainly with his colleagues from the University of Lausanne, Yunnan University, Lyon 1 University, University of Lille, Royal Belgian Institute of Natural Sciences, University of Brest, University Cadi-Ayyad, and Charles University. He is a co-author of a synopsis of the Ordovician in the Bohemian Massif (manuscript accepted in 2022) and with numerous colleagues, he described fossil assemblage at the new Fezouata locality Taichoute (published in 2022). He also worked on the exploitation of the pelagic realm by trilobite larvae, on the development of trilobites from the Fezouata Shale, as well as on the oldest trilobites from Belgium (all manuscripts submitted in 2022). Lukáš also did a considerable amount of science communication. He published a paper in a popular science journal dealing with the main Ordovician Konservat-Lagerstätten worldwide, a trilobite guide for kids, and presented talks about Fezouata Shale.

Lukáš Laibl

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Jeong-Hyun LEE (South Korea) continues to work on Cambro-Ordovician reefs and related geological events. In 2022, he published a summary of the Ordovician of the Korean Peninsula, a part of "A Global Synthesis of the Ordovician System" published in the Geological Society of London Special Publications. His current Ordovician research topic includes sponge-microbial reefs in the Great Basin (USA), stromatolites in Oklahoma (USA), brachiopod-microbial reef (Russia), the affinities of *Renalcis* and *Solenopora*, and *Solenopora* reefs.

Jeong-Hyun Lee

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Bertrand LEFEBVRE (France) continues working on Ordovician echinoderm systematics, palaeoecology and paleobiogeography. Last year, he supervised two BSc research projects. Pauline BOUTRELLE investigated the evolution of benthic communities through time in the lower part of the Fezouata Formation (late Tremadocian) in the Zagoara area (Morocco). Maxime RENAUD focused on new occurrences of stylophoran echinoderms in the Postolonnec Formation (Darriwilian) in Crozon peninsula (France). During the summer, the latter project was followed by field work in western Brittany, with Muriel VIDAL and several colleagues involved in the Crozon natural reserve. Bertrand also supervised the MSc research project of Christophe DUPICHAUD, on solutan echinoderms from the Lower Ordovician Fezouata Lagerstätte. Since October 2022, Christophe is now beginning a PhD thesis on the anatomy and phylogeny of Cambro-Ordovician echinoderms.

In 2022, with colleagues from Dijon (Alexandre POHL), Lille (Thomas SERVAIS) and Wimereux (Grégory BEAUGRAND), Bertrand was successful in obtaining a four-year project funded by the French Research Agency (ANR). This project, entitled 'Evolution of the Cambrian-Ordovician Biodiversification Onset Over Space and Time' (ECO-BOOST), will combine empirical palaeontological data with palaeoclimate and (macro-)ecological modelling, so as to analyse the onset of Cambro-Ordovician radiations through time and space.

Last year, Bertrand was mostly involved in editorial tasks. In the first half of 2022, the long-awaited volume 485 of the *Geological Society of London Special Publications (The Great Ordovician Biodiversification Event: Insights from the Tafilalt Biota, Morocco)*, co-edited with Aaron W. HUNTER, Javier ÁLVARO, Peter VAN ROY and Samuel ZAMORA, was finally completed and published. In 2022, he was also strongly involved in two new editorial projects: (1) volumes 532 and 533 of the *Geological Society of London Special Publications (A Global Synthesis of the Ordovician System, parts 1 and 2)*, co-edited with David HARPER, Ian PERCIVAL and Thomas SERVAIS, which are already online and will appear in print in July 2023; and (2) a thematic volume in *Geobios*, related to the

IGCP 653-735 meeting in Lille (2021), co-edited with Thomas SERVAIS, and which should be completed in late 2023.

With Yves CANDELA, Khadija EL HARIRI, Mansoureh GHOBADI POUR, Elena RAEVSKAYA, Oive TINN, Beatriz WAISFELD and Wenhui WANG, Bertrand is also one of the co-leaders of the IGCP project 735 'Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification' (Rocks n' ROL). In 2002, the main achievements of IGCP 735 were the organization of the second annual meeting in Marrakesh (Morocco), and the initiation of a project of short videos on Ordovician rocks from all around the world.

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Stephen LESLIE (USA) is primarily working on Middle and Late Ordovician, and a bit on early Silurian, conodont biostratigraphy and integrating the biostratigraphy with studies of Ordovician paleoclimate change. Work continues with Dan GOLDMAN integrating graptolite and conodont biostratigraphy in dark shale successions. Dan GOLDMAN and he, along with Yan LIANG and Stig BERGSTROM have just completed a revised Ordovician biostratigraphy review paper that correlates the GTS2020 Ordovician timescale and global stages with 8 graptolite, 10 conodont and 8 chitinozoan zonal schemes. The integrated biozone charts are downloadable as pdf files at the bottom of the GSL site (https://geolsoc.figshare.com/collections/Ordovician_Biostratigraphy_Index_Fossils_Biozones_and_Correlation/6246574/1).

Work also continues with Paul MYROW on Ordovician successions in Colorado, and with Achim HERRMANN testing the early Late Ordovician cool water carbonate hypothesis in the North American Midcontinent using oxygen isotopes from conodont apatite. This past year, Steve has finished a project with Antun HUSINEC on Late Ordovician to Early Silurian conodont biostratigraphy and carbon isotope stratigraphy in the Williston Basin, and began work with Justin STRAUSS and his lab on Late Ordovician to early Silurian conodonts from the Yukon.

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Lixia LI (China) continues to work on the Paleozoic sponges and graptolites from South China. Her research activities in 2022 were mainly on taxonomy, paleoecology and macroevolution of sponges from Ordovician-Silurian boundary section in South China. There is a good progress in the study of systematic paleontology of the hexactinellids and a new stiadermatid (Hexactinellida, Porifera) from the latest Ordovician of Anhui, South China and its significance for searching the missing link between the Cambrian and late Paleozoic stiadermatid lineage was published in Historical Biology. Another manuscript

about Late Ordovician sponge spicules from South China has also been submitted. She carried out a project about sponge biodiversification during the Ordovician-Silurian boundary interval in South China and its implication, cooperated with Prof. Joachim REITNER (Göttingen University). Furthermore, she is also working on the Early-Middle Ordovician graptolites from South China, mainly focusing on graptolite taxonomy and biostratigraphy. One paper about the upper Tremadocian (Ordovician) graptolite *Kiaerograptus* from central Hunan, China has been published in *Acta Geologica Sinica*.

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-

Ming LI (China) continues her work on Early Ordovician (Tremadocian) graptolite systematics, phylogeny and biostratigraphy. This year, the main work areas are the South China and North China. Focus on the taxonomy of graptolites and stratigraphic division in Tremadocian.

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Qi-jian LI (China) is mainly working on Ordovician-Silurian reefs and hypercalcified sponges (e.g. calathids, stromatoporoids and siphonozoans). In 2022, he continued his sedimentological and paleoecological research on Ordovician reefs. Apart from the fossil materials, he also continues his collaborations on quantitative paleoecological analyses of reefs at the Ordovician-Silurian transition with several colleagues, mainly based on several databases. As a member in the advisory board of the Geobiodiversity Database (GBDB), he has worked with Dr. NA Lin on the further optimization of the database functions. Please contact him if any of you are interested in the GBDB. In addition, he is also carrying out an ongoing project, targeting the feeding ecology of archaeocyaths and calathids by using computational fluid dynamics techniques.

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-

Jianbo LIU (China) continues research on the sedimentary and geochemical changes in the Lower and Middle Ordovician and their relationship with the GOBE in South China with Renbin ZHAN (Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences) and other members in his research group. The studies on the Phanerozoic

microbialites are still in progress with Yoichi EZAKI, Natsuko ADACHI (Osaka City University).

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Jörg MALETZ (Germany) is working on several projects in the Ordovician and Silurian. The project on the graptolite evolution of the late Cambrian (the Furongian Gap of some authors) Guole Biota with ZHANG Yuandong and ZHU Xuejian (NIGPAS, Nanjing, China) should be now a main focus, as travel to China will be possible again. The "Graptolite Treatise" is nearly finished, and hopefully will be published in the summer of 2023.

Further work on Lower to Middle Ordovician faunas from various sections in Scandinavia is in progress, but his main graptolite focus in 2022 was on the taxonomy and biostratigraphy of the Silurian Retiolitidae.

Jörg Maletz

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Peep MÄNNIK (Estonia) is working on evolution, taxonomy and palaeoecology of conodonts, conodont-based high-resolution stratigraphy, bioevents and palaeogeography. He is also interested in sequence stratigraphy, palaeoclimatology and evolution of sedimentary basins. A new five-year project, “From Greenhouse to Icehouse: Reconstructing Ordovician Climate Transitions and Biotic Responses in Baltica”, starts in this year. Also, joint studies together with colleagues from Estonia, Germany, Poland, Sweden, U.K. and USA on evolution and high-resolution stratigraphy of the Early Palaeozoic faunas and sedimentary basins on different palaeocontinents are going on.

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Tim McCORMICK (UK) continues to design and maintain key digital data sets for the British Geological Survey, and to teach and advise on digital data management and database design in the UK and internationally. Notable among the data he manages is the BGS Lexicon of Named Rock Units, a controlled vocabulary covering the entire geological history of the British Isles, including definitions of c. 1,100 Ordovician lithostratigraphic and lithodemic terms. Recent international collaborations include development of ‘Geo-Data Centres’ with government agencies in Kenya and Nigeria.

Tim also continues as Treasurer and Membership Secretary of The Palaeontographical Society. Nearly the entire run of *Monographs of the Palaeontographical Society* from 1847 to 2022 is now available online from <https://www.tandfonline.com/toc/tmps20/current> and <https://www.palaeosoc.org/>, including many describing Ordovician faunas from the British Isles.

Tim McCormick

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Patrick McLAUGHLIN (USA). It was an especially busy year taking a new job in Illinois, moving house, and juggling multiple projects focused on critical minerals. Job satisfaction had severely diminished at the Indiana Geological Survey by 2021 following the incoming of a new administration a few years before. Several close colleagues, outstanding researchers that should have been awarded for their dedication and inspired work, were harassed into leaving the organization. Patrick held out longer than most, but with the departure of cherished friend and collaborator Alyssa BANCROFT (now happily settled at the Iowa Geological Survey/University of Iowa), he was desperately looking for other options. Luckily a colleague knew of the Illinois State Geological Survey's (ISGS) need of a sedimentary geologist and fortunately Patrick fits the description. He started the job remotely at the beginning of 2022 and moved the family to Illinois in early May.

Patrick continued to work on the Upper Katian and Hirnantian during 2022 with Poul EMSBO, Alyssa BANCROFT, Thijs VANDENBROUCKE, and U. Ghent PhD student Cristiana ESTEVES. They also had the great pleasure of having two new PhD students join their research group, focusing primarily on Silurian events. Patrick was lucky to be able to hire Tim PATON to join him at the ISGS in July to work on critical minerals projects. Tim has a MS from University of Cincinnati, where his work on a fabulous set of early Katian hardgrounds from southern Ontario was guided by Carlton BRETT. Tim also got a few years of PhD work under his belt at University of Tennessee before moving on to work for the Kentucky Geological Survey and now ISGS. He is rapidly advancing the study of over 600 cores that were drilled in the Chicago area during the 1970s and 80s. With Patrick, they are cranking up the resolution on age assessment of complex late Katian paleokarst and incised valley systems that crisscross the eastern U.S. and the rare earth-enriched phosphate deposits that onlap them.

During 2022, Patrick had the honor of writing two Ordovician manuscripts with outstanding colleagues. Alycia STIGALL and he condensed the Ordovician geology of the U.S. into just 11 pages of text and figures (followed by another 11 pages of references!) with the assistance of reviewers Stan FINNEY and Carl BRETT and guest editor Ian PERCIVAL. Patrick also led the charge on a summary of Ordovician tephra studies with coauthors Leon NORMORE, Brian SELL, and Jahan RAMEZANI.

Best wishes to you all for a happy and productive 2023!

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Tõnu MEIDL (**Estonia**) is holding the positions of Professor of Palaeontology and Stratigraphy at the University of Tartu (Institute of Ecology and Earth Sciences) and is working on different aspects of litho-and biostratigraphy, ostracods and stable isotopes in the Ordovician of Estonia, Latvia and Lithuania (together with L. AINSAAR, A. LEPLAND, O. TINN, O. HINTS, P. MÄNNIK, K. TRUUVER, T. PAISTE, K. KUNGLA, A. SPIRIDONOV, S. PETRUKONÈ and S. RADZEVIČIUS).

He acted as a member of the scientific committee of 19th International Symposium on Ostracoda.

He is involved in organising the 14th International Symposium on the Ordovician System. together with colleagues from the University of Tartu, Tallinn University of Technology (Taltech), Estonian Geological Survey and Estonian Museum of Natural History. The meeting will take place on July 15-26th, 2023 (see: <https://isos14.org/>).

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Michal MERGL (**Czech Republic**) is working on research of linguliformean brachiopods of Tremadocian and Floian age, and the unique new Dapingian/Darriwilian fossil assemblage from the Barrandian. However, most of current interest is focused to linguliformean brachiopods of Lochkovian to Eifelian age. The Ordovician studies, unfortunately, have been overshadowed by Devonian research in the last year.

Michal Mergl

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Ana MESTRE (**Argentina**) is working on different topics related to biostratigraphy and taxonomy of the Lower – Middle Ordovician conodonts, as well as the sedimentology, stratigraphy, and evolution of the Ordovician and Silurian Precordillera basins. She keeps working on conodont biostratigraphy and the U-Pb zircon dates from K-bentonite of Lower-Middle Ordovician from the Precordillera in collaboration with Drs. Anders LINDSKOG (Lund University), André Navin PAUL and Urs SCHALTEGGER (University of Geneva). She also continues to collaborate on a multi-year project about the minerals of the clay group of the Ordovician-Silurian sedimentary succession from the Precordillera, which is developed in collaboration with Drs. Susana HEREDIA (CONICET – UNSJ), Juan Pablo MILANA (CONICET – UNSJ), Daniel POIRÉ (CONICET – CIG), Estefania ASURMENDI (CONICET – UNRC), and Josefina CARLOROSI (CONICET – UNSUGEO). Lower-Middle Ordovician conodonts and trilobite continue to be studied together with Drs. Josefina CARLOROSI (CONICET – UNSUGEO), Daniela MONTI (CONICET – IEGEBA), and Franco TORTELLO (CONICET – UNLP), through the collaborative project about the comparison and correlation of the Ordovician fauna from Argentine Precordillera, Famatina, and Eastern Cordillera. A post-doctoral plan is developed

by Florencia MORENO under her co-direction on microfacies, biostratigraphy, and biodiversity of Lower-Middle Ordovician conodonts from the Precordillera.

Ana Mestre

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Jim MILLER (USA) continues working on Cambrian and lowest Ordovician conodonts and strata in western Utah and eastern Nevada. A data-filled manuscript is in review, and it revises lithostratigraphic assignment of upper Cambrian and lowest Ordovician strata in eastern Nevada using conodonts, brachiopods, carbon isotopes, and sequence stratigraphy. There are multiple co-authors.

He recently moved from Springfield, Missouri to a suburb of Cleveland, Ohio. He is no longer directly associated with Missouri State University except for his email address, which remains the same as previously. In February he became 80 years old. No new publications.

James F. MILLER

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Stewart MOLYNEUX (UK) has recently completed a review of Ordovician successions in Britain and Ireland with Dave HARPER, Mark COOPER, Steve HOLLIS, Rob RAINES, Adrian RUSHTON, Paul SMITH, Phil STONE, Mark WILLIAMS, Nigel WOODCOCK and Jan ZALASIEWICZ, and published a paper on Early Ordovician chitinozoans from South Wales with Chloé AMBERG, Jan ZALASIEWICZ and Thijs VANDENBROUCKE. Work reviewing Cambrian and Ordovician palynology in Saudi Arabia for a forthcoming publication is ongoing and he is currently working on the palynology of a Middle Ordovician succession in North Wales.

Stewart G. Molyneux

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Diego Fernando MUÑOZ (Argentina) is a researcher at Centro de Investigaciones en Ciencias de la Tierra (CICTERRA - CONICET and Universidad Nacional de Córdoba) investigating Paleozoic deposits in Argentina. He is mainly studying marine siliciclastic trace fossils, particularly cruzianids, supervised by Dr M.G. MANGANO and Dr B.G. WAISFELD. He is particularly interested in the relationship between the occurrences between trace fossils and their probable producers and in studying the ichnological record from a paleobiological perspective. Regarding the ichnology studies, he has been working in the last years with radial to rosette trace fossils. Furthermore, he is in collaboration with colleagues studying graptolite and trilobite Ordovician biostratigraphy of the "Central Andean Basin".

Diego F. Muñoz

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Elise NARDIN (France) is currently working on Ordovician echinoderms (eocrinoids, rhombiferans, diploporitans) focusing on systematics, palaeoecology, and phylogeny. During past years, she was in long-term sick leave. But she has collaborated with Bertrand LEFEBVRE, Martina NOHEJLOVÁ, Chris PAUL, and Yamouna MAKLHOUF on the systematics and phylogeny of ‘cystoids’. New projects about the paleogeographic dynamics of Cambrian-Ordovician echinoderms are underway with Bertrand LEFEBVRE, Martina NOHEJLOVÁ, and Gilles ESCARGUEL.

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Navid NAVIDI-IZAD (Iran) continues his work on biostratigraphy and paleobiogeography of the late Cambrian and Ordovician organic-walled marine microphytoplankton of northern Iran and elsewhere. This year he published an article about *Virgatasporites* and *Atritasporites*, two enigmatic organic microfossils from the late Cambrian and Early Ordovician that have been considered originally as “spore” but in some research, they have been attributed to acritarchs. The biostratigraphy, paleobiogeography and possible affinity of these *incertae sedis* genera have been published in *Botany Letters*. Ongoing studies are the taxonomic revision of some Ordovician acritarchs taxa.

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Arne Thorshøj NIELSEN (Denmark) is still working mainly on Cambrian issues, but has done some work in the Ordovician in the past few years including introducing a new stage system for Scandinavia (with various colleagues). This work also reviews the stratigraphy of the Ordovician in Denmark, Norway and Sweden. Work on the Alum Shale Formation, mainly Cambrian but reaching into the Tremadocian, includes a publication on astronomical cycles & dating and a publication on stable isotope stratigraphy (lead author of both papers: Z. Zhao). A publication on the Lower and Middle Ordovician at Lanna, south-central Sweden, also primarily focusses on stable isotope stratigraphy (lead author A. Lindskog). Planned projects include description of the outer shelf trilobite fauna from Herramb, Norway.

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Martina NOHEJLOVÁ (Czech Republic) continues her work on Ordovician echinoderms (eocrinoids, solutans, stylophorans) focusing on systematics, palaeoecology, palaeobiogeography and phylogeny. During the last year, she closely collaborated with Bertrand LEFEBVRE on several projects. She was mainly working on material from Morocco (Fezouta and Tafilalt) and Czech Republic. She was author and co-author of four publications in the *GSL Special Publications* volume 485.

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Leon NORMORE (Australia) is currently on extended leave from the Geological Survey of Western Australia. In 2022, he continued working on the Ordovician with two contributions to the *GSL A Global Synthesis of the Ordovician System* and a recent publication on the Ordovician of the Canning Basin.

Leon Normore

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Alan OWEN (UK). The description of the very diverse (now 50+ species) trilobite fauna of the upper Katian Slade and Redhill Mudstones of South Wales with Lucy McCOBB (National Museum of Wales, Cardiff) and Patrick McDERMOTT is, at last, nearing completion. Several other projects on British and Irish Ordovician trilobite faunas are on the ‘to complete list’.

Alan W. Owen

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Tõnn PAISTE (Estonia). A relatively important article introduced the new genus *Amorphognathus* species in the Sandbian interval, that has a stratigraphic importance across Baltoscandia and probably beyond, in form of a new conodont biozone. Additionally, widely used *A. inaequalis* Conodont Subzone in the Baltoscandian region has no findings of the species it is based, thus calls for change in the current stratigraphic schemes (Meidla et al. 2023, Nielsen et al. 2023). Plus a new 848 illustrations of early evolution of genus *Amorphognathus* was added in form of supplementary material for free to access as a raw data for further taxonomic and stratigraphic analysis.

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Silvio PERALTA (Argentina) continued to work in 2022 on the Ordovician-Silurian transition and on the tecto-sedimentary evolution of the Hirnantian-Silurian basin of Precordillera in Western Argentina. This research was carried out together with Ph.D. Jessica GÓMEZ, by mean of a Research Fellow of the National Council of Scientific and Technical Research of Argentina (CONICET), with Dr. Matilde BERESI (Advisor) and Dr. Silvio H. PERALTA (Co-Advisor). The main subject of the work is performed on sedimentary, paleobiologic, isotopic and paleoenvironmental events in the Hirnantian-Rhuddanian transition in the San Juan Precordillera of Western Argentina.

Besides, he also supervised the PhD thesis of Dr. Jessica GÓMEZ at the National University of San Juan, together with Dr. Matilde BERESI (IANIGLA - CONICET) as a co-Advisor, working also on the Ordovician-Silurian boundary of the Precordillera de San Juan, Western Argentina. The thesis finished in November 16, 2022. This project was focusing on high-resolution stratigraphic correlation elements: a) characterization of diagnostic deposits such as lag deposits, phosphate lag, upwelling, and ironstone (Fe-phosphate oolites); b) biostratigraphic elements, as is the case of diagnostic faunal associations such as *Hirnantia Fauna* and associated trilobites, graptolites of the *M. persculptus* Zone, and palynomorphs (with Dr. Mercedes DI PASCUO, CONICET- ENTRE RÍOS-UADER); c) isotopic anomalies, essentially of C, O, TOC, Hg (with Dr. Alcides SIAL, NEG-LABISE); d) condensed section analysis; e) regional correlation with homologous successions of northwestern Argentina, as the Zapla and Lipeón formations; as well as in Bolivia, Peru, Venezuela, and Ordovician-Silurian basins of the Amazon in Brazil and Paraná in Paraguay; f) continental correlation, mainly with Africa and Gondwanan areas of Europe and China.

From 2020 to 2022, he led the Research Project “*High-resolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128)*”. This project was funded by the National University of San Juan (UNSJ), Argentina. He published as a co-author, some abstracts at the 8th Latin American Congress of Sedimentology, Parana, Argentina (with Jessica GÓMEZ, Matilde BERESI); at the Virtual Annual Meeting of IGCP 653 and 735, Lille, France (with Jessica GÓMEZ and Mercedes DI PASCUO).

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Ian PERCIVAL (Australia) has mostly concentrated this year on editing his allocation of manuscripts submitted for the *Global Synthesis of the Ordovician System* (Geological Society of London Special Publications 532 & 533, of which he is one of four co-editors). These volumes are on schedule to be published in mid-2023 to coincide with the 14th International Symposium on the Ordovician System to be held in Tallinn, Estonia. Ian is also contributing two chapters to this monumental work, one on the Ordovician System in Australia and New Zealand (with Yong Yi ZHEN and Leon NORMORE) and the other (considerably smaller) on the Ordovician of Antarctica (with Dick GLEN and Yong Yi). Apart from that, he worked intermittently on several other projects with Yong Yi, mainly involving Middle and Late Ordovician conodont biostratigraphy in central New South Wales. Two papers with Chinese colleagues appeared in 2022, one (Cui et al.) on heliolitine corals of Sandbian age from SW China, and the other on Llandovery conodont biofacies of South China.

Ian Percival

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Sofia PEREIRA (Portugal) has currently a fixed-term contract at the Centro de Geociências (University of Coimbra, Portugal). Her research follows two main lines: the geological study of poorly known Portuguese Ordovician areas (geological mapping/stratigraphy /paleontology; e.g. Penha Garcia, Portalegre and S. Jorge-Carvoeiro synclines) and the study of the Late Ordovician communities, particularly trilobites and the peri-Gondwana realm, describing assemblages from Portugal, Spain, Belgium, and Morocco, in collaboration with other researchers (Jorge COLMENAR, Juan Carlos GUTIÉRREZ-MARCO, Isabel RÁBANO, among others). She has been also supporting a new outreach centre (Centro Paleontológico Nery Delgado, Tomar, Portugal), currently under construction, mostly dedicated to the Portuguese Ordovician record.

Sofia Pereira

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Marika POLECHOVA (Czech Republic) continues her work on the Ordovician bivalves focusing on systematics, palaeoecology, palaeobiogeography, and early diversification. She works on the Late Ordovician bivalves of the Czech Republic and prepares a new revision

of the Lower Ordovician bivalves from the Montagne Noire and their impact on the early evolution of bivalves.

Marika Polechová

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Leonid POPOV (United Kingdom) is currently working on the Ordovician brachiopod faunas of Uzbekistan with Irina KIM (Uzbek Geological Survey, Tashkent) and Early Ordovician brachiopods of South Urals in cooperation with Robin COCKS (Natural History Museum, London). Work is also ongoing on the Ordovician brachiopod faunas of the East Baltic, Kazakhstan and Kyrgyzstan.

Reviews on the Ordovician of Kazakhstan and Central Asia are completed and will be published later this year in the *Geological Society of London Special Publications* series.

Leonid E. Popov

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John E. REPETSKI (USA). Continuing to work on conodonts and biostratigraphy of late Cambrian and Ordovician conodonts and biostratigraphy of North America and elsewhere, especially currently with colleagues J.F. TAYLOR, J.D. LOCH, J.F. MILLER, Justin STRAUSS and others on the Cambrian/Ordovician boundary interval. Also, histological and morphological studies with colleagues D. MURDOCK, P. SMITH, and others. With Rob RAINES and Paul SMITH, they are working on a project on northern Scotland, and with Randy ORNDORFF and Steve LESLIE we continue work on Ordovician successions in the Appalachians. Continuing work on conodonts from some impact structures, and conodont-based stratigraphic support for several USGS mapping projects. Recently, with colleagues Julie DUMOULIN (USGS-Anchorage) and Justin STRAUSS (Dartmouth College), they have completed the chapter on 'Ordovician Rocks of Alaska' for the forthcoming *Geol. Soc. London* volume on A Global Synthesis of the Ordovician System. Currently, as USGS-Emeritus, he is mainly working at home because of the pandemic, as library facilities, etc. at USGS are not fully accessible at this time.

John E. Repetski

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Farid SALEH (Switzerland) investigated niche and dispersal processes for trilobites and echinoderms during the Early Ordovician of Central Anti Atlas (Morocco), Cordillera Oriental (Argentina), and Montagne Noire (France), with a team of international researchers. In a paper published in *Scientific Reports*, they showed that dispersal increased

asynchronously for different animal groups and between the investigated regions. In another paper published also in *Scientific Reports*, Farid worked with international colleagues on describing a new site with exceptional fossil preservation from the Fezouata Shale (Early Ordovician, Morocco). This site is unique because it preserves abundant remains of large nektonic radiodonts in the most distal environmental setting of the Fezouata Shale. In the Fezouata Shale, Fe from Ordovician continental weathering played a vital role in the preservation of soft tissues, by inducing damage to bacterial membranes living under oxic conditions and favoring the replication of soft tissues in pyrite under sulfate-reducing conditions. These results were published in *Terra Nova*.

Farid Saleh

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Matthew SALTZMAN (USA) continues working on traditional stable C and radiogenic Sr/Nd isotope studies in the Ordovician, as well as new studies of non-traditional lithium (Li) and calcium (Ca) isotopes. Papers in 2022 include a Geology paper first-authored by my PhD student Chris CONWELL on Nd isotope stratigraphy and cooling in the mid-Darriwilian and PhD student Teresa AVILA's work on Ordovician Sr and O isotopes (with Michael Joachimski) from the Arbuckle Mtns of Oklahoma published in Earth and Planetary Science Letters. PhD student Datu ADIATMA has a manuscript nearing completion on Li isotopes in the Ordovician with Xiaoming LIU at UNC-Chapel Hill. Ca isotope work in the TIMS lab run by Liz GRIFFITH at Ohio State includes MDICE data from Meiklejohn Peak analyzed Datu and Swedish and Maryland samples analyzed by Chris CONWELL.

Matthew R. Saltzman

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-

Thomas SERVAIS (France) continues working on different Ordovician topics, from acritarch taxonomy and biostratigraphy, to more general views on the Ordovician radiation and its triggers. In the frame of his PhD research, SHAN Longlong (Nanjing, China) spent a year at Lille, between late 2021 and late 2022, and we published together a paper (*Philosophical Transactions of the Royal Society, B* 377: 20210035) on the significant shift in the late Cambrian/Early Ordovician, when new acritarch morphologies massively occupied all marine environments. Another paper by Shan *et al.* (*Palynology*) illustrates that the acritarch *Goniomorpha* actually represents teeth of a priapulid worm (extending the range of this classical Burgess-shale fossils into the Ordovician). Other acritarchs, that are actually not organic-walled phytoplankton, but most probably spores of an organism between algae and land plants, are the genera *Virgatasporites* and *Attritasporites*, revised in collaboration with some former PhD students, Navid NAVIDI-IZAD (Tehran, Iran), Houcine BENACHOUR (Tlemcen, Algeria), and others. The review of Palaeoceanic acritarch diversity was finally published by Kroeck *et al.* in 2022 (*Earth-Science Reviews*). Regional studies on the Ordovician of Belgium were focused on the oldest trilobites (with

Lukas LAIBL, Prague, Czech Republic, and Bernard MOTTEQUIN (Brussels, Belgium). Most time was spent, however, into the different books and special issues, partly related to the closing meeting of IGCP 653 (Lille, September 2021): special issues in *Geobios* (co-guest-edited with Bertrand LEFEBVRE) and in *Palaeo3* (co-guest-edited with Dave HARPER and WANG Wenhui) and of course the *Geol. Soc. Sp. Publ.* volumes 532 and 533 (a large project started by Dave HARPER and Ian PERCIVAL, playing first and second violin, and finally finished in a quartet together with Bertrand LEFEBVRE). The two books will be published in 2023, and be presented at the ISOS at Tallinn, Estonia.

Thomas Servais

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Matthias SINNESAEL (France) finished his PhD entitled “Astronomical cycle identification – new methodological approaches and application to high-resolution Ordovician stratigraphy” with Thijs VANDENBROUCKE (Ghent University) and Philippe CLAEYS (Vrije Universiteit Brussel) in 2020. After a post-doc in statistical chronostratigraphy at Durham University (2020-2021) tackling the problem of stratigraphic correlation and integration using Bayesian statistics applied to Cambrian strata, Matthias is now working as a post-doc at the Observatoire de Paris with Jacques LASKAR. Current work focuses on the use of (deep-time) cyclostratigraphic data to further constrain astronomical solutions and derive past Solar System dynamics. Matthias stays interested in better understanding Ordovician paleoclimate and stratigraphy - especially cyclostratigraphy and astrochronology, as illustrated in the 2022 *Geochronology* paper discussing cyclostratigraphy of the Middle Ordovician sections in Brittany (France), and a review chapter on ‘Ordovician cyclostratigraphy and astrochronology’ in the upcoming Ordovician *Geological Society London, Special Publication*.

Matthias Sinnesael

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Patrick Mark SMITH (Australia) is continuing to work on Australian Ordovician biostratigraphy. During 2022 along with Russell BICKNELL, Thomas HOWELLS, and John FOSTER he described a malformed specimen of the Ordovician trilobite *Ogygiocarella debuchii* (Brongniart, 1822) (along with a host of other Cambrian trilobites) from Wales, UK. He has also been actively involved in three other manuscripts which have been submitted at the start of 2023, including: (1) the description of a large trilobite fauna from the Tremadocian to Floian Nambeet Formation in the Barnicarndy 1 drill core with Heidi ALLEN of the Western Australian Geological Survey; (2) a field guide and catalogue of Ordovician–Devonian fossils from the southern Cobar Basin, New South Wales with Yong Yi ZHEN, Ian PERCIVAL and host of others; and (3) a description of biozones from the Middle to Upper Ordovician conodonts from the Gunningbland area, New South Wales also with Yong Yi ZHEN and Ian PERCIVAL. Outside of these papers Patrick is continuing

to describe the trilobite and conodont fauna from the Tremadocian aged Florina Formation (NT), Nootumbulla Sandstone (NSW), Bynguano Quartzite (NSW), and Scropes Range Formation (NSW).

Patrick Mark Smith

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- *****

Jim SPRINKLE (USA) is still working on Ordovician projects even though he has been retired for 9-1/2 years. Right now he is getting ready to move to a somewhat smaller office with all his reprints, other echinoderm worker's reprints (10 shelves worth), some of his fossil collections (most will go out to the Non-vertebrate Paleontological Laboratory about 10 mi. north of here), many years of various paleontological journals, correspondence with other workers, etc. Most of his research has been with Tom GUENSBURG, now at the Field Museum, Colin SUMRALL (University of Tennessee), Samuel ZAMORA (Geological Institute of Spain), Rich MOOI (California Academy of Sciences), Forest GAHN (Brigham Young Univ. Idaho), and several amateurs on Ordovician projects in Oklahoma, Utah, and Nevada, trying to get new (and especially old) projects finished.

He still has copies of his 1973 hard-bound Ph.D. Dissertation on Blastozoan Echinoderms to sell for \$15 (postage paid); this is another item that probably won't fit into his new office. It covers both Cambrian and Ordovician echinoderms at the beginning of their fossil record.

James Sprinkle

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- *****

Colin D. SPROAT (Canada) is continuing to work on the Ordovician brachiopods of Canada with diversions into the Cambrian and Silurian. His Ordovician work is currently focused on collections from Manitoba (central Canada), including an unusual brachiopod fauna from the highly restricted Williams Lake locality where brachiopods occur together with unusual phosphatic tube-shaped fossils (probably *Sphenothallus*) and a variety of arthropods and jellyfish. He continues to work with Yuchen ZHANG and Renbin ZHAN in Nanjing, China, studying brachiopods from western China and their evolutionary and biogeographical significance.

Colin D. Sproat

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Philippe STEEMANS (Belgium) has very few things to tell. He just would like to highlight results from Ordovician palynomorphs published in the paper he co-authored in *Botany Letters* with NAVIDI-IZAD *et al.* (2022). Although they stay wise in the conclusions, in his mind, there are a lot of biological elements suggesting that *Virgatasporites* is the oldest witness of the continental vegetation, because of its morphology, very typical of monad land plant spore: thick exine, a distal and proximal faces with different morphology. The proximal face is covered by radial muri and the distal face is laevigate, as is *Artemopyra*, which is known to be produced by land plants (observed *in situ*) during the Late Silurian, and by *Emphanisporites* during the Late Silurian and the Devonian. It is very likely that *Artemopyra* is a junior synonym to *Virgatasporites*. The largest majority of *Virgatasporites* are known from the Gondwana, which is more and more believed to be the palaeogeographic area of the occurrence of the land plants. Later, only two badly specimens of *Virgatasporites* have been found in the Silurian from Euramerica (Sweden and Nova Scotia).

Cryptospores are usually definite according to their morphology (tetrads, dyads and monads), but their biological affinity is still controversial. Some consider that all palynomorphs coming from the continent are cryptospores (mixing eggs, algae, spores etc). Others consider that cryptospores are produced only by earliest land plants. In both cases, this is unsatisfactory. As all so-called cryptospores earlier than Late Silurian are found in marine or near-shore sediments, all of them are abusively considered as cryptospores. The same, if they are not proved as produced by plants.

One exception, the chemical analysis of palynomorphs attributed to plant cryptospores are composed by the same wall exine than spores produced by plants (Steemans *et al.* 2010; doi: 10.1016/j.revpalbo.2010.07.006). This analysis had been done on Early Silurian palynomorphs from Gotland (samples from A. Le Hérissé). Therefore, all palynomorphs of the same morphology than those observed *in situ* and the ones chemically analysed may be supposed to be true cryptospores produced by land plants.

The presence of an assemblage of trilete spores in the Late Ordovician from Saudi Arabia (Steemans *et al.* 2009; doi: 10.1126/science.1169659) proves that land plants existed during this time despite the denigrating remarks of certain authors, it has never been proven that this observation was erroneous.

In conclusion, it is time to organize a working group to define what are cryptospores. The best place to do this is the CIMP.

On March 1 Philippe will be retired but he will be very happy to continue to contribute to new projects, review papers, give advice, information... So, if you believe in his experience, please contact him (see below).

Philippe Steemans

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Sarah STEWART (UK) is still working on mollusc collections and historical collections in the museum. A Masters student she was supervising has successfully completed her dissertation on the Opalised molluscs from the Cretaceous Griman Creek Formation at Lightning Ridge in Australia.

Sarah Stewart

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Alycia L. STIGALL (USA) is working mainly on Ordovician projects involving the GOBE and Richmondian Invasion from a biogeographical, palaeoecological, and phylogenetic framework using articulated brachiopods as model organisms. Her students and she have continuing field projects investigating morphological change across the GOBE in Oklahoma and paleoecological changes across invasion events in the Cincinnati Arch and Nashville Dome regions.

After moving to the University of Tennessee, Knoxville in August 2022, Alycia is working on establishing a larger, productive lab that will include students ranging from undergraduate to PhD students as well as post-docs over the next few years. She is looking forward to continuing collaborations with the international Ordovician community as well as expanding work on the nearby Upper Ordovician strata in Tennessee and the southeastern US.

Alycia Stigall

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Svend STOUGE (Denmark) continuing his work on Cambrian and Ordovician conodonts from Baltoscandia (Baltica), western Newfoundland and Greenland (Laurentia) and China. Main project being: (1) integration of upper Cambrian–mid Ordovician conodont and trilobite zones (with Arne T. NIELSEN); (2) Svalbard conodonts based on own and older collections (with Oliver LEHNERT and Hubert SZANIAWSKI); (3) Upper Ordovician conodont biostratigraphy, Washington Land, western North Greenland (with Peter ALSEN) and (4) the Dapingian Stage, South China (with Zhihong LI).

Svend Stouge

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Paul K. STROTHER (USA) continues to work on the discovery and systematics of cryptospores and other marine and non-marine palynology of the lower Paleozoic. Following on the 2021 report in *Science*, “A fossil record of plant origins from charophyte algae” with Clinton FOSTER (Australian National University) they are examining a Middle Ordovician cryptospore assemblage from Australia. Their research is reformulating how they view the timing of land plant origins -- as a serial process of acquisition of a developmental genome that took place throughout the entirety of the Ordovician Period – rather than as a point in Geologic time. Together with Marco VECOLI, he is also continuing the study of biology of freshwater environments in the Hirnantian of Gondwana.

Paul K. Strother

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John TAYLOR (USA) continues to nudge several projects on Ordovician trilobites and agnostoid arthropods forward, and one has risen to the top of the queue for 2023. A mid-2023 deadline for contribution to an *Australasian Palaeontological Memoir* (Cambrian-Ordovician Studies VII) assures that a large manuscript on Tremadocian faunas, sedimentology, and Carbon isotope stratigraphy of the Laurentian Skullrockian-Stairsian Stage boundary interval in the El Paso Group of the southwestern USA will be completed this year. Other Ordovician projects with John REPETSKI, James LOCH, Paul MYROW, Rob RIPPERDAN, and Justin STRAUSS continue, and perhaps a second manuscript on one of those will also be completed in 2023.

John F. Taylor

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James R. THOMKA (USA) continued research on stalked echinoderms, ichnofossils, and high-resolution cratonic sequence stratigraphy. His student, James FERRONE, and he have been working on the diversity, taphonomy, and microstratigraphic distribution of crinoidal material from Ordovician ‘butter shales’ of the Cincinnati Arch region, which are distinctive units well-known for their articulated and enrolled trilobites but also yielding a rich (although disarticulated) crinoid fauna. In other Ordovician echinoderm-related endeavors, James spent part of 2022 working on Middle Ordovician rhombiferan specimens representing the oldest examples of parasitic swollen pits in echinoderm hosts—the beginning of a host-parasite association that would persists for more than 200 million years! In addition, colleagues (including Ben DATTILO, Rebecca FREEMAN, Dave MEYER, and Davey WRIGHT) and he wrote up and submitted the results of their years-long study on phosphatic micro-molding and its role in high-fidelity preservation of Ordovician crinoid column stereomic microstructure. This provided an important guide for comparison between Paleozoic and modern crinoid soft-tissue distribution. Very preliminary research was conducted on the roles of stalked echinoderms as sediment binders and sediment producers in Chazyan bioherms in northeastern New York state. Beyond Echinodermata, his students, Parker LECLAIR and Alex MERCIER, and he worked on the detailed sequence stratigraphy and magnetic susceptibility analysis of Darriwilian-Sandbian biothermal carbonates and dolomitized Katian mixed carbonate-siliciclastic successions.

James R. Thomka

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Petra TONAROVÁ (Czech Republic) continues in the study of Lower Palaeozoic palynomorphs, with major focus to scolecodonts. Together with colleagues from Tallinn University of Technology (Olle HINTS, Jaak NÖLVAK), she studies taxonomy, palaeobiogeography and diversification history of Palaeozoic jaw bearing polychaetes based

on data from various sections all around the world. In 2022 a study on Katian and Hirnantian scolecodonts from the Prague Basin (Tonarová et al. in press) was finished.

Petra Tonarová

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Ursula TOOM (Estonia) continues studies on the bioerosion on Baltica in collaboration with Dirk KNAUST, Olev VENN, Kenneth de BAETS, Weronika ŁASKA, Mark A. WILSON, and Andrei ERNST. Joint studies together with colleagues from Estonia, Poland, Finland, Germany, Sweden, the U.K., the USA, Russia, China, and Korea, on the evolution and taxonomy of the Early Palaeozoic faunas are going on. In 2022, she started her postdoctoral studies in Krakow, under the supervision of Professor Alfred UCHMAN.

Ursula Toom

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Blanca Azucena TORO (Argentina) remains focused on studies related to Lower Paleozoic graptolites from South America, at the Central Andean Basin (Argentina, Bolivia, Perú and Colombia) and the Argentine Precordillera (San Juan Province). She is leading two multidisciplinary projects regarding biostratigraphic correlations and paleobiogeography, based on graptolites, palynomorphs, conodonts, brachiopods and trace fossils from Northwest Argentina, in cooperation with colleagues from several Argentine universities, and their respective teams; as well as a collaborative research in progress together with Juan Carlos GUTIÉRREZ-MARCO, Complutense University, Spain. Innovative graptolite research applications for South America, like the study of morphological diversity of graptoloids related to paleoenvironmental features and their habitat distribution, are also developing under her direction, in the framework of the Gerardo A. LO VALVO PhD Thesis. Likewise, she continues running pioneering results for the NW Argentina and Precordillera, as supervisor of Nellys C. HERRERA SÁNCHEZ Postdoctoral Project about graptolite reflectance in comparison with inorganic proxies, constraining graptolite biostratigraphy and diversity patterns obtained with CONOP; in cooperation with Thomas GENTZIS, Core Laboratories, Texas, Margarita DO CAMPO, INGEIS, University of Buenos Aires and Daniel GOLDMAN, Department of Geology and Environmental Geosciences, University of Dayton, respectively.

Blanca Azucena Toro

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Thijs VANDENBROUCKE (Belgium) remains interested in reconstructing the Ordovician palaeoclimate and palaeo-environment. Julie DE WEIRDT is finalizing her PhD research project with him at UGent. Julie focusses on geochemistry and palynology of the Upper Ordovician - lower Silurian in N. America. PhD student Cristiana ESTEVES continues her research project on the chitinozoan biostratigraphy of the Katian Maquoketa Group in the USA. As part of his postdoc, Dr. Thomas Wong HEARING embarked on a project on Ordovician graptolite biogeography. Nick VAN FAALS has just joined the lab to pursue a PhD project on chitinozoan ecology with a focus on Upper Ordovician sections. MSc student Rosalia Alba VITTIGLIO investigates the palynology of the Hirnantian of Missouri. These all are projects in collaboration with Poul EMSBO (USGS), Patrick McLAUGHLIN (Illinois Geol. Survey), Mikael CALNER (ULund), Alyssa BANCROFT (UIowa), Mark WILLIAMS (ULeicester) and André DESROCHERS (UOttawa). Mathilde BON is a joint PhD student between UGent and ULille, co-supervised by Kevin Lepot, and investigates the organic geochemistry of, amongst others, Ordovician palynomorphs.

The other members of the lab pursue their interests in the Silurian, but remain involved in various Ordovician side projects. Tim DE BACKER is finalizing his PhD research project on the geochemistry and palynology of upper Silurian and Devonian sections in the US and Europe. The PhD projects of Carolina KLOCK and Iris VANCOPPENOLLE focus on the palynology of the Silurian and Mulde Ireviken event respectively (both co-supervised by Poul Emsbo and Pat McLaughlin). PhD student Joana ROSIN focusses on the Triassic-Jurassic, co-supervised by Bas van de Shootbrugge (UUtrecht). MSc student Daan DE VOS works on limestone-marl rhythmites from Gotland, co-supervised by Axel Munnecke (UErlangen).

The HFSP (The Human Frontier Science Program) funded project is a collaboration between UGhent, Bas VAN DE SCHOOTBRUGGE (UUtrecht), Barry LOMAX (UNottingham) and Cindy LOOY (UC Berkeley), continues into 2023, and focusses on teratology in microfossils as a proxy for understanding mass-extinctions through time. The year 2022 saw the start of an FWO (Research Foundation Flanders), which is a collaboration between the UGhent lab, Poul EMSBO (USGS) and Patrick McLAUGHLIN (Illinois Geol. Survey) focussing on mid-Palaeozoic biogeochemical events. A second and new FWO grant just started in 2023, between the UGent lab, Poul EMSBO and Appy SLUIJS (UUtrecht) and will focus on stable carbon isotope geochemistry in the Ordovician and Silurian. We will be recruiting two new PhD students on this grant in 2023.

Thijs R. A. Vandebroucke

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Jacques VERNIERS (Belgium) is officially retired but still part-time active at the university (and mostly on Silurian).

Jacques Verniers

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Olev VINN (Estonia) is working on the evolution of symbiosis, predation, bioerosion and encrustation in the Ordovician. He is also working on the palaeontology of problematic tubeworms from the Palaeozoic (e.g. cornulitids, tentaculitids, microconchids, *Sphenothallus* etc.) and evolution of tubeworm biomineralization. His other research interests include trace fossils of the Ordovician of Estonia and beyond. Since October 2022, he is associate editor of two journals, *Frontiers in Ecology and Evolution*, and *Frontiers in Earth Science*: all papers on the Ordovician paleontology are very welcome!

Olev Vinn

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Gustavo G. VOLDMAN (Argentina) continues working on taxonomy and biostratigraphy of lower Paleozoic conodonts and associated faunas from South America, mostly from the Argentine Precordillera and the Central Andean Basin, with colleagues from the Centro de Investigaciones en Ciencias de la Tierra (CONICET-UNC) and the Universidad Nacional de San Juan, Argentina. He also collaborates with Ali BAHRAMI and Farzad POURSALEHI from the University of Isfahan, Iran, in order to refine the Ordovician North and South Gondwana intercontinental correlations.

Gustavo G. Voldman

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Beatriz G. WAISFELD (Argentina) continues to work on Lower Paleozoic trilobites from South America mainly focused on taxonomy, biostratigraphy, and paleoecology. She is involved in a long-term study of Late Cambrian – Early Ordovician diversification patterns and ecosystems structure in the Central Andean Basin together with Argentine colleagues. She was involved in the elaboration of the chapter ‘The Ordovician of the southern South America’ along with colleagues from different Argentinian institutions and from Chile and Brazil for the forthcoming book ‘A global synthesis of the Ordovician System’ (Geological Society of London).

A joint international cooperation programme with colleagues from the University of Lille and the Centro de Investigaciones en Ciencias de la Tierra (CICTERRA, National University of Córdoba) has just finished at the end of 2022. Among the most important outputs is the development of a dynamic, open, and collaborative database for morphogeometric information of trilobites together with a landmark acquisition protocol. The database will be useful for multiple purposes, for example, comparisons of disparity and diversity trends and ecological and evolutionary implications of morphological diversity in different contexts. Hopefully, results will be published this year.

She continues working in different collaborative projects, such as the study of a Floian to Darriwilian trilobite fauna from southwest Perú together with Juan Carlos GUTIÉRREZ-MARCO (Spain) and Emilio VACCARI (CICTERRA); the analysis of diversity and disparity trajectories of Furongian - Early Ordovician trilobites from the Central Andean Basin with Fernanda SERRA and Diego BALSEIRO (CICTERRA), the study of trilobites and associated trace fossil in late Cambrian – Early Ordovician marginal-marine settings

from NW Argentina with Gabriela MÁNGANO and Luis BUATOIS (University of Saskatchewan)

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Guangxu WANG (China). Several Ordovician-related papers were published in collaboration with colleagues in 2022, most of which focus on the thus far little known shallow-water Ordovician rocks and fossils in the western Yangtze region, South China.

Guangxu Wang

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Wenhui WANG (China). In the past year (2022), Wenhui and her colleagues continued their work on biostratigraphy and chemo-stratigraphy around the Cambrian-Ordovician boundary and Ordovician-Silurian boundary.

She and her students collected OSB graptolites and used computational fluid dynamics (CFD) analysis to study semi-conical forms of *Demirastrites* genus and found that the formation of this kind of tubarium structure might have improved the hydrodynamic properties of Monograptids and is benefit for their locomotion in up-welling regions.

Wang and her students did high-resolution measurements of mercury (Hg) concentrations and redox sensitive elements analysis in the strata of Ordovician-Silurian age, which is interbedded by volcanic ash layers in South China. This work suggested that the marine ecological crisis was related to a series of disruptions in biogeochemical cycles in the post-volcanic period.

The Furongian biodiversity gap (FBG) is also the research interest of Wang and her colleagues. They did a systematic investigation of the relationships between fossil sampling intensity, spatial extent, and biodiversity during the Cambrian and Ordovician, using data from the Paleobiology Database (PBDB) to gain a better understanding of this lowstand in biodiversity.

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Xiaofeng WANG (China). Due to the impact of the epidemic in 2022, the energy of his Ordovician-Silurian research group was mainly contributed to the compilation and publication of Chinese stratigraphic Lexicon (Early Paleozoic) and the monographs of

Dayangcha ASSP, in addition to in-house research and fossil identification besides doing a few field works in the Yangtze gorges area.

Xiaofeng WANG

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Xin WEI (China) is interested in the macroevolution, taxonomy, palaeoecology and biogeography of Ordovician trilobites, especially two major bioevents, *i.e.*, the Great Ordovician Biodiversification Event and end-Ordovician mass extinction. He is working now on the Middle-Upper Ordovician trilobites of South China, together with Prof. ZHAN Renbin (NIGPAS), Prof. ZHOU Zhiqiang (Xi'an Institute of Geology and Mineral Resources) and Prof. WANG Guangxu (NIGPAS). Recently, Xin and his collaborators have collected abundant trilobite samples from the Koumenzi Fm. (Katian, Upper Ordovician) in Menyuan, northeastern Qinghai Province of China (North Qilian Mts), which will be investigated in the near future.

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Charles WELLMAN (UK) continues his research on the earliest terrestrial vegetation (the earliest land plants and the microbiota that existed on the continents before the appearance of land plants). He is currently involved in collaborative work on Ordovician palynomorph assemblages from Oman, Saudi Arabia and South Africa, and undertook fieldwork in January-February 2022 on the Cape Supergroup in the northernmost part of the Cape Basin of South Africa (in conjunction with Cameron Penn-Clarke).

Charles Wellman

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Rongchang WU (China) is working on the Ordovician and Silurian (bio-, litho- and chemo-) stratigraphy and conodonts. In collaboration with Profs. Mikael CALNER, Oliver LEHNERT, his research is currently focused on the Ordovician and Silurian bioevents (such as GOBE, LOME) and palaeoclimatic and palaeoenvironmental background based on the integrative study of geochemistry, palaeontology, sedimentology and stratigraphy.

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Kui YAN (China) still focuses on the Palaeozoic phytoplankton in China this year. He still worked on the palaeoecology evolution of acritarch during Cambrian-Ordovician with his student and colleague. He and his student also worked on Cambrian/Ordovician in North China, found some Small Carbonaceous Fossils (SCFs), and discussed their affinity. He worked on the Late Ordovician acritarch palaeogeography implication with statistic analysis.

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Seth A. YOUNG (USA) continues working on environmental and climatic reconstructions in the early Paleozoic, that include marine oxygen levels at both local and global scales from late Cambrian, Ordovician, and Silurian stratigraphic successions. Current and ongoing projects are focused on intervals just prior to, during, and after the Ordovician radiation of marine life and the Late Ordovician Mass Extinction (LOME); and throughout multiple intervals of biotic extinction and recovery within the Silurian. This work continues in multiple basins from around the globe including: the Great Basin (Nevada, USA), Appalachian Basin (Tennessee/Virginia, USA), USA Midcontinent (Tennessee), Sweden, Estonia, Latvia, and Czech Republic. These various projects in the early-mid Paleozoic are ongoing collaborations with Jeremy OWENS (FSU), Benjamin GILL (VTU), Sara PRUSS (SC), Per AHLBERG (LU), Mats ERIKSSON (LU), Tim LYONS (UCR), Olle HINTS (TUT), Dimitri KALJO (TUT), Tonu MARTMA (TUT), Matthew R.SALTZMAN (OSU), Cole EDWARDS (ASU), Leho Ainsaar (TU), Emma HAMMERLUND (LU), Paula NOBLE (UNR), Mu LIU (IGG-CAS), and Jiri FRYDA (CGS). In the last year Seth published three papers with his former PhD student, Nevin KOZIK (currently Visiting Professor at OC). The *AGU Advances* paper, is a multibasin multiproxy study of carbonate successions in the Late Ordovician that indicate a combination of reducing marine conditions, cooling, habitat reduction, and glacioeustacy caused the first mass extinction in the Phanerozoic. The *Science Advances* paper is a pioneering study utilizing thallium isotopes throughout the LOME interval documenting a strong temporal link between vacillating (de)oxygenation and extinction intervals highlighting the importance of dynamic marine oxygen fluctuations played a major role in the LOME. The *Geobiology* paper is a multiproxy shale investigation of marine redox conditions from Baltoscandia that provide some of the first direct paleoredox evidence for an increase in marine oxygen concentrations as a key mechanism for the early onsets of the Ordovician Radiation of marine life across the Cambrian-Ordovician boundary. A synthesis of the last two decades of work on reconstructing Ordovician climate and environment via direct geochemical proxy datasets and/or numerical modelling approaches was published as a chapter in the *Geological Society London, Special Publication* on the Ordovician System. Finally, a paper in *Palaeogeography, Palaeoclimatology, Palaeoecology* with my former postdoc (Anders LINDSKOG, research scientist at LU) a new detailed biostratigraphic and carbon isotope

chemostratigraphic study of a very complete Lower-Middle Ordovician carbonate succession from Sweden that demonstrates local-regional $\delta^{13}\text{C}$ gradients throughout the Middle Ordovician.

Seth A. Young

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Renbin ZHAN (China) was paying his attention, during 2022, on the major biotic events happening in the Ordovician, i.e. the GOBE (Great Ordovician Biodiversification Event) and the EOME (End Ordovician Mass Extinction), based on the material from China, particularly southern China. With the financial support from the NSFC (National Science Foundation of China), he and his group went to visit several Ordovician sections in Guizhou and Yunnan provinces covering the South China and Indo-China palaeoplates, and collected many important fossils at some sections, some of which had never been visited before. Besides, Renbin is now also collaborating with his Iranian colleagues on the Middle Ordovician *Saucrorthis* fauna, the token of the second diversity acme of the GOBE in South China and its neighbouring palaeoplates. This year, Renbin also collaborated with his good friend and colleague, Dr. ZHANG Yuandong, to make a thorough revision on the Ordovician stratigraphy of China covering all relevant palaeoplates. The manuscript, a contribution of the great project initiated and led by Profs. Thomas SERVAIS, David HARPER and Ian PERCIVAL, has now been formally accepted by the *Geological Society of London Special Publication* series.

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Shunxin ZHANG (Canada) has continued working in Canadian Arctic area in 2022, but 100% from home without any fieldwork, owing to the COVID-19 pandemic. She has mainly focused on three projects:

- 1) Ordovician conodont biostratigraphy of northwestern Baffin Island, Canada. This project is based on the data collected from previous field season.
- 2) Ordovician conodont biostratigraphy and revised lithostratigraphy in the fault and fold zones of the Boothia Uplift, south-western Boothia Peninsula, Canada. This project is also based on the data collected from previous field season.
- 3) The youngest preserved Paleozoic strata on southern Baffin Island. This project is partly based on the data collected from previous field season; will be mainly based on the newly proposed field work in the summer 2023.

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Yuandong ZHANG (China) is continuously working on:

(1) An integrated stratigraphy of graptolite, conodont, chitinozoan, acritarch, radiolarians, and carbon isotope chemostratigraphy, and cyclostratigraphy of the Ordovician in China. This work aims at a refined stratigraphic correlation of the Ordovician in China based mainly on biostratigraphic and chemostratigraphic records. Among the latest and most significant products is the accepted manuscript “*Regional synthesis of the Ordovician geology and stratigraphy of China*” (Chapter 13 of book *A Global Synthesis of the Ordovician System (Part 2)*).

(2) Hirnantian Conservat-Lagerstätte in Anji, Zhejiang Province, China—Anji Biota, in cooperation with Joe BOTTING and Lucy MUIR of UK, financially supported by President’s International Fellowship Initiatives (PIFI) program and a recently approved NSFC grant (2018-2021). This sponge-dominated Conservat-Lagerstätte, discovered in late 2012, is typified by the abundant and highly diverse articulate sponges (over 100 species) often with soft tissues, in association of graptolites, nautiloids, arthropods, echinoderms, etc. The Anji Fauna is preserved within a 9-meter-thick black shale, and is of latest Hirnantian age as constrained by the associated graptolites. A preliminary study indicates that this extraordinarily diverse, sponge-dominated community thrived in the aftermath of the Hirnantian Mass Extinction.

(3) Origination of the Palaeozoic Evolutionary Fauna: a case study in South China. This work, financially supported by an initiative fund from CAS and a major grant from the National Natural Science Foundation of China (NSFC, *Origination of Palaeozoic Evolutionary Fauna*, 2021-2025), is derived of IGCP Project 653 “The Onset of the GOBE”, and now in close correlation with the ongoing IGCP735 “Rocks and Rise of Ordovician Life”. This work brings together some world-class palaeontologists on Ordovician and Cambrian fossil groups, along with some sedimentologists and geochemists, including Thomas SERVAIS, Axel MUNNECKE, Timothy W. LYONS, Yongyi ZHEN, etc., to focus on the early occurrence records of graptolites, conodonts, chitinozoans, cephalopods, radiolarians, and the potential coincident changes of geochemical proxies for redox and oxygenations in South China.

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Yong Yi ZHEN (Australia) is working on several projects this year documenting the geology and biostratigraphy of NSW. These include a semi-monographic work reviewing Ordovician to Devonian fossils from the southern Cobar Superbasin in central-western New South Wales jointly with Ian PERCIVAL, Patrick SMITH, Yuandong ZHANG, Des STRUSZ and others, which will be published as a special issue of the *Quarterly Notes of the Geological Survey of New South Wales*, and studies of Middle–Late Ordovician conodonts from various sectors of the Junee–Narromine Volcanic Belt in central New South Wales jointly with Ian PERCIVAL. He has contributed to four chapters for the *Global Synthesis of the Ordovician System* (a Geological Society of London Special Publication) in collaboration with local and international colleagues.

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RECENT ORDOVICIAN RESEARCH PUBLICATIONS

A

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