

ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
INTERNATIONAL COMMISSION ON STRATIGRAPHY

Number 38 (for 2020)

Edited by Bertrand Lefebvre



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Cover photo

The fine grey crystalline limestones of the Mt Jolmo Lungma Formation (Darriwilian, Middle Ordovician) at the height of 8550 m, on the way to the summit of Mt Jolmo Lungma (Mt Everest). The photo was taken by the Xizang (Tibet) Mountaineering Team during the May 2020 Survey-Mountaineering Expedition aiming at getting the most accurate measurement of Mt Jolmo Lungma, and eventually resulted in a height estimate of 8848.86 m announced by both China and Nepal in 2020. Photograph courtesy of the Xizang (Tibet) Mountaineering Team, via Zhang Yuandong. For more details on the Ordovician System in the Mt Jolmo Lungma region, please refer to Fang *et al.* (2020) (doi: 10.19839/j.cnki.dcxzz.2020.0039).

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CHAIRMAN'S MESSAGE

This is my first message as chairman of the '**Ordovician Subcommission**' because this is the first 'Ordovician News' issue with me in this role. Last year I should have taken over the job from the previous chair, Andrei Dronov, during the official meeting of the International Commission on Stratigraphy (ICS) at the 36th International Geological Congress (IGC) at New Delhi, India (early March, 2020), but the organisers in India cancelled the Congress in the last minute. This was before the global outbreak of the covid-19 pandemic, but already too late to stop the very numerous Chinese delegates getting to New Delhi in March 2020. Postponed a few times, initially to November 2020, the IGC still did not take place (and at the time of the writing of these lines is re-scheduled for August 2021), but the IUGS and the ICS had to advance, and the new Ordovician Subcommission with the new executive took over somewhat virtually during July and August 2020.

Now, I will not go to the 36th International Geological Congress, if ever it will take place. Many participants (including me), lost a lot of money, with air tickets and hotel rooms being booked, and not always being able to be cancelled, and the refund policy of the organisers being somewhat disorganized and extremely late.

Well, that was 2020. We all have our (bad) experiences of that year, that will be remembered, by all of us, for one reason or another, but certainly it will be in our memories in the next decades. And 2021 looks very similar so far...

The composition of the new Subcommission, i.e. the Executive and the **Voting (Titular) Members** is published in the present issue. The changes have been announced in the last issue of *Ordovician News* (n°37) in the chairman's message by Andrei Dronov. The list of the former Voting Members (2016–2020) was published in the last four issues of *Ordovician News*. For the next years (2020–2024), we have a new Subcommission, with a slightly higher number of Members (+3), more female Members (+4) totaling now seven women, and covering almost all disciplines, and all (palaeo-) continents.

The new Subcommission came together a few weeks ago for the first time. The covid-19 pandemic forced us to meet online, and this actually allowed us to have a first meeting with ALL voting members. This is extraordinary ! Probably never in the long existence of the Subcommission have all voting members come together at the same time. Internet (and covid-19) made this possible.

You can find a short report about this meeting in this newsletter. There will be surely more meetings with this format in future !

The **International Geoscience Programmes (IGCP)** also suffered from the covid-19. All IGCP meetings have been cancelled in 2020 (except for a single IGCP project, n°668, that organized its annual meeting before the global pandemic), and in 2021 it very much looks the same.

IGCP 653 (The onset of the Great Ordovician Biodiversification Event) was running from 2016 to 2020 (see reports of meetings in the previous issues of *Ordovician News*), and was expected to be on extended term (OET) in 2021, with several meetings, including the main annual meetings in Copenhagen in September 2020 and in Lille in September 2021.

The Copenhagen meeting was cancelled on-site, but was maintained online. Although (similarly to the virtual meeting of the voting members) the Copenhagen congress was 'only' online, it can be considered as a huge success. Instead of having the usual 50 to 100 scientists, present physically in a lecture hall, and during an excursion, there were over 200 participants registered from all over the world, listening to the online keynote lectures and talks, allowing

many to participate, when intercontinental flights were not possible, and for many scientists were, and will be, not affordable. You can read a report on the meeting in this issue. Many thanks to Chris Rasmussen, Alycia Stigall and all others who helped in the organisation to make this major Ordovician congress in Copenhagen possible !

The 2021 annual meeting in Lille in September will hopefully be similar. Again, the covid-19 pandemic will not allow us to keep this meeting on-site, and certainly not the organisation of the field trips in Belgium and in the (post-Brexit) UK. As the Copenhagen meeting, the Lille meeting will take place, at the initial dates, but only online. Please, look out for the information about this meeting in this issue of *Ordovician News*.

However, due to a large demand, the excursions will be maintained, and are now postponed to spring 2022. The pre- and post-congress excursions will take place before and after the indoor sessions at Lille, scheduled May 30th–June 1st, 2022. The First Circular is presented in this issue. The meeting will no longer run under the flag of IGCP 653 (that will be definitively over), but under that of IGCP 735.

IGCP 735 is indeed the new International Geoscience Programme dedicated to the Ordovician. It was accepted earlier this year by the UNESCO/IGCP. Congratulations to the eight co-leaders. The full title of IGCP 735 is '**Rocks and the Rise of Ordovician Life (Rocks n'ROL). Filling knowledge gaps in the Early Palaeozoic Biodiversification**' and it will run from 2021 to 2025. The eight leaders (including six female scientist, and half of the leaders working in 'developing' countries) propose a very exciting programme for the next five years (2021–2025). You can find further details in this issue. This IGCP is also strongly linked to the Ordovician Subcommission, with four co-leaders being actually Voting Members of our Subcommission.

In addition to the meetings related directly to the IGCP's, there are a few **other meetings** that should be also postponed, and that are also on our agenda. The Baltic Stratigraphic Congress was scheduled in Saint Petersburg in September 2020, and is currently postponed. Similarly, we are looking forward to the official inauguration of the new ASSP for the base of the Ordovician System in the Xiaoyangqiao section at Dayangcha, North China, ratified in 2019 by the Ordovician Subcommission. The ceremony was scheduled in May 2020, but is currently also postponed.

Among the other major events in the next years, we can announce the main annual meeting of IGCP 735 in Marrakech, Morocco, in October, 2022, and our next Congress on the Ordovician System in Tartu, Estonia, in 2023 (see first announcement in *Ordovician News* n°37 and further information in this issue n° 38).

In the last issues of *Ordovician News* you may have seen the announcement of a publication on a '**Global Synthesis on the Ordovician System**' initiated almost ten years ago. One of the tasks of the current Executive of the Subcommission is to move forward with this project, and to finally see the publication of this book series, hopefully before the next Ordovician Congress in Estonia. Contacts with the Geological Society of London have now been taken, and different corresponding authors have been contacted, among them all Voting Members of the Subcommission, in order to develop a book project including over 40 chapters, that will be possibly published in the *Special Publications* or *Memoir* series of the Geological Society. More information about this will surely be available in the next issue.

Another important element of our Subcommission is our **Webpage** : <http://ordovician.stratigraphy.org>. This page will soon move to be integrated in the

webpage of the ICS. Many thanks to Olle Hints for keeping our website extremely interesting, and updated (!) in the last years. It is actually fantastic to see all issues of *Ordovician News* available for download (many thanks, Olle, for uploading all of them). Alycia Stigall, new Titular/Voting Member accepted to take over the job as webmaster. I am sure that very soon, the Ordovician will also be visible on other social medias !

This brings me to the last point. *Ordovician News*.

Our newsletter is a fantastic way to share our news and results. The present copy that you are holding in your hands, or reading on your screen, is already the 38th issue of *Ordovician News*, and the first that I have the honour to present. Many thanks to Bertrand Lefebvre, the new secretary of the Subcommission to have compiled this issue! Many thanks also to Ian Percival, previous editor, to help us with our first issue, the present n°38. Ian made a smooth transition possible. Our acknowledgments to Ian, especially for the last twelve years (!) as editor of *Ordovician News*, from 2009 to 2020, i.e., a compilation of over 1000 pages of information!

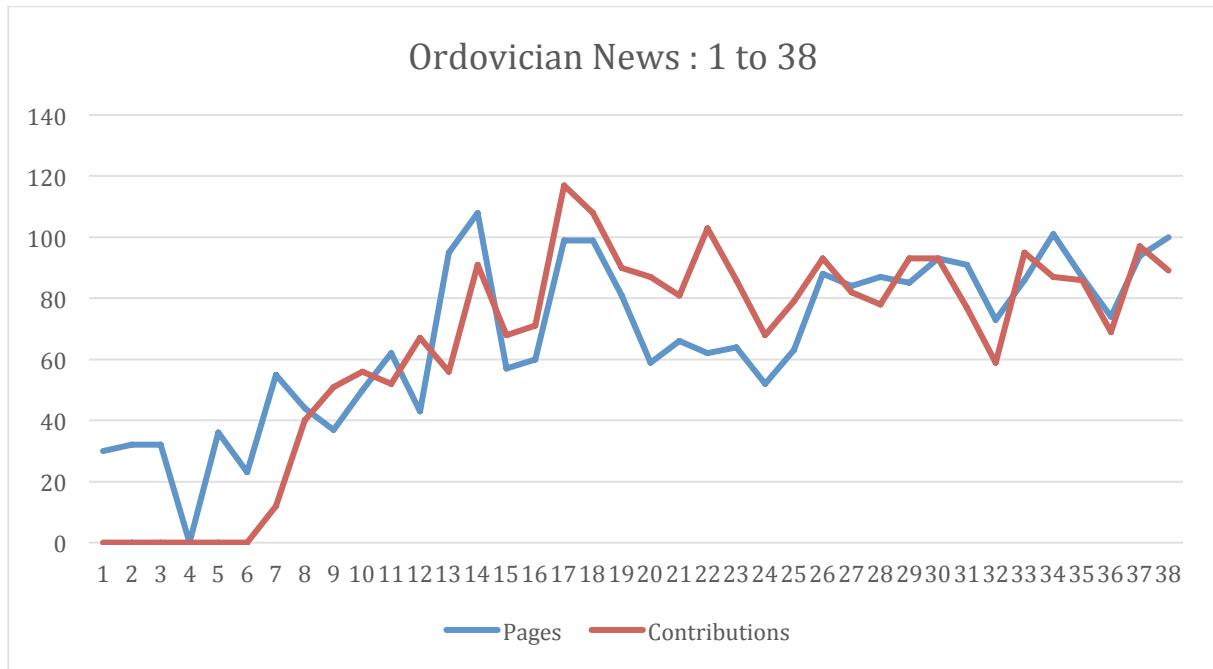
As indicated above, it is possible to download all previous issues of *Ordovician News*. Please, have a look at our webpage. On a dedicated page, you can have access to all issues compiled since 1983 : <http://ordovician.stratigraphy.org/ordovician-news>

The first issues (1983 to 1987) were compiled by Barry Webby, followed by ten issues edited by Henry Williams (volumes 6 to 15, covering the years 1988 to 1998). Henry Williams was also the editor who introduced a new section with our contributions ('news and current research'). Guillermo Albanesi took over for another ten years (volumes 16 to 25, years 1999 to 2008), before Ian Percival managed *Ordovician News* from 2009 to 2020 with twelve issues (volumes 26–37).

The figure below indicates you the number of pages (blue line, no data available for issue 4) and number of contributors (orange line, number of those persons who sent in the 'news and current research' between 1990 and 2020) for previous editions of *Ordovician News*. Statisticians now may want to see a relation between the curves, and indeed, there is of course a positive correlation : if you send in your news, there are more pages in the newsletter! You can see that in the last 20 years, the page numbers and the number of contributors are at a cruising speed, with about 80 pages and a similar number of Ordovician workers sending in their news, every year. A peak of contributions was reached in the year 2000 (117 Ordovician workers sent in their news). This also correlates with the outstanding work of ... IGCP n°410, organized by ... Barry Webby and co-leaders.

The fantastic work of the previous editors, i.e. secretaries of the Subcommission, is really impressive. This is truly a goldmine of data. There are now over 2000 pages of information produced over the last 38 years. We will try to continue like this, but this is only possible with your help. Please, continue to send in your news about our **favourite geological period, the Ordovician !**

Thomas Servais



SECRETARY'S MESSAGE

This is the very first year I am editing *Ordovician News*, as I am succeeding to Ian Percival as Secretary of the Subcommission on Ordovician Stratigraphy. I first would like to thank Ian very much for the fantastic job he did as editor of the annual newsletter in the last twelve years, and also for having kindly and carefully checked preliminary versions of this new volume. Maintaining the editorial excellence of previous issues of *Ordovician News* is a real challenge. I also would like to thank sincerely all those of you (and you have been very numerous, i.e. over ninety!), who sent me contributions (e.g. book reviews, conference announcements and reports, obituaries) and reports of their Ordovician-related research undertaken in 2020. It was really a fantastic experience to exchange emails with colleagues and friends from all over the world. Thank you very much to all of you for your kind messages and support.

The format of *Ordovician News* Number 38 closely follows that of previous issues and it will be accessible online, along with all former volumes, on the Ordovician Subcommission web page, at: <http://ordovician.stratigraphy.org>. Please do not hesitate to share this newsletter with any colleague or student, interested in Ordovician-related studies and who might not be on the mailing list for *Ordovician News*.

Stay safe and enjoy *Ordovician News*!

Bertrand Lefebvre

ANNUAL REPORT OF ORDOVICIAN SUBCOMMISSION FOR 2020

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) now comprises an Executive (Chair, Vice-Chair and Secretary), plus 17 other Voting Members (and >300 Corresponding Members).

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 653 project “The onset of the Great Ordovician Biodiversification Event” (2016-2020). The Annual Meeting of IGCP 653 for 2020 was held in Copenhagen, Denmark, but took place only by videoconference.

Together with the SOS, a new team of Ordovician specialists proposed a successor project of IGCP 653 (to be evaluated in early 2021) that, if accepted, would strongly collaborate with the SOS during the years 2021 to 2025. The co-leaders of this project include four Voting Members of the SOS.

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 2020

- Due to the covid-19 pandemics, the initial plans for activities in 2020 could not be carried out. The 36th International Geological Congress, with the official meeting of the ICS and the take-over of the new subcommission and its officers, was cancelled at the last minute.

- In accordance with ICS Rules, about 2/3 of the current Voting Members of SOS were going to retire in March 2020, coincident with the IGC. Replacement candidates were proposed to the Voting Membership, which voted to select a new Executive and Voting Members for the term 2020-2024. The Voting Membership was increased to 20.
- The Subcommission changed, according to the new rules of the ICS and the IUGS, with a significant replacement of the Voting Members. Seven former Voting Members remain in the new subcommission (2020-2024) and a total of 13 new Voting Members stepped in. The gender balance improved, with now seven female Voting Members.
- 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), scheduled for May 2020, was cancelled and is provisionally postponed to May 2021.
- The closing meeting of the International Geoscience Programme (IGCP) 653 ‘The onset of the Great Ordovician Biodiversification Event,’ cancelled in May 2020, took finally place as a successful videoconference congress, September 7th-10th, with over 200 participants, and a strong involvement of members of the Ordovician Subcommission, including the Voting Members.
- *Ordovician News 37* (for 2019) was published in March 2020 and is available from the SOS webpage (<http://ordovician.stratigraphy.org/>).

6. SUMMARY OF EXPENDITURE IN 2020: (all figures in USD, totals rounded due to exchange rates)

- a) T. Servais’ (incoming Chair) expenses (transport by car, accommodation & food: US\$ 630) in meeting B. Lefebvre (incoming Secretary) at Lyon University, France, February 19-22, 2020, to discuss Subcommission duties.
- b) Air fares Brussels - Delhi (US\$ 1015), registration costs (US\$ 805) for T. Servais to attend the 36th International Geological Congress and the ICS related official meetings, March 1st-10th, 2020. The meeting was cancelled in the last minute, and refunds have not (yet) been made. The meeting is currently postponed to August 2021.
- c) SOS Secretary B. Lefebvre’s expenses (train, hotel & food: US\$ 550) to meet the SOS Chair T. Servais, at Lille University, France, September 2-4th 2020, to discuss Subcommission duties and the submission of an Ordovician related International Geoscience Programme (IGCP) in October 2020, to run as a successor project of IGCP 653, if accepted, from 2021 to 2025.

7. SUMMARY OF INCOME IN 2020 Same as next item (ICS was the sole source of income)

8. BUDGET RECEIVED FROM ICS IN 2020 USD 3,000

9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2021)

- Support of the Annual Meeting (absolutely final meeting) of IGCP653 to be held in Lille, France (September 10th-20th 2021), including a pre-conference excursion to the Ordovician of Belgium and a post-conference excursion to the Ordovician of Wales and the Welsh Borderland, UK. The meeting will also serve as a mid-term meeting between the ISOS meetings in Novosibirsk (2019) and Tallinn (2023). In addition, it would be the opening meeting of the new IGCP project, if accepted by the UNESCO.
- Support of the Seminar on Regional Stratigraphic Classification Standard in China in Baishan, Jilin Province, May 2021 (organized by the Chinese Commission on Stratigraphy), to include an inspection and unveiling ceremony for the Xiaoyangqiao ASSP section (originally planned to be organized in May 2020).
- Further work is needed to compile an updated summary on Ordovician regional stratigraphy and geology: *A Global Synthesis of the Ordovician System*. A meeting of editors and contributors is planned (possibly in Nanjing, late 2021).
- Data will be gathered for *Ordovician News* 38 (to be published in March 2021).

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 summary on Ordovician regional stratigraphy and geology: *A Global Synthesis of the Ordovician System*. Special attention is going to be paid to precise correlation of the Ordovician depositional sequences and sea level curves as well as stable isotope and regional biodiversity curves. Though work has been proceeding on this aim, regrettably it is at a glacial pace.
- 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 2021 (all figures in USD)

1. Support for attendance and participation (airfare only) of SOS members (e.g., from Iran, Argentina, Australia, and Russia) at the IGCP 653 Final Meeting in Lille (September 2020): USD 4,200
2. Support (airfare only) for T. Servais (chairman) to attend opening of Xiaoyangqiao ASSP, China & associated conference, May 2021: USD 900
3. Support (airfare only) for B. Lefebvre (secretary) to attend opening of Xiaoyangqiao ASSP, China & associated conference, May 2021: USD 900
4. Support for contributors and editors of "*A Global Synthesis of the Ordovician System*" to attend meeting: USD 1,000

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 2021 BUDGET: 7,000 USD

REQUESTED FROM ICS: 7,000 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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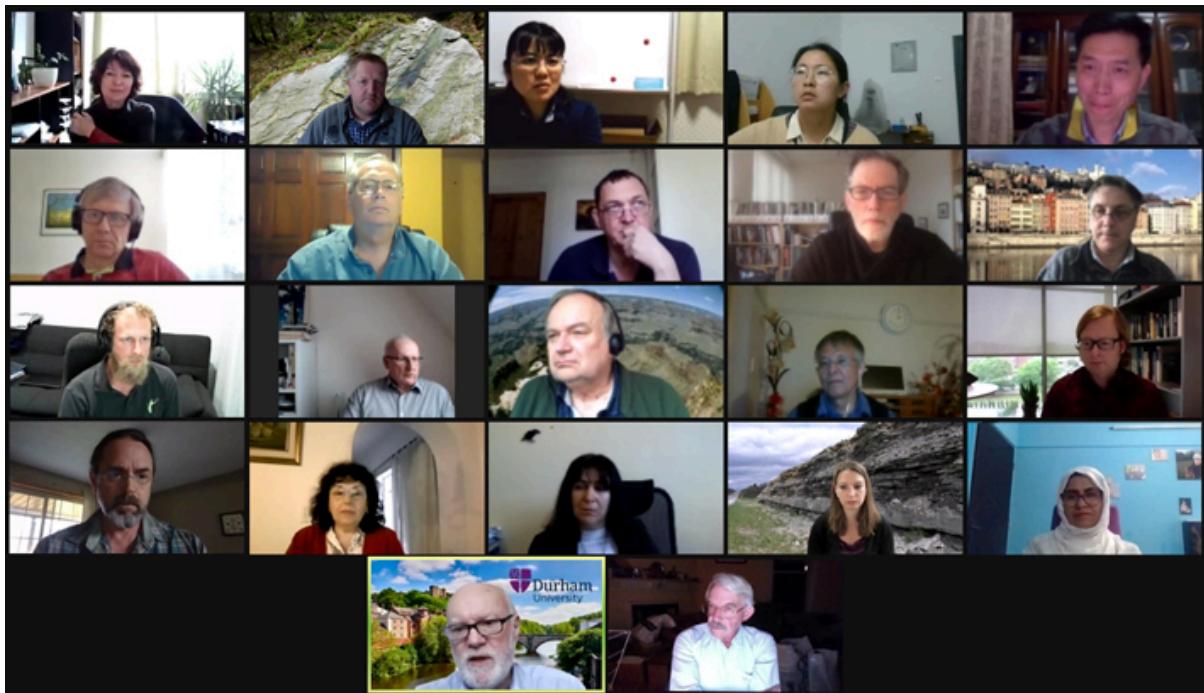
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ONLINE MEETING OF THE VOTING MEMBERS OF THE SUBCOMMISSION

The Voting (Titular) Members of the Subcommission on Ordovician Stratigraphy (SOS) usually come together at the International Congresses of the Ordovician System. However, usually only a fraction of the members are able to join these meetings, and most decisions and votes take currently place by e-mail ballot. With the different congresses and symposia being cancelled due to the covid-19 pandemic, and the impossibility to meet face-to-face, the new executive board of the Subcommission proposed a first ‘virtual’ meeting for all Voting Members of the Ordovician Subcommission. This first online meeting was organised on Wednesday, March 31st. In addition to the Voting Members, David Harper (Durham, UK), current chair of the ICS (International Commission on Stratigraphy) and former chair of the SOS, and Ian Percival (Sydney, Australia), former (long-term) secretary of the SOS, were also invited.



Snapshot from the 1st online meeting of Voting Members of the Subcommission on Ordovician Stratigraphy. First upper row, from left to right: Elena Raevskaya, Thomas Servais, Sachiko Agematsu-Watanabe, Wenhui Wang, Renbin Zhan. Second row, from left to right: Petr Kraft, Daniel Goldman, Charles Wellman, André Desrochers, Bertrand Lefebvre. Third row, from left to right: Leon Normore, Tõnu Meidla, Lars Holmer, Yong Yi Zhen, Seth Young. Fourth row, from left to right: Patrick McLaughlin, Matilde Beresi, Tatiana Tolmacheva, Alycia Stigall, Mansoureh Ghobadi Pour. Lower row, from left to right: David Harper, Ian Percival.

The meeting took place at 1 pm Central European Time (CET), which allowed all 20 members, and the two former members to join. This was probably the first meeting in the history of the Subcommission that brought together *all* Voting Members. Some Members joined very early, such as Daniel Goldman at 4 am (!) local time (from Arizona). Many time zones were covered, with Voting Members from Canada, the United States and Argentina being present at 7 or 8 am local time (Matilde Beresi, André Desrochers, Patrick McLaughlin, Alycia Stigall, Seth Young), many European members joining at 12 pm noon (David Harper, Charles Wellman), 1 pm (Lars Holmer, Petr Kraft, Bertrand Lefebvre, Thomas Servais) or 2 pm (Tõnu Meidla, Elena Raevskaya, Tatiana Tolmacheva). Mansoureh Ghobadi Pour joined

from Iran at 3.30 pm, and the Chinese and Japanese Voting Members at 7 and 8 pm (Sachiko Agematsu-Watanabe, Wang Wenhui, Zhan Renbin), whereas the Australians waited until 7 pm (Leon Normore) and 10 pm (Ian Percival and Zhen Yong Yi) to attend the meeting. As the meeting lasted over two hours, it was after midnight for the participants from eastern Australia when the first online meeting was closed.

We thank all members to have taken the time to join, in particular those in far east Australia and the members joining from the 'Wild West' !

The agenda of the meeting included a number of points. After an introduction and the welcome by the chairman, Thomas Servais, all participants were invited to introduce themselves. Thirteen members are new voting member, and many participants of the meeting never met before. David Harper presented the International Commission of Stratigraphy (ICS), its organisation and its major objectives. This was a perfect introduction to the purpose and objectives of the Ordovician Subcommission, presented by the chairman. Ian Percival, former secretary during three terms (2008–2012, 2012–2016, 2016–2020) in the executive board (serving two different chairmen) presented the SOS Newsletter (*Ordovician News*) of which he edited the last twelve issues. The webpage of the SOS was presented, and it was agreed by the Voting Members to accept the proposal from the ICS to host the webpages of our Subcommission. All members were invited to propose names to take over the job of Olle Hints (Tallinn, Estonia), who did an outstanding job as 'webmaster' during the last years. The next point on the agenda was a short discussion about the finances of the Subcommission.

Subsequently, the relation of the SOS and the different IGCP projects was discussed. IGCP 653 is now in its final year (on extended term). The incoming secretary of the Subcommission, Bertrand Lefebvre, who is also co-leader of the new project IGCP 735, introduced this project (that was recently accepted by the UNESCO/IGCP) and explained its programme for the next five years (2021–2025). In this context, the future meetings of the Subcommission and of the IGCP projects were presented and discussed.

A final, but important part of the meeting was the presentation of the book project on the 'Global synthesis of the Ordovician System.' All Voting Members considered this project to be interesting and most participants of the meeting proposed their participation, as corresponding or co-authors of one or several chapters of this book.

The meeting was closed at about 3.15 pm CET. It was most probably only the first online meeting of the subcommision members, with many others to be scheduled in the future.

Thomas Servais (chairman), **Bertrand Lefebvre** (secretary)

BOOK REVIEW

The Ordovician Period – a new contribution chapter to *Geologic Time Scale 2020* (F.M. Gradstein *et al.*, eds.: Elsevier, 12th November 2020, 2 vols., 1390 pp.)

At the end of 2020 Elsevier Press published a new and revised edition of the Geological Time Scale series. Earlier versions of this series, conceived and edited by Felix M. Gradstein and collaborators, were published by the Cambridge University Press in 2004, and by Elsevier Press in 2012. Additionally, “Concise” versions were compiled by James G. Ogg and collaborators in 2008 (Cambridge Univ.) and in 2016 (Elsevier).

In the preceding books, the synthesis of knowledge about the Ordovician Period had been carried out by the scientific efforts of Roger A. Cooper and Peter M. Sadler, while the most recent 2020 revision is co-authored by our colleagues Dan Goldman, Pete Sadler and Steve Leslie (along with contributions from Mike Melchin, Frits Agterberg and Felix Gradstein).

The new chapter spans 64 pages of section IV (Geologic Periods, Phanerozoic) and begins with a heartfelt dedication to the late Roger Cooper, lead author of the Ordovician chapters for the GTS 2004 and 2012. It is followed by a short historical introduction on the definition of the Ordovician System and a discussion of the key fossil groups used in selecting reliable and easily recognizable levels that define the bases of the global chronostratigraphic (and geochronological) units.

The first part of the chapter is an extensive and up-to-date summary of the current divisions of the Ordovician system, including detailed information on the type location, boundary levels, and correlation of each of the GSSPs for the base of the seven stages and three series formally defined in the global Ordovician timescale. The 2020 revision also includes some discussion on the controversies that arose after the formalization of some boundary stratotypes, particularly regarding the suitability of certain GSSP markers such as the conodont FAD (*Iapetognathus fluctivagus*) that defines the base of the Tremadocian, or the graptolite FAD (*Nemagraptus gracilis*), whose level marks the base of the Sandbian.

In parallel with the global chronostratigraphic units based on the fossil-based bioevents, the authors highlight the positive contribution of the regional Ordovician subdivisions as well as the notable increase in studies on Ordovician biostratigraphy, chemostratigraphy, sequence stratigraphy, climate, and biodiversity from the various paleo-continents. These regional scales both elucidate and help solve correlation problems caused by the marked faunal provincialism and facies differentiation that occurs throughout most of the Ordovician world. In the absence (total or partial) of the fossil-based biohorizons that define the global scale, the regional scales offer useful biostratigraphic frameworks for intra-basinal, single paleocontinental, or limited paleolatitudinal studies. The British, Australasia, East Baltic, Bohemo-Iberia, North and South China and North America regional chronostratigraphic units are mentioned in this way. I did find a small mistake in Figure 20.12, which does not illustrate the extent of the global Hirnantian Stage within the Bohemo-Iberian regional scale.

Other operating units rarely mentioned in the chapter are the Ordovician stage slices defined in 2009, which are used in various places in the text despite being considered as ‘directly equivalents to the Australasian graptolite zones’ (p. 24–25) which, in this author’s opinion is a highly debatable statement.

The second part of this updated synthesis is dedicated to Ordovician stratigraphy, including sections on biostratigraphy, chemostratigraphy, cyclostratigraphy, and biotic and climatic events. The biostratigraphy is focused on graptolites and conodonts, the fossil groups most used for correlation in the Ordovician. Goldman et al. also provide a summary of the latest work on the integration of graptolite, conodont, and chitinozoan biozonations, which increases the precision of correlations across a wide range of facies and latitudinal zones.

The chemostratigraphy section summarizes the advances (and also some limitations) in carbon isotope stratigraphy, paired carbon isotope analysis, strontium isotope stratigraphy and oxygen isotope stratigraphy, particularly in the construction of Ordovician curves that discriminate both variations and excursions on a global or regional scale. Some of these considerations are also included in part II of the book, in other chapters devoted specifically to chemostratigraphic methodology.

Regarding advances in cyclostratigraphy, the chapter provides a few examples of the most recent work on Ordovician astrochronology, which examines sedimentary cycles derived from orbitally-forced climate and sea-level variation as well as its influence on species turnover among planktonic organisms.

The second part concludes with a brief introduction to the two extraordinary biological events that take place during the Ordovician Period, and that are of great importance for the development of life on Earth. The time frame, causes, and driving mechanisms of the abundantly cited GOBE (the ‘Great Ordovician Biodiversification Event’) and LOME (Latest Ordovician Mass Extinction) are well summarized.

Finally, the last part of the chapter is dedicated to the Ordovician time scale itself, which begins with an update of the radioisotopic dates published in the last 8 years. Of 37 new dates, 11 are from Lower Ordovician rocks, 7 from the Middle Ordovician and 19 from Upper Ordovician strata, and almost all of them are biostratigraphically associated with conodonts, graptolites or related to zonations of different fossil groups. The results concerning the more famous K-bentonites from Laurentia and Baltica represent important advances in Ordovician geochronology as well as in paleogeographic correlation.

The key contribution of the chapter is, however, the presentation of an updated time scale using the CONOP9 (constrained optimization) method for constructing global graptolite and conodont composite range charts, which are scaled with the new set of interpolated radioisotope dates. The new composites use a much enlarged database, and with regard to the aforementioned fossils, for the first time an independently time-scaled CONOP9 composite conodont range chart is presented. This alternate timescale facilitates the application of the primary graptolite time scale to carbonate facies sections. The subdivision of the Ordovician and Silurian CONOP9 composite range charts is derived from >800 stratigraphic sections and >2600 graptolite taxa with interpolated radioisotopic dates. The finalized time scale after calibration of zone and stage boundaries by composite standard optimization, also considering four sources of uncertainty, provides an estimate of 43.8 Myr as the duration of the Ordovician Period (15.6 Myr for the Early Ordovician, 13.1 Myr for the Middle Ordovician and 15.1 Myr for the Late Ordovician). The largest differences in the 2020 timescale compared with the GTS2012 time scale are a 1.5 Myr older base Tremadocian boundary, a 1.3 Myr older base Dapingian, and a 2.1 Myr older base Darriwilian boundary.

A total of 18 color figures and 4 tables accompany the text of the chapter. The former compile the essential information on the GSSPs, as well as detailed biostrat-geochemistry sequence correlation charts; There is also a great deal of geochronological and statistical calibration information in the illustrations and tables that accompany the final part. This information helps clarify the multiple uncertainties involved in timescale construction.

As a personal assessment, I think that this new Ordovician chapter represents an excellent work of synthesis and presentation of new results, which is essential for researchers and friends of the Paleozoic in general, and for all Ordovician lovers in particular.

Juan Carlos Gutiérrez-Marco, Institute of Geosciences, Madrid, Spain

REPORT OF RECENT CONFERENCES

IGCP 653 virtual Annual Meeting, Copenhagen, September 2020

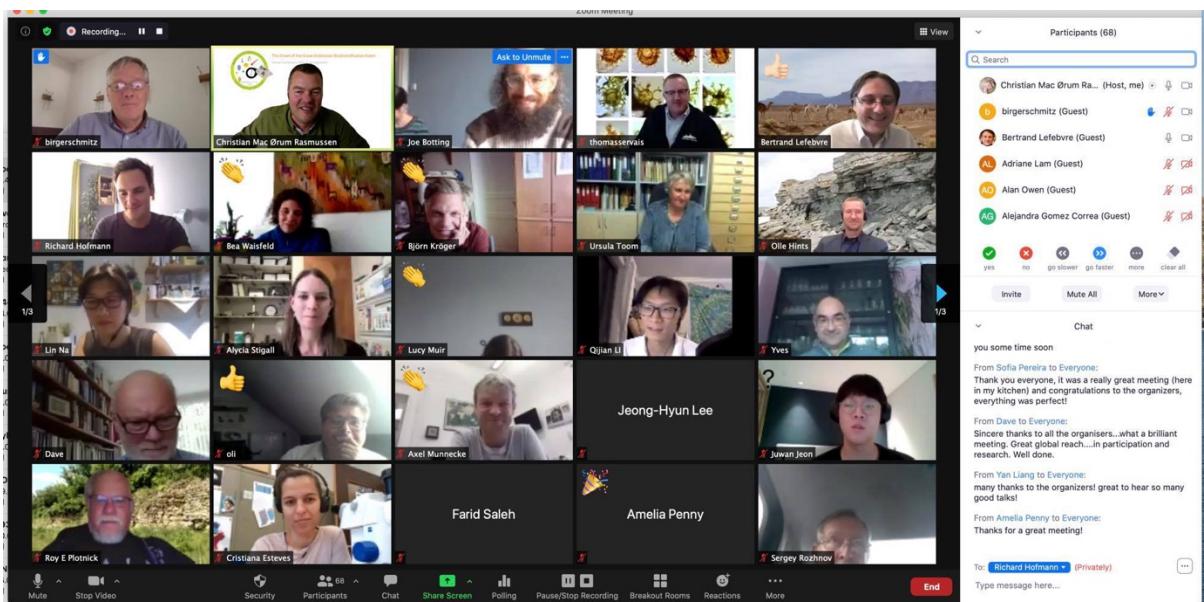
Virtual event kept the IGCP653 network running in 2020 despite the Covid-19 pandemic.

2020 was supposed to be the final year of UNESCO's five-year International Geoscience Programme (IGCP) Project 653: *The Onset of the Great Ordovician Biodiversification Event* and was planned to close with a conference at the Natural History Museum of Denmark in Copenhagen. Project 653 combines many geoscience disciplines, such as palaeontology, geochemistry, sedimentology, geochronology and stratigraphy with the common goal of elucidating the causal drivers behind the greatest rise in marine biodiversity in all of earth history, which occurred some 470 million years ago. But then came corona.



The new virtual conference also got its own logo. Note the hint to the current pandemic on the hand lens: what may appear to be a corona virion is in fact a Middle Ordovician acritarch called *Peteinosphaeridium velatum* Kjellström, 1971

The conference was first scheduled to take place in June, then it was postponed to September in case the pandemic situation would cease by the early Fall. It did not, as we all know now.



Snapshot from the ‘closing ceremonies’ at the conference

Instead, an online concept based on Zoom was rapidly developed, including a new conference website and logo. The virtual event, entitled [Zooming in on the GOBE](#), took place from September 7th–10th, 2020. Even though registration for this new virtual conference only was open for a month, it was quite well received by the scientific community. There was no conference fee, no hotel or plane ticket to buy, so essentially researchers should just sign up online. This new way of organizing a conference was untested. Yet, it surprisingly turned out to become one of the networks' most successful, most inclusive, meetings as 45 talks were presented with presenters spanning 17 time zones from California to Korea and Australia and more than 200 scientists from 29 countries registered for the conference. It thus became a truly global meeting with many presenters from countries that had not previously been represented at IGCP 653 events.

(conference report courtesy of **Christian M.Ø. Rasmussen & Alycia Stigall**)

CONFERENCE ANNOUNCEMENTS

IGCP 668 Annual Meeting, Japan (Online) – Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics

16th to 20th July, 2021
First Circular

IGCP 668: Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics aims to describe paleoenvironments surrounding the Cambrian–Ordovician “boom and bust” events and to discuss on the evolution of the “Earth–Life” system. We are developing a multidisciplinary approach to this goal based on geochronology, igneous petrology, stratigraphy, and paleontology. The 2021 annual meeting is being hosted by the University of Tsukuba, Japan. The purpose of the meeting is to discuss recent progress in the fields of Cambrian and Ordovician geology, geochronology, petrology, and paleontology. It is hoped that the meeting will both encourage our cooperation in these fields and stimulate young workers.

The 2021 meeting will be an ONLINE conference with oral presentations (live) and posters (on demand). All participants are admitted FREE after registration.

TOPICS of 2021 meeting

- **Workshops:** we are planning to hold online lectures on the Paleobiology Database and EPICC integrated Collections Network.
- **Student awards:** we set up a special session for students working on almost all geological aspects of Sibumasu and other Asian paleocontinents. We will give an award for excellent works.
- **Multilanguage:** we accept any language for spoken presentations. All participants can speak in their own language with providing English subtitles to their material.

DATES: 16th (Tue) to 20th (Tue) July 2021

Tentative schedule:

- 16th and 17th: oral session (live), poster session (on demand), and student session (on demand)
- 18th: poster session (on demand) and student session (on demand)
- 19th: workshops (live)
- 20th: award ceremony of the student sessions

(Recorded videos of oral presentations and workshops will be delivered after each session)
(All of LIVE sessions will be held between 11:00 am and 4:00 pm Japan Time)

PRESENTATION FORMAT

Oral sessions: we are going to use an online-meeting application (ZOOM). Speaker prepares a presentation material and talks with sharing his/her screen. We accept all presenters talking in their own language. In this case, please add English subtitles in slides. We also welcome English speakers who provide English subtitles.

Poster sessions: presenter prepares his/her poster as a PDF file and submits it to the organizing committee in advance.

Student session: speaker prepares “lightening talk”, which is a recorded talk of no longer than 3 minutes with no more than 3 slides. Any presentation related to “the geological evolution of Asia and the ways to assess it” would be welcomed. We strongly encourage all presenters—including English speakers—to talk in their own language and provide English subtitles in their recorded materials. We suggest using free software automatically generating subtitles, e.g. Maestra (<https://app.maestrasuite.com/captions>).

REGISTRATION

We will open registration 15th April (free of charge).

IMPORTANT DATES

Application deadline of all presentations: 16th May 2021

Abstract submission deadline: 31st May 2021

Submission deadline of poster/student presentation materials: 15th June 2021

Application of participation deadline (for audience without presentations): 12th July 2021

Conference Days: 16th to 20th July 2021

More information in second circular (April 2021)

ORGANIZING COMMITTEE

Chairperson: Sachiko Agematsu-Watanabe (University of Tsukuba)

Secretary: Kittichai Tontherm and Jerali D. Rodrigo (University of Tsukuba)





Equatorial Gondwana History and Early Paleozoic Evolutionary Dynamics

This form registers you for the IGCP 668 inaugural meeting in Tsukuba, JAPAN 16th to 20th July, 2021. Thanks to support from the University of Tsukuba.

Participant Information (all fields required)

Full Name:..... Title:.....

Family _____ **Given** _____

Email:.....

Postal Address:.....

Street Address

Apartment/Unit #

City _____ **State/Province** _____ **ZIP Code** _____ **Country** _____

Nationality:..... Primary Institution:.....

Student: [] No [] (Post) Grad [] Undergrad

Presentation: [] Oral [] Poster [] Student session [] Participant without presentation

For presenters of oral session:

We are planning to record oral presentations including question/answer sessions and deliver them on the meeting-web site for one week. Do you agree with this?

[] Agree [] Decline (do not record)

Email a completed form to the Organizing committee (igcp668sukuba@gmail.com) by 16th May 2021.

IGCP 653/735 virtual Annual Meeting, Lille, September 2021

<http://www.igcp653.org/meetings/>
<https://rocksnrol.wordpress.com/meetings/>

IGCP 653 (*The onset of the Great Ordovician Biodiversification Event*) was accepted in early 2016 by the UNESCO/IGCP and was scheduled for five years (2016 to 2020). Numerous regional meetings and specific symposia organised by the IGCP 653, including the main annual meetings (2016: Durham, UK; 2017: Yichang, China; 2018: Athens, OH, USA; 2019: Novosibirsk, Russia) were very successful, well attended on-site events. The main closing meeting was planned to be organised in Copenhagen, Denmark, in September 2020. Due to the covid-19 pandemic, this meeting was held online only (*Zooming in on the GOBE*), but was nevertheless a great success, with many more participants attending (over 200 participants from almost 30 countries). The meeting included some 45 talks from presenters covering 17 time zones (see report in this newsletter).

Successful IGCP projects usually run for an additional year on extended term (OET), without financial support from UNESCO. The original plan was therefore to have an additional year, in 2021, with an 'absolutely final' meeting of IGCP 653 in September, in addition to regional activities during this last, final year. Moreover, this 'absolutely final meeting' of IGCP 653 was planned to coincide with the first annual meeting of the new IGCP project (**IGCP 735 Rocks and the Rise of Ordovician Life**; see below) accepted by UNESCO/IGCP in March 2021 and scheduled for five years (2021–2025). In the initial plan, the Lille meeting was thus perfect for a smooth transition between the two IGCP projects.

Due to the ongoing pandemic, it is still not possible to organise field trips and on-site conferences. All events have therefore been cancelled, at least those until September. There is still some hope that a meeting in Nanjing, China, will take place later this year.

The leaders of both IGCP 653 and 735 therefore took the decision in April 2021 to organise the Lille meeting, scheduled in September 2021, fully online, similarly to the very successful Copenhagen 2020 congress. The Lille meeting will take place during four days:

Monday 13th to Thursday 16th, September 2021

The on-site meeting and the field trips are now postponed to early 2022 (see announcement in this newsletter).

Several online **keynote lectures** and about 40 **regular talks** will be scheduled, with sessions at different time zones, to cover most parts of the world. As in Copenhagen, the online version will allow many more IGCP participants to join, and we hope to cover Ordovician contributions from all continents.

The main topic of the Lille 2021 meeting is the '**Ordovician of the World.**'

It is evident that some geographical areas are very well studied, in particular several European regions (the British former type-localities; the classical Scandinavian, Baltic and western Russian sections; the famous 'Barrandian' in the Czech Republic; just to name a few), the classic regions of North America (Great Basin, Cincinnati Arch, etc.) and in more recent years the different tectonic blocks that together form modern China. The data on the

fossil record of many of these regions are available in the datasets that are accessible online, in particular the Paleobiology Database (PBDB) and the Geobiodiversity Database (GBDB).

We particularly welcome contributions from other, more remote and comparatively less well-known areas. IGCP participants from such regions, that are generally not able to join the regular on-site meetings, could present their papers online to the Lille conference.

We plan to schedule two keynote lectures per day, including more innovative aspects on Ordovician geology and palaeontology, such as, for example astrochronology and cyclostratigraphy, surface and deep oceanic water circulation modelling, but also syntheses of Ordovician sequences of less well-known areas.

We invite all contributions on all aspects of Ordovician palaeontology and geology !

Further information, also about the conference proceedings volume, will be soon available on the websites of both IGCP 653 (<http://www.igcp653.org/meetings/>) and 735 (<https://rocksnrol.wordpress.com/>) and will be distributed via email to all participants of the two IGCP projects.

The registration to the Lille 2021 online meeting is free !

We look forward to your participation.

Organising committee :

Thomas Servais (chair, organisation committee), CNRS, Lille University, France
Taniel Danelian, Lille University, France
David Harper, Durham University, UK
Bertrand Lefebvre, CNRS, Lyon University, France

International Conference on Palaeobiology, High Resolution Stratigraphy and Fossil Energy

古生物、精时地层及化石能源国际研讨会

November 18-19, 2021, Nanjing China

First Circular

To celebrate the 70th Anniversary of Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS), the ***International Conference on Palaeobiology, High Resolution Stratigraphy and Fossil Energy*** will be held in Nanjing during 18-19 November 2021. The Organizing Committee cordially invites you to join us for this big convention. The conference will concentrate on recent advances and perspectives in the fields of palaeobiology, stratigraphy, fossil energy and other relevant areas.

VENUE

Nanjing Museum of Palaeontology, NIGPAS, 39 East Beijing Road, Nanjing, China.

SPONSORS

Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences

ORGANISERS:

State Key Laboratory of Palaeobiology and Stratigraphy (LPS)

Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS)

STEERING COMMITTEE

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Members (listed in alphabetical order):

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Degan, WANG Chengshan, WANG Pinxian, WANG Tieguan, WU Fuyuan, WU Xinzhi,

YIN Hongfu, XU Yigang, ZHANG Miman, ZHOU Zhonghe, ZOU Caineng

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Vice Chair: WANG Jun, Vice-Director of NIGPAS

Members: (to be completed)

SCIENTIFIC COMMITTEE

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Vice Chair: WANG Bo, NIGPAS

Members: (to be completed)

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Secretary-General:

WU Rongchang NIGPAS

CHEN Xiaozheng NIGPAS

Members:

WANG Dan NIGPAS

YIN Zongjun NIGPAS

WAN Mingli NIGPAS

PRELIMINARY AGENDA

Nov. 17, 2021 (Wednesday): Arrival and ice breaker

Nov. 18, 2021 (Thursday): Opening ceremony, invited plenary talks and other lectures

Nov. 19, 2021 (Friday): Invited plenary talks and other lectures

Nov. 20, 2021 (Saturday): Departures

INVITATION AND VISA

An official invitation letter will be available for participants upon request for their application for visas at the Embassys or Consulates of China in their own countries. Such invitation letter will be arranged by electronic version (PDF file) signed by the Chair of the Organizing Committee with the official seal and will be sent to participants as email attachments. Those who need an Invitation Letter are required to provide the following information when making their preliminary registration:

- 1). Full name (Family and given names);
- 2). Gender;
- 3). Date of birth;
- 4). Nationality;
- 5). Passport number and valid dates (a scanned file of passport is required);
- 6). Institution or affiliation;
- 7). Periods of stay in China.

TRANSPORTATION

All delegates travelling to Nanjing are suggested to stay in the Jiuhua Hotel, about 600 m east of NIGPAS along the same side of the East Beijing Road. It is about 44 km to the Nanjing Lukou International Airport, and about 5 km to the Nanjing High Speed Railway

Station. Public underground transportation is very convenient between the Hotel and the Airport or Station.

ACCOMODATION AND HOTEL RESERVATION

Jiuhua Hotel: We will book some hotel rooms in advance with a special discount. Delegates who need can contact us when they make the registration.



CORRESPONDENCE

Office of Science & Technology
Nanjing Institute of Geology & Palaeontology
Chinese Academy of Sciences
39 East Beijing Road, Nanjing 210008
CHINA
Email: kjc@nigpas.ac.cn
Tel : 025-83282106, 83282198



古生物、精时地层及化石能源国际研讨会

International Conference on Palaeobiology, High Resolution Stratigraphy and Fossil Energy

November 18-19, 2021, Nanjing, China

Registration Form

Family name (last name): _____ First name(s): _____

Title or position: _____ Nationality: _____

Male () Female ()

Institution: _____

Address: _____

Periods of stay in China _____

Passport number and valid dates: _____

E-mail: _____

Phone: _____ Fax: _____

• I plan to register as (use √ to indicate your choice):

Formal participant (); Student ()

• I plan to give:

()Oral presentation entitled:

()Poster presentation entitled:

Other suggestions and comments:

Date:

Signature:

Please send this form by email before May 31, 2021 to:

Office of Science & Technology
Nanjing Institute of Geology and Palaeontology, CAS
39 East Beijing Road, Nanjing 210008, P. R. CHINA
e-mail: kjc@nigpas.ac.cn

International Geoscience Programme (IGCP)
Subcommission on Ordovician Stratigraphy (SOS)

Regional Meeting of IGCP 735
'Rocks and the Rise of Ordovician Life' ('Rocks n'ROL')

May 26th – June 6th 2022
Lille (France)

A global synthesis of the Ordovician



Jalhay Formation, Tremadocian, Stavelot Massif, Belgium

1st Circular



Regional Meeting of IGCP 735

‘Rocks and the Rise of Ordovician Life’ (‘Rocks n’ROL’)

May 26th – June 6th 2022
Lille (France)

The International Geoscience Programme IGCP n°735 ‘Rocks and the Rise of Ordovician Life’ (‘Rocks n’ROL’) is following IGCP n° 653 ‘The onset of the Great Ordovician Biodiversification Event’ (2016-2020).

Due to the outbreak of the Covid-19 pandemic, almost all IGCP activities have been cancelled in 2020 and 2021, and no on-site meetings and field trips could be organised by most of the international UNESCO programmes. Therefore, the official closing meeting of IGCP 653 in 2020 in Copenhagen, Denmark, and the absolutely final meeting of IGCP 653 in Lille, France, could only be retained as virtual meetings (September 2020 and 2021 respectively). The latter meeting is now rescheduled to take place in May-June 2022, as a regional meeting of IGCP 735.

After six prolific years that have brought together researchers from all over the planet, focusing on the most significant marine radiation in the history of the Earth (the so-called ‘GOBE’) IGCP 653 is now succeeded by the new project IGCP 735, with its first regional meeting, that also serves as a conference of the Subcommission on Ordovician Stratigraphy (SOS), after the official congress in Novosibirsk, Russia, 2019 (13th International Symposium on the Ordovician System) and before the congress in Tallinn, Estonia, 2023 (14th International Symposium on the Ordovician System).

We are happy to announce the main topic of the Lille 2022 meeting:

A global synthesis of the Ordovician



General Information

The International Geoscience Programme (at that time still labelled as an ‘International Geological Correlation Programme’ IGCP) n°410 ran from 1997 to 2001 (+ 2002 on extended term) under the title *‘The Great Ordovician Biodiversification Event.’* The subsequent project IGCP n°503 (2004 to 2008 with an extension in 2009) ‘Ordovician palaeogeography and palaeoclimate’ attempted to pinpoint the origins of this major marine radiation. The different possible triggers of the biodiversification event have been discussed in a number of papers, leading to the subsequent project IGCP n° 653 *‘The onset of the Great Ordovician Biodiversification Event’* that continued to document in greater detail the Ordovician radiation.

In the last few decades, this Ordovician radiation was considered by some authors to be a short ‘event’, that was caused by either an extrinsic (abiotic) or an intrinsic (biotic) trigger. It remains difficult, however, to find a single cause for the radiation, that appears very complex, both in terms of different palaeocontinents, and in terms of different biological clades. It became evident that the different palaeogeographical areas show biodiversification events at different times. Similarly, the different fossil groups also radiated at different moments during the Ordovician, with apparently planktonic groups showing a biodiversification prior to the benthic groups and the reef building organisms. More recently it also became evident that the different datasets show different scenarios. For example, while the Paleobiology Database (PBDB) indicates a more pronounced increase of diversity during the Middle Ordovician, the Geobiology Database (GBDB) clearly points at an ‘onset’ of the Ordovician Biodiversification already in the Cambrian. It is now obvious that none of the datasets used is complete. The information from some palaeogeographical areas is sometimes not included in the datasets, and, partly, or even not (yet) available. Large areas are simply not yet analysed or not yet included in the datasets and, therefore, in the biodiversification scenarios. The recent results, largely brought together in relation to the activities of IGCP n° 653 (2016-2020), indicate some potential future research questions : how can we fill the gaps in the datasets and how can we get a (more) complete picture of the Great Ordovician Biodiversification (or the Great Ordovician Biodiversification Event, that apparently was not an ‘event’ in the sense of a geological event) ?

The 2022 Lille meeting *‘A global synthesis of the Ordovician’* attempts to start filling some of the gaps in the currently available datasets. In collaboration with the Subcommission on Ordovician Stratigraphy (SOS), it is planned to provide the most complete picture of Ordovician data from all regions of the world, and for all fossil groups. Keynote speakers will be invited to present review papers of the Ordovician of several areas that have not been visited during the previous IGCP programmes related to the Ordovician. Several talks are already scheduled, focusing, for example, on the review of the Ordovician biodiversification of Antarctica, Australia and New Zealand, Iran and the Middle East, North Africa, Saudi Arabia, South America, and other regions.

In order to allow a complete *‘global synthesis of the Ordovician’* we plan to organise the meeting partly ‘virtual’, with online presentations from colleagues who are not able to travel.



Université
de Lille



LILLIAD
LEARNING CENTER
INNOVATION



The new Lilliad buildings (Lille University Learning Center) on the Campus 'Cité Scientifique' at Villeneuve d'Ascq

The meeting starts with a **pre-conference fieldtrip to the Ordovician of Belgium** (Friday to Sunday, May 27th-29th) and a registration of participants and an ice-breaker reception on Sunday, September 29th.

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. They are scheduled from Monday, May 30th to Wednesday, June 1th.

A **post-conference fieldtrip to Wales and the Welsh Borderland, UK**, is scheduled to take place from Thursday to Monday, June 2th-6th.

Social activities include the **icebreaker party** and reception on Sunday June 29th, a **visit of the Natural History Museum Lille** scheduled at the end of the first day of the indoor sessions, and a **conference dinner** that will be organised on Tuesday, June 30th, at the Brewery Dubuisson, Tournai, Belgium, including a guided tour of the oldest family brewery of Wallonia (founded in 1769), near the type localities of the Tournaisian Stage (lowermost stage of the Mississippian, Lower Carboniferous) with a travel by coach to Belgium.



Natural History Museum Lille



Lille Grande Place with the 'Vieille Bourse'

Excursions

Pre-conference field excursion to the Ordovician of Belgium

A pre-conference field trip to selected Ordovician sequences will be organised before the indoor sessions. Lower Palaeozoic rocks of Belgium occur in the Brabant Massif, the Condroz Inlier, and in the different inliers of the Ardennes. All these areas were located in the eastern part of the microcontinent Avalonia, which moved from high to low latitudes during the Ordovician. All areas show different thick siliciclastic successions, with abundant turbiditic and pelagic sequences representing most Ordovician stages, and some fossil rich outcrops in the lower and upper parts of the Ordovician. The excursion will visit some of these areas with stops at classical Ordovician graptolite localities, but also famous localities of the Belgian Upper Palaeozoic (Tournai, Namur, Dinant, etc.).

Added to these are some tourist stops, such as Waterloo (last battle of the Napoleonic Wars), and others.

Duration: 3 days, including two nights in Belgium

Estimated costs < 350 € (including travel, accommodation and food)



The famous Belgian *coticule* (whetstone) in outcrop in the Recht slate mine (Belgium)



Unconformity in the Onny River section, Caradoc, Shropshire, UK

Post-conference field excursion to the Ordovician of Wales and the Welsh Borderland, UK

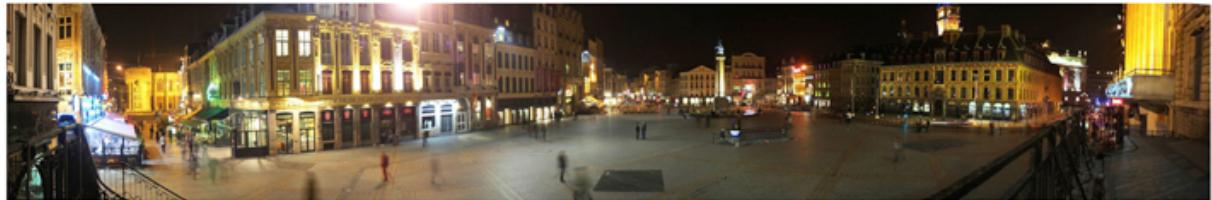
A post-excursion field trip to the classical Ordovician sections of Wales and the Welsh Borderland, UK, is planned. After the excursion to some of the classic localities in northern England (English Lake District and North Pennines) during the 2016 meeting at Durham, the 2022 excursion will allow the participants to see some of the classic British localities that have long served as the reference sections for the Ordovician, such as Tremadoc, Arenig, Llanvirn, Llandeilo and Caradoc. The Caradoc type section in the Welsh Borderland will be visited in detail. Short stops will also be made in the Silurian of the area, including at Ludlow or Much Wenlock.

Duration: 5 days, including travel to the UK from France.

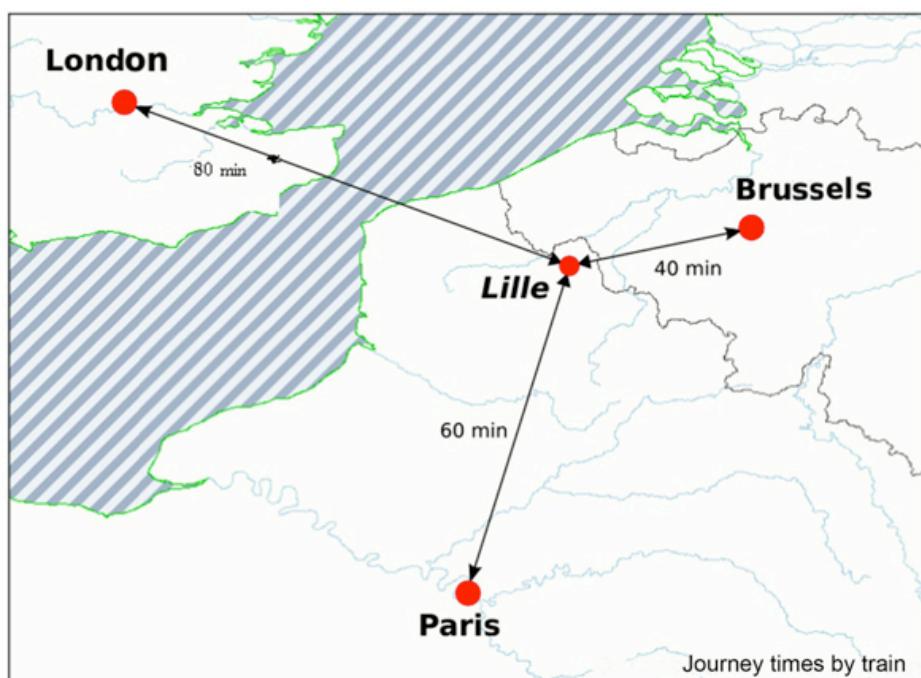
Estimated costs < 750 € (including travel, accommodation and food)

Getting to Lille

Lille University is one of the largest universities in France, with its science campus (*Cité Scientifique*), where the indoor sessions will take place, in the eastern part of the city, easily accessible by subway (12 to 15 minutes from the city centre).



Lille is located in the northernmost part of France, near the Belgian border. Although Lille has an international airport, it is probably most convenient to travel to one of the major international airports in Paris (France), Brussels (Belgium), or London (UK, especially for participants of the post-congress field trip). High-speed train connections are abundant and very practical, with very short travel time to Lille. The train stations (Lille Europe for arrivals from Brussels, London and Paris ; Lille Flandres for arrivals from Paris) are in the city centre and directly connected to the subway (metro) lines. Hotels and restaurants are available in all price categories, mostly in walking distance from the metro and train stations.



Important Dates

April 2021:	1st Circular issued
December 2021:	2nd Circular issued
February 28 th 2022:	Abstract submission and registration deadline
May 1 th 2022:	Distribution of Final Circular with Programme

Estimated registration fees

The '*global synthesis of the Ordovician*' meeting at Lille 2022 is planned to be a meeting in the spirit of the UNESCO, with registration costs limited, in particular for attendants from developing countries and students.

Registration costs for students will not exceed 100 Euros, those for regular participants should be below 200 Euros, including all receptions and lunches during the indoor sessions.

Support from IGCP and SOS will be distributed primarily to attendants from developing countries and students. Such support is available for 2022. Please contact the organisers for details.

Conference publications

Abstract and excursion guide volumes will be distributed upon arrival and registration in Lille to all participants, and will be also available online.

A proceedings volume is planned to be published in one of the major international palaeontological journals. Further information will be available in the 2nd Circular.

In addition, a publication in the frame of a book series (**Geological Society of London, Special Publications**) is planned to document the '*A global synthesis of the Ordovician*' topic. Most papers will be invited (organised by the SOS).

Scientific Committee

Thomas Servais, Lille, France (PI)
Yves Candela, Edinburgh, UK
Khadija El Hariri, Marrakech, Morocco
Mansoureh Ghobadi Pour, Gorgan, Iran
Oive Tinn, Tartu, Estonia
Wenhui Wang, Changsha, China

Bertrand Lefebvre, Lyon, France (co-PI)
Taniel Danelian, Lille, France
David A.T. Harper, Durham, UK
Elena Raevskaia, Saint Petersburg, Russia
Beatriz Waisfeld, Córdoba, Argentina

Organizing Committee

Thomas Servais, Lille, France (PI)
Taniel Danelian, Lille, France
David A.T. Harper, Durham, UK
Bertrand Lefebvre, Lyon, France

Contact information

Thomas.Servais@univ-lille.fr

Places to be visited



Lion's Mound, Waterloo Battlefield, Brabant, Belgium
Memorial of the last Napoleonic battle, June 16, 1815



Villers-la-Ville Abbey, founded 1147, Brabant, Belgium
Constructed with Middle Ordovician 'quartzophyllades'



Citadel, Namur, Carboniferous, Belgium
Former type locality of the Namurian stage



Tremadoc Bay
Scenic view of the village in north-western Wales, UK



Ironbridge, Shropshire, UK
View of the bridge inaugurated in 1781



Ludlow Castle, Shropshire, UK
One of the first stone castles

14th International Symposium on the Ordovician System: Estonia, 2023

The 14th International Symposium on the Ordovician System will take place in June/July 2023 on Baltica. It will also correspond to the 3rd annual meeting of IGCP 735 'Rocks and the Rise of Ordovician Life (Rocks n'ROL)'. Indoor sessions will be held in Tallinn, Estonia. The conference will include a pre-conference excursion to Sweden, a mid-conference excursion, and a post-conference field trip introducing all classic Ordovician successions in the eastern Baltic region.

The conference will be organised jointly by Tallinn University of Technology, University of Tartu, and the Geological Survey of Estonia, in collaboration with colleagues from Sweden and Russia.

For additional information and updates check the conference website: <https://isos14.org>

Olle Hints and Tõnu Meidla



Reaching out to the base of the System: Cambrian–Ordovician boundary beds at Cape Pakri, NW Estonia.



*This is the end...
Ordovician–Silurian
boundary beds in the Reinu
quarry, central Estonia.*

New IGCP 735: Rocks and the Rise of Ordovician Life (Rocks n'ROL). Filling knowledge gaps in the Early Palaeozoic Biodiversification, 2021–2025

The new project IGCP 735 (<https://rocksnrol.wordpress.com>), which was formally accepted on 15th March 2021 by the IGCP Scientific Board can be considered as the successor project of previous successful Ordovician-related IGCP projects n°410 *The Great Ordovician Biodiversification Event* (1997–2002), n°503 *Ordovician Palaeogeography and Palaeoclimate: Paleogeography of the GOBE, relationships with climate, sea levels, ecology* (2004–2009), n°591 *The Early to Middle Palaeozoic Revolution: Bridging the gap between the Great Ordovician Biodiversification Event and the Devonian terrestrial revolution* (2011–2015), and n°653 *The onset of the Great Biodiversification Event* (2016–2021). As is suggested by its title, the new project 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, SE Asia, Siberia. We have identified many other specific items (gaps) on which more research efforts should be encouraged, in particular with 'emerging countries', through enhanced collaboration, field work, educational and outreach programmes together with workshops.

Short description of the project:

Deciphering the complex interactions between climate change, biodiversity and ecosystem structure is a major societal issue for future generations. The geological record offers a unique opportunity to document the impact of environmental changes in the biosphere in the past, and thus can provide some clues for the future. In this context, the Early Palaeozoic is probably one of the most critical intervals to document such interactions between biotas and the Earth system. This interval embraces major evolutionary events such as the Cambrian Explosion and the Great Ordovician Biodiversification Event, but also covers major shifts in climate with a dramatic impact on the biosphere. Recently, the development of large-scale collaborative palaeontological databases promoted high-resolution analyses of biodiversity patterns, which could be compared with different environmental proxies. However, most available data are so far strongly biased towards some geographic areas (Europe, North America) and time intervals (lower–middle Cambrian, Middle–Upper Ordovician). Through a multidisciplinary approach, and in close collaboration with the Subcommission on Ordovician Stratigraphy, the project aims at filling the numerous knowledge gaps in most regions of the world (e.g. Africa, Asia and South America), with a special focus on less-documented time intervals (e.g. late Cambrian to Early Ordovician).

Leaders of the project:

- **Bertrand LEFEBVRE**, UMR CNRS 5276 LGLTPE, Université Lyon 1, Villeurbanne, France. E-mail: bertrand.lefebvre@univ-lyon1.fr
- **Yves CANDELA**, Department of Natural Sciences, National Museum of Scotland, Edinburgh, United Kingdom. E-mail: y.candela@nms.ac.uk
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- **Mansoureh GHOBADI POUR**, Department of Geology, Faculty of Sciences, Golestan University, Gorgan, Iran & Department of Natural Sciences, National

Museum of Wales, Cardiff, United Kingdom. E-mail: mghobadipour@yahoo.co.uk & m.ghobadipour@gu.ac.ir

- **Elena RAEVSKAYA**, JSC “Geologorazvedka”, St. Petersburg, Russia. E-mail: lena.raevskaya@mail.ru
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- **Beatriz WAISFELD**, Centro de Investigaciones en Ciencias de la Tierra / Earth Sciences Research Centre (CICTERA) - National Council for Scientific and Technological Research (CONICET) - National University of Córdoba. Córdoba, Argentina. E-mail: bwaisfeld@unc.edu.ar
- **Wenhui WANG**, School of Geosciences and Info-Physics, Central South University, Changsha, PR China. E-mail: whwang@csu.edu.cn

Workplan:

It is planned to run the new IGCP project over a period of five next years (2021–2025) comprising five major annual meetings and field excursions. Business meetings will be organized during these five main annual conferences, so as to announce and discuss activities of the project.

2021, September: Opening virtual meeting, joint event with the absolutely final meeting of IGCP 653, **Lille** University, Villeneuve d'Ascq, **France**. Field excursions and on-site congress postponed to 2022 (due to covid pandemic).

2022, October: 2nd main annual meeting of IGCP 735, Cadi-Ayyad University, **Marrakesh, Morocco**. Indoor sessions and field excursion to Lower Palaeozoic sections of the Anti-Atlas and the project of Fezouata geopark in Zagora Province (Gondwana).

2023, July: 3rd main annual meeting of IGCP 735, joint event with 14th International Symposium on the Ordovician System, Tallinn University, **Tallinn, Estonia**. Indoor sessions and field excursions to Lower Palaeozoic sections of Estonia, Russia (Saint-Petersburg area) and Sweden (Baltica).

2024, September: 4th main annual meeting of IGCP 735, Córdoba University, **Córdoba, Argentina**. Indoor sessions and field excursion to Lower Palaeozoic sections of the Precordillera Basin (Gondwana).

2025, September: Closing meeting of IGCP 735, Central South University, **Changsha, China**. Indoor sessions and field excursions to Lower Palaeozoic sections of Hunan Province (South China).

As field excursions, international collaboration and direct scientific exchange are essential, a series of smaller regional meetings focusing more explicitly on regional geology and/or geological heritage projects are also scheduled. These smaller conferences are also ideal for the organization of workshops and training courses for students.

2022, late May–early June: regional IGCP 735 meeting, **Lille** University, Villeneuve d'Ascq, **France**. Indoor sessions and field excursion to Lower Palaeozoic sections of Belgium, Wales, and Welsh Borderland (Avalonia).

2022, June: regional IGCP 735 meeting, Panjab University, **Chandigarh, India.** Indoor sessions and field excursion to Lower Palaeozoic sections of Spiti area (Himalaya).

2023, February: regional IGCP 735 meeting, University of Malaya, **Kuala Lumpur, Malaysia.** Indoor sessions and field excursion to Lower Palaeozoic sections of Malaysia

2024, April: regional IGCP 735 meeting, Kitab Natural Reserve, **Shakhrisabz, Uzbekistan.** Indoor sessions and field excursion to Lower Palaeozoic sections of Kitab Natural Reserve

2025, March: regional meeting of IGCP 735, Mashhad University, **Mashad, Iran.** Indoor sessions and field excursion to Lower Palaeozoic sections of Kopet-Dagh and Alborz

The 2020–2021 covid pandemic has also evidenced that virtual conferences were an additional, useful and efficient way to promote scientific exchanges. The absence of registration fees, travel and accommodation costs are positive points widening the audience and increasing the reach of such meetings by allowing an increased participation of young researchers and/or geoscientists from developing countries. So as to reduce problems related to time differences, virtual meetings every year in a different time zone have been scheduled.

Scientific sessions dedicated to the IGCP 735 have been also planned at various international, regional or thematic meetings, as for example at the 7th International Conference on Trilobites and their Relatives, Cincinnati, USA (July 2022), the 9th International Conference on Brachiopods, Berlin, Germany (2022), the 6th International Palaeontological Congress, Khon Kaen, Thailand (November 2022; joint session and field excursion with IGCP project 668), the 66th Annual meeting of the Palaeontological Association, Cork, Ireland (December), and the 11th European Conference on Echinoderms, Lyon, France (September 2023).

The necessity to share scientific results, methods and concepts with students, young researchers and geoscientists from developing countries is a priority for IGCP 735. The idea is to organize virtual international seminar lectures, so as to gather through members of the IGCP project a series of thematic lectures related to all aspects of the Early Palaeozoic Biodiversification. These seminar lectures could be made available (either live and interactive, or recorded e.g. on a dedicated IGCP YouTube channel) for graduate and doctorate students from universities in developing countries.

In the frame of the UNESCO programme building knowledge societies, specific 'Early Palaeozoic' actions towards the public could be organized every year during events such as e.g. the International Fossil Day or the Geodiversity Day. All actions supporting geological heritage related to the Lower Palaeozoic will be also supported, as for example in the Kitab Natural Reserve (Uzbekistan) and Zhangjiajie UNESCO Global Geopark (China), or through several projects of new geoparks in the Anti-Atlas (Morocco) and Southeastern China. Finally the best way to share knowledge with local populations and have them involved in the protection and valorisation of geological heritage is not to organize big scientific meetings with talks in English, but to promote smaller scale events (seminar lectures, exhibitions, school visits) and products (small books for children, leaflets, in situ explanatory panels) in the respect of the cultural and linguistic diversity of the populations.

Please contact the co-leaders at ddmograptus@gmail.com if you wish to join the project, organize a session, a regional meeting or a session !

IN MEMORIAM

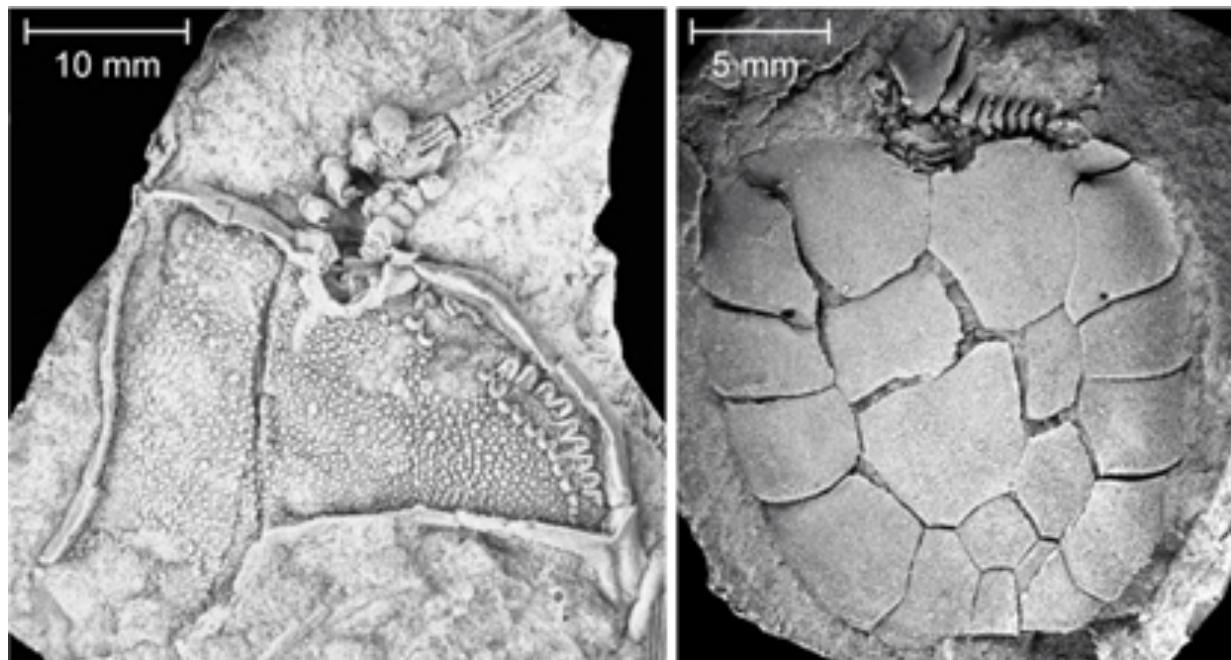
Richard Jefferies (1932–2020)

Richard Peter Spencer Jefferies was born on 15th January, 1932 in Croydon (then in the county of Surrey) in the UK. During WWII, he was evacuated to Sussex, away from the intensive bombing of the London Blitz and surrounding areas. It is during his childhood spent in the countryside, that the young Richard developed his curiosity for the natural sciences. After showing brilliance at school, he was accepted to the prestigious Gonville & Caius College at the University of Cambridge, where after having graduated in Natural Sciences specialising in Geology, he was accepted for PhD studies on Mesozoic molluscs and, more specifically, on Turonian faunas from the Paris Basin. While a student in Cambridge, he heard for the first time about carpoids, a group of strange, flattened and asymmetrical Palaeozoic echinoderms. Although these fossils were interpreted following the classical views of Francis Bather, alternative interpretations were also presented to the students, including that of the Swedish zoologist Torsten Gislén, who suggested, in 1930, that carpoids could represent early deuterostomes with gill slits.

Immediately after having defended his PhD thesis, Richard Jefferies met and married his wife, Beryl Towl (1960). The same year, after a first job as geologist at British Iranian Petroleum, he was recruited as a scientific officer in the Department of Palaeontology at the British Museum (Natural History), now the Natural History Museum, London, where he would then spend his entire career, until retirement in 1992. In his early years at the Natural History Museum, he carried on his work on Mesozoic bivalves. However, the then head of Department, Errol White, was frequently suggesting to him to work on other projects, one notable example, was the preparation of a public exhibition on echinoderms for the museum. This task prompted him to read for the first time the publications of Bather and Gislén he had heard about when he was a student. His curiosity and interest on Early Palaeozoic echinoderms and more specifically on carpoids then grew, when an unexpected event changed definitively the course of his scientific career. On 3rd February 1964, David Lewis, who was in charge of the collections of fossil echinoderms at the Natural History Museum, London showed him strange fossils he had just collected in the Upper Ordovician of Church Stretton area in Shropshire, England. The tadpole-like morphology of these mitrate stylophorans (*Barrandeocarpus*), very similar to that of primitive vertebrates, inspired Richard Jefferies to dig deeper and learn more about these fossils. In the following months, he read again Gislén's paper and went very carefully through the abundant collections of stylophorans housed in the museum, including the Mrs Elizabeth Gray collection, which contains hundreds of very well preserved cornutes from the famous Lady Burn Starfish Bed of Girvan (Upper Ordovician, Scotland). By 1964, he had all but given up his research on Mesozoic molluscs to devote the rest of his life to the study of cornute and mitrate stylophorans.

After three years spent working on carpoids and other extinct echinoderms, Richard Jefferies was involved as a co-author of the chapter on pelmatozoans in the first edition of *The Fossil Record* published by the Geological Society of London and the Palaeontological Association. The same year (1967), he also published his first paper on stylophorans. Largely inspired by Gislén's ideas, he proposed to reinterpret these fossils as 'calcichordates', i.e., as primitive chordates retaining an echinoderm-like calcite skeleton. Based on the detailed description of four Ordovician stylophorans, namely the two cornutes *Cothurnocystis elizae* and *Scotiaecystis curvata* (Scotland), and the two mitrates *Mitrocystella incipiens* (Brittany)

and *Mitrocystites mitra* (Bohemia), he interpreted stylophorans as consisting of a head (with gill slits) and a chordate-like tail (with a notochord).



Two iconic Ordovician fossils used by Richard Jefferies to build his calcichordate theory: Cothurnocystis elizae (on the left) from the South Threave Formation (late Katian), Girvan (Scotland, UK), and Mitrocystites mitra (on the right) from the Šárka Formation (Darriwilian), Barrandian area (Bohemia, Czech Republic).

During the rest of his life, Richard Jefferies defended and permanently refined his calcichordate theory. In 1969, hemichordates were introduced into the model, with cornute stylophorans being derived from a *Cephalodiscus*-like ancestor that would have been lying on the sea floor on its right side and thus lost its right internal organs (dexiothetism). In 1972, in his paper on *Reticulocarpos hanusi* from the Middle Ordovician of Bohemia, he explained how mitrates were derived from cornutes, through the loss of the tail in most-derived cornutes and the origination of a new, morphologically similar -but dorso-ventrally inverted- one in mitrates. In 1975, Richard Jefferies definitively rejected the putative homology of the crinoid stem with the tail of calcichordates and vertebrates. In 1978, the calcichordate theory became even more complex and sophisticated, with the identification of three distinct lineages of mitrates, each considered to represent the stem-group of one clade of extant chordates (cephalochordates, tunicates and vertebrates). This scenario involved three independent losses of the calcite skeleton in the course of evolution, instead of a single one as proposed in previous papers. In the 1990s, all other groups of carpoids (cinctans, ctenocystoids, solutans) were progressively incorporated in the calcichordate theory, which was thus providing a global scenario describing the origins of both echinoderms and chordates. Finally, in the early 2000s, Richard Jefferies took into account the last advances in metazoan phylogenies resulting from the advent of molecular analyses, and slightly modified his model.



Richard Jefferies in the field (July 1996) near Chuch Stretton, Shropshire, England, with the hill of Caer Caradoc in the background.

During his particularly long and prolific scientific career at the Natural History Museum, London, he kept working actively until the end of the 2000s, i.e. 15 years past his retirement, Richard Jefferies has been a precursor in many fields. Particularly skilled in foreign languages (he could speak fluently at least six, including French and German), he was one of the very first to read and translate into English the seminal publication of the German entomologist Willi Hennig, which defines the bases of phylogenetic analyses. As early as the early 1970s, he was probably one of the very first palaeontologists to understand the potential of these new methods and to promote them, within a then widely reluctant palaeontological community. Well before the advent of tomography and its use in palaeontology, Richard Jefferies was one of the very first to understand the potential of large 3D models to better understand the internal anatomy of fossils. In the 1970s, with the assistance of David Lewis, he managed to produce a series of large three-dimensional polystyrene reconstructions of mitrates, based on successive serial sections of actual specimens of *Balanocystites primus* (Ordovician, Bohemia) and *Placocystites forbesianus* (Silurian, England). He also performed morpho-functional analogical models, so as to investigate the locomotion of carpoids and the putative traces they could have left on the sediment. He also was one of the very first to use computational retro-deformation techniques, so as to reconstruct the original aspect of fossils preserved in tectonically distorted rocks.



The 'calcichordate team' at the main entrance of the Natural History Museum (May 1996), with from left to right: Anthony Cripps, Paul Daley, Marcello Ruta, Richard Jefferies and David Lewis.

In the second half of his long career, Richard Jefferies was particularly keen on supervising Master and PhD degree students, so as to share his experience and interpretations with them (e.g. A. Craske, I. Woods, M. Beisswenger, A. Cripps, P. Daley, M. Ruta, P. Domínguez). This generated a wider number of publications and contributed to significantly popularize the calcichordate theory in the 1990s. However, very few of his students kept working on calcichordates and, many of them, conversely contributed to point out weaknesses and inconsistencies in the theory (e.g. B. Lefebvre, M. Marti Mus, M. Ruta). Although the calcichordate theory has nowadays been almost totally abandoned, some of its ideas are still influencing discussions on the diversification of early deuterostomes. Incidentally, although molecular analyses have demonstrated that the initial premise of the calcichordate model was incorrect (echinoderms are not the sister-group of chordates), they have also recently brought strong support to some other predictions of the theory, e.g. the sister-group relationship of tunicates and chordates. This clade of chordates is named 'Olfactores', a term originally coined by Richard Jefferies in 1991.

Bertrand Lefebvre, Lyon (France) & **Aaron W. Hunter**, Cambridge (UK)

Martin Keller (1958–2020)

Seneca the Roman philosopher, said ‘Life, if well lived, is long enough’... but Martin Keller proved him wrong... His life was well lived but too short and he was ripped out of the circle of his colleagues and friends far too soon. They remember him as an always helpful and understanding man who had a strong backbone and didn’t hesitate to fight when necessary – especially for his friends but also for good ideas and scientific progress. Beside his love for family and friends he was passionate about his geology profession.



Martin - as many don't know him - working on water resources in Saudi Arabia

Martin was born on 18th January 1958 in Darmstadt, Germany. As young man he made long bike trips with his friends exploring many places in the countryside; as well he was an excellent swimmer and active in the well-known competitions of ‘youth trains for olympics’. He started studying geology in 1976 at the Technical University of Darmstadt, realising that in geosciences he could enjoy fieldwork in different parts of the world. Martin finished his Diplom with honours in May 1983 based on mapping in the Cantabrian Mountains in northern Spain, which inspired his devotion to work on the Early Palaeozoic for decades. He got his first short-term assistant professorship for Geology and Palaeontology at TU Darmstadt in March 1984 but quit in September that year to follow his PhD supervisor Werner Buggisch who had moved to Erlangen to become head of the Institute of Geology there. Erik Flügel, who also taught in Darmstadt before, was already Head of the Institute of Palaeontology in Erlangen at that time. Both eminent geoscientists strongly influenced Martin’s career that subsequently mostly focused on carbonate shelf facies, corresponding ecosystems and sequence stratigraphy in the framework of plate tectonic reconstructions and basin research.

At Erlangen he continued working in the Cantabrian Mountains for his PhD, finishing his thesis ‘Die La-Vid-Gruppe: Fazies, Paläogeographie und synsedimentärre Tektonik im Unterdevon des Kantabrischen Gebirges, (NW-Spanien)’ and his doctoral degree in

November 1987 with *magna cum laude*. His thesis work was published in 1998 in *Erlanger Geologische Abhandlungen*. For more than 20 years, Martin published interesting articles on the area, guided field trips and led field camps in the Cantabrian Mountains, and enthusiastically taught many students in regional geology the value of good field mapping and detailed field work. Whoever spent time in the field with him realized that he was an enthusiastic, passionate and fantastic field geologist catching the big picture of a large area very quickly, but also focusing on smaller details when necessary. He was a great sedimentologist, excellent mapping geologist, and a highly skilled teacher.



Martin – guiding a field trip in the famous Cantabrian Mountains in 2006

After his PhD, with research grants from the Deutsche Forschungsgemeinschaft, Martin started working in Argentina where he and I undertook collaborative studies while I worked on my Diploma thesis in the Precordillera in 1986–87. Subsequent collaborations involved Argentine friends like Osvaldo Bordonaro (Mendoza) and Fernando Cañas (Córdoba) on regional geology, Cambro–Ordovician stratigraphy, Ordovician reefs and geodynamic processes as well as the terrane aspect of the Precordillera and its Laurentian origin. With a ‘habilitation grant’ from the Deutsche Forschungsgemeinschaft, Martin started the comparison between the Argentine Precordillera and Laurentian sequences in the Great Basin, where he was invited and guided by Allison ‘Pete’ Palmer (Boulder, Colorado), at that time Director of the Institute for Cambrian Studies, who showed Martin the ‘Grand Cycles’ and explained the trilobite biomere concept to him. Martin was also cooperating with ‘Pat’ (Patricia W.) Dickerson (Austin, Texas) who showed him sequences in Texas corresponding to the Precordilleran succession. Later work with John D. Cooper (UC Fullerton) had a major

influence on further studies focussing on sequence stratigraphy in the Early Palaeozoic of the southern Great Basin including research on palaeokarst and climate. Together with John, he became heavily involved in the 7th ISOS in Las Vegas in 1995, where both guided a wonderful post-conference field trip to the Mojave Desert and across the Death Valley area. Over the years Martin got in touch with almost everybody working on geology and paleontology of the southern Great Basin including many friends from our Ordovician community.



Martin and John D. Cooper (Fullerton) on the evening cruise on Lake Mead at the 7th ISOS in Las Vegas, 1995

Martin finished his habilitation at the Friedrich-Alexander-University (FAU) in Erlangen in July 1997, being recognised by the Emmy Noether Award of the FAU for his outstanding thesis work. The publication of his great habilitation thesis ‘Argentine Precordillera: sedimentary and plate tectonic history of a Laurentian crustal fragment in South America’ as *Geological Society of America Special Paper* 341 in 1999, represents his most cited paper (> 200 citations) and has influenced much subsequent research in this region.

After occupying several full professorships in Darmstadt, Regensburg, and Göttingen, Martin realized how difficult it was to get any further financial support in Germany and so he

switched careers to the ground water business in Saudi Arabia, his fourth and last main study area, in 2009. There he worked initially for GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) and Dornier in Rijadh on aquifers in the Rub al Khali desert and areas close to the Arabian shield. He trained students in the sedimentology of the Palaeozoic and Mesozoic successions and also supervised the dissertation of Hussain Fahhad Al-Ajmi on the sedimentology of the Palaeozoic Wajid Sandstone in SW Saudi Arabia. Together with Hussain and others, Martin published papers on the Ordovician glaciation in the Kingdom of Saudi Arabia when he worked at the Ministry of Environment, Water & Agriculture (MEWA), where his duties were strongly focused on the aquifers and groundwater reserves of the country and the water supply for agriculture, for Bedouins in the desert and military bases along the borders.



Martin with his former student Hussain Al-Ajmi (MEWA, Rijadh, Saudi Arabia) & Matthias Hinderer (TU Darmstadt, Germany) at Hussains PhD defence in Darmstadt in 2013

Martin was Chief Technical Advisor at MEWA and between 2010 and 2020 he was working for development programs of the United Nations in Saudi Arabia and Bahrain. Martin died in Bahrain after a heart attack on 19th December 2020. It happened after he angrily had left Rijadh after his Christmas holidays were not approved by the Saudi heads in the ministry.

In June 1985 Martin had married Else-Marie Werner who supported him until his death after more than 35 years of marriage, visiting him in different regions of the world where he did extensive field work. Especially for the last 12 years since Martin was active in Saudi Arabia, Else and Martin had to endure a long-distance relationship.

Beside his activities in the Middle East he had still fulfilled his duties as an extraordinary professor at the University of Erlangen in Germany until 2019, leading field excursions and mapping courses. Interestingly, since the Geozentrum Nordbayern in Erlangen has no

information about its history, former heads and professors of the Institute of Geology, Martin and other ‘externals’ are not found on the University webpage, which fails to acknowledge people who worked hard and published extensively for that institution in the past. Therefore, I am hopeful that - and would be glad if - his name and achievements will be remembered and honoured by many friends and colleagues in this community.

When I look back over the last few decades, there are many great memories of Martin, especially of weeks and months together in the field, from the Precordillera, Spain, the southern Great Basin and the time we spent together in Saudi Arabia. Many of us have their own memories of Martin who died far too early at the age of 62 and I hope with this obituary I am bringing up some of these enjoyable moments again.



An evening with Martin in the Rub al Khali (Saudi Arabia), the world's largest sandbox

Oliver Lehnert, Erlangen (Germany)

John Fioretto Valder RIVA (17 June 1929 – 29 July 2020)



John F. Riva in his office at INRS, Québec, Canada on June, 1st 2010.

As a postdoc I took my first trans-Atlantic flight in the summer of 1987 to meet with John Riva in Québec City. He had agreed to introduce me to my field work area at Lévis on the southern side of the St. Lawrence river. Thus, I met a very interested and highly skilled person, teaching me about graptolites, how to collect them, how to determine them, how to prepare them and how to produce publishable illustrations. At that time it was still rare to publish photos of graptolites and specialists largely used ink drawings for illustration. Sitting at a microscope, producing first pencil drawings at high magnifications and being very careful in avoiding unwarranted interpretations – this is what I was taught at Laval University that summer.

John F. Riva died on July 29th in Québec City, Canada, where he spent most of his professional life. As a graptolite specialist, John is especially known for his meticulous illustrations of graptolite specimens that can be found in so many of his palaeontological publications. However, he was much more than just a graptolite specialist as can be seen from his numerous publications on various aspects of Palaeozoic geology of North America with quite a number of co-authors who appreciated his knowledge and understanding as well as his scientific expertise on his favorite fossils. His main palaeontological focus was on the Middle to Upper Ordovician graptolite faunas of eastern North America, where he established the unusual endemicity of the graptolite faunas of the Appalachian basin and the St. Lawrence Platform, namely from the subsurface of Anticosti Island and the St. Lawrence lowlands, but

obviously his interests were much wider in scope. He was knowledgeable about graptolites in general and left behind an enormous fundus of illustrations that he prepared during numerous visits in museums all over the world or by borrowing important type material.

John was born in the small mountain village of Digomà, near Voltago in the Agordo valley in the province of Belluno, Italy (Italian Dolomites), on June 17, 1929. He was the only child of Costante Olivo Riva (1894–1957) and Genoveffa Case (1900–1936). Both parents came from large families and he grew up with many uncles, aunts and cousins. After the early death of his mother from tuberculosis when he was only six, he lived first in the care of his maternal cousin Emma Marcon and later of his aunt Annunziata Comina, one of his father's older sisters. His father emigrated for work in the United States in 1911, returning to Italy for extended stays in 1923, 1927–28, and 1933–34. It was during his second visit that Costante met and married his wife, who always remained in Italy. At first Costante worked in the copper mines of Utah, Arizona and Nevada. In the U.S. Army during World War I, he was stationed at Bicester in England where he served as an air mechanic. Returning to the U.S. in 1934, he worked on the construction of the Hoover Dam on the Colorado River, then moved to Las Vegas in 1942 to work in the lumber industry. John's early education was in Voltago and Agordo, then in Belluno at the Liceo-Ginnasio "Tiziano". John joined his father in Las Vegas in November of 1947 at the age of 18, where he completed the requirements for an American high school diploma at Las Vegas High School in 1948. John got his B.A. in 1950 in Modern Languages at the University of Nevada-Reno.

In 1951, John was drafted into the U.S. Army and fought in the Korean War. He was awarded the Presidential Unit Citation for participating in the defense of Eerie Hill in the Iron Triangle on June 12–14, 1952, with the 3rd Battalion, 180th Regiment, 45th Infantry Division.

In 1957, he earned a M.Sc. in Geological Engineering at the Mackay School of Mines, University of Nevada-Reno, where his thesis advisor was E. Richard Larson. The title of his thesis was 'Geology of a portion of the Diamond Range, White Pine County, Nevada'.

John attended the Université de Grenoble, France (1957–1958) and Stanford University, California, USA (1958–1959), before transferring to Columbia University, New York, USA, in the fall of 1959. In 1962 he obtained his Ph.D. from Columbia University for his work on 'Allochthonous Ordovician–Silurian cherts, argillites and volcanic rocks on Knoll Mountain, Elko County, Nevada' under the guidance of Prof. Marshall Kay.

Work opportunity then brought John to Canada and he worked as a research associate at McGill University (Montréal, Canada) (1961–1963) with Thomas H. Clark. On a trip back to Italy to visit his cousins, he met Livia Angela Vianello, elementary school teacher, daughter of Ornella Panebianco and Alessandro Vianello, medical doctor at Castellavazzo (Belluno, Italy). They were married August 17, 1961 in Castellavazzo and Livia emigrated to Montreal in 1962. Their daughter, Pat, was born in Montréal shortly after. Their son David was born in Québec City in 1974.

John returned to the United States for his first academic position as assistant professor at Villanova University (Pennsylvania, USA) (1963–1966), where he also served as Acting Chair of the Geology Department (1965–1966), his only administrative appointment. It was during his time at Villanova that John started his collaboration with Ed S. Belt, who moved to Amherst College (MA) in 1966. In 1966, John became assistant professor at Université Laval, in Québec City, Canada, where his mentor was F. Fitz Osborne. John was granted tenure and

promotion to associate professor in 1969. In 1977, John attained the rank of full professor and in 1995, after his retirement from Université Laval in 1994, he joined INRS-ETE (Institut national de la recherche scientifique – Eau-Terre-Environnement), part of the Université du Québec, Québec, Canada as a visiting professor.

Early in his retirement, John turned some of his attention to family history research, which he pursued with full scientific rigour, and then more broadly to emigration from his native region to North America. He compiled a comprehensive account of his paternal family as far back as the 1500s, and also wrote about the life of his grandfather, Giovanni Riva (1846–1926), who was head schoolmaster in the elementary school at Tiser for 41 years. His account of the life of his great-uncle Luigi Isidoro Riva (1842–1909), who served in Garibaldi's army during the reunification of Italy, was published in an Italian history journal.

His scientific work started with stratigraphic, biostratigraphic and tectonic investigations of the Palaeozoic succession of the Diamond Range in central and NE Nevada (HD Range, Snake Range, Mount Blanchard, White Peaks and Windermere Hills). He quickly expanded into the Ordovician to Silurian successions of eastern North America. John's studies on the Upper Ordovician graptolites of the Québec lowlands and of Anticosti Island are essential contributions and still some of the most important references for the Ordovician successions of eastern North America and beyond.



John together with Tatyana Koren' at his home in Québec in the summer of 1988.

Travel for research brought John to the USSR, where he had long-time collaborators, to major American, British and European museums, and to China and Australia for extended

stays. He was a polyglot, learning Russian to read scientific papers, some Chinese in his travels, as well as his native Ladin (a dialect of Rhaeto-Rumansch), Italian, Latin, English, French and German. His visits in many museums for the investigation of important graptolite material were appreciated and his notes can be found in the boxes associated with many type specimens in museums all over the world. During this time, John prepared numerous meticulous drawings of graptolite type specimens that are now preserved at FU Berlin (Germany) and can even be found in the new ‘Graptolite’ Treatise.



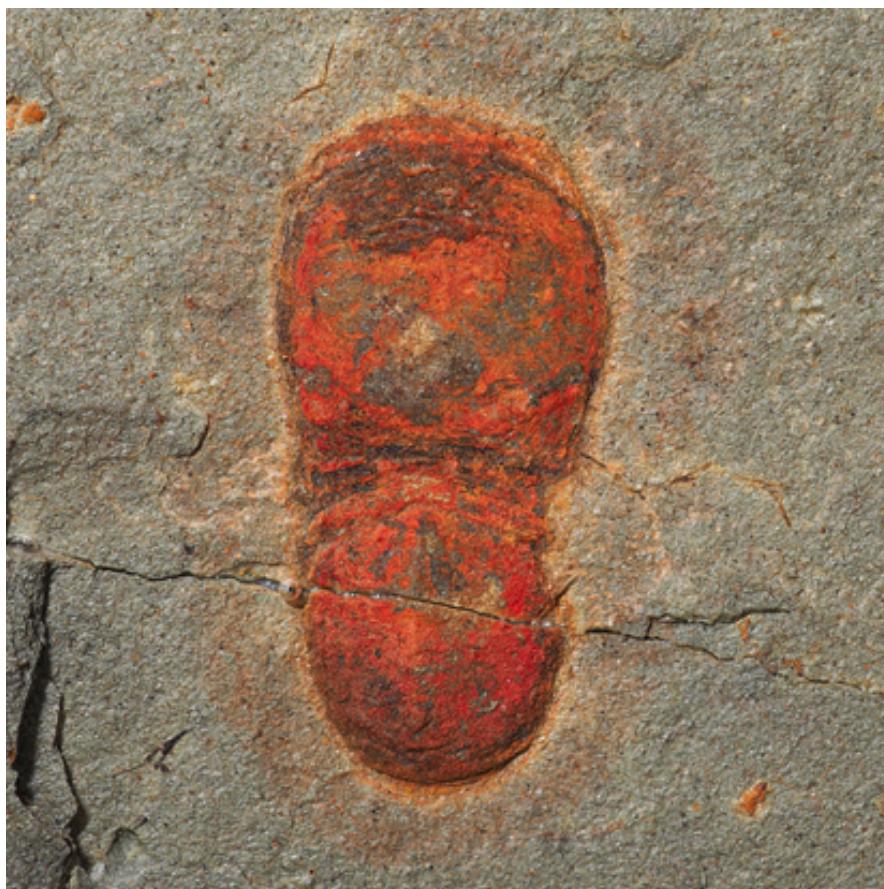
*John with friends and colleagues, 3. November 2004 at INRS, Québec, Canada.
From left to right: Esther Asselin, Thijs Vandenbrouke, John, Aïcha Achab*

After his retirement from Laval University – and already before – his fieldwork centered on the Upper Ordovician successions of the Cloridorme Formation of the Gaspé Peninsula of Québec, Canada. He collected in great detail numerous successions to understand the biostratigraphy of the foreland basin-floor turbidite system with its excellent exposures of more than 7700 m of clastic sediments (largely graywackes to shales) along the southern shore of the St. Lawrence River. A complex structure of three main structural blocks was formed through the late Ordovician Taconic Orogeny and was difficult to sort out due to the rarity of fossil faunas for biostratigraphic correlations, needing endless days of fieldwork and subsequent fossil

preparation. This succession was formerly referred to as the Normanskill Formation, due to the comparison with the successions in New York State. John's work on the Cloridorme Formation, unfortunately, remains largely unpublished.

John was certainly not an easy going personality, but was supportive, helpful and loyal to his closest collaborators. He was a true scientist with a view to detail and always honest with his colleagues. He never lost the scientific focus and worked hard until a few years ago when he had to stop his fieldwork in the Gaspé Peninsula due to health concerns. I last met with him in the summer of 2018 when his health was already declining considerably and he had to move out of his home into a care facility. Large parts of his reprint collection, his original drawings and his Gaspé graptolites are now in Berlin with me and await further attention. His unique perspective, his cautionary enthusiasm and his careful manner will be greatly missed in our scientific community and we will retain him and his work in our collective memory.

Jörg Maletz, Berlin (Germany) with the help of **Pat Riva** (Concordia University, Montréal, Canada), **Aïcha Achab** (INRS, Québec, Canada) and **Esther Asselin** (RNCan, Québec, Canada).



Holotype of *Tariccoia tazagurtensis*, a new nektaspid euarthropod from the Lower Ordovician Fezouata Shale (Morocco). It was named after the city of Zagora (in Tamazight language, Zagora is called Tazagurt). Photograph courtesy of **Lukáš Laibl**.

ORDOVICIAN RESEARCH REPORTS & CONTACTS

Leho AINSAAR (Estonia) is continuing to work on stable isotope chemostratigraphy and palaeoenvironmental history of the Ordovician and Silurian of Baltoscandia (together with T. MEIDLÄ, A. LEPLAND, O. TINN, O. HINTS, S. RADZEVICIUS, and others), as much as administrative tasks at the university allow.

Leho Ainsaar

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Guillermo ALBANESI (Argentina) is working on lower Paleozoic conodont faunas from South America. Research projects from the Precordillera and northwestern Argentine basins are continued with G. ORTEGA, former PhD students, and colleagues from Argentina and other countries. G. DELLA COSTA, F. LÓPEZ, and E. K. RUEDA are working under my direction by means of doctoral scholarships. Likewise, M. MANGO is continuing his postdoctoral studies. Research programs include conodont biostratigraphy, paleoenvironments and evolution from carbonate and siliciclastic sequences of the Ordovician System in Argentina. I am Professor of Paleontology and the director of the “Centro de Investigaciones Geológicas Aplicadas” (CIGEA, <http://www.efn.uncor.edu/investigacion/CIGEA>) at the Facultad de Ciencias Exactas, Físicas y Naturales (FCEFyN), Universidad Nacional de Córdoba (UNC), which includes a micropaleontology laboratory especially equipped for conodont preparation. My office is located at the CICTERRA (CONICET-UNC, <http://cicterra.conicet.unc.edu.ar/es/>) in the university campus, and the conodont collections are housed at the Museo de Paleontología (FCEFyN, UNC).

Guillermo L. Albanesi

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Galina ANEKEEVA (Russia) works on Ordovician echinoderms of the Baltic Basin (under leadership of Sergey ROZHNOV) - studying holdfasts of stemmed echinoderms, cyclocystoids (together with Georgy MIRANTSEV) and echinoderm paleoecology.

Galina A. Anekeeva

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Chris Barnes (Canada). Continuing my conodont paleontology/stratigraphy/isotope geochemistry research. The main projects being: a) Ordovician paleotemperature record for tracking the Argentine Precordillera across Iapetus Ocean determined from SHRIMP oxygen isotope measurements from conodonts (with ALBANESI (CONICET, Cordoba), TROTTER (UWA), WILLIAMS (ANU), and BERGSTRÖM (OSU)); b) analysis of the effects of climate, eustasy and tectonics on conodont evolution and ecology during the early Paleozoic from the major database developed from a half-century of sampling throughout Canadian part of Laurentia; c) Ordovician and Silurian conodont biostratigraphy, bioevents, eustasy and thermal maturation; d) Late Ordovician organic black shales and conodont paleoecology, northern Hudson Bay, Nunavut (with Shunxin ZHANG).

Chris Barnes

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Matilde Sylvia BERESI (Argentina) continues her palaeontology/stratigraphy research at the CONICET, Mendoza, Argentina. Together with Jéssica GOMEZ (PhD student, San Juan University and CONICET), we are focusing on stratigraphy, sedimentology and lithofacies changes of the post-glacial Hirnantian Stage–Rhuddanian transition in the Eastern and Central Precordillera of western Argentina. Based on these studies, two articles have been submitted. In addition, a first faunule of silicified hexactinellid spicules has been recovered from carbonate lens of the Upper Ordovician outcrops on the eastern flank of the Villicum range, Eastern Precordillera of San Juan Province (one paper has been submitted). There are currently two collaborative projects with colleagues from the Universidad de Sonora and the Universidad Autónoma de México. The first one focuses on the stratigraphy, depositional cycles, palaeoenvironments and the fossil communities from the Ordovician carbonate platform of Sonora. The second one is on chancelloriids, sponges and associated fauna from the Cambrian of Sonora (one article has been submitted and two have been published). I have also developed new collaborations with colleagues from the Universidad de Los Andes in Bogotá to further current research and studies of the Ordovician from Colombia as well as other countries in the region.

Dr. Matilde Sylvia Beresi

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Yves CANDELA (Scotland) is working with Bernard MOTTEQUIN (Royal Belgian Institute of Natural Sciences, Brussels) on several projects focussed on Lower Ordovician brachiopods from Belgium; one of which has just been accepted for publication and it also involves Thomas SERVAIS, Wenhui WANG, Jean-Marc MARION and Mark WOLVERS as co-authors.

Work continues with David HARPER (Durham University) and Michal MERGL (University of West Bohemia, Pilsen) on the Lower Ordovician brachiopod faunas of the Fezouata Lagerstätte (Morocco). Some good progress was made early last year but unfortunately was interrupted by successive periods of lockdown (as was work on the following projects). Yves is still working with Consuelo SENDINO (NHM London) on an assemblage of machaeridians from the Sandbian of Scotland, collected by the late Archie LAMONT. Projects started with Juan Carlos GUTIÉRREZ-MARCO (Institute of Geosciences, Madrid) on Ordovician brachiopods from Spain are still on-going.

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.

Yves is also co-leader of the 5-year, IGCP project 735 "Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification" recently funded by the UNESCO. This project is led by Bertrand LEFEBVRE (France) and also comprises Mansoureh GHOBADI POUR (Iran), Khadija EL HARIRI (Morocco), Beatriz WAISFELD (Argentina), Oive TINN (Estonia), Wenhui WANG (China) and Elena RAEVSKAYA (Russia).

Yves Candela

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Marcelo G. CARRERA (Argentina). I'm actively working on the evolutionary history of Paleozoic sponges and bryozoans (taxonomy, paleoecology and paleobiogeographic significance). In particular, I'm 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 submitted. This last study is a part of a major project carried out together with Dr Andrej ERNST regarding the remarkably diverse bryozoan fauna from the Ordovician of western Argentina. I am also studying a collected microfossil material of enigmatic octocoral sclerites. Previous studies of Ordovician sponges have finally been published in their printed version

Marcelo G. Carrera

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Lucía CATTANA (Argentina) is currently a PhD student at Universidad Nacional de Río Cuarto. She is working in the project “Analysis of reef structure and building organisms of the Lower Ordovician of the Argentine Precordillera”. The main goal of this project is the study and analysis of Early Ordovician reefs, their main framebuilders (calcified cyanobacteria, calcareous algae, sponges and associated organisms), meso and macro-morphology and areal distribution, and the paleoenvironmental context in which the different types of reefs were developed. Also, to determine their relationship with the main stratigraphic controls and the sequence stratigraphic distribution.

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Xu CHEN (China). I am working with Research Institute of Petroleum Exploration and Development, PetroChina and China Petroleum and Chemical Corporation (SINOPEC) on the Ordovician and Silurian Shale gas strata of the Yangtze Platform.

Xu Chen

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Robin COCKS (England). 2020 was normal until March 23rd, after which access to my Natural History Museum office was denied because of the coronavirus (apart from a single day when I got special permission to collect some things). Nevertheless, I have been busy working from home, with all contact by e-mail and no meetings, holidays, or the usual working trips to Norway. A paper with Trond TORSVIK on Ordovician palaeogeography and climates was submitted to *Gondwana Research* and is now in proof and work has started with him on a comparable paper for the Devonian. However, a bigger monograph on Late Ordovician brachiopods from the Chu Ili Terrane in Kazakhstan, with Leonid POPOV (Cardiff and Iran), with 73 genera (8 new) within 12 associations (newly defined) was finished and accepted by *Fossils & Strata* and we await proofs. Leonid and I are now well on with a new paper on the distribution and brachiopod associations of the Early Ordovician Mediterranean Province, which was largely in southern higher latitudes.

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G. Susana DE LA PUENTE (Argentina). My research continues to focus on chitinozoan and Paleozoic geological studies.

G. Susana de la Puente

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André DESROCHERS (Canada). I am working on the Upper Ordovician to Lower Silurian strata of Anticosti Island in Eastern Canada. My 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 as an alternative cause for the Hirnantian mass extinction (with Julie DE WEIRDT, Thijs VANDERBROUKE and others); ii) time-series analyses derived from high-resolution stable isotope data of the Upper Ordovician Anticosti succession (with Matthias SINNESAEL and others); iii) stratigraphy and timing of the End Ordovician mass extinction (with Joshua ZIMMT and Seth FINNEGAN); iv) sedimentology and paleoecology of Telychian encrinites (with Bill AUSICH, Selina COLE, and David WRIGHT); and v) paleoecology of giant Aulacerid stromatoporoids. (with Geneviève RIOPEL and Rachel WOOD).

André Desrochers

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Andrei DRONOV (Russia) continued his work on facies, sea-level changes, biotic and abiotic events on the Siberian and Russian platforms during the Ordovician. In the year 2019, we started a new 3-year project “Regional and Global Aspects of the Great Ordovician Biodiversification Event on the Siberian and Russian platforms”. The project’s team includes, Alexander TIMOKHIN, Taras GONTA, Olga MASLOVA, Veronica KUSHLINA, Alexey ZAITSEV, Elena RAEVSKAYA and Tatiana TOLMACHEVA. Under umbrella of this project, we continue investigations of the Siberian K-bentonite beds conducted in collaboration with Warren HUFF and studies of carbon isotope chemostratigraphy of the Ordovician of Tungus basin in cooperation with Boris POKROVSKY, Oliver LEHNERT and Peep MÄNNIK. Studies of extraterrestrial chromates in the Darriwilian sections of St. Petersburg region and Siberia together with Birger SCHMITZ are also in the agenda as well as investigation of the Ordovician trace fossils in cooperation with Radek MIKULÁŠ and Dirk KNAUST. In the year 2020, we won a Grant for a complex 3-year investigation of the Moyero River reference section in Northeastern Siberia. One of the goals is a magnetostratigraphic study of the beginning and the end of the Moyero Superchron. The project’s team includes Vladimir PAVLOV, Tatiana TOLMACHEVA, Nadezhda

PRIJATKINA and Olga MASLOVA. In August 2020, we made a preliminary investigation of the section and during the summer of 2021 we are planning the 1.5 month expedition there.

Andrei V. Dronov

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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. New faunas from Peru are described with Juan Carlos GUTIÉRREZ-MARCO (Madrid), and a new Lower Ordovician fauna from South Wales with John COPE (Cardiff). The catalogue of the specimens described by Wahlenberg (1818) in *Petrificata Telluris Svecanae* is developing well, in collaboration with Vivianne BERG-MADSEN (Uppsala). This very early work contains a number of Ordovician type specimens, and the material and types have hitherto been poorly known.

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Cole EDWARDS (USA) continues to work on Ordovician stable and radiogenic isotope stratigraphy. Collaborations with David FIKE (Washington University in St. Louis) and Page QUINTON (SUNY Potsdam) continue on $\delta^{18}\text{O}$ study of Ordovician conodonts using the Cameca 7f/geo Secondary Ion Mass Spectrometer (SIMS), work that should be published in early 2021. Collaborations with Matt SALTZMAN (The Ohio State University) continue, now with his Ph.D. students (Christopher CONWELL, Datu ADIATMA, and Teresa AVILA), on conodont biostratigraphy and radiogenic isotope chemostratigraphy of the Middle–Late Ordovician. Current and future 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) will use similar approaches to identify intervals of anoxia as possible drivers of the Late Devonian mass extinction from sections exposed in the Great Basin region, western USA.

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Khadija EL HARIRI (Morocco) is vice-president of the International Palaeontological Association (IPA) and also of the Association for the protection and enhancement of the Moroccan geological heritage (APPGM). Pr. Khadija EL HARIRI was chair of the first international conference on 'The Rise of Animal Life' (Oct. 2015). She was also the coordinator of the IGCP 653 regional meeting in Marrakesh and field excursion in the Anti-Atlas (Feb. 2018). She supervised the thesis of KOURAÏSS Khaoula (defended Feb. 2020) on the protection and enhancement of the Lower Ordovician Lagerstätten of the Zagora area (Central Anti-Atlas, Morocco) and also the thesis of AZIZI Abdelfettah (defended Feb. 2020) on the sedimentology and palaeoecology of the Moroccan Anti-Atlas at the Neoproterozoic-Cambrian transition.

Khadija El Hariri

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Bob ELIAS (Canada), with co-authors Dong-Jin LEE and Brian PRATT, has a paper in press in *Geology* (The “earliest tabulate corals” are not tabulates). Other papers are in preparation on coral-like fossils from the Lower Ordovician of western Newfoundland, Canada.

Bob Elias

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Ru FAN (China) continues working on Ordovician and Cambrian integrated stratigraphy, especially on conodonts and carbon isotope chemostratigraphy from the Upper Yangtze Platform, the Ordos Basin and the Tarim Basin in China.

Fan Ru

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FANG Xiang (China), an Assistant Researcher in NIGPAS, Nanjing, is still working on the Early Palaeozoic cephalopods. Currently, his research interest is focused on the late Cambrian and Ordovician cephalopods in South China and other regions near the northeastern peri-Gondwana, i.e., North China, Xizang (Tibet), Tarim and Sibumasu, especially on their diversity and biogeographic patterns.

Fang Xiang

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Annalisa FERRETTI (Italy) continues her work on Ordovician conodont faunas from Europe and elsewhere, focusing with Stig BERGSTRÖM on conodonts from different localities in UK, the Carnic Alps (with Hans Peter SCHÖNLAUB) and the United Arabian Emirates (with Giles MILLER). A study on new conodont material from the Late Ordovician Kalkbank unit (Germany) with Peter KÖNIGSHOF and Ulf LINNEMANN is going on.

Recent papers have strictly focused on the effect of diagenesis on bioapatite mineralogy and crystallization patterns over geological time (Medici *et al.*, 2020, 2021; Ferretti *et al.*, 2021). She has also co-guest edited with Alyssa BANCROFT and John REPETSKI (Ferretti *et al.*, 2020b) the Special Issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* “GECKO: Global Events impacting CONodont evolution”, a collection of 20 conodont contributions, including six Ordovician papers. A detailed biostratigraphic investigation has been carried out by means of conodonts in the uppermost Ordovician–lowermost Devonian sector of the Valentintörl cliff, located in the Austrian part of the Carnic Alps (Corriga *et al.*, 2021). The behaviour of the iconic ichnogenus *Chondrites* was re-evaluated in Baucon *et al.* (2020) based on review of existing literature and analysis of novel data (macroscopic, thin section and ESEM-EDX observations; CT-scans and resin peels of modern analogues; computer-controlled serial grinding; morphometric analysis and theoretical morphology). Finally, a paper describing Leonardo da Vinci’s contribution to stratigraphy, of broad interest to any stratigrapher, exactly five hundred years after Leonardo’s death, has been published (Ferretti *et al.*, 2020a).

Annalisa Ferretti

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Richard FORTEY (UK): An ongoing project on the Burmese types of F.R.C. REED continues. Another long term project on the Ordovician of the Sultanate of Oman with Alan HEWARD and colleagues also progresses –three papers headed by Alan have appeared since 2009, and a fourth is in prospect. I am collaborating with Juan Carlos GUTIERREZ-MARCO on a remarkable trinucleid trilobite from South America. As an additional project, Diana CLEMENTS discovered a lost collection of Ordovician trilobites from the Nares expedition to the Canadian Arctic and Greenland (1875–6) in the NHM collections, published recently.

Richard Fortey

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Mansoureh GHOBADI POUR (Iran) currently completed revision of the Ordovician stratigraphy of northern Iran in cooperation with Leonid POPOV, Javier ALVARO, Arash AMINI and Hadi JAHANGIR. Her work on the Mid to Late Ordovician trilobites of the West Balkhash Region is in good progress. Also a short manuscript on the early Ordovician graptolites of the Alborz Mountains written together with Adrian RUSHTON and some other colleagues, has been submitted for publication.

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Daniel GOLDMAN (USA), with Peter SADLER and Stephen LESLIE, co-authored the Ordovician Chapter for the recently published *Geologic Time Scale 2020*. The revised Ordovician time scale uses a substantial number of new and more precise radiometric dates that have been published since 2012 to construct independently calibrated sets of biozones from carbonate and clastic facies sections. Ordovician workers will be able to compare graptolite and conodont-based timescales, and better judge the uncertainties around stage boundary ages. They have also provided more extensive correlation charts and summaries of the advances in chemostratigraphy that have been made in the last 8 years.

He has been working with Guillermo ALBANESI and Gladys ORTEGA on the integration of graptolite and conodont biostratigraphy from the Argentine Precordillera; and with Gladys ORTEGA and Cyntia KAUFMANN on graptolites from the Villicum Range. He is also working with LIANG Yan, Olle HINTS, Peng TANG, Chengyang CAI, Ke PANG, Jaak NÖLVAK, Joseph BERNARDO, and Wenhui WANG on exceptionally preserved chitinozoans that were fossilized while undergoing reproduction. With LIANG Yan as lead author a manuscript was published in *Geology*.

Daniel Goldman

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Juan Carlos GUTIÉRREZ-MARCO (Spain) has survived a particularly difficult and boring year, both due to the limitations of all kinds imposed by the coronavirus, as well as the interruption of his field investigations in Iberia, Morocco and South America. His current work includes the description of new Ordovician hyoliths from Iberia (in collaboration with John MALINKY), a review on smooth pentaradiate Spanish cystoids (with Chris PAUL), a new trinucleid trilobite from the Ordovician of Peru (with Richard FORTEY), and the preparation of several papers on Silurian and Devonian graptolites.

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David A.T. HARPER (UK) reports that research continues on a variety of Ordovician brachiopod and other faunas. In particular he is collaborating with Yves CANDELA and Michal MERGL investigating the Lower Ordovician brachiopod fauna of the Fezouata Lagerstätte (Morocco), Robin COCKS on the brachiopod fauna of the Portrane Limestone (Ireland) and Thomas SERVAIS and Bernard MOTTEQUIN on the Upper Ordovician brachiopods from Belgium. Current projects include the description of a new *Hirnantia* brachiopod fauna from Belgium (with Sofia PEREIRA, Jorge COLMENAR and others), the bioregionalization of the Ordovician biodiversifications (with Thomas SERVAIS and Borja CASCALES-MIÑANA), the phylogeny of plectambonitoid brachiopods (with Yves CANDELA and ZHEN Guo). Editorial work on and contributions to a major new book on the Global Ordovician will occupy a significant amount of time over the next two years.

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Alain HERBOSCH (Belgium). Although long formally retired, I continue geological investigations on Lower Paleozoic from Belgium. Now that the geological history of the Brabant Massif is well known in every aspect, I will try to compare it with the Ardenne inliers (Stavelot-Venn, Rocroi and Givonne). I have recently published two papers: the first one in *Geologica Belgica* on a new geological map of the outcrop area of the Brabant Massif, and the second one, on the Stavelot-Venn Massif (Ardenne, Belgium). I have just finished writing with F. BOULVAIN a chapter entitled "The Ardenne" for a book to be published by Elsevier "Geology of the Central Variscides and its Avalonian-Cadomian precursors (Ed. U. Linnemann).

Alain Herbosch

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Susana HEREDIA (Argentina). I'm still working on biostratigraphy and taxonomy of Ordovician conodonts from different areas of Northwest Argentina (Cordillera Oriental), Famatina Ranges, Precordillera and the Ponón Trehue outcrops. Susana HEREDIA is working on taxonomy and biofacies of Ordovician conodonts from the Precordillera and the Andean Basin (Puna and Eastern Cordillera). Upper Ordovician Conodonts from Precordillera are still under study. All these matters are developed in collaboration with Dr. Ana MESTRE, Dr. Josefina CARLOROSI and PhD student Florencia MORENO. Susana shares interests on Ordovician matters with Drs. Guillermo ACEÑOLAZA, Blanca TORO, Daniel POIRE and Juan Pablo MILANA. Dr. Carlo CORRADINI is collaborating (2014–2016) with the Micropaleontology Lab on developing Silurian conodonts from the Central Precordillera, as result Lic. María José GOMEZ is almost finishing with a Silurian conodont PhD project.

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 Yan LIANG, WANG Wenhui and Jaak NÖLVAK he is continuing studies on chitinozoans and other organic-walled microfossils from Baltoscandia as well as South China, focusing on taxonomy, biostratigraphy, biogeography and palaeoecology. On these topics several papers were published in 2020, including one proposing a protistan affinity of the Chitinozoa. In collaboration with Petra TONAROVA and Mats E. ERIKSSON, he is studying Ordovician and Silurian scolecodonts to provide new insights into the taxonomy, paleobiogeography and diversification history of Palaeozoic jaw-bearing polychaetes. Olle is involved in studies on chemostratigraphy together with Tõnu MEIDLÄ, Leho AINSAAR, Aivo LEPLAND, David FIKE, Seth YOUNG and other colleagues, aiming at better documenting and understanding stable isotope signatures and other geochemical proxies within the Baltoscandian carbonate sedimentary basin. Together with Ursula TOOM he is involved in Baltic Ordovician trace fossil research. Olle is also responsible for the development of national geocollections database and related services under a national research infrastructure project (various data are accessible at <https://geocollections.info>).

Olle Hints

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Juwon JEON (South Korea) is working on Ordovician stromatoporoids as an integrated Ph.D. program student in Nanjing Institute of Geology and Palaeontology (NIGPAS) under the supervision of Prof. ZHANG Yuandong and Dr. LIANG Kun. He is currently working on the taxonomy of Late Ordovician stromatoporoids from the Chinese paleo-plates and their implications for paleobiogeography and paleoecology. He is particularly interested in stromatoporoid diversification during the Great Ordovician Biodiversification Event and the faunal transition of stromatoporoids during the Ordovician – Silurian interval.

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Dimitri KALJO (Estonia) continued some studies on the Ordovician and Silurian bio- and chemostratigraphy of Baltica as an emeritus member at the geology department of the Taltech. The Covid pandemic slowed down different activities, but electronic cooperation with some colleagues from USA and Europe still works. Last half a year I have been mostly busy together with my earlier Taltech colleagues (T. MARTMA, T. MÄRSS, V. NESTOR, V. VIIRA) on a paper about the Silurian bio- and chemostratigraphy. Hopefully we can report about publication in the next issue of the news.

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Marcus M. KEY (USA). I am working with Dr. Patrick N. WYSE JACKSON (Trinity College, Dublin, Ireland) and Catherine REID (University of Canterbury, New Zealand) on quantifying the amount of calcification of trepostome bryozoan colonies across the Calcite I-Aragonite II seas transition. We are using the Bryozoan Skeletal Index (BSI) which we defined last year.

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Khaoula KOURAISS (Morocco). In February 2020, she defended her PhD thesis entiteld “Preservation and valorization of fossiliferous deposits with exceptional preservation of the Lower Ordovician (480 Ma) of the region of Zagora (Anti-Atlas Central, Morocco)” at University Cadi Ayyad of Marrakech, Morocco. Her work for the last 6 years has involved the analysis of the composition and evolution of fossil assemblages of the Fezouata Shale (Lower Ordovician) in time and space, as well as the conservation of Fezouata fossils. In the context of valorization, three-dimensional digitization techniques were proposed to create virtual fossils. Such digital models make easier the dissemination of technical information to non-specialist as well as giving the chance to those who consider fossils as very old and dusty objects, to see them in an artistic way and discover the ‘beauty’ of the iconic specimens. During her PhD, Khaoula was pleased to work with many specialists in the Ordovician field and publish with them several scientific papers.

Khaoula Kouraiss

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Petr KRAFT (Czech Republic) continued studies on a small project about dendroid graptolites supported by the Czech Grant Agency, and on a long-lasting project supported by the West Bohemian Museum focused on a systematic documentation of paleontologic localities in the Ordovician of the Prague Basin. Together with J. BRUTHANSOVA, he participated in rescue research and collected huge material of the Late Ordovician graptolites from the mining of the tunnel of a new subway line in Prague.

Petr Kraft

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Lukáš LAIBL (Czechia) continues to work on the morphology and development of various euarthropods from the Fezouata Shale (Tremadocian, Morocco) together with colleagues from ANOM Lab (University of Lausanne, Switzerland), Laboratoire de Géologie de Lyon (Lyon 1 University, France), Laboratoire Géosciences Océan (University of Brest, France), Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie (Sorbonne University, France), Département des Sciences de la Terre (University Cadi-Ayyad, Morocco). Besides, he works on the evolutionary modifications of trilobite post-embryonic development during Cambrian and Ordovician. In 2020, he was awarded funding from the Czech Science Foundation for his three-year research project “Exploring developmental aspects in fossil arthropods during Cambrian explosion and Ordovician biodiversification”. He co-authored several papers focused on the Fezouata Shale taphonomy and its fossil content.

Lukáš Laibl

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and

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Jeong-Hyun LEE (South Korea) is working on Cambro-Ordovician reefs and related geological events. A recently published manuscript in *Geobiology* suggests that late Cambrian *Cryptozoan* from NY, USA, the earliest "stromatolite" ever named and described, is a sponge-microbial consortium, which might have flourished prior to the Darriwilian skeletal reef diversification. In 2021, he will continue to work on Cambro-Ordovician stromatolites in Korea, China, USA and Canada.

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Bertrand LEFEBVRE (France) continues working on Ordovician echinoderm systematics, palaeoecology and paleobiogeography. Lockdown was useful in providing a great amount of time available to catch up with late publications and more efficiently work on several ongoing projects. Decisive progress was made on the monographic reviews of Middle–Late Ordovician cornute stylophorans from peri-Gondwanan areas (with Martina NOHEJLOVA, Emmanuel MARTIN, Libor KASICKA, Ondřej ZICHA and Juan Carlos GUTIERREZ-MARCO) and Late Ordovician solutans from Morocco (with Martina NOHEJLOVA), both scheduled for the GSL Special Publications volume 485 on the Tafilalt Biota. He was also strongly involved in several publications (in progress) and ongoing collaborations on the Fezouata Biota with Farid SALEH and several other colleagues from (mostly) Brest, Lausanne, Lyon and Marrakesh. During most of the year 2020 and in close collaboration with Yves CANDELA, Khadija EL HARIRI, Mansoureh GHOBADI POUR, Elena RAEVSKAYA, Oive TINN, Beatriz WAISFELD and Wenhui WANG, he was also strongly involved in the elaboration of a new Ordovician-related IGCP project. On Sept. 10, the main guidelines of the project were presented during the closing ceremony of the virtual annual meeting of IGCP 653 and, in the following days and weeks, benefited from a strong support from colleagues worldwide (over 130 supporting statements from 32 countries). The project was submitted on Oct. 15, and was finally accepted six months later by the IGCP board at the UNESCO. Following in the steps of previous successful IGCP projects 410 (1997–2002), 503 (2004–2009), 591 (2011–2015) and 653 (2016–2021), the new IGCP project 735 “Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification” (Rocks n' ROL) will be running from 2021 to 2025.

Bertrand Lefebvre

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Lixia LI (China) continues to work on the Paleozoic sponges and Ordovician graptolites from South China. Her research activities in 2020 were mainly on taxonomy and palaeoecology of sponges from Ordovician–Silurian boundary section in South China. There is a good progress in the study of systematic palaeontology of the hexactinellids and the manuscript has been submitted. She carried out a new project about sponge biodiversification during the Ordovician–Silurian boundary interval in South China and its implication, in cooperation 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.

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Ming LI (China) continues her work on Early Ordovician graptolites systematics, phylogeny and biostratigraphy. Results from this work were compiled into a paper about the phylogeny of Tremadocian graptolites from South China, which will be published in *Acta Geologica Sinica* in 2021.

Ming Li

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Qi-jian LI (China) is mainly working on Ordovician–Silurian reefs and hypercalcified sponges (e.g. calathids, stromatoporoids and sphinctozoans). In 2020, I continued my sedimentological and paleoecological research on Ordovician reefs. Apart from the materials from South China, Tarim, Malaysia and Thailand, I carried out a new project with Prof. Andrei DRONOV and Prof. Anna ANTOSHKINA, targeting the Ordovician reefs in Siberia. Moreover, I am now working on some Early Silurian reefs of South China, in collaboration with Prof. Axel MUNNECKE, Dr Stephen KERSHAW and Dr. Andrej ERNST. I also continue my collaborations focused on quantitative paleoecological analyses of reefs at the Ordovician–Silurian transition with several colleagues.

Qi-jian Li

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Yan LIANG (China) continued her study on Ordovician chitinozoans. Together with her collaborators, she focused on the morphological ultrastructure of chitinozoans and put forward another possibility about the chitinozoan biological affinity. Based on the study of exceptional specimens from the Middle and Upper Ordovician limestone of Baltica and North America, some of the inner morphologies have been clearly revealed and an ultrastructural study has been carried out for the first time. The results show that those exceptional specimens turn out to be the key materials recording the chitinozoan reproductive moments and thus it is more plausible to assume that chitinozoans are a group of independent micro-organisms. She participated in the IGCP 653 virtual meeting hosted by the IGCP 653 project leaders and gave a presentation of their recent work focusing on the chitinozoan biological affinity. Besides, systematic and biostratigraphic studies have also been the main focuses. By analyzing the chitinozoan assemblages in the western margin and upper part of the Yangtze Platform, their work provides new age information of the poorly aged Hungshihyen Formation at Songliang, Yunnan Province.

Yan Liang

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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, and Natsuko ADACHI (Osaka City University).

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Xiaocong LUAN (China) is an assistant researcher at the Nanjing Institute of Palaeontology and Geology, Chinese Academy of Sciences, where he is part of the Lower Paleozoic Working Team. He is interested in Ordovician sedimentology and stratigraphy, especially the environmental background of bioevents, *i.e.*, the Great Ordovician Biodiversification Event and end-Ordovician mass extinction. Ongoing studies include ferruginous time-specific facies (TSFs) deposited in the Yangtze region during GOBE (*e.g.*, ferruginous ooids and marine red beds) and end-Ordovician limestones in South China.

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Jörg MALETZ (Germany) is working on several projects in the Ordovician and Silurian, mainly on graptolites, but also on radiolarians. The Ordovician work includes the taxonomy of early Ordovician *Rhabdinopora* species from North China (Dayangcha) and Canada (western Newfoundland, Green Point) with WANG Xiaofeng, WANG Chuanshang and colleagues from Wuhan, Hubei Province, China. Further work is done on a number of drill cores with Ordovician successions in Scania (southern Sweden) together with Per AHLBERG (Lund, Sweden). Taxonomic work on early biserial graptolites from the Darriwilian of Scandinavia, China and Canada is in progress. Work on the *Treatise on Invertebrate Paleontology*, part V, Hemichordata (Graptolithina, Enteropneusta) is nearly finished and most chapters are available through ‘Treatise Online’.

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 and evolution of sedimentary basins. Joint studies together with colleagues from Estonia, Germany, Iran, Poland, Russia, 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.

Peep Männik

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Alexander (Sandy) D. McCracken (Canada) is periodically working on good Ordovician–Silurian collections from Hudson Bay and Moose River basins, Ontario and Manitoba, and also has some Arctic Island Ordovician–Silurian conodonts to review. I retired to Victoria, BC in September 2017, but continue as a part-time volunteer with the GSC Calgary office. I am in email contact with the Calgary office once a week, and so may be a bit slow to respond to emails. Regular mail to the Calgary office does not get forwarded so please send only emails or email attachments.

Alexander (Sandy) D. McCracken

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Patrick I. McLAUGHLIN (USA). During 2020 I continued working on the time-rock correlation of Katian and Hirnantian strata in the Illinois, Michigan, Appalachian, and Anticosti basins and their correlations to age-equivalent successions around the world. This work is maturing through collaborative activities with Alyssa BANCROFT, Thijs VANDENBROUCKE, Poul EMSBO, Matthias SINNEAEL, Carlton BRETT, and students Julie DE WEIRDT, Tim DE BACKER, and our newest PhD student Cristiana DE JESUS PAULO ESTEVES. Though travel restrictions during 2020 slowed our field work substantially, we still managed some profitable lab work and data synthesis. In particular, many wonderful new discoveries were made right here in Indiana through study of our extensive core collection. We hope to begin publishing the exciting results of these collaborative activities during 2021. During the coming year, I will also be starting a new project in collaboration with the US Geological Survey and state surveys across the Midwest focused on Upper Ordovician phosphorites, their rare earth endowment, and process origins. As a recently appointed voting member of SOS, I look forward to advancing the discussion(s) of global initiatives in Ordovician chemostratigraphy, geochronology, and sea level history.

Patrick I. McLaughlin

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Tõnu MEIDLÄ (Estonia) is holding the positions of Professor of Palaeontology and Stratigraphy at the University of Tartu (Institute of Ecology and Earth Sciences) and Head the national Doctoral School of Ecology and Earth Sciences. I am chairing the Estonian Commission on Stratigraphy affiliated with the Geological Society of Estonia. I am 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. PETRUKONE and S. RADZEVICIUS). Ordovician-related projects in other areas are in progress with A. DRONOV, L. GONÇALVES and M. WILLIAMS.

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Tatiana L. MODZALEVSKAYA (Russia). I continue to work on Ordovician–Silurian–Lower Devonian brachiopods and stratigraphy in a thematic project connected with analysis of Regional scales of Eurussian Russian regions. In the network of this project an Atlas of compilation on the Ordovician and Silurian stratigraphical key sections and faunas of Asian Arctic Russia is completed in manuscript. I take part as author in the Regional Stratigraphic chart of Ordovician deposits of West-Siberian geosyncline foundation prepared by N.V. SENNIKOV in Novosibirsk.

Tatiana L. Modzalevskaya

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Navid NAVIDI-IZAD (Iran) finished his PhD in 2020 at the Department of Earth Sciences, Kharazmi University, Tehran, Iran on palynology of the Cambrian-Ordovician sediments in northern Iran. In 2020, he published several papers with his colleagues on revision of some Ordovician acritarch genera such as *Orthosphaeridium* and *Vulcanisphaera* (*Review of Palaeobotany and Palynology*) and the Upper Ordovician colonial palynomorphs (*Palynology*). Also the first evidence of the Ordovician sediments in northwestern Algeria based on palynological findings was published in *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen* with colleagues from Algeria and France. Additionally, a systematic revision of some Ordovician acritarch taxa is in progress.

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Martina NOHEJLOVA (Czech Republic) continues her work on Ordovician echinoderms (mainly eocrinoids and solutans) focusing on systematics, palaeoecology, palaeobiogeography and phylogeny. Study material originated from Czech Republic, Morocco and Argentina. She was working on Late Ordovician solutans from Morocco (Tafilalt Biota, *GSL Special Publications* volume 485, in collaboration with Bertrand LEFEBVRE), descriptions of new echinoderm Lagerstätte from the Czech Republic (general publication about the locality in collaboration with Oldřich FATKA, Petr BUDIL, Elise NARDIN, Ondřej ZICHA and Bertrand LEFEBVRE and on descriptions of starfish bed in collaboration with Aaron HUNTER).

Martina Nohejlová

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Leon NORMORE (Australia) continues working on geochronology, chemostratigraphy, biostratigraphy, source rock analysis, data distribution and 3D outcrop modelling in the outcrop and subsurface Ordovician strata of Australia. Most recent work included management of a deep stratigraphic drillhole, Barnicarndy 1, in the southwest Canning Basin of northwest, Western Australia, with over 1000 m of this continuously cored interval within Ordovician strata. Post well analysis is ongoing including detrital and CA-IDTIMS geochronology, conodont biostratigraphy, source rock analysis, geomechanical analysis, seismic property analysis and chemostratigraphy.

Leon Normore

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Alan OWEN (UK). Significant progress has been made on the description of trilobites from the Upper Ordovician Slade and Redhill Mudstones of South Wales with Lucy McCOBB (National Museum of Wales, Cardiff) and Patrick McDERMOTT. Travel and other covid-19 restrictions have severely limited progress on several other projects on British and Irish faunas but they remain high on the “to do list” for the hoped-for better days ahead.

Alan W. Owen

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Ian PERCIVAL (Australia) is retired but has been reappointed an Honorary Research Associate of the Geological Survey of NSW. My research continues to concentrate on Ordovician conodonts and brachiopods, working mainly with Yong Yi ZHEN on faunas from New South Wales and Western Australia (the latter in collaboration with the Geological Survey of WA). I also continue fruitful cooperation with colleagues (particularly Guangxu WANG) from the Nanjing Institute of Geology & Palaeontology, involving study of Late Ordovician biotas, extinction mechanisms and stratigraphy across the Ordovician–Silurian boundary.

Ian Percival

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Teresa PODHALANSKA (Poland). I continue my work on Ordovician and Silurian stratigraphy, graptolites, and prospectivity of lower Palaeozoic unconventional hydrocarbon systems in Poland.

Teresa Podhalańska

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Leonid POPOV (United Kingdom) continues to work on the brachiopod faunas of Zerafshan Range (Uzbekistan) in cooperation with Irina KIM (Geological Survey of Uzbekistan) and brachiopods from the Ishim region (Kazakhstan). A large manuscript on the Mid to Late Ordovician brachiopods from the Chu-Ili Range and the West Balkhash Region written in cooperation with Robin COCKS has been submitted to *Fossils and Strata* and now it is awaiting for publication.

Leonid Popov

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Elena RAEVSKAYA (Russia) continues to work on Ordovician acritarchs from different regions of Russia focusing on taxonomy, biostratigraphy and paleobiogeography. For many years she has participated in consecutive multidisciplinary projects (under leadership of Andrei DRONOV) supported by Russian Foundation for Basic Researches and partly by IGCP projects aimed to study evolution of the Ordovician basins from Siberian and East-European platforms and to search for reliable correlative markers of biotic and abiotic events. Under umbrella of the current project titled as “Regional and Global Aspects of the Great Ordovician Biodiversification Event on the Siberian and Russian platforms” she continues to study different aspects of microphytoplankton diversity and distribution.

Together with an international team including Bertrand LEFEBVRE, Yves CANDELA, Khadija EL HARIRI, Mansoureh GHOBADI POUR, Oive TINN, Beatriz WAISFELD, Wenhui WANG, she is a co-leader of the new IGCP project entitled 'Rocks and the Rise of Ordovician Life' ('Rocks n'ROL'), which was submitted in October 2020 and had been recently accepted by the IGCP board at the UNESCO. The project is now running under the number IGCP 735, from 2021 to 2025 with an aim to fill the numerous knowledge gaps related to various aspects of the Ordovician diversification.

She is now a voting member of the International Subcommission on Ordovician Stratigraphy. Her current position is a Head of the Stratigraphy Department and a Deputy Director of JSC “Geologorazvedka” of the Russian Geological Holding JSC “ROSGEO”.

Elena G. Raevskaya

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Christian M.Ø. RASMUSSEN (Denmark) planned the organization the final meeting of IGCP653 in Copenhagen – the so-called GOBEnhagen meeting – but had to cancel the event due to the corona pandemic. Instead he, together with co-organizers Alycia STIGALL, Svend STOUGE, Niels SCHOVSBO and Arne NIELSEN, organized a virtual meeting via Zoom called ‘Zooming in on the GOBE’. This event was well-attended with contributions from all over the world.

Research-wise Christian continues to work on elucidating the abiotic drivers behind the GOBE. Current work focuses on the Swedish island of Öland, where both faunal and geochemical data have been collected over a number of years. The aim is to develop an astrochronological framework for the Middle Ordovician that may serve to calibrate the radiations in absolute time.

Christian M.Ø. Rasmussen

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Jiayu RONG (China). I have been studying the brachiopod faunas across the end-Ordovician mass extinction. Recently, the brachiopods of the late Hirnantian–early Rhuddanian Edgewood Fauna have been discovered from Sichuan, South China and the new collection will be investigated in the near future.

Jiayu Rong

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Sergey ROZHNOV (Russia). I continue working on Early Palaeozoic echinoderms from various parts of Russia focusing on the Ordovician representatives from Baltica. The main topics of my researches are comparative morphology and morphogenesis of the Early Palaeozoic echinoderms, interaction of internal and external factors in their evolution.

Sergey V. Rozhnov

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Farid SALEH (China) continues to work on the preservation of the Fezouata Shale (Lower Ordovician, Morocco) in a collaboration with the Laboratoire de Géologie de Lyon at Lyon1 University, the ANOMLab at the University of Lausanne, the Laboratoire Géosciences Océan at the University of Brest, the Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie at Sorbonne University, the Department of Earth Sciences at the University of Cambridge, the Czech Geological Survey, the Institute of Geology at the Czech Academy of Sciences, the Institute of Geology and Paleontology at Charles University, and the Département des Sciences de la Terre at Université Cadi-Ayyad. Saleh *et al.* have published a paper reconstructing the preservational sequence of fossils from the Fezouata Shale, and another one comparing the preservation potential of the Fezouata Shale to Cambrian sites with soft-tissue preservation. Moreover, they analyzed pyrite crystals from the Fezouata Shale using Raman Spectroscopy and provided a new hypothesis on the role of biogenic iron in the preservation of nervous systems in the Paleozoic. Finally, they investigated the preservation of specific patterns in eocrinoids and somasteroids from the Fezouata Biota and found that these are mimics of soft-tissues introduced by modern weathering rather than real anatomies preserved in minute details.

Farid Saleh

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Matthew SALTZMAN (USA) continues to work on stable and radiogenic isotope studies in the Ordovician. Along with PhD students Datu ADIATMA, Chris CONWELL and Teresa AVILA, he is focused on pairing Sr and Nd analyses in the Darriwilian to Sandbian to understand the role of silicate weathering on climate. Datu is also starting to add in Li isotope work from this time interval, in collaboration with Xiaoming LIU at UNC Chapel Hill. Teresa's work in the Ordovician has also involved oxygen isotope study of the Oklahoma I-35 section to pair with the Sr isotope studies from those same conodont samples, with a quantitative model of the Sr isotope curve that is focused on seafloor weathering (trying to isolate the component as separate from continental basalt weathering during the Taconic Orogeny). Chris CONWELL also been collaborating with Cole EDWARDS, who has worked on oxygen isotopes from Ordovician sections using SIMS on conodont samples. Eventually Matt will be able to do his own research again after a four year sentence as School Director ends on June 30, 2021 – hopes to see some of you again at conferences when freed!

Matthew R. Saltzman

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Thomas SERVAIS (France) continues working on Ordovician palynology, mainly on acritarchs, and related topics, including the plankton revolution and its role to trigger (at least partly) the Ordovician biodiversification. The latter clearly appears to be not related to a single event; analyses of biodiversity, palaeogeography and palaeoecology of the GOBE continue with David A.T. HARPER (Durham, UK) and Borja CASCALES-MIÑANA (Lille).

Ordovician palynological research also includes the study of the oldest 'spores' and thus the first fossil record of land plants.

Regional studies are focused on the Ordovician of Belgium, Germany and France, with re-investigations of brachiopod, trilobite and graptolite faunas in collaboration with specialists of these groups.

During the last months, a number of students (who spent all or part of their PhD at Lille) finished their studies, including Navid NAVIDI-IZAD (Tehran, Iran) on Cambrian-Ordovician acritarchs from the Alborz Mountains, Hocine BENACHOUR (Tlemcen, Algeria) on Cambrian-Ordovician acritarchs from north-eastern Morocco and north-western Algeria, and David KROECK (Lille, France) on palaeobiodiversity trends of Palaeozoic micro-phytoplankton. The post-doctoral research of Axelle ZACAÏ (Lille, now Poitiers, France) resulted in the documentation of the latitudinal diversity gradient of Cambrian and Ordovician acritarchs, in relation to palaeogeographical and palaeoclimatic changes.

International collaboration continues with LIANG Yan, LI Jun, SHAN Longlong, YAN Kui, and ZHANG Yuandong (Nanjing, China) and with WANG Wenhui (Changsha, China), as well as with Elena RAEVSKAIA (Saint Petersburg, Russia) and Zbigniew SZCZEPANIK (Kielce, Poland), among others.

In September 2021 the palaeontology research team at Lille will organise the 'absolutely final meeting' of IGCP 653, that will also serve as the opening meeting of IGCP 735, and as a meeting of the Ordovician Subcommission, of which Thomas is the chairman from 2020 to 2024.

Thomas Servais

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Husain SHABBAR (India) received Maulana Azad National Fellowship in 2015 to carry out research on the Ordovician–Silurian palaeobiodiversity of Spiti, Tethyan Himalaya, India. Later, in 2017 I have joined the Ph.D. course at Sambalpur University with the principal objective of the thesis “Palaeobiodiversity of the Ordovician-Silurian Periods of Spiti”. Recently, I have successfully defended the pre-submission *viva voce* of my Ph.D. thesis. During 2019–2020, I have presented my work in two national and three international

conferences on the aspects of palynomorphs, macrofauna, and macroflora retrieved from Ordovician–Silurian strata of Spiti. One article dealing with the occurrence of Ordovician calcareous green algae Cyclocrinitids is published in 2020. Another article dealing with Middle Ordovician Tentaculitoids is under review in the journal *Historical Biology*. Apart from these two articles, four articles are under preparation that will be soon communicated.

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Lyubov SHMELEVA (Russia). I and my supervisor Dr. Anna ANTOSHKINA are working on the Upper Ordovician paleogeography, stratigraphy, and spatial-temporal and paleoecological structures of the Bol'shaya Kos'yu reef paleocoenoses in the Northern Urals.

Lyubov Shmeleva

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Matthias SINNEAEL (U.K.) 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). He is now working as a post-doc in statistical chronostratigraphy at Durham University tackling the problem of stratigraphic correlation and integration using Bayesian statistics applied to Cambrian strata. Matthias stays interested in better understanding Ordovician paleoclimate and stratigraphy - especially cyclostratigraphy and astrochronology.

Matthias Sinnesael

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Patrick Mark SMITH (Australia) recently started working on Ordovician biostratigraphy in Tasmania, New South Wales and the Northern Territory, Australia. During 2020 he documented several new trilobite taxa, including one genus and two species from the middle Katian Gunningbland Formation of central New South Wales; as well as one species from middle Katian Gordon Group of Tasmania. Both publications demonstrate a cryptic diversity of Ordovician calymenids in Australia which had previously gone unrecognised. Patrick is also working to publish several projects with John LAURIE of Geoscience Australia, as well

as with Yong Yi ZHEN and Ian PERCIVAL of the New South Wales Geological Survey. These projects revolve around various aspects of conodont and trilobite biostratigraphy of the Tremadocian, Darriwilian, and Katian of the Northern Territory and New South Wales; including papers on the Stairway Sandstone, Stokes Siltstone, Florina Formation, Nootumbulla Sandstone, Bynguano Quartzite, Scropes Range Formation, Rowena Formation and Gunningbland Formation.

Patrick Mark Smith

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Colin SPROAT (Canada) was awarded a research grant to compare the Late Ordovician brachiopod fauna of eastern North America on a storm-dominated coastline to the equatorial epicontinental fauna of the continental interior. The project was mostly put on hold for this year due to the pandemic, but he is looking forward to a busy field season next summer (pandemic notwithstanding). He has also been continuing to work with Renbin ZHAN and Yuchen ZHANG in Nanjing studying the Late Ordovician shallow-water brachiopod fauna of northwestern China.

Colin D. Sproat

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Alycia L. STIGALL (USA) continues studying ancient species invasions and Ordovician brachiopod biogeography, evolution, and paleoecology with an emphasis on clades with North American members. I am particularly interested in teasing apart speciation and biogeographic patterns during the GOBE and Richmondian Invasion intervals. Within that context, I am a co-leader of the IGCP 653 project on the GOBE. My students and I are currently focusing our efforts on phylogenetic biogeography, ecological niche modelling methods, and field-based paleoecological techniques to better constrain speciation and invasive species impacts during this interval, and look forward to sharing more results on this work in the upcoming year.

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Justin STRAUSS (USA) is continuing to work on the Ordovician of Alaska and Yukon in collaboration with John TAYLOR (IUP Emeritus), John REPETSKI (USGS Emeritus), Michael MELCHIN (St. Francis Xavier), David MOYNIHAN (YGS), and Erik SPERLING (Stanford). In 2020, we published a paper in the *Canadian Journal of Earth Sciences* refining the nomenclature and depositional history of the Road River Group in Yukon, Canada, and we have ~4-5 more papers in preparation that explore the redox geochemistry of this spectacular deep-marine succession. In addition, Strauss' postdoctoral scholar (Akshay MEHRA) and PhD student (James BUSCH) are working on a shelf-slope transect across the Ordovician–Silurian boundary interval in Yukon, Canada, which will result in a number of publications integrating sequence stratigraphy, sedimentology, and biostratigraphy. Finally, I am also continuing a >10-year old project studying the Cambrian–Ordovician faunas of the Brooks Range and Jones Ridge regions of Alaska with TAYLOR and REPETSKI, which is making progress towards publication.

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John TAYLOR (USA) once again found himself entirely preoccupied with Cambrian trilobites and agnostoid arthropods in 2020, and is unlikely to resume his work on the numerous projects on Ordovician faunas in Laurentian North America listed in previous issues of *Ordovician News* until sometime late in 2021 or early 2022. Once he does manage to escape that subjacent system, he is looking forward to completing a few of those long-standing projects on Early Ordovician faunas collected from the El Paso Group in the southwestern USA, Snowy Range Formation in Wyoming and Montana, Beekmantown Group in the central Appalachians, and strata of similar age in Alaska and the Yukon with his colleagues John REPETSKI, James LOCH, Paul MYROW, Rob RIPPERDAN, and Justin STRAUSS.

John F. Taylor

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James R. THOMKA (USA) continued research on stalked echinoderm taphonomy and paleoecology. Much of my work during 2020 focused on documenting symbiotic, probably parasitic pits on echinoderm hosts (the ichnogenus *Tremichnus*). The biotic interaction between echinoderms and pit-forming organisms dates back to the Darriwilian, and description of some of the oldest examples of this important association is ongoing. Parasitized echinoderms include crinoids from USA and hemicosmitid rhombiferans from Russia and China. The most up-to-date and exhaustive overview of Paleozoic stalked echinoderm parasitism, co-authored with Carlton E. BRETT (University of Cincinnati), was

completed and is in press as a chapter in an edited volume on the fossil record of parasitism, with numerous examples of Ordovician specimens discussed.

My relatively new position at SUNY Plattsburgh (started in Fall 2019) has afforded me tremendous opportunities to readily study Middle Ordovician strata, as I am surrounded by rocks of the type Chazyan North American regional stage (Darriwilian-Sandbian). I am currently investigating (1) the diversity and functional morphology of echinoderm attachment structures in local bioherms (the classic “Chazy reef” mounds) and (2) the stratigraphy and magnetic susceptibility of inter-mound peritidal carbonates of the Crown Point Formation.

Additional Ordovician research conducted in 2020 include work on the preservation of crinoids in unlithified ‘butter shales,’ focusing on the relative abundance of isolated brachial and columnal plates, and high-resolution preservation of crinoid stereom in Upper Ordovician carbonates through diagenetic processes such as phosphatization. The results of these studies will hopefully be published in the near future.

James R. Thomka

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Oive TINN (Estonia) continues to work together with Tõnu MEIDLÄ, Leho AINSAAR and PhD student Karin TRUUVER on Ordovician stratigraphy and palaeoecology. Together with Karin TRUUVER and Tõnu MEIDLÄ we have been working on end-Ordovician and Silurian ostracods and ostracod associations. Together with Olev VENN we studied an enigmatic cnidarian fossil *Martsaphyton*. Besides that I also continue research on Silurian Kalana Lagerstätte.

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Tatiana TOLMACHEVA (Russia) continues studies on Ordovician conodonts from the Siberian Platform and Kazakhstan. Recently I submitted a paper on the Kazakhstanian Lower–Middle Ordovician pelagic deep-water conodont biostratigraphy and diversity to *Palaeogeography, Palaeoclimatology, Palaeoecology*. A paper on Katian conodonts from the Mirny creek in the Omuleve Mountains of North-East Russia is in preparation. I participate in the project with Dr. Andrei DRONOV on the Cambrian and Ordovician of the Siberian Platform (the Moyero River).

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Thijs VANDENBROUCKE (Belgium) continues running a research group that focuses on reconstructing the Lower Palaeozoic palaeoclimate and palaeo-environment, using (micro) fossil proxies. Within the UGent group, Julie DE WEIRDT continues her PhD research project focusing on geochemistry and palynology of the Upper Ordovician – lower Silurian in N. America (in collaboration with Poul EMSBO, USGS; Patrick McLAUGHLIN, IGWS and André DESROCHERS, UOttawa). Cristiana ESTEVES continues her PhD research project focusing on the chitinozoan biostratigraphy of the Katian Maquoketa Group in the USA (in collaboration with Patrick McLAUGHLIN & Alyssa BANCROFT at IGWS, and Poul EMSBO at USGS). Cecile-Marie LISSENS has started her PhD research project focusing on Ordovician graptolite and chitinozoan palaeo-ecology (in collaboration with Peter SADLER & Alexandre POHL, UCRiverside; Jean-François GHIENNE, CNRS; Patrick McLAUGHLIN, IGWS and Mark WILLIAMS, University of Leicester). Dr. Thomas WONG HEARING remains a postdoc in the lab and Tim DE BACKER is finishing his PhD, and whilst they are focusing on reconstructing Cambrian and Devonian palaeoclimates & palaeo-environments respectively, they also are pursuing their interests in various Ordovician side projects. Finally, although Matthias SINNESAEL has left the lab for a postdoc in Durham, we are currently writing up his results on astronomical forcing during the Late Ordovician.

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Peter VAN ROY (Belgium) is emerging from a multi-year period of relative inactivity, with his main research interests remaining focused on early metazoan evolution in general, and panarthropod origins, relationships and biology in particular. He continues working with his colleagues Allison DALEY, Bertrand LEFEBVRE and Javier ORTEGA-HERNÁNDEZ and their respective teams on various aspects of the Fezouata Biota, and is also involved in a project led by Petr BUDIL and Oldřich FATKA on the exceptionally preserved faunas from the Upper Ordovician of Bohemia. One of his current main efforts is centered on cheloniellids from the Ordovician of Bohemia and Morocco, involving significant numbers of newly discovered and previously undescribed material. A paper dealing with two thylacocephalans from the Upper Ordovician of Bohemia is currently in press.

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Marco VECOLI (Saudi Arabia). I have ongoing collaborations with Prof. Paul STROTHER (Weston Observatory of Boston College) on the taxonomy and paleoecology of Late Ordovician acritarch assemblages dominated by new taxa, which show affinity to freshwater algae, and on a revision of the paleobiology, paleoecology and stratigraphic distribution of the genus *Moyeria* in Gondwana. I collaborate also with Prof. Geoff CLAYTON (Sheffield, UK) on optical methods for determination of maturity of organic matter, and with Stewart MOLYNEUX (BGS, Keyworth) on a revision of palynostratigraphy in the Ordovician of the Middle East.

Marco Vecoli

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Olev Vinn (Estonia) is working on the evolution of symbiosis, predation, bioerosion and encrustation in the Ordovician. I am also working on the palaeontology of problematic tubeworms from the Palaeozoic (e.g. cornulitids, tentaculitids, microconchids, *Sphenothallus* etc.) and evolution of tubeworm biomineralization. My other research interests include trace fossils of the Ordovician of Estonia and beyond.

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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 the Argentine Precordillera and the Central Andean Basin. He also participates in multidisciplinary projects to study the lower Paleozoic basin evolution of the Precordillera.

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Beatriz G. WAISFELD (Argentina) continues work on Lower Paleozoic trilobites from the Central Andean Basin mainly focused on taxonomy and paleoecology. She is involved in a long-term study of Late Cambrian – Early Ordovician diversification patterns and ecosystems structure in Northwest Argentina together with Argentine colleagues studying different invertebrate groups. A joint international cooperation programme (MINCYT-ECOS-Sud) with Catherine CRONIER, Claude MONET, and Thomas SERVAIS (University of Lille) and Diego BALSEIRO, Arnaud BIGNON, Juan José RUSTAN, Fernanda SERRA, and Emilio VACCARI (CICTERRA, National University of Córdoba) involves the influence on trilobite taxonomic diversity and morphological disparity of the large scale complexity increase in ecosystems across the Early and Middle Paleozoic (particularly in the context of the Ordovician Radiation and the Middle Paleozoic Marine Revolution). Ongoing research in

collaboration with Arnaud BIGNON, Emilio VACCARI, and Brian CHATTERTON (Canada) explore phylogenetic relationships within the recently re-erected Order Trinucleida, a highly diverse and widespread Ordovician trilobite group. She recently started another project with Juan Carlos GUTIERREZ MARCO (Spain) and Emilio VACCARI to study an interesting Floian to Darriwilian trilobite fauna from Southwest Perú.

Beatriz G. Waisfeld

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Guangxu WANG (China). In 2020, two papers were published in collaboration with colleagues, one on revised stratigraphy of the Wulipo Formation in northern Guizhou, SW China, which represents one of the very rare records of shelly fauna across the Ordovician and Silurian transition worldwide, and the other about a systematic study on the youngest Ordovician (latest Katian) coral fauna from eastern Australia, in the uppermost Malachis Hill Formation of central New South Wales. Another paper co-authored with Yunong CUI on a revision of Late Ordovician (late Katian) heliolitine corals from northern Kuruktag, NE Tarim, has now been submitted for publication in *Alcheringa*. I am now working on Ordovician rocks and fossils from the western Yangtze Platform, South China with colleagues from NIGPAS, and a thematic issue on this topic has now being organized for *Palaeoworld*. In addition, a monograph on the Ordovician–Silurian boundary rugose corals in South China is being prepared and will be hopefully finalized in 2021.

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Wenhui WANG (China) in the past year (2020), put most of her energy on the ultrastructure and biostratigraphy of Ordovician planktons (chitinozoan and graptolite). On the one hand, she worked on the ultrastructure of carinae in *Cyathochitina* with LIANG Yan (China), Olle HINTS and Jaak NÖLVAK from Estonia. A coupling study of both Computational Fluid Dynamics analysis and ultrastructure is conducted to help to understand floating properties of different chitinozoan morphotypes, in hope of interpreting functional morphology of the chitinozoan genus *Cyathochitina*, which is wearing a “skirt”-like carina. On the other hand, Wenhui restudied the base of the Katian Stage in South China, which had been studied 30 years ago by investigation of the graptolite biostratigraphy. Taxonomic revision of graptolites and chemo-stratigraphy around the base of the Katian Stage will be the main task for her in the coming two years.

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Xiaofeng WANG (China). The unveiling ceremony of the Xiaoyangqiao New ASSP, originally planned to be held in Dayangcha, Jilin Province, northern China in spring 2020, had to be postponed due to the effects of corona-19 virus. The relevant research of our group is still continuing, together with those colleagues from Denmark, Germany, Italy and Russia who completed two articles and a monograph to be published. My other time was devoted to a new project on the division of Silurian standard strata in China and scientific popularization, editing and publishing two monographs in Chinese: “Hubei Palaeontology” and “Hubei's Rare Fossil Group”.

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Charles WELLMAN (UK) continues his research on early land plants and the terrestrial 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, with recent fieldwork conducted on the Cape Supergroup around the Cape Basin of South Africa (in conjunction with Cameron PENN-CLARKE of the Council for Geoscience).

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Kui YAN (China). I still focus on the Early Ordovician acritarchs in South China this year, and work on late Cambrian to Early Ordovician acritarchs from North China. In October, my colleague and I went to Tangshan and Qinghuangdao for field trip. We visited several Furongian (Cambrian) to Lower Ordovician sections and collected samples for acritarchs and conodonts. In November, I attended the conference for microfossils in Chenjiang, Yunan, and visited the Wangjiawan section in Kunming, which preserves sediment of Cambrian. Together with my colleague, I also discussed with Thomas SERVAIS by Zoom.

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Graham YOUNG (Canada). I am continuing to study Paleozoic paleoecology and the diversity of Ordovician Cnidaria. Substantial progress has been made with detailed studies of Ordovician cnidarian medusae (jellyfish) from the Late Ordovician Willard Lake site (central Manitoba), and I am collaborating with David RUDKIN, Michael CUGGY, and others to study arthropods from the same locality. A recent publication on the global fossil record of medusae, with James HAGADORN, places these strange fossils in a paleoenvironmental and taphonomic context.

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Seth A. YOUNG (USA) is continuing to investigate and reconstruct marine redox conditions on both local and global scales from late Cambrian, Ordovician, and Silurian stratigraphic successions from the Great Basin (Nevada, USA), Appalachian Basin (Virginia/West 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), Per AHLBERG (LU), Mats ERIKSSON (LU), Olle HINTS (TUT), Dimitri KALJO (TUT), Tonu MARTMA (TUT), Stig M. BERGSTRÖM (OSU), Theodore THEM II (COC), Emma HAMMERLUND (LU), Paula NOBLE (UNR), Sarah PRUSS (SC), Mu LIU (IGG-CAS), and Jiri FRYDA (CGS). Last year I published with my former MS student (Emily BENAYOUN) and PhD student (Nevin KOZIK) new Upper Ordovician–early Silurian C and S isotope chemostratigraphy, Fe speciation, and trace metal geochemistry from two well characterized drill core sequences in the Baltic Basin. This work was published in *Palaeogeography, Palaeoclimatology, Palaeoecology* and provides local- to regional-scale marine paleoredox reconstructions of this paleobasin throughout the LOME interval and several Llandovery extinction intervals. At the moment I have currently one manuscript in review documenting local to global-scale changes in (de)oxygenation from carbonate-dominated successions in the Great Basin (USA), Anticosti Island (Canada), and Baltic Basin (Estonia) spanning the entire LOME interval. My ongoing projects include reconstructing both local and global marine redox conditions spanning the GOBE interval using novel proxies (e.g., I/Ca, Tl isotopes, Fe speciation, trace metals) in both Appalachian and Baltic basins.

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Renbin ZHAN (China). Together with my colleagues here at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, I have conducted some more case studies particularly on the Great Ordovician Biodiversification Event (GOBE) and the end-Ordovician mass extinction (EOME) during 2020. Besides, we have also compiled and published a reference book on the Ordovician stratigraphy and index fossils of China particularly for experts in exploring oil and gas, and geological survey, and also for university graduate and undergraduate students. It contains more than 230 plates covering most of the major fossil groups such as graptolites, brachiopods, trilobites, cephalopods, conodonts, chitinozoans, radiolarians, etc.

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Shunxin ZHANG (Canada) has continued working in the Canadian Arctic area in 2020, but 100% from home without any fieldwork, owing to the COVID-19 pandemic. She has mainly focused on a project (having cooperated with Dr. Chris Barnes), in which she has used statistical analysis as a tool, and employed her previously published Late Ordovician conodont data from Southampton Island to identify conodont communities. She has tried to use conodont communities in the organic-rich intervals in the Upper Ordovician sequence to provide evidence for shallow-water anoxia in the Hudson Bay Basin during the Late Ordovician.

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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 will be the publication of the book *Ordovician Stratigraphy and Index Fossils of China* by Zhejiang University Press and Elsevier, which is now in press and will be available in 2021. The book includes the detailed descriptions of 10 key Ordovician sections in South China, North China and Tarim, and an integrative stratigraphic subdivision and correlation scheme of China, and 167 plates of index fossils including graptolites, conodonts, trilobites, brachiopods, cephalopods, acritarchs, chitinozoans, radiolarians, corals and stromatoporoids.

(2) Hirnantian Konservat-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 Lagerstätte, discovered in late 2012, is typified by the abundant and highly diverse articulate sponges (over 100 species) often with soft tissues, in association with graptolites, nautiloids, arthropods, echinoderms, etc. The Anji Fauna is preserved within a 9 meter-thick black shale, underlain and overlain by siltstones and sandstones, in the Wenchang Formation of clastic facies. Up to date, over 5000 specimens have been collected from seven sections in the Anji County. As constrained by the associated graptolites, the fauna is of latest Hirnantian age. A preliminary study indicates that this extraordinarily diverse, sponge-dominated community thrived immediately after the Hirnantian mass extinction in South China.

(3) IGCP Project 653 “The Onset of the GOBE”. Under the framework of this project, my proposed research project on the “Origination of Early Palaeozoic Evolutionary Fauna: a case study in South China” has just been granted by the NSFC (2021–2025), in addition to the initiative financial support from CAS. This work brings some world-renowned palaeontologists on Ordovician and Cambrian fossil groups together with a few sedimentologists and geochemists, including Thomas SERVAIS, ZHEN Yongyi, Axel MUNNECKE 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. Among the latest envisaged products of this project is the edition of a special issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* on marine oxygenation, de-oxygenation, and life during the early Paleozoic, which is scheduled for publication in 2021.

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Yong Yi ZHEN (Australia) is working on various projects in research of the Ordovician biostratigraphic and palaeobiogeographic applications based mainly on the studies of conodonts, corals and stromatoporoids. During 2020, he successfully completed several research projects including (1) a major revision of the Middle Ordovician conodonts documented by Watson (1988) from the Canning Basin of Western Australia, which has systematically updated the taxonomy of this internationally well-known fauna and its biostratigraphy; (2) a study (jointly with Prof. ZHANG Yuandong and others) of a bedding plane assemblage of the basal Darriwilian graptolites and conodonts from southern New South Wales, documenting the conodont biostratigraphy of the turbiditic sequences in New South Wales; and (3) study of the Late Ordovician corals from the Malachis Hill Formation of central New South Wales jointly with Dr WANG Guangxu (NIGPAS). Yong Yi has also actively collaborated with colleagues from Geoscience Australia and the Geological Survey of Western Australia working on the Middle Ordovician conodont biostratigraphy of the Canning Basin and from Nanjing Institute of Geology and Palaeontology working on Ordovician conodonts from South China and Tibet.

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RECENT ORDOVICIAN RESEARCH PUBLICATIONS

A

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- Albanesi, G.L., Barnes, C.R., Trotter, J.A., Williams, I.S. & Bergström, S.M. 2020. Comparative Lower–Middle Ordovician conodont oxygen isotope palaeothermometry of the Argentine Precordillera and Laurentian margins. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **549**, 109115.
- Albanesi, G.L., Rueda, E.K., Ortega G. & Monaldi, C.R. 2020. Age precisions of the Acoite Formation (Lower Ordovician) at Aguas Blancas, Cordillera Oriental, Jujuy Province, Argentina. *Alcheringa*, **44**(4), 484–495.
- Anekeeva G.A. 2019. First findings of the multiplated *Lichenocrinus* holdfasts from the Middle Ordovician of the Leningrad region. *10th European Conference on Echinoderms, Moscow, 16–19 September. Abstracts*, 3.
- Anekeeva G.A. & Rozhnov S.V. 2019. Unbranched holdfasts of stalked echinoderms from the Ordovician of the Leningrad region. In: Obut, O.T., Sennikov, N.V. & Kipriyanova, T.P. (eds). *13th International Symposium on the Ordovician System: Contributions of International Symposium*. Trofimuk Institute of Petroleum Geology and Geophysics SB RAS; Novosibirsk National Research State University. Novosibirsk: Publishing House of SB RAS. 15–17.
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- Aubrechtová, M. & Meidla, T. 2020. Lituitid cephalopods from the upper Darriwilian and basal Sandbian (Middle–Upper Ordovician) of Estonia. *GFF*, **142**(4), 267–296.

B

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