

ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
INTERNATIONAL COMMISSION ON STRATIGRAPHY

Number 39 (for 2021)

Edited by Bertrand Lefebvre



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Cover photo

Late Ordovician limestones from Vauréal Canyon, Anticosti Island, eastern Canada. (Image: René Bourque, Municipalité de l'Île-d'Anticosti). This image made the cover of *Nature Geoscience* in November 2021 to highlight a study about ocean anoxia in the Late Ordovician. Reorganized ocean circulation during Late Ordovician cooling altered oxygenation through the water column, leading to widespread extinctions, according to anoxia reconstructions using the I/Ca proxy and Earth system modelling (see Pohl *et al.* 2021; doi.org/10.1038/s41561-021-00843-9).

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CHAIRMAN'S MESSAGE

This is my second Chairman's Message as chair of the **Ordovician Subcommission** and the second *Ordovician News* issue with me in this role. Our secretary, Bertrand Lefebvre, compiled his second issue, that you have in your hands (or see on your screen), the 2021 edition, that is one of the largest ever produced (over 100 pages), but that is also an issue that breaks all records: with over 140 contributions from Ordovician workers around the world, we have a strong increase compared to the issues of the last years. Many thanks to Bertrand for accomplishing the time-consuming task of editing this issue, but also to Ian Percival, former secretary and newsletter editor, who helps with the editing process!

Never in the history of the Subcommission have we got so many **contributions**. Why is this? Well, maybe this is because of the Covid-19 pandemic that started in 2020. We were unable to meet during these two years, and Ordovician workers only started to come together again in late 2021 (see report on the IGCP workshop at Lyon in late November 2021). All our onsite meetings and our planned excursions have been cancelled in 2020 and 2021.

Two major **events** (closing meeting of IGCP 653 in September 2020 organized in Copenhagen, Denmark; and the final meeting of IGCP 653 together with the opening meeting of IGCP 735 in September 2021 organized in Lille, France) took place, but only online. Both events set records: Copenhagen 2020 was attended by over 200 participants, and the Lille online meeting was attended by nearly 300 Ordovician scientists (see report in this issue).

Online platforms make thus things happen that were not possible before. Never in the history of the Ordovician Subcommission have all voting members come together, but this was made possible for the first time during a meeting on March 31st, 2021 (when all 'titular' or 'voting' members joined online). And never before have nearly 300 Ordovician workers joined a meeting, as they did in September 2021. Covid-19 changed and changes our work and our ways of communication. Most probably, the future will be hybrid, with meetings being partly online, allowing Ordovician scientists from remote areas to join our congresses.

And ... some of those who attended the Lille **online congress** (including a new young generation) possibly heard for the first time about the Ordovician Subcommission, and about *Ordovician News*. We have a lot of new names in the list of contributors. Thanks for all your contributions!

The composition of the Subcommission, i.e. the Executive and the **Voting (Titular) Members**, is again published in the present issue. The changes from the previous period (2016–2020) were explained in the last issue of *Ordovician News* (n°38). For period 2020–2024, we have a Subcommission composed by 20 'titular' or 'voting' members, 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.

In the last *Ordovician News*, we informed you that one of the titular/voting members accepted to take over the job as webmaster, and we are now very happy to see that our webmaster is also officially a member of the **Executive of the Subcommission**. Alycia Stigall is at present, with the chair, vice-chair and secretary, a member of the Executive Board. This is (finally!) a first step forward towards a better gender balance. Never, in the entire history of our Subcommission, was a female scientist a member of the Executive. This is, unfortunately, still the case for some other subcommissions

(<https://stratigraphy.org/subcommissions>), and this needs, of course, to be better balanced in the next years!

The **International Geoscience Programmes (IGCP)** also switched. IGCP 653 is over now, after 6 years of activities: IGCP 653 (The onset of the Great Ordovician Biodiversification Event) was running from 2016 to 2021, with the last year on extended term (OET). **IGCP 735** is now operating as the new International Geoscience Programme dedicated to the Ordovician. The project, with its full title '**Rocks and the Rise of Ordovician Life (Rocks n'ROL): Filling knowledge gaps in the Early Palaeozoic Biodiversification**' will run from 2021 to 2025 (and possibly on extended term in 2026). Please, see the announcements of the meetings of the new IGCP project in this issue and follow their websites.

The major event of 2022 for the Ordovician community will be the IGCP 735 meeting in Marrakech, Morocco, in October (see announcement in this issue) and our next International Symposium on the Ordovician System will be organized in Estonia, in July 2023 (see further information in this issue).

It is also next year, 2023, and hopefully before the congress in Estonia, that we will see the publication of the '**A Global Synthesis of the Ordovician System.**' Initiated almost ten years ago, the current Executive of the Subcommission moved forward with this project. The *Geological Society of London* accepted to publish this book project, and it should appear as two separate *Special Publications* issues. The two volumes should present over 1000 pages, with over 40 chapters of syntheses of Ordovician studies from all around the world. We are looking forward to provide you a presentation of the book series next year, for issue n°40 of *Ordovician News!* More information about this will surely be available in the next issue.

Sadly, we also have to report the deaths of two Ordovician workers in this issue, Bernd-Dietrich Erdtmann and Frank Niklaisen. The first one, Bernie, was actually my post-doc supervisor in Berlin. Bernie brought me to the Ordovician Subcommission, and to my first Ordovician Symposium in Las Vegas in 1995.

Please, continue to send us your contributions, by contacting our secretary Bertrand Lefebvre. Please, also visit our website, <http://ordovician.stratigraphy.org>, and do not hesitate to send your information to our webmaster Alycia Stigall. Many thanks!

With best regards,

Thomas Servais

ANNUAL REPORT OF ORDOVICIAN SUBCOMMISSION FOR 2021

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

Chairman:

Thomas Servais
UMR 8198 Evo-Eco-Paleo
Batiment SN5
Université Lille1
F-59655 Villeneuve d'Ascq, FRANCE
Tel: 0033(0)320337220
E-mail: thomas.servais@univ-lille1.fr

Vice Chair:

Zhan Renbin
State Key Laboratory of Paleobiology and Stratigraphy
Nanjing Institute of Geology and Palaeontology (NIGP)
Chinese Academy of Sciences (CAS)
39 East Beijing Road, Nanjing, 210008, CHINA
Tel: +86 25 83282132
E-mail: rbzhan@nigpas.ac.cn

Secretary:

Bertrand Lefebvre
UMR 5276 LGL -TPE
CNRS - Université de Lyon 1
Bâtiment GODE, 69622 Villeurbanne Cedex, FRANCE
Tel: +33 (0)4 72 43 28 34
E-mail: bertrand.lefebvre@univ-lyon1.fr

Internet Officer:

Alycia Stigall
Department of Geological Sciences
Ohio University
316 Clippinger Laboratories
Athens, Ohio 45701 USA
Tel: +1 (740) 593-3093
E-mail: stigall@ohio.edu

2. OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY

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

Specific objectives are:

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

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

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

3. ORGANISATION - interface with other international projects / groups

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

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

The Subcommission on Ordovician Stratigraphy closely cooperates with the IGCP 653 project “The onset of the Great Ordovician Biodiversification Event” (2016-2021) and IGCP 735 project “Rocks ‘n’ ROL (Filling knowledge gaps in the Early Palaeozoic Biodiversification” (2021-2025). The joint Annual (Closing) Meeting of IGCP 653 for 2021 and Annual (opening) Meeting of IGCP 735 was held in Lille, France, and took place by videoconference (see below).

Together with the SOS, the new team of Ordovician specialists that proposed the successor project IGCP 735 (accepted in early 2021) strongly collaborates with the SOS during the years 2021 to 2025. The co-leaders of the new IGCP 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 2021

- Due to the covid-19 pandemics, the initial plans for activities in 2021 could not be undertaken, similar to 2020. The 36th International Geological Congress, originally scheduled in 2020 and postponed, was finally cancelled, together with the official meeting of the ICS and the take-over of the new subcommission and its officers (accordingly, no allocation from the SOS budget was spent in 2021).
- The official inauguration of the second Auxiliary Boundary Stratigraphic Section and Point (ASSP) for the base of the Ordovician System in the Dayangcha section (Northern China), originally scheduled for May 2020, was postponed to May 2021, and is currently postponed again to a later date, possibly in 2022 (no SOS budget spent in 2021).
- In accordance with ICS Rules, the Voting Members of SOS were replaced in 2020, and the Voting Membership voted to select a new Executive and Voting Members for the term 2020-2024. The Voting Membership was increased to 20. An online meeting organized in March 2021 allowed (for the first time in the history of the SOS) all 20 voting members to join for a business meeting.
- The Subcommission decided to co-opt an Internet Officer as an additional member of the Executive. For the first time in the history of the SOS, a female voting member joined the Executive in 2021.
- The final meeting of the International Geoscience Programme (IGCP) 653 ‘The onset of the Great Ordovician Biodiversification Event’ finally took place as a successful videoconference congress, September 13th-16th 2021, with about 300 participants, with the Ordovician subcommission being a co-organising body. The associated excursions (Belgium and France; Wales and Welsh Borderland) were cancelled (and are postponed to be held as a regional field meeting of IGCP 735). The Lille online meeting was the largest meeting of Ordovician workers ever organized, including a wide attendance by the Voting Members of the SOS.
- *Ordovician News* 38 (for 2020) was published in April 2021 and is available from the SOS webpage (<http://ordovician.stratigraphy.org/>).
- The SOS webpage changed its host, and is now managed as a separate page of the webpage of the ICS (<http://stratigraphy.org/>).

6. SUMMARY OF EXPENDITURE IN 2021: (all figures in USD, totals rounded due to exchange rates)

- a) T. Servais' (Chair) expenses (transport by car, accommodation & food: US\$ 750) in meeting B. Lefebvre (Secretary) at Lyon University, France, June 16-19, 2021, to discuss Subcommission duties.
- b) T. Servais' (Chair) expenses (transport train, accommodation & food: US\$ 750) to attend the IGCP 653/735 – SOS workshop at Lyon University, France, November 28 – December 1, 2021.
- c) A. Stigall's (Internet Officer) expenses (transport flight, train, accommodation & food: US\$ 2000) to attend the IGCP 653/735 – SOS workshop at Lyon University, France, November 28 – December 1, 2021.

7. SUMMARY OF INCOME IN 2021

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

8. BUDGET RECEIVED FROM ICS IN 2021: USD 3500

9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2022)

- Support of the Annual Meeting of IGCP 735 to be held in Marrakech, Morocco (October 19-25, 2022), including field excursions to the Ordovician of the Anti-Atlas.
- Support of the Seminar on Regional Stratigraphic Classification Standard in China in Baishan, Jilin Province, in summer 2022 (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 and postponed to early 2021).
- 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 (probably in Lille, or Lyon, in early 2022).
- Data will be gathered for *Ordovician News* 39 (to be published in March 2022).

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. This project was launched in 2021, and manuscripts will be submitted in 2022. Two volumes (*Geological Society of London, Special Publications*), with ~600-800 pages, each should be compiled during 2022 and be published in 2023.
- To better correlate Ordovician depositional sequences throughout the World.
- To design and execute a program of radiogenic dating of key Ordovician horizons (using Pb-Pb isotopes and CA-IDTIMS dating of zircons).
- The Ordovician website will be updated including development of a database for GSSPs and ASSPs.

11. Budget and ICS component requested for 2022 (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 735 Annual Meeting in Marrakech (October 2022): **\$5000**
2. Support (airfare only) for T. Servais (chairman) to attend opening of Xiaoyangqiao ASSP, China & associated conference, summer 2022: **\$1000**
3. Support (airfare only) for B. Lefebvre (secretary) to attend opening of Xiaoyangqiao ASSP, China & associated conference, summer 2022: **\$1000**
4. Support for contributors and editors of “*A Global Synthesis of the Ordovician System*” to attend editorial meeting (Lille-Lyon, early 2022): **\$1000**

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 2022 BUDGET: 8000 USD

REQUESTED FROM ICS: 8000 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

Executive:

Thomas Servais

UMR 8198 Evo-Eco-Paleo
Batiment SNS
Université Lille1
F-59655 Villeneuve d'Ascq, FRANCE
Telephone: 0033(0)320337220
E-mail: thomas.servais@univ-lille1.fr

Zhan Renbin

State Key Laboratory of Paleobiology and Stratigraphy
Nanjing Institute of Geology and Palaeontology (NIGP)
Chinese Academy of Sciences (CAS)
39 East Beijing Road
Nanjing, 210008, CHINA
Telephone: +86 25 83282132
E-mail: rbzhan@nigpas.ac.cn

Bertrand Lefebvre

UMR CNRS 5276 LGTPE
bâtiment Géode, campus de la Doua
Université Lyon 1
2 rue Raphaël Dubois
F-69622 Villeurbanne cedex, FRANCE
Telephone: 0033 472 432 834
E-mail: bertrand.lefebvre@univ-lyon1.fr

Alycia L. Stigall

Department of Geological Sciences
316 Clippinger Laboratories
Ohio University
Athens, Ohio 45701, USA
Telephone: 1-740-590-9382
E-mail: stigall@ohio.edu

Voting Members:

Sachiko Agematsu

Department of Geoscience
Life and Environmental Sciences
University of Tsukuba
Ibaraki, 305-8572, JAPAN
Telephone: 81-29-853-4427
E-mail: agematsu@geol.tsukuba.ac.jp

Matilde Sylvia Beresi

IANIGLA - CCT MENDOZA-CONICET
Avd. Ruiz Leal s/n, Parque Gral. San Martín
5500 Mendoza, ARGENTINA
Telephone: 54-261-5244247
E-mail: mberesi@mendoza-conicet.gob.ar

André Desrochers

Département des sciences de la Terre et de l'environnement
Université d'Ottawa
150 Louis Pasteur (460)
Ottawa
Ontario K1N 6N5, CANADA
Telephone: +1 613 562-5800 X6852
E-mail: andre.desrochers@uottawa.ca

Mansoureh Ghobadi Pour

Department of Geology, Faculty of Sciences,
Golestan University
49138-15739 Gorgan, IRAN
Telephone: +98 9132654300;
E-mail: mghobadipour@yahoo.co.uk

Daniel Goldman

Department of Geology
University of Dayton
300 College Park
Dayton, OH 45469, USA
Telephone: 937-229-5637 (Office)
Telephone: 937-229-4820 (Lab)
E-mail: dan.goldman@notes.udayton.edu

Lars Holmer

Uppsala University
Department of Earth Sciences / Palaeobiology
Villavägen 16
SE-752 36 Uppsala, SWEDEN
Telephone: +46-18-4712761
E-mail: lars.holmer@pal.uu.se

Petr Kraft

Charles University in Prague
Faculty of Science, Institute of Geology and Palaeontology
Albertov 6,
128 43 Praha 2, CZECH REPUBLIC
Telephone: +420 22195 1459
E-mail: kraft@natur.cuni.cz

Patrick McLaughlin

Illinois State Geological Survey
Prairie Research Institute
University of Illinois, Urbana-Champaign
615 E. Peabody Drive
Champaign, IL 61820, USA
Telephone: (217) 333-4442
E-mail: pim@illinois.edu

Tõnu Meidla

Department of Geology, Institute of Ecology and Earth Sciences
University of Tartu
14A, Ravila Street
Tartu 50411, ESTONIA
Telephone: +372 737 5895 (office)
E-mail: tonu.meidla@ut.ee

Leon Normore

Geological Survey and Resource Strategy Division
Department of Mines, Industry Regulation and Safety
100 Plain Street East
Perth WA 6004, AUSTRALIA
Telephone: +61 8 9222 3326
E-mail: leon.normore@dmirs.wa.gov.au

Elena Raevskaya

A.P. Karpinsky Russian Geological Research Institute
Sredny pr. 74
199106 Saint Petersburg, RUSSIA
Telephone: +7 (812) 412 66 67
E-mail: lena.raevskaya@mail.ru, Elena_Raevskaya@vsegei.ru

Tatiana Tolmacheva

A.P. Karpinsky Russian Geological Research Institute
Sredny pr. 74
199106 Saint Petersburg, RUSSIA
Telephone +7 (812) 321 30 22
E-mail: tatiana_tolmacheva@vsegei.ru

Wang Wenhui

Room 425, Dixin Building
Central South University
Lushannan Avenue No. 932
Yuelu District
Changsha
Hunan Province, CHINA
Telephone: +86 13951830656
E-mail: wwhever@126.com, whwang@csu.edu.cn

Charles Wellman

Dept. of Animal & Plant Sciences
University of Sheffield
Alfred Denny Building
Western Bank
Sheffield S10 2TN, UK
Telephone: + 0114 222 3689
E-mail: c.wellman@sheffield.ac.uk

Seth A Young

Department of Earth, Ocean, & Atmospheric Science
1011 Academic Way
Florida State University
Tallahassee, FL 32306-4520, USA
Telephone: +18506442703
E-mail: sayoung2@fsu.edu

Zhen Yong Yi

Geological Survey of New South Wales
Mining, Exploration & Geoscience Department of Regional NSW
W.B. Clarke Geoscience Centre
947-953 Londonderry Rd
Londonderry, NSW 2753, AUSTRALIA
Telephone: +61 2 47777810
E-mail: yong-yi.zhen@planning.nsw.gov.au

NEWS AND VIEWS

Anticosti Island under consideration to become a UNESCO World Heritage Site

Anticosti Island is recognized worldwide for its remarkable record of marine life from the Upper Ordovician to the Lower Silurian. An important step was taken towards the recognition of Anticosti Island as a UNESCO World Heritage Site with the submission of a 2,500-page nomination document last January. The International Union for Conservation of Nature will be responsible for analyzing the Anticosti file over the next 18 months. Specialists will travel to the island this summer to conduct this evaluation. A final decision will be made by UNESCO in 2023. The Municipality of Anticosti Island, the Government of Canada and the Government of Quebec must demonstrate their capacity to protect, manage and enhance Anticosti's geoheritage.

Anticosti Island is an exceptional natural environment. Anyone who has set foot on the island can see the presence of a phenomenal quantity of fossils. These fossils illustrate a critical turning point in the history of life on Earth: the first mass extinction of life in the oceans at the end of the Ordovician and the slow recovery of marine life at the beginning of the Silurian. The International Commission on Stratigraphy and the sub-commissions on Ordovician and Silurian stratigraphy support the nomination of Anticosti Island to UNESCO's World Heritage List as a unique stratigraphic and paleontological site of global significance. No site covering this important period of the Earth's history is currently inscribed on the UNESCO's World Heritage List.

André Desrochers

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





Planet Earth, 26th February 2022

Declaration against war and authoritarianism for the affirmation of human freedom and dignity

The International Association for Promoting Geoethics (IAPG) expresses its solidarity with all the people who are experiencing their present situation with difficulty and fear due to armed conflicts and who are suffering the repression of fundamental freedoms by authoritarian regimes.

We are close to colleagues from our section in Ukraine who are suffering from the invasion of their nation and are trying to resist the barbarism of war. We are also close to those Russian scientists and intellectuals who are courageously manifesting their rejection of war and demanding the right to peace.

Likewise, we cannot forget our colleagues in Myanmar who are experiencing government repression and our colleagues in Afghanistan, including those of the local IAPG section, for the harsh living conditions in which freedom, health and safety are not guaranteed. We are also close to our colleagues in Yemen, in the Democratic Republic of Congo and in all those countries in which governments or groups of powers don't respect the fundamental Human Rights of United Nations.

The IAPG rejects war and oppression for the resolution of conflicts and supports all those who fight for the affirmation of human dignity and for freedom from the oppression of dictatorships and fundamentalisms.

We strongly affirm that all human beings must be guaranteed dignity, freedom and knowledge. Everyone has the right to be able to live in freedom, health and safety and at the same time has the duty to responsibly guarantee freedom, health and safety to other human beings.

We are convinced that power must be implemented as a responsible exercise of community service, for the construction of more just, equitable, inclusive, supportive, peaceful, sustainable and ecologically oriented societies.

The revival of nationalistic models is anachronistic and represents a real threat to humanity, which instead, precisely in the recognition of its unity, albeit in the diversity of the cultures that constitute it, is beginning to cultivate that feeling of planetary citizenship that can accompany it towards a future of solidarity.

We invite the international scientific community, geosciences organizations and beyond, to sign this declaration.

Support this declaration by sending an email to: iapgeoethics@gmail.com

IAPG - International Association for Promoting Geoethics
c/o Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata 605, 00143 Rome, Italy
website: www.geoethics.org; email: iapgeoethics@gmail.com

REPORT OF RECENT CONFERENCES

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

16–20 July 2021

The regular meeting of IGCP 668: Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics was held at University of Tsukuba, Japan (online), from July 16 to 19, 2021 (Fig. 1). There were 18 oral presentations, 5 poster presentations, and 6 student presentations, all of which resulted in lively discussions. We also held two workshops entitled "Paleobiology Database (PBDB)" and "Best Practices in Invertebrate Paleontology collections management" with Matthew E. Clapham and Lauren T. English as lecturers. In addition, lectures for students on Cambrian, Geochemical analysis, Stromatolites, Trilobites, Conodonts, Molluscan biomineralization, and four special talks were given. 124 participants from 21 countries attended, making the conference a great success.

Sachiko Agematsu



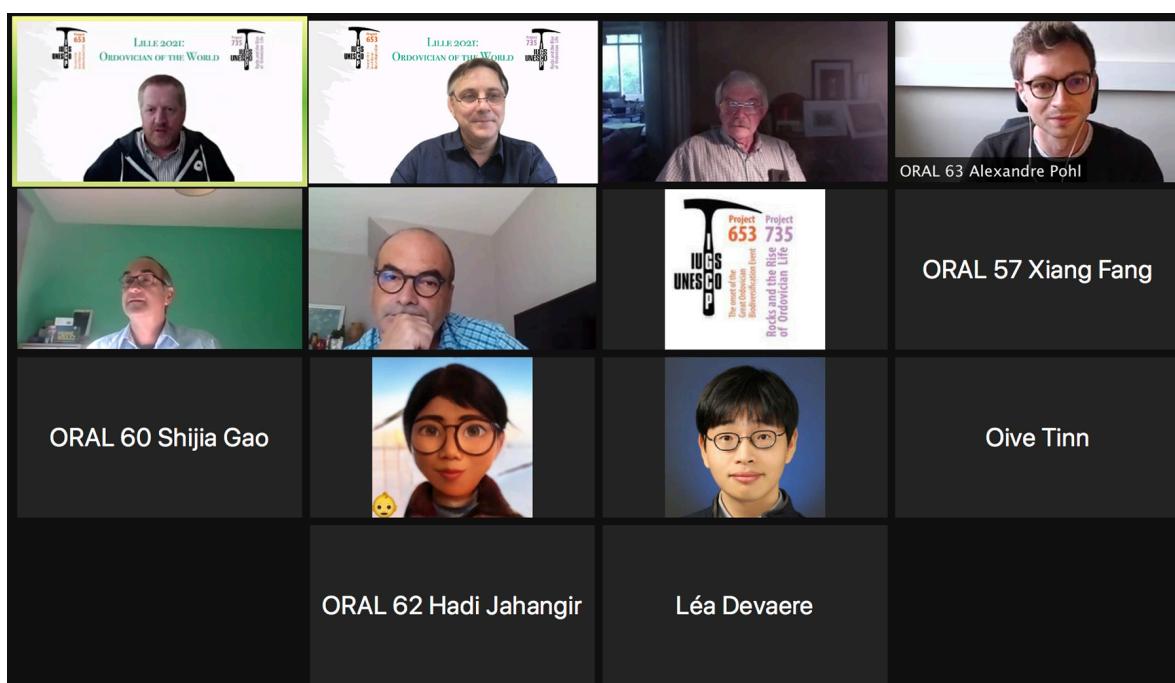
IGCP 653 Absolutely Final Meeting & IGCP 735 Opening Meeting, Lille, France (online) – Ordovician of the World

13–16 September 2021

Congratulations to the organisers of the closing conference for the UNESCO project IGCP 653 and opening meeting of project IGCP 735. This conference took place online and ran smoothly thanks to the technical support offered by the Université de Lille. The online format of the conference showed a record audience with 294 registered participants (1/3 from the UNESCO's developed countries list) from 40 countries that have joined the meeting at one stage or another. The peak audience reached 130 participants, and the most popular time for connecting was 14h00 Paris time. The time zones covered ranged from the Pacific coast of the Americas to the eastern coast of China and Australia.

Those four days of talks were very busy with 12 inaugural speeches for each of the 12 sessions, 36 oral presentations and 25 lightning-talks. The programme of the conference can still be consulted on the conference website (<https://lille2021.wordpress.com/>). Business meetings dedicated to IGCP 653/735, ISOS, and a presentation of IGCP 668 also took place.

The topics covered were very diverse, ranging many aspects of palaeontology, (taxonomy,...), palaeobiodiversity, palaeogeography, ichnology, databases (PBDB, GBDB), exceptional preservation, astrochronology, oceanic current modelling, just to mention a few examples. Many presentations were also dedicated to the Ordovician geology of, for example, Russia, Argentina, Serbia, Australia, as well as the Korean Peninsula, Central Asia and the Middle East. Many of these presentations will form the core of a Palaeo3 special issue (publication to be announced: stay tuned). The programme with abstracts is also published in a special issue of the Journal of the French Palaeontological Association (AFP): <http://www.assopaleo.fr/medias/files/numero-special-2-ordovicien.pdf>



Snapshot from the online IGCP annual meeting

The closing ceremony was led by Khadija El Hariri (Cadi Ayyad University, Marrakech) who made a presentation of the next IGCP 735 annual conference that will take place of course in Marrakesh with field excursions in and around Zagora. Please consult the IGCP 735 website for more and updated information (<https://rocksnrol.wordpress.com/meetings/>) as well as the official website for this conference (<http://ens-marrakech.ac.ma/projets/igcp735/>). Once again many congratulations to the organisers: Thomas Servais, David Harper, Bertrand Lefebvre and Alycia Stigall.

Yves Candela

IGCP 653, IGCP 735 & Ordovician Subcommission Workshop Lyon (France)

29–30 November 2021

After two years apart, (some) members of IGCP 653 were able to gather in person for a final workshop on November 29–30 at Lyon University in France. The workshop was hosted jointly by IGCP 653, 735, and the Ordovician Subcommission and beautifully organized by Bertrand Lebevre and Thomas Servais. We were fortunate to gather right before travel became restricted related to the emergence of the COVID-19 Omicron variant. The Ordovician Workshop included twenty eight in-person participants from France, Switzerland, Spain, the Czech Republic, Germany, the United Kingdom, and the United States. Four additional participants from the UK, Sweden, and Morocco joined some sessions via Zoom.



Group photograph of the participants to the Lyon workshop

The meeting was a productive environment featuring presentations from both junior and senior Ordovician workers accompanied by Lyon's famous gastronomy and friendly environment. Sessions included updates on the Fezouata Biota in a session dedicated to the late Bernard Pittet, evolution of land plants, Ordovician diversification patterns, with a key emphasis on regional records, and synthetic overview of key tools such as astrochronology, global chemical cycles, and model-based approaches. Many new ideas and animated conversations and discussions occurred, and as always, we wished we had more time to discuss the exciting events of the Ordovician Period.

Although IGCP 653 is now closed, our community certainly has a wonderful pathway going forward for continued discussion, discovery, and insights with the IGCP 735 project.

Alycia Stigall



CONFERENCE ANNOUNCEMENTS

Geological Society of America North-Central-Southeastern section meeting Cincinnati, USA

7–9 April 2022

Christopher Waid of the Ohio Geological Survey, Cole Farnam (University of Cincinnati), Pat McLaughlin (Illinois geological Survey), and Carlton Brett have continued to extend highest Ordovician and Silurian correlations through the Ohio subsurface into New York, Ontario and other adjacent regions. Brett, Waid, Farnam, and McLaughlin will present a pre-meeting, combined core-outcrop workshop “Upper Ordovician and lower Silurian, Facies, Cycles, and Sequences in Southern Ohio” for the Geological Society of America North-Central-Southeastern section meeting in Cincinnati in April 6, 2022.

Carlton Brett (University of Cincinnati), Ben Dattilo (Purdue University, Fort Wayne) and Kyle Hartshorne (Cincinnati Dry Dredgers) will present post-meeting a field trip titled: “A New Look at the Classic Cincinnati Sequences, Cycles, and Events in the Upper Ordovician of the Cincinnati Vicinity” also for the Geological Society of America North-Central-Southeastern section meeting in Cincinnati in April 9, 2022. This one-day, post-meeting field trip will highlight key reference sections of the world-renowned Upper Ordovician Cincinnati Series (ca. 450-446 Ma) in its type region. This trip will provide an overview of highly fossiliferous shale/limestone successions, focused on the interpretation of depositional processes, cycles, taphonomy, and paleoecology in the context of a recently revised sequence stratigraphic framework.

Here is a link to those trip descriptions:

https://www.geosociety.org/GSA/Events/Section_Meetings/GSA/Sections/nc/2022mtg/fieldtrips.aspx



5th International Conodont Symposium (ICOS5)

Wuhan, China

24–27 June 2022

BEYOND BIOSTRATIGRAPHY: CONODONT MATTERS IN EVOLVING PLANETARY SCENARIOS



Dear Colleagues,

We are proposing the Session **Beyond biostratigraphy: Conodont matters in evolving planetary scenarios** as part of the **5th International Conodont Symposium “ICOS 5”** to be held in Wuhan, China (June 24th–27th, 2022). Considering the pandemic situation, the Symposium will combine offline (on site) and online (visual) presentations.

Session profile: *Conodont elements are the only mineralized skeletal remains of a soft-bodied, nektonic, extinct early chordate that inhabited ancient oceans for over 300 million years (late Cambrian to Late Triassic). The usefulness of conodonts in biostratigraphical correlation has been well demonstrated, but conodonts have been found to be essential to solve fundamental geological, environmental, evolutionary, and biological problems. The proposed Session seeks to take the concept of conodont animals beyond the simple idea of their utility as biostratigraphical markers in order to explore how conodonts serve, as well as geochemical archives, to reveal changing marine environments and climates, past geographies and biodiversity revolutions, and to enhance our understanding of the biology of these extinct organisms. Topics covered include but are not limited to biodiversity, evolution, geochemistry, paleoecology, paleogeography and paleoclimatology. All geological periods will be considered and we especially encourage a multidisciplinary discussion involving different fields.*

Our hope is that you or members of your research group might even consider our invitation to be part of this innovative exploratory Session.

Papers resulting from the ICOS 5 Session will be published as a Virtual Special Issue of **Marine Micropaleontology**. IF YOU ARE INTERESTED IN CONTRIBUTING, PLEASE CONTACT US! We are collecting a list of possible contributors to return to the journal before ICOS 5. Please note that submission of manuscripts is due in **April 2023**. We look forward to hearing from you soon.



With best regards

Guillermo Albanesi¹ and Annalisa Ferretti²

¹ CICTERRA (CONICET-UNC), Museo de Paleontología, CIGEA, FCEFyN, Universidad Nacional de Córdoba, 5000 Córdoba, Argentina. E-mail address: guillermo.albanesi@unc.edu.ar

² Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, 41125 Modena, Italy. E-mail address: ferretti@unimore.it

7th International Conference on Trilobites and their Relatives (ICTR7)

Cincinnati, USA

14–18 July 2022

LAST MINUTE: CANCELLED

Dear Trilobite Friends

Unfortunately, the projected registration to ICTR7 is well short of that needed to make the meeting financially and logically viable. Given the current global situation, the pattern of registration is not surprising: We had pretty good registration from North America, but low levels from the rest of the world (and thus a special thanks to those of you from elsewhere who valiantly did so!) Accordingly, **we regret to announce that the Cincinnati meeting cannot proceed as planned this summer**. For those who did register, we include information below concerning refunding your registration fee.

A broader question is raised as to whether such a specialist, international in-person meeting will be viable at *any* time in the near-term future. Given the planning and work-to-date done for the Cincinnati meeting, we'd like to propose the following:

1. We provisionally defer the 7th International Conference on Trilobites and their Relatives until summer 2024, with the plan to hold it in-person in Cincinnati at CMC, according to the format and schedule of the proposed 2022 meeting (precise dates to be announced at a later date).
2. In October 2022, Brenda will solicit the community for interest in holding such a meeting, with a questionnaire on likelihood of attendance, and about preferences for meeting mode.
3. If the result of that survey is that community favors an online only meeting, or an in-person meeting held elsewhere, then we will withdraw plans for the Cincinnati meeting. Otherwise, we will proceed with organizing the meeting at Cincinnati in summer 2024.

We anticipate that registrants for the 2022 meeting will receive a full refund (minus the processing fee of the third-party booking vendor). Brenda will be able to initiate this within the next few weeks, contingent on CMC's online reconnection.

We are sincerely sorry to have to share this news of the cancellation of the summer 2022 meeting, and regret any inconvenience that you will suffer on this account. Mark and I can share with you the huge amount of work that Brenda has put in to get us this far. Our hope was that summer 2022 would find the world in a better situation than in recent years making the meeting not only viable but also especially well attended; our hope remains that this will be the case in 2024.

All good wishes,

Nigel Hughes, Brenda Hunda and Mark Webster



July 14th - July 18th, 2022

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

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

Schedule of Events:

Pre-conference Field Trip: July 10th - July 14th

Trilobite paleobiology in its stratigraphic context: the late Cambrian of the Upper Mississippi Valley

Meeting July 14-18th

Sunday July 17th – intra-conference field trip to the Cincinnati Series

Post-conference Field Trip: Tuesday July 19th - Friday July 22nd

Ordovician - Devonian Trilobites of the Niagara Region

Session Topics:

Phylogeny and Macroevolution

Paleo-Evo-Devo and Functional Morphology

Exceptional Preservation

Trilobites and Environments: synecology to paleogeography

Systematics and Biostratigraphy

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

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

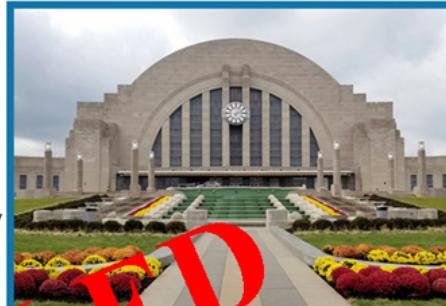
Organizing Committee:

Brenda Hunda, Cincinnati Museum Center bhunda@cincymuseum.org

Nigel Hughes, University of California, Riverside nigel.hughes@ucr.edu

Mark Webster, University of Chicago, mwebster@geosci.uchicago.edu

WE HOPE TO SEE YOU IN CINCINNATI!



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

Conference Highlights:

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

19th International Symposium on Ostracoda (ISO19)

Lyon, France

18–22 July 2022

Website: <http://iso2022.univ-lyon1.fr/en>

Description: The French Ostracologists' Group and the International Research Group on Ostracoda are pleased to invite you to attend the 19th International Symposium on Ostracoda that will be held in Lyon at the University Claude Bernard Lyon 1 from July 18th–22nd 2022.

The ISO meetings are rare occasions for ostracologists of different countries, disciplines, generations to meet and discuss so we'll do anything we can to maintain the meeting in person.

We would like to strongly encourage the younger generation (MScs, PhDs, Postdocs) to come and present their work in front of our welcoming community. The IRGO will provide at least two travel grants (up to 1000€) to students that have no other source of funds for attending the conference. The two best student abstracts will be selected by the advisory board of SF*IRGO (<https://www.support-irgo.net/advisory-board/>) for the attribution of these grants and the laureates will be notified on April 30th at the latest.

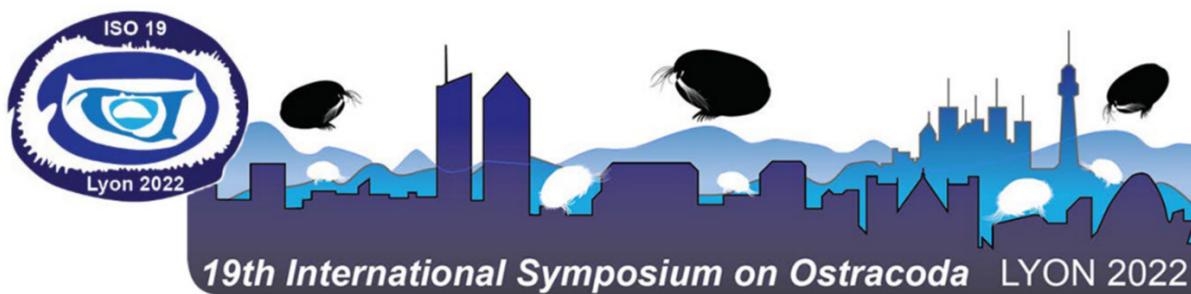
We also know that not every one of you will be able to attend the meeting. Those participants who know, or expect, that they will be unable to attend in person because of travel, health or mobility restrictions will still be able to present their work and follow the conference online. If their abstracts are accepted, they will be invited to submit pre-recorded talks ahead of the meeting and to attend a live virtual Q&A session after their talks. Oral sessions during the meeting will therefore be a mix of predominantly live, in-person presentations and some pre-recorded presentations, presented to both the in-person and virtual audience. The symposium will thus be fully streamed for virtual attendees but social events taking place in Lyon will be for in-person attendees only.

Organising Committee: Vincent Perrier, Marie-Béatrice Forel, Sylvie Crasquin

Important dates:

Deadline for abstract submission: March 31st 2022

Decisions on abstracts and deadline for payment of reduced fees for symposium and field-trip(s): April 30th 2022



2nd Annual Meeting of IGCP 735 Marrakesh and Zagora, Morocco

19–24 October 2022

The 2nd Annual Meeting of IGCP 735 in Marrakesh and its associated workshop and field excursion in Zagora will be devoted to 'Filling knowledge gaps in the Early Palaeozoic Biodiversification' and 'Promoting Geological Heritage'.



GENERAL PROGRAMME

Wed. 19 Oct. 2022: registration, opening ceremony, oral and poster sessions
Thu. 20 Oct. 2022: oral and poster sessions, workshop
Fri. 21 Oct. 2022: travel from Marrakesh to Zagora
Sat. 22 Oct. 2022: workshop in Zagora
Sun. 23 Oct. 2022: post-conference field excursion, Zagora Province
Mon. 24 Oct. 2022: travel from Zagora to Marrakesh

IGCP 735 ANNUAL MEETING, MARRAKESH (19–20 Oct. 2022)

Indoor sessions with keynote talks and regular lectures will take place in the new '*Cité de l'Innovation*' of Cadi Ayyad University on the Campus. They are scheduled for both Wednesday, October 19th and Thursday, October 20th.

Social activities are varied, and will include a conference dinner at "Club chez Ali", that will take place on Wed. 19 October. Very interesting visits (by caleche) into the famous Jamaa El Fna Square, the Museum of Water Marrakesh and the Majorelle Gardens are also scheduled at the end of the second day of indoor sessions.

IGCP 735 WORKSHOP AND FIELD EXCURSION, ZAGORA (21–24 Oct. 2022)

A four-days workshop and post-conference excursion will be organized across the Marrakesh High Atlas and Central Anti-Atlas regions. It will be an opportunity to visit localities yielding exceptionally preserved assemblages of the Lower Ordovician Fezouata Biota and Hirnantian tunnel palaeo-valleys. Regular and volunteer stops for panoramic views and cultural sites will be planned along the geotraverse of the Central High Atlas and Anti-Atlas.



THE MAJESTIC DRAA VALLEY AND THE
ORDOVICIAN OUTCROPS IN THE
BACKGROUND.

Fri. 21 Oct. 2022: Marrakesh - Zagora via Tizi n'Tichka and Agdz. Geotraverse of the Central High Atlas and Anti-Atlas.

- **Stop 1:** panorama of the Marrakesh High Atlas from the Haouz plain (31.5631° N, 7.7101° W)
- **Stop 2:** middle Cambrian–Lower Ordovician transition at Tichka Pass (High Atlas) (31.2869° N, 7.3812° W)
- **Stop 3:** Late Neoproterozoic stromatolites at Aït Saoune (Central Anti-Atlas) (30.7925° N, 6.7219° W)
- **Stop 4:** panorama (Jbel Kissane and Anti-Atlas), north of Agdz (30.7071° N, 6.5922° W)
- **Stop 5:** Cambrian Brèche à Micmacca at Ourika Wawrmas (30.7259° N, 6.5315° W)
- **Stop 6:** Sunset on Draa Valley (30.3979° N, 5.8624° W)

night in Zagora

Sat. 22 Oct. 2022: workshop in Zagora

The aim of this workshop is to bring together, through discussions and oral presentations, scientists, the Geoparks, and the local civil society, decision-makers and representatives from the city.

night in Zagora

Sun. 23 Oct. 2022: workshop in Zagora

- **Stop 1 (morning):** Hirnantian glacial deposits at Tizi n'Beni Sâlmane (GPS : 29.8995°N, 5.6178°W)
- **Stop 2 (afternoon):** Fezouata Shale Lagerstätte, Ternata Plain

Mon. 24 Oct. 2022: Zagora-Marrakesh via Aït Ben Haddou (UNESCO world heritage site)

- **Stop 1:** Taourirt Kasbah
- **Stop 2:** Ouarzazate Studio-Museum
- **Stop 3:** Lunch at Ksar of Aït Ben Haddou: UNESCO World heritage

Marrakesh: end of the field excursion

REGISTRATION AND PAYMENT

The 2nd Annual Meeting of IGCP 735 (Filling knowledge gaps in the Early Palaeozoic Biodiversification and Promoting Geological Heritage) in Marrakesh and associated workshop and field excursion in Zagora are planned to be meetings in the spirit of the UNESCO, with low registration costs, in particular for attendants from developing countries and students, including all receptions and lunches during the indoor sessions.

items	participant category	fees
conference registration	full participant	350 €
	student	150 €
workshop & field excursion	all participants	490 €

*Note that registration should be completed through the website of the meeting:
<http://ens-marrakech.ac.ma/projets/igcp735/>

The total amount of registration fees will be given automatically when the registration is completed. The payment should be made by bank transfer (please do not forget to specify your name, when transferring money) to:

NAME OF BENEFICIARY: ASS FONDATION ATLAS DARK SKY

ACCOUNT NUMBER: 14545021 1 163061036001413

PHONE NUMBER : +212 524308675

BANK NAME: Banque Populaire, MOULAY ABDELLAH Agency

SWIFT ADDRESS CODE: BCOPMAMC

BANK ADDRESS: RESIDENCE TAIBA IMM. B1, BD. MOULAY ABDELLAH
MARRAKECH, MOROCCO

or alternatively, on site, at the meeting. Please send by email the receipt of your bank transfer to: igcp735@uca.ac.ma. Credit card payment is not available.

CONFERENCE PUBLICATIONS

A volume of extended abstracts (conference proceedings) will be published by the Hassan II Academy of Sciences and Technology (Rabat, Morocco) as a regular book with an ISBN number.

A guide book of the excursion will be distributed to the participants of the workshop and field excursion in Zagora.

Participants to the 2022 Annual Meeting of IGCP 735 in Marrakech will have the possibility to submit MS into at least two, probably three, thematic volumes in regular, indexed, peer-reviewed journals.

The first thematic set will be published in *Frontiers in Science and Engineering* (FSE: <https://revues.imist.ma/index.php/fsejournal/>). It will gather papers on '*Geological Heritage and Geoparks: New Perspectives*'. **The deadline for MS submission to this special issue is June, 30 (2022)**: the plan is to have this volume in print and distributed to all participants next October in Marrakesh. If you are interested in contributing to this volume, please contact: igcp735@uca.ac.ma

The second thematic volume will be published in the *Bulletin de la Société Géologique de France* (BSGF: <https://pubs.geoscienceworld.org/bsgf>). It will gather original contributions on '*The Great Ordovician Biodiversification Event: A Gondwanan Perspective*'. More details will be provided about it during the Marrakesh meeting, but the plan is to have MS submitted between November 2022 and February 2023, so as to have the volume completed and issued in late 2023/early 2024.

Participants will also have the possibility to submit MS to a third thematic volume probably more focused on taphonomy and Cambro-Ordovician Lagerstätten. More information about it will be provided during the Marrakesh conference.

IMPORTANT DATES

- **22 December 2021:** distribution of First Circular
- **7 February 2022:** Opening of conference website for information and registration (<http://ens-marrakech.ac.ma/projets/igcp735/>)
- **20 March 2022:** distribution of Second Circular
- **1 May 2022:** deadline for extended abstracts submission on the website of the conference (<http://ens-marrakech.ac.ma/projets/igcp735/>) or by e-mail to: igcp735@uca.ac.ma
- **30 June 2022:** deadline for MS submission to thematic volume on *Geological Heritage and Geoparks: New Perspectives* in the journal *Frontiers in Science and Engineering*
- **15 September 2022:** distribution of Third (last) Circular



GETTING TO MARRAKESH

Marrakesh is the fourth largest city and one of the four Imperial cities of Morocco. Marrakesh is also the capital of the Marrakesh-Safi region. The city is situated west of the foothills of the Atlas Mountains.

Marrakesh was founded in 1070 as the imperial capital of the Almoravid Empire. The Almoravids established the first major structures in the city and shaped its layout for centuries. The red city walls and various buildings constructed with red sandstones afterwards have given the city its nicknames of the "Red City" or "Ochre City". The old city of Marrakesh (medina) is a UNESCO World Heritage Site. Today, it is one of the busiest cities in Africa and it serves as a major economic center and touristic destination.

<https://www.visitmorocco.com/en/travel/marrakesh>

Marrakesh is served by the Menara International Airport and by the Marrakesh railway station, which connects the city to Casablanca and northern Morocco.

ACCOMMODATION

Each participant is responsible for his/her own hotel accommodation. Marrakesh has a very wide range of hotels and other types of accommodation such as youth hostels and guest houses. We advise you to make your booking through recognised websites such as www.booking.com. It is strongly recommended to choose an accommodation close to the event location.

We suggest the following nearby hotels:

- **Le Sémiramis** located at about 850 m from the Faculty of Science and Technology of Marrakesh.
- **Mogador Opera Marrakech** : located at about 1,8 km from the Faculty of Science and Technology of Marrakesh.
- **Imperial Plaza** : located at about 250 m from the Faculty of Science and Technology of Marrakesh. Hotel's website.

DOCUMENTS AND REQUIREMENTS TO ENTER MOROCCO

Each visitor to Morocco must have a valid passport and a visa, if required. Foreign participants whose countries are subject to visa requirements should contact the Moroccan Embassy or Consulate in their country. Be sure to allow sufficient time to apply for your visa before your departure date.

Here is the list of countries whose nationals are exempted from the visa to enter Morocco on this [link](#).

Due to the current sanitary conditions related to COVID-19, travelers have access to the Moroccan territory, under certain conditions, if they have a vaccination pass or a negative PCR test at least 48 hours before the date of entry into Morocco. The conditions of access to the Moroccan territory change according to the country of origin. We recommend that you check with the Moroccan embassy in your country before traveling. It should also be noted that the conditions of access to Morocco may be updated regularly and at very short notice.

The directory of Moroccan embassies in the world can be found on this [link](#).

Airlines may require additional formalities, we also recommend that you check the conditions of travel on their flights, directly on the website of each carrier.



YOUR ARRIVAL TO MARRAKESH

Participants can take direct flights from their home countries to Marrakesh-Menara Airport or make a stop-over at Mohammed V International Airport in Casablanca.

The Marrakesh-Menara airport is located approximately 6 km south of the city centre. To get to the hotel you can take bus 19 to the city centre and then take a cab to your hotel. You can also take a cab directly from the airport to your hotel.

Do not hesitate to contact your hotel, they may offer free shuttle services or at negotiated rates.

It is recommended to have a small amount of cash (500 MAD) with you upon arrival, or to have Euros or Dollars. Cabs and buses do not accept credit cards.

It should be noted that the current pandemic situation makes it mandatory to wear a mask at the airport and on public transportation.

SANITARY MEASURES

Wearing a mask remains mandatory throughout the Kingdom of Morocco. The vaccination certificate is required for access to all enclosed areas : hotels, cafes and restaurants, movie theaters,

Everyone is required to comply with the mandatory measures provided for under the state of emergency, under penalty of sanctions provided for in the penal code. It is advisable to respect the instructions of the Moroccan authorities.

MONEY

The local currency is the Moroccan dirham (MAD) :
1 USD = 9 MAD and 1 Euro = 11MAD (approximately).

You can find the current exchange rate on websites such as :
<https://countryeconomy.com/currencies/morocco>
<https://www.xe.com/currencyconverter/convert/?Amount=10&From=USD&To=MAD>

OTHER DETAILS

The electrical outlets used in Morocco are two-pin and operate on 220V/55Hz. Adapters are hard to find, so it is best to bring your own.

October in Marrakesh is mostly sunny. Average rainfall is 21 mm, with 29 days without rain. Minimum temperatures average 17°C and maximums 28°C. Temperatures are generally cool in the morning and evening and warmer during the day.

The average temperature in October in Zagora is 20°C and the average rainfall is 13 mm. At night, temperatures drop to 13°C and during the day they can reach 27°C.

It is recommended that participants to the excursion bring all the necessary equipment for a field trip (shoes, hammer, magnifying glass, ...).

Participants are also asked to inform the organisers in advance of any medical or dietary problems they may have.

SCIENTIFIC COMMITTEE

CANDELA, Yves (Edinburgh, UK)
DALEY, Allison (Lausanne, Switzerland)
HARPER, David (Durham, UK)
EL ALBANI, Abderrazak (Poitiers, France)
EL HARIRI, Khadija (Marrakesh, Morocco)
GHIENNE, Jean-François (Strasbourg, France)
GHOBADI POUR, Mansoureh (Gorgan, Iran)
GUTIERREZ-MARCO, Juan Carlos (Madrid, Spain)

LEFEBVRE, Bertrand (Lyon, France)
ORTEGA-HERNANDEZ, Javier (Cambridge, USA)
RAEVSKAYA, Elena (Saint-Petersburg, Russia)
SERVAIS, Thomas (Lille, France)
TINN, Oive (Tartu, Estonia)
WAISFELD, Beatriz (Cordobá, Argentina)
WANG, Wenhui (Changsha, China)

ORGANIZING COMMITTEE

AZIZI, Abdelfattah (Marrakesh, Morocco)
BELAQZIZ, Mohammed (Marrakesh, Morocco)
BENNANI, Oumaima (Marrakesh, Morocco)
BOUGADIR, Belaid (Marrakesh, Morocco)
CANDELA, Yves (Edinburgh, UK)
CHAYEB, Fatiha (Marrakesh, Morocco)
EL ALBANI, Abderrazak (Poitiers, France)
EL HARIRI, Khadija (Marrakesh, Morocco)
GHIENNE, Jean-François (Strasbourg, France)
GUTIERREZ-MARCO, Juan Carlos (Madrid, Spain)
HACHAD, Nadia (Marrakesh, Morocco)
LEFEBVRE, Bertrand (Lyon, France)
SOULAIMANI, Abderrahmane (Marrakesh, Morocco)
TAOURIRTE, Moha (Marrakesh, Morocco)
WITAM, Omar (Marrakesh, Morocco)

CONTACT / INFORMATION

- k.elhariri@uca.ac.ma
- bertrand.lefebvre@univ-lyon1.fr
- <http://ens-marrakech.ac.ma/projets/igcp735/>

OFFICIAL PARTNERS / SPONSORS

AAPG (Association for the Protection of Moroccan Geological Heritage)
Académie Hassan II des Sciences et Techniques
Atlas Dark Sky Foundation
Cadi Ayyad University, Marrakesh



6th International Palaeontological Congress (IPC6)

Khon Kaen, Thailand

7–12 November 2022

After Sydney in 2002, Beijing in 2006, London in 2010, Mendoza in 2014 and Paris in 2018, Thailand will host the next International Palaeontological Congress in November 2022. Thailand is ready and prepared to receive all palaeontologists in Khon Kaen, for the conference and in all the kingdom's territories for the fieldtrips. Due to its origins as two terranes in Gondwana in the Palaeozoic, their fusion with Laurasia in the Triassic and the development of the Sundaic biota in the Neogene, Thailand is a land of great geological and palaeontological diversity – hence our theme ‘From Gondwana to Laurasia’.

Registration is due by 15th June 2022 and will include welcoming ice breaker, abstract volume, morning and afternoon teas and lunch. Payment may be made by bank transfer. Invoices and invitation letters can be requested by contacting the organizing committee at generalchair_ipc6@msu.ac.th

For more information, please visit the IPC6 website: <https://ipc6.msu.ac.th/>

Thirty-four thematic sessions will be hosted at IPC6, two of which are officially organized (sesion 27) or co-organized (session 28) by IGCP 735.

SESSION 27 (IGCP project 735)

Recent advances on metazoan diversifications from Early Palaeozoic Lagerstätten

Farid Saleh, Bertrand Lefebvre, Joseph. P. Botting, Allison C. Daley, Xiaoya Ma and Javier Ortega-Hernandez

Description: Konservat-Lagerstätten, or sites with soft-tissue preservation, provide a unique opportunity to understand the initial rise and major diversifications of metazoans during the Early Palaeozoic. This IGCP 735 session will explore the latest advances obtained on this critical time interval through the study of exceptionally preserved faunas. We encourage all contributions related to any aspect of Early Palaeozoic Lagerstätten including but not limited to systematic palaeontology, geochemistry, palaeoecology, palaeoichnology, and taphonomy.

SESSION 28 (IGCP projects 668 and 735)

Freedom to breathe: integrating the evolution of animals and their environments during the early Palaeozoic

Nigel Hughes and Xiang Fang

Description: The evolution of life into and during the early Palaeozoic is increasingly being tied to global scale changes in environmental conditions, including fluctuating but overall rising levels of oxygen in the atmosphere and oceans. Our symposium, jointly sponsored by IGCP 668 and 735, will explore the linkages between organismal evolution and environments at this critical time, with a particular emphasis on the geological and paleoenvironmental context of evolutionary innovation. We encourage contributions that explore these linkages in innovative ways, ranging from anatomical evidence for respiratory evolution in fossil organisms through to geochemical evidence for secular and evolving environmental conditions in the Earth-Life system.

14th International Symposium on the Ordovician System (ISOS-14)

Tallinn, Estonia

19–21 July 2023

Save the dates:

- Late 2022: Early bird registration
- April 2023: Deadline for registration and short papers
- July 14, 2023: Arrival to Tallinn, Icebreaker
- July 15–18, 2023: Pre-conference excursion in Estonia
- July 19–21, 2023: Conference in Tallinn
- July 22: Departures from Tallinn
- July 23–26, 2023: Post-conference excursion in Sweden
- July 27, 2023: Departures from Stockholm

After ten meetings on various continents, the major event for all friends of the Ordovician System will return to Baltica. The last time was in August 1982, when the meeting was organised in Norway. In July 2023, Estonia will welcome you to ISOS-14 – the 14th International Symposium on the Ordovician System.

The Ordovician succession of Estonia has been attracting geologists since the early 19th Century, and the rich and well-preserved fossil record has made the region renowned worldwide. Together with the neighbouring Baltoscandian countries, Estonia has continued to serve as one of the model areas for the Ordovician studies.

The conference part of ISOS-14 will be held on July 19–21 in Tallinn, the capital of Estonia and a city built from the Ordovician limestone. The pre-conference excursion will introduce the Ordovician outcrops in northern and central Estonia. The post-conference field trip on July 23–26 will take participants to the Ordovician localities in Sweden (organiser Jan Ove Ebbestad from Uppsala University).

Conference fees are expected to be similar to those of recent physical meetings. Conference volume of short papers will be published as a special issue of the *Estonian Journal of Earth Sciences*. Options for special volumes of regular papers related to ISOS-14 are being discussed.

ISOS-14 will be organised jointly by the Subcommission on Ordovician Stratigraphy, University of Tartu, Tallinn University of Technology, and the Geological Survey of Estonia. We are looking forward to meeting all friends of the Ordovician in 2023 in Estonia!

For additional information and updates, check the conference website: <https://isos14.org> and FB event: <https://fb.me/e/5fJQLNfng>, or contact us directly:

- Tõnu Meidla, University of Tartu, tonu.meidla@ut.ee
- Olle Hints, Tallinn University of Technology, olle.hints@taltech.ee

IN MEMORIAM

Bernd-Dietrich ERDTMANN (1939–2021)



Bernd-Dietrich Erdtmann
(17.08.1939; Breslau, Germany [now
Wrocław, Poland] – 23.12.2021; Phoenix,
Arizona, USA)

All his German students called him ‚Bernie‘. Now he died at his home in Phoenix, Arizona, USA at the age of 82. When I first met him in Göttingen in the autumn of 1983, he was the professor recently returned from the US, working with this strange fossil group, the graptolites. Who knew these fossils from more than a course in palaeontology? My interest was initially aroused through the possibility to work in Sweden or Norway for my diploma thesis. Eventually, it became the Hunneberg in Västergötland, Sweden (now the GSSP for the base of the Floian Stage of the Ordovician System). Since that time Erdtmann was part of my life, sometimes a closer, sometimes a more distant figure. The last time I saw him was at the celebration of his 80th birthday in 2019. I attended this celebration together with Michael Steiner, another of Bernie’s PhD students and a number of old friends and colleagues, where he entertained us with a lot of old stories and his usual humour.

„Bernie“ – Bernd-Dietrich Erdtmann was born in 1939 in Breslau (now Poland) and came to Hamburg in northern Germany at the end of the war. After his school years in Hamburg and his initial geology studies at Hamburg university, ‘Bernie’ moved to Norway in the early 1960s. The work for his Cand. real. thesis (comparable to the Diploma thesis of Germany; or a master thesis in the US) on the graptolites of the Tøyen Shale Formation at the University of Oslo was supervised by Gunnar Henningsmoen, at the time senior curator at the Palaeontological Museum, Oslo (Erdtmann, 1965). Bernie then went for a postdoc fellowship of the Canadian National Research Council to Laval University (Québec: 1966) and Carleton University (Ottawa: 1967-1968) in Canada. Actually, Bulman suggested to F. F. Osborne at Laval University, Québec that Erdtmann should be working on the Lévis succession

graptolites and compare them with the Tøyen Shale fauna of Norway. Bernie arrived in Canada, but his connection with Osborne soon became sour. Thus, Bernie quickly moved to Carleton University, Ottawa, Canada.

Bernie got the position as an assistant professor at Indiana State University, Fort Wayne, Indiana, USA in 1968 and stayed at the university later as associate professor, full professor and chairman of the department until 1978. During his time in Indiana, he also produced a German Doktorarbeit (PhD thesis) at the University in Hamburg during a sabbatical (Erdtmann, 1976). After a short stint as visiting professor of sedimentology(!) at Arizona State University in Tempe, Phoenix, Arizona, USA (1978-1979), Bernie re-appeared in Germany with a Heisenberg Stipend in Göttingen (1979-1987). Finally he moved to Berlin as professor of historical geology and palaeontology at Technische Universität Berlin until his retirement in 2004.

Bernie was initially well-known as a graptolite specialist and his most important palaeontological contribution may be the work establishing the dendroid '*Dictyonema*' *flabelliforme* as a planktic graptolite, separate from the benthic *Dictyonema*'s, now bearing the name *Rhabdinopora flabelliformis* (Erdtmann, 1982). '*Dictyonema*' or now *Rhabdinopora flabelliformis*, indicating the old '*Dictyonema* Shale', was long considered to provide a good basis for the definition of the base of the Ordovician System and the Cambrian/Ordovician working group for long time looked at this level, but the decision was to use the FAD of the conodont *Iapetognathus fluctivagus* to define the base of the Ordovician System. Even though Cooper *et al.* (2001, p. 20) stated that 'the FAD of planktic graptolites can be taken as a reasonable proxy for the boundary', the graptolites were not considered any more as a key to the definition of this boundary. Thus, as a member of the Cambrian/Ordovician Boundary working group and the key specialist for the graptolites, Bernie did not succeed to establish *Rhabdinopora flabelliformis* as the index species for the base of the Ordovician System. However, his contribution on the Cambrian/Ordovician boundary and the biostratigraphic ranges of the various *Rhabdinopora* species in the successions of western Newfoundland (Erdtmann, 1988; Cooper *et al.*, 1998) and of Dayangcha, N. China (Chen *et al.*, 1985; Wang & Erdtmann, 1986), remain important resources for palaeontologists worldwide. His latest interests in graptolite research included the early Ordovician graptolite succession of southern Bolivia, that was recognized to show high similarity to the Scandinavian succession (Erdtmann *et al.*, 1995; Maletz *et al.*, 1999; Egenhoff *et al.*, 2004).

At the end of the 1980s, Bernie started working on the now so famous Chengjiang fauna of early Cambrian age with Chen Yun Juan and colleagues at NIGPAS, Nanjing (Chen *et al.*, 1989; Chen & Erdtmann, 1991). This work led to Bernie's temporary interest into the late Precambrian-Cambrian evolution of life and the spectacular material found at Chengjiang. With the increasing competition and research done by many other researchers, Bernie's interest on this incredible fauna quickly evaporated, unfortunately.

In the 1990s, research of his PhD. student Andy Hoffknecht on the reflectance of graptolites (see Wang *et al.*, 1992) and its use as indicator of thermal maturity led to Bernie's interest in work with Prof. Sam Akande and his students from the University of Ilorin (Nigeria) on the burial and thermal history and petroleum source rock potential of Cretaceous sediments in the Dahomey, Anambra and Gongola rift basins of southern Nigeria (cf. Akande *et al.*, 1992). This eventually proved to be the longest surviving interest in his scientific life and a paper by Adeoye *et al.* (2020) appears to be Bernie's latest scientific contribution.

His wide, but superficial interest in geology and palaeontology led to numerous projects and an enormous travel activity, especially during his years in Berlin. His interests unfortunately often did not survive a first attempt and many projects were abandoned quickly. This is how we as his students knew him; easy going, discussing many aspects over long days and nights, but then quickly moving on to new aspects and forgetting to reach the finishing line. He always wanted the best for his students, and for me that was taking me to the ‘Graptolite Conference’ in Copenhagen in 1985 - I was only a diploma student at the time – and introducing me to the International World of Palaeontology, meaning to all the graptolite specialists. Thus, I was introduced to all these people I only knew from their publications, but from this time on I was part of the community.

There are so many aspects about Bernie that few people are aware of: Who knew that he was involved in a project on the Jurassic of Somalia in his early years in Berlin? He had a number of diploma students in Spain in the late 1980s, two PhD students did their theses on the Cambrian/Ordovician boundary of the Digermul Peninsula of northern Norway when Bernie was in Göttingen in the 1980s. He worked with colleagues in Brazil on the fossil *Corumbella* (Walde *et al.*, 2015, 2019) and on the late Precambrian-Cambrian transition of South America. There would be so much more to talk about ...

Jörg Maletz, Berlin

Selected Publications (in chronological order)

- Erdtmann, B.-D. 1965. Outline stratigraphy of graptolite-bearing 3b (Lower Ordovician) strata in the Oslo Region, Norway. *Norsk Geologisk Tidsskrift*, **45**, 481–547.
- Erdtmann, B.-D. 1976. Die Graptolithenfauna der Exploits Gruppe (Oberes Ordovizium) von Zentral-Neufundland. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, **45**, 65–140.
- Erdtmann, B.-D. 1982. A reorganization and proposed phylogenetic classification of planktic Tremadoc (early Ordovician) dendroid graptolites. *Norsk Geologisk Tidsskrift*, **62**, 121–145.
- Chen J. Y., Qian J.-Y., Lin Y.-K., Zhang J.-M., Wang Z.-G., Yin L.-M., Erdtmann, B.-D. 1985. *Study on Cambrian-Ordovician boundary strata and its biota in Dayangcha, Hunjiang, Jilin, China*. Beijing, China Prospect Publishing House.
- Wang, X. F. & Erdtmann, B.-D. 1986. The earliest Ordovician graptolite sequence from Hunjiang, Jilin Province, China. *Acta Geologica Sinica*, **60**(3), 226–236.
- Erdtmann, B.-D. 1988. The earliest Ordovician nematophorid graptolites: taxonomy and correlation. *Geological Magazine*, **125**(4), 327–348.
- Chen J. Y., Hou, X.G. & Erdtmann, B.-D. 1989. New soft-bodied fossil fauna near the base of the Cambrian System at Chengjiang, eastern Yunnan, China. *Developments in Geoscience. Beijing, Chinese Academy of Science*, 265-277.
- Chen, J. Y. & Erdtmann, B.-D. 1991. Lower Cambrian fossil lagerstätte from Chengjiang, Yunnan, China: Insights for reconstructing early metazoan life. In: Simonetta, A.M. & CConway Morris, S. (eds) *The early evolution of metazoa and the significance of problematic taxa*. Cambridge University Press, Cambridge, 57–76.
- Akande, S., Hoffknecht, A. & Erdtmann, B.-D. 1992. Upper Cretaceous and Tertiary coals of southern Nigeria; composition, rank, depositional environments and their technological properties. *Nigeria Association of Petroleum Explorationists Bulletin*, **7**, 26–38, 7 figs, 2 tables, Lagos.

- Wang, X. F., Hoffknecht, A., Xiao, J. X., Chen, S. Q., Li, Z. H., Brocke, R. & Erdtmann, B.-D. 1992. Reflectance of graptolite and its use as indicator of thermal maturity. *Bulletin of the Yichang Institute of Geology and Mineral Resources, CAGS*, **18**, 85–93.
- Erdtmann, B.-D., Kley, J., Müller, J., Jacobshagen, V. 1995. Ordovician basin dynamics and new graptolite data from the Tarija region, eastern Cordillera, South Bolivia. *Ordovician Odyssey: Short Papers for the Seventh International Symposium on the Ordovician System*. J. D. Cooper, M. L. Droser and S. C. Finney, The Pacific Section Society for Sedimentary Geology (SEPM), **77**, 69–73.
- Cooper, R. A., Maletz, J., Wang, H. F., & Erdtmann, B.-D. 1998. Taxonomy and evolution of earliest Ordovician graptoloids. *Norsk Geologisk Tidsskrift*, **78**, 3–32.
- Maletz, J., Egenhoff, J. O. & Erdtmann, B.-D. 1999. Late Tremadoc to early Arenig graptolite succession of southern Bolivia. *Acta Universitatis Carolinae — Geologica*, **43**, 29–32.
- Egenhoff, S., Maletz, J. & Erdtmann, B.-D. 2004. Lower Ordovician graptolite biozonation and lithofacies of southern Bolivia: relevance for palaeogeographic interpretations. *Geological Magazine*, **141**, 287–299.
- Wang, X., Stouge, S., Chen, X. H., Li, Z. H., Wang, C. S., Finney, S. C., Zeng, Q. L., Zhou, Z. Q., Chen, H. M. & Erdtmann, B.-D. 2009. The global stratotype section and point for the base of the Middle Ordovician Series and the third stage (Dapingian). *Episodes*, **32**(2), 96–113.
- Walde, D.H.G, Do Carmo, D.A., GuimarAes, E.M., Vieira, L.C., Erdtmann, B.D., Sanchez, E.A.M, Adorno, R.R. & Tobias, T.C. 2015. New aspects of Neoproterozoic–Cambrian transition in the Corumba region (state of Mato Grosso do Sul, Brazil). *Annales de Paléontologie*, **101**, 213–224.
- Walde, D. H.-G., Weber, B., Erdtmann, B.-D. & Steiner, M. 2019. Taphonomy of *Corumbella werneri* from the Ediacaran of Brazil: sinotubulitid tube or conularid test? *Alcheringa*, **43**(3), 335–350.
- Adeoye, J. A., Akande, S. O., Adekeye, O. A., Sonibare, W. A., Ondrak, R., Dominik, W., Erdtmann, B.-D. & Neeka, J. 2020. Source rock maturity and petroleum generation in the Dahomey Basin SW Nigeria: insights from geologic and geochemical modelling. *Journal of Petroleum Science and Engineering*, **195**, 107844.

Frank Nikolaisen (1940–2021)



Photo Karl Bruton (2019)

Frank Nikolaisen died alone at home in Oslo on September 20th 2021, aged 81. At a very early age he became interested in the natural sciences and chose Vestheim School, one of two schools in Oslo where this was possible. He later studied geology at the University and became immediately fascinated with the rocks and fossils of the Oslo Region. He became a regular visitor at the University Palaeontological Museum, Tøyen and was invited to join Gunnar Henningsmoen on an expedition to Digermulen in the far north of the country and later Frank became the senior author of two joint papers on the Cambrian trilobites collected (Nikolaisen & Henningsmoen 1985, 1990).

Frank had a keen eye for detail, which he revealed by careful use of the vibro-tool. I first met Frank in 1963 when I visited the Palaeontological Museum and later we became close friends especially after I took over Henningsmoen's position in 1967. When I started lecturing, Frank became my mentor and scientific assistant and introduced me to the localities and fossils of the Oslo Region. In the field he also had a rich knowledge of the flowers, animals and birds. Ornithology was his big hobby in later years and he travelled world-wide to study rare birds.

Frank published three important papers on Ordovicain trilobites from the Oslo Region between 1961 and 1965. In 1971, he joined Gunnar Henningsmoen, Richard Fortey, myself and others for an expedition to Ny Friesland, Spitsbergen. In 1973 he assisted me with the organisation of the 1st International Trilobite meeting held in Oslo. After this, Frank left us for other activities in private business, but returned to publish two important works on the Remopleurididae in 1983 and 1991. In 2017 Frank was present at the 6th International Trilobite meeting I held Tallinn, Estonia and we met often at meetings of the Norwegian

Geological Society in Oslo. In his years at Tøyen, Frank met many visiting guest researchers who, since his death, have written their appreciation for his help and friendship. Interestingly all remember well his style of dress of flowered shirts with large collars. Frank retained his “Elvis-style” from his schooldays to the end. At his funeral, the service ended with Frank Sinatra’s “My Way”. Frank Nikolaisen’s life was always his way.

David L. Bruton

Publications (in chronological order)

- Nikolaisen, F. 1961. The Middle Ordovician of the Oslo Region, Norway. 7. Trilobites of the suborder Cheirurina. *Norsk Geologisk Tidsskrift*, **41**, 279–310.
- Nikolaisen, F. 1963. The Middle Ordovician of the Oslo Region, Norway. 14. The trilobite family Telephinidae. *Norsk Geologisk Tidsskrift*, **43**, 345–399.
- Nikolaisen, F. 1965. The Middle Ordovician of the Oslo Region, Norway. 18. Rare trilobites of the families Olenidae, Harpidae, Ityophoridae and Cheiruridae. *Norsk Geologisk Tidsskrift*, **45**, 231–248.
- Nikolaisen, F. 1983. The Middle Ordovician of the Oslo Region, Norway. 32 Trilobites of the family Remopleurididae. *Norsk Geologisk Tidsskrift*, **62**, 232–329 (for 1982).
- Nikolaisen, F. 1991. The Ordovician trilobite genus *Robergia* Wiman, 1905 and some other species hitherto included. *Norsk Geologisk Tidsskrift*, **71**, 37–62.
- Nikolaisen, F. & Henningsmoen, G. 1985. Upper Cambrian and lower Tremadoc olenid trilobites from the Digermul peninsula, Finnmark, northern Norway. *Norges Geologiske Undersøkelse Bulletin*, **400**, 1–49.
- Nikolaisen, F. & Henningsmoen, G. 1990. Lower and Middle Cambrian trilobites from the Digermul peninsula, Finnmark, northern Norway. *Norges Geologiske Undersøkelse Bulletin*, **419**, 55–95.
- Bruton, D.L. & Nikolaisen, F. 2017. Nomenclatorial Note. The homonyms *Brachypleura* Angelin, 1854 (Trilobita) and *Brachypleura* Günther, 1862 (Actinopterygii) with discussion of N.P. Angelin’s published work. *Bulletin of Zoological Nomenclature*, **74**, 138–141.

ORDOVICIAN RESEARCH REPORTS & CONTACTS

Aicha ACHAB (Canada) co-authored with Jörg MALETZ a publication in *Review of Palaeobotany and Palynology*, in which they bring new data from Lévis showing that the *Euconochitina symmetrica* Zone does not correspond to the *P. approximatus* Zone (i.e. the base of the Floian) as it was previously suggested, but rather to the *S. murrayi* Zone (i.e. late Tremadocian). This new interpretation confirms the stratigraphic significance of the *symmetrica* assemblage, which is thus identified as Tremadocian in all palaeocontinents.

Aicha Achab

- INRS, Institut national de la recherche scientifique, Centre Eau Terre Environnement, 490, rue de la Couronne, Québec, QC G1K 9A9, CANADA
- E-mail: Aicha.Achab@inrs.ca

Sachiko AGEMATSU (Japan) is continuing her research on the Ordovician conodont biostratigraphy in Thailand and Malaysia. In a joint project with the Geological Survey of Thailand, she is also investigating the graptolite biostratigraphy and lithostratigraphy of the Ordovician-Silurian boundary.

Sachiko Agematsu

- Department of Geoscience, Life and Environmental Sciences, University of Tsukuba, Ibaraki, 305-8572, JAPAN
- Telephone: 81-29-853-4427
- E-mail: agematsu@geol.tsukuba.ac.jp

Guillermo L. ALBANESI (Argentina) works on Lower Paleozoic conodont faunas from South America. Diverse projects from the Precordillera and northwestern Argentina follow on with G. ORTEGA, former PhD students, and a number of colleagues. Doctoral plans are developed by G.M. DELLA COSTA, F.E. LÓPEZ and E.K. RUEDA under his direction. Likewise, he follows the supervision of M.J. MANGO as CONICET assistant researcher. Research programs include conodont biostratigraphy, paleoenvironments, and evolution from carbonate and siliciclastic sequences of the Ordovician System in Argentina. He is Professor of Paleontology and director of the Centro de Investigaciones Geológicas Aplicadas (CIGEA) at Facultad de Ciencias Exactas, Físicas y Naturales (FCEFyN), Universidad Nacional de Córdoba (UNC), which includes a micropaleontology laboratory especially equipped for conodont preparation. Office located at CICTERRA (CONICET-UNC, <http://cicterra.conicet.unc.edu.ar>) in the university campus, and the conodont collections are housed at Museo de Paleontología (FCEFyN, UNC).

He has been elected as Chief of the Pander Society (the international society of conodont specialists) for the period 2022-2026:

https://dxy.cug.edu.cn/dxyen/THE_PANDER_SOCIETY/About_the_Pander_Society.htm.

Guillermo L. Albanesi

- CICTERRA (CONICET-UNC), Museo de Paleontología, CIGEA, FCEFyN, Universidad Nacional de Córdoba, 5000 Córdoba, ARGENTINA
- Telephone.: 54-351-5353800, int. 30207
- E-mail: guillermo.albanesi@unc.edu.ar

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

- Borissiak Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya 123, Moscow 117647, RUSSIA
- E-mail: anekeeva@paleo.ru

Martina AUBRECHTOVÁ (Czech Republic) is a postdoctoral researcher at the Czech Academy of Sciences and the Charles University Prague. She continues her cooperation with Dieter KORN (Museum für Naturkunde Berlin) to investigate ontogenetic changes in conchs of Ordovician coiled cephalopods from Baltoscandia, and with Vojtěch TUREK (National Museum Prague) on the description of an exceptionally preserved Late Ordovician actinoceratid from Bohemia. She is also engaged with a team of colleagues, who are working to deepen the knowledge on fossil assemblages, palaeogeographic relationships and correlation of Ordovician strata of the Prague Basin.

Martina Aubrechtová

- Institute of Geology, Czech Academy of Sciences, Rozvojová 269, CZ-16500, Prague 6, CZECH REPUBLIC
- Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6, Prague, CZ-12843, CZECH REPUBLIC
- E-mail: aubrechtova@gli.cas.cz & aubrech1@natur.cuni.cz

William I. AUSICH (USA) continues study of Ordovician crinoid systematics, phylogeny, paleoecology, and Late Ordovician–early Silurian extinctions and faunal recovery. Current projects include study of a new Katian echinoderm fauna from Québec and comparisons of Katian echinoderm faunas from eastern North America.

William I. Ausich

- School of Earth Sciences, 125 South Oval Mall, Ohio State University, Columbus, OH 43210, USA
- E-mail: ausich.1@osu.edu

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

Gabriella Bagnoli

- Department of Earth Sciences, Via S. Maria, 53, 56126 Pisa, ITALY
- E-mail: gabriella.bagnoli@unipi.it

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

Chris Barnes

- School of Earth and Ocean Sciences, University of Victoria, P.O. Box 1700, STN CSC, Victoria, BC V8W 2Y2, CANADA
- Telephone: +1-250-920-8382
- Fax: +1-250-721-6200
- E-mail: crbarnes@uvic.ca

Matilde Sylvia BERESI (Argentina) worked in collaboration with colleagues from the Sonora University (Francisco CUEN and others) and UNAM, Mexico (Blanca BUITRÓN) focused on the Middle Ordovician biota of Sonora, northwestern Mexico. As a result from this collective research, a manuscript about Middle Ordovician gastropods of Central Sonora, was recently accepted for publication in *Journal of Paleontology*. This article was done in cooperation with David ROHR and Robert BLOGETT. The Mexican team and M. BERESI have submitted the manuscript entitled Ordovician stratigraphy and biota of Mexico for the *GSL Special Publication*. Furthermore with Jessica C. GÓMEZ, PhD student (CONICET-Universidad Nacional de San Juan), M. BERESI have worked on the stratigraphy, sedimentology of the post-glacial Hirnantian–Rhuddanian transition in the Eastern and Central Precordillera of western Argentina. An article in collaboration with S. PERALTA (Universidad Nacional de San Juan) was presented in the 17th Conference of Sedimentology in Argentina and the 8th Latino-American Conference of Sedimentology.

Matilde Sylvia Beresi

- IANIGLA - CCT MENDOZA-CONICET, Avd. Ruiz Leal s/n, Parque Gral. San Martín, 5500 Mendoza, ARGENTINA
- Telephone: 54-261-5244247
- Fax: 54-261-5244201
- E-mail: mberesi@mendoza-conicet.gob.ar
- Website: <http://www.mendoza-conicet.gob.ar/portal/ianigla/>

Stig M. BERGSTRÖM (USA) continued his global geological research during 2021 despite the virus epidemic and a serious accident that caused a broken hip in November resulting in a lengthy hospital stay. Several projects on Ordovician biostratigraphy, paleontology, and chemostratigraphy are currently underway in western North America, Argentina, Sweden, China, and other regions. During the past year, a study (with Annalisa FERRETTI) on the stratigraphic significance and taxonomy of the conodonts of the type sections of the British standard Llandeilo Stage was finally published. A taxonomic and biostratigraphic study of the conodont genus *Histiodella* (with Y.Y. ZHEN and J. BAUER) has been submitted to the *Journal of Paleontology* and two other projects are in almost finished manuscripts. Stig is also involved in a large project on the Ordovician biostratigraphy of a variety of fossil groups and Ordovician chemostratigraphy. Although he spent two months in Sweden this past summer, he hopes it will be possible to do some more extensive travel in 2022.

Stig M. Bergström

- School of Earth Sciences, The Ohio State University, 125 S. Oval Mall, Columbus, OH 43210, USA
 - E-mail: Bergstrom.1@osu.edu
- *****

Carlton E. BRETT (USA). During the pandemic years of 2020 and 2021, he continued research on several projects related to Ordovician stratigraphy and paleoecology in the local Tri-state (Kentucky, Ohio, Indiana) region, with present and former students. Major research projects continued in three areas, as discussed below.

- 1) *Katian Sequence Stratigraphy and Chemostratigraphy in Eastern Laurentia.* In 2020, Carlton and his colleagues published a major paper that documents a decade of study on the sequence stratigraphy, correlation and paleoecology of the Katian (Mohawkian and Cincinnati) of the Cincinnati Arch (Brett *et al.*, 2020, *Palaeo-3*). On the basis of these syntheses, they are now moving ahead with a series of projects that completely revise the long-standing sequence stratigraphy of HOLLAND and PATZKOWSKY. In their present research, Carlton and his colleagues are extending this framework into the Nashville Dome in Tennessee, southern Ontario, Canada and New York State. Research with former student, Tim PATON, in spring 2021 resulted in discovery of brand new road cut sections east of Nashville that provide important insights into the sequence stratigraphy and provides a number of markers that can be traced into the Cincinnati Arch.
- 2) *Uppermost Katian, Hirnantian, and the Ordovician-Silurian Boundary in the Cincinnati Arch.* Collaborative research with graduate student Cole FARNAM and Dr. Pat McLAUGHLIN, of Illinois Geological Survey, at present aims to improve correlations and examine patterns of sea level, climate and faunal change during the latest Ordovician to Silurian transition in eastern North America. They are studying the upper Cincinnati strata (Whitewater and Elkhorn formations) that reveal the detailed sea level, climatic and faunal changes that immediately preceded the great crash in biodiversity associated with latest Ordovician Hirnantian climate change and mass extinction. Their recent isotope stratigraphic studies have confirmed that the Centerville Formation strata, formerly assigned to Silurian, record this very late, post-glacial Ordovician, Hirnantian Stage. The fossil assemblages of these highest strata are totally unlike the long-ranging Cincinnati faunas immediately below and resemble generalized Silurian faunas.

They also completed detailed measurement of four core sections in central and northern Ohio. Carbon isotopic studies have been completed for each of these core sections. Curves of isotopic variation have also been plotted against detailed stratigraphic sections. These correlations will help provide for a regional picture of changes during this critical latest part of the Ordovician Period.

3) *Ordovician-Silurian Echinoderm Faunas and Paleoecology*. Dr. James THOMKA (SUNY at Plattsburgh) and Carlton are continuing study of the paleoecology and organism interactions involving pelmatozoan (stalked) echinoderms. They produced a review paper and synthesis on fossil parasitism among Paleozoic echinoderms, which was published in late 2021. They are now completing a paper on using crinoid stems to better assess the biodiversity and relative abundance of crinoid populations (using the weight [mass] of disarticulated columns of distinct species sorted from bulk collections). Given that the majority of the fossil record consists of the disarticulated columns of crinoids and other pelmatozoans, this tool could provide much more data on fossil crinoid distributions in beds that never yield complete crowns (normally the only part used in identification). They are also working on manuscripts dealing with evolution of parasitic interactions in Ordovician to Silurian “cystoids”; the oldest definite parasitic interactions in the fossil record.

Carlton E. Brett

- Department of Geology, University of Cincinnati, Cincinnati, OH 45221-0013, USA
- Telephone: 001 513 556-4556
- Fax: 001 513 556-6931
- E-mail: carlton.brett@uc.edu

Jana BRUTHANSOVÁ (Czech Republic) is interested in Ordovician and younger conulariids and sphenothallids mainly from the Prague Basin. In cooperation with Heyo VAN ITEN (USA), they published several papers on Ordovician conulariid palaeoecology and taphonomy. Other interesting topics for her include selected taphonomic and palaeoecologic problems, on which she is working on with Petr KRAFT (Czech Republic).

Jana Bruthansová

- Paleontological Department, National museum, Cirkusová 1740, Prague 9, 190 00, CZECH REPUBLIC
- E-mail: jana.bruthansova@nm.cz

Mikael CALNER (Sweden) continued his work in 2021 on the Katian–Hirnantian strata of Sweden and Norway. The first more complete and integrated sea-level/HICE-curve from Norway was published and during these studies a range of new research questions arose, so there may be a continuation of work in this area. He is currently expanding his work on the stratigraphy and the environmental changes associated with the Late Ordovician Mass Extinction (LOME) and glaciation with particular focus on the environmental impact on shallow-marine carbonate environments. This work is done in collaboration with colleagues from China, North America and Europe. Work is also ongoing on the Kinnekulle drillcore. The core is unique because it includes the entire Ordovician succession that is preserved in

the classical plateau mountains of southern Sweden and enables study of the GOBE through LOME interval in one continuous section. Research is underway based on this core, one study is published, and hopefully a few more will be submitted in 2022, among the latter an integrated high-resolution conodont and carbon isotope stratigraphy in collaboration with colleagues from NIGPAS, Erlangen and Lund University.

Mikael Calner

- Department of Geology, Lund University, Sölvegatan 12, SE-223 62 Lund, SWEDEN.
 - Telephone: +46-46-222-14-24
 - E-mail: mikael.calner@geol.lu.se
- *****

Yves CANDELA (Scotland) has now completed the first two projects with Bernard MOTTEQUIN (Royal Belgian Institute of Natural Sciences -RBINS-, Brussels) and several other colleagues (see *Ordovician News* no 38) focusing on Lower Ordovician brachiopod faunas from Belgium – two papers were published. Yves and Bernard are now collaborating on a new project destined to document Middle Ordovician brachiopod faunas from Belgium; this project is funded by a Synthesys+ grant (to YC to visit RBINS). Work is resuming with David HARPER (Durham University) and Michal MERGL (University of West Bohemia, Pilsen) on the study of Lower Ordovician brachiopod faunas of the Fezouata Lagerstätte (Morocco). 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, as well as welcoming research visitors.

IGCP project 735 “Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification” led by Bertrand LEFEBVRE (France) and also comprises Mansoureh GHOBADI POUR (Iran), Khadija EL HARIRI (Morocco), Beatriz WAISFELD (Argentina), Oive TINN (Estonia), Wenhui WANG (China), Elena RAEVSKAYA (Russia) and Yves has started its second year and has attracted so far 192 colleagues representing 42 countries. If you are interested in joining this project please check our website: <https://rocksnrol.wordpress.com/> or drop us a line directly.

Yves Candela

- Department of Natural Sciences, National Museums Scotland, Chambers Street, Edinburgh EH1 1JF, Scotland, U.K.
 - Telephone: +44 (0)131 247 4280
 - E-mail: y.candela@nms.ac.uk
- *****

Josefina M.T. CARLOROSI (Argentina) is still working on biostratigraphy and taxonomy of Lower and Middle Ordovician conodonts from different areas of Northwest Argentina (Cordillera Oriental and Sierras Subandinas) and Famatina Ranges. Besides, she is collaborating with the taxonomical investigation of the Ordovician conodonts from Perú with the Drs. Juan Carlos GUTIERREZ-MARCO and Graciela SARMIENTO. Josefina is currently co-directing with Dr. Ana MESTRE, and in collaboration with Drs. Franco

TORTELLO and Daniela MONTI, a research project funded by CONICET to study the paleobiogeographic links between the Ordovician basins of Precordillera, Famatina and northwestern Argentina, based on the comparison of their conodont associations. She is also collaborating in other projects that investigate different fossil groups of northern Argentina and the Precordillera with Drs Blanca TORO, Susana HEREDIA, Ana MESTRE, among others. In addition, she is part of the Paleontology department of the Facultad de Ciencias Naturales e IML- UNT developing teaching tasks.

Josefina is a member of the Laboratorio de Micropaleontología (CONICET – CIGEOBIO - UNSJ), a working group focusing on Ordovician conodonts of Argentina composed by Dr. Susana HEREDIA and Dr. Ana MESTRE. At the same time, she is part of the INSUGEO staff and carrying out the task of co-editor of the magazine *Serie Correlación Geológica (SCG)*.

Josefina M. T. Carlorosi

- INSUGEO- CONICET- UNT, 4000 Tucumán, ARGENTINA.
 - E-mail: josefinacarlorosi77@gmail.com
- *****

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

Marcelo G. Carrera

- CICTERRA-CONICET, Facultad Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba Av. Velez Sarsfield 1611, Ciudad Universitaria (5000) Córdoba, ARGENTINA
 - Telephone: 5353800 (office code 30222)
 - Fax: 54-351-4332097
 - E-mail: mcarrera@unc.edu.ar or marcelogcarrera@gmail.com
- *****

Euan CLARKSON (Scotland), at age of nearly 85, is still very interested in the Lower Palaeozoic and trilobites especially. His last long Ordovician paper was with Kristina MÅNSSON (2020) on the revised ontogeny of the early Ordovician trilobite *Leptoplastides salteri* Callaway 1877. A couple of older, semi-popular books are: (1) Euan Clarkson and Brian Upton (2006) *Edinburgh Rock* (on the geology of the Edinburgh district); (2) Euan Clarkson and Brian Upton (2009) *Death of an Ocean* (on the geology of Southern Scotland, with an extended discussion of Charles Lapworth, Ordovician and Silurian graptolitic shales etc.); and (3) for igneous geologists, there is also Brian Upton's 2015 *Volcanoes and the making of Scotland (2nd edition)*. All are published by Dunedin Press. Edinburgh, with nice illustrations. Finally, Brigitte SCHOENEMANN and Euan are still working on compound eyes in trilobites. They would be grateful to know of compound eyes in any Ordovician trilobites with the calcite lenses intact. The great majority are preserved as moulds and do not preserve internal structures.

WANTED !



Brigitte SCHOENEMANN and Euan CLARKSON are looking for eyes, fragments of cephalon with (fragments) of eyes, hopefully with lenses, because they would like to clarify the calcitic character of trilobite lenses, which for several reasons seems to be most promising in Ordovician trilobites (Brigitte and Euan would be very happy even with pieces collectors would not keep for their collections ...). They would also love to have many nice pictures of Ordovician trilobite eyes, which appear to be most diverse in the Ordovician, during the "GOBE". Please send photographs (or fossils) to Brigitte SCHOENEMANN (bschoenem@web.de) and/or Euan CLARKSON (Euan.Clarkson@ed.ac.uk).

Euan Clarkson

E-mail: Euan.Clarkson@ed.ac.uk

Robin COCKS (England). 2021 was the second exceptional Covid-related year, with access denied to his Natural History Museum office and collections until July although he had been fully vaccinated before then. However, Robin has been busy, largely working from home as well as a visit to Berlin in September to work with Trond TORSVIK (normally Oslo), although largely on global Devonian palaeogeography and climate. A *Gondwana Research* paper with Trond on global Ordovician palaeogeography and climate was completed and published just before the end of the year. Another paper with Leonid POPOV (Cardiff) on the distribution of Ordovician higher-latitude Mediterranean brachiopods and their assemblages was completed, submitted, and published in the *Geological Magazine*. Although proofs were corrected for the Popov and Cocks *Fossils & Strata* late Ordovician brachiopods monograph from the Chu-Ili terrane, Kazakhstan, it was still not published by the year's end.

L. Robin M. Cocks

- Department of Earth Sciences, The Natural History Museum, Cromwell Road LONDON SW7 5BD, UK
- Telephone: +44 20 7942 5140
- E-mail: r.cocks@nhm.ac.uk

Jorge COLMENAR (Spain). During this year Jorge got a permanent research position at the Spanish Geological Survey (IGME). His research follows two main lines: (1) analyzing the diversity changes in the lower Paleozoic in collaboration with Christian M.Ø. RASMUSSEN and others; and (2) describing new brachiopod and other invertebrate assemblages from the Ordovician of peri-Gondwana in collaboration with Sofia PEREIRA, Samuel ZAMORA, Enrique VILLAS, David A.T. HARPER and Juan Carlos GUTIÉRREZ-MARCO among others.

Currently active projects include analyzing the brachiopod diversity in the Cuyania Terrane (Precordillera) during the Cambrian-Silurian interval, studying the Ordovician faunas and paleobiogeography of the Proto-Andean margin of Gondwana and from other peri-Gondwanan localities.

Jorge Colmenar

- Instituto Geológico y Minero de España (IGME)-CSIC / Geological Survey of Spain (IGME)-CSIC, C/ La Calera, 1. 28760 Tres Cantos – Madrid, SPAIN.
- E-mail: j.colmenar@igme.es

Helena COUTO (Portugal) is working on the study of Palaeozoic stratigraphy, palaeontology and on associated gold and antimony mineralizations in Dúrico-Beirã area (North Portugal). These studies aim contributing for a better knowledge of the Palaeozoic stratigraphy and palaeontology of the Valongo Anticline and to define prospecting guides for gold and antimony deposits. Geological mapping, petrographic, geochemical and stratigraphic studies go on being developed on the Palaeozoic succession.

Helena Couto

- Department of Geosciences Environment and Territorial Management, Faculty of Sciences, University of Porto & ICT – Institute of Earth Sciences, University of Porto, Rua do Campo Alegre 687, 4169-007 Porto, PORTUGAL
 - Telephone: +351 22 0402489/69
 - E-mail: hcouto@fc.up.pt
- *****

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

G. Susana de la Puente

- CITAAC, CONICET – CIGPat, Departamento de Geología y Petróleo, Facultad de Ingeniería, Universidad Nacional del Comahue, Buenos Aires 1400 , Q8300IBX Neuquén, ARGENTINA
 - E-mail: sudelapuente@gmail.com, and: susana.delapuente@comahue-conicet.gob.ar
- *****

Liting DENG (China), with co-authors LI Ming and YANG Zhenjing, has a paper in press in *Geoscience* (Early Tremadoc Graptolites Taxonomy and Biozonation in Central Hunan, China). Other papers are in preparation on graptolites from the Middle Ordovician of Qaidam basin, China.

DENG Liting

- School of Earth Sciences, Hebei Geosciences University, 136 Huaian East Road, Shijiazhuang 050031, CHINA
 - Ministry of Nature and Resources, Institute of Geology, Chinese Academy of Geological Sciences, Baiwanzhuang Road, Beijing 100037, CHINA
 - Telephone: (+86)15731600775.
 - E-mail: 15731600775@163.com
- *****

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

André Desrochers

- Department of Earth and Environmental Sciences, University of Ottawa – STEM 460, Ottawa, ON, K1N 6N5, CANADA
 - Telephone: 1 613 562-5800 X6852
 - Fax: 1 613 562-5192
 - E-mail: andre.desrochers@uottawa.ca
- *****

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 2020 he started a 3-year project for a complex investigation of the Moyero River reference section in Northeastern Siberia. It is one of the best and most well-exposed Ordovician sections on the entire Siberian platform. However, it is situated in a rather remote place (2,5 hours by helicopter from the nearest village). Due to this reason the section was rarely visited by specialists and remains underinvestigated. One of the goals of the project 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. Taras GONTA, Alexandr TIMOKHIN and Veronica KUSHLINA are also taking part in the field studies and laboratory investigations. In August 2020, they made a preliminary investigation of the section with a special emphasis on the Lower Ordovician part of the section and Cambrian/Ordovician boundary interval, which had never been studied in detail here. In the summer 2021, they made a more detailed sampling and correlation of the outcrops during the 1.5 month expedition. In the field season 2022, they are planning to continue their investigations.

Under umbrella of this project, they 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. Studies of acritarchs by Elena RAEVSKAYA and carbonate microfacies by Alexei ZAITSEV are also part of the project.

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.

Andrei V. Dronov

- Geological Institute, Russian Academy of Sciences, Pyzhevsky per.7, 119017 Moscow, RUSSIA
 - Telephone: +7 (495) 959-30-17
 - Fax: +7 (495) 959-07-60
 - E-mail: avdronov@gmail.com; dronov@ginras.ru
- *****

Jan Ove R. EBESTAD (Sweden) continues working on Ordovician gastropods and other molluscs from Baltica, Avalonia, Laurentia and peri-Gondwana settings. A new Lower Ordovician fauna from South Wales was described together with John COPE (Cardiff). Work on the Wahlenberg (1818) type catalogue continued during 2021, in collaboration with Vivianne BERG-MADSEN (Uppsala). Besides various gastropod projects, upcoming studies include cheirurid trilobites and machaeridians.

Jan Ove R. Ebbestad

- Museum of Evolution, Uppsala University, Norbyvägen 16, SE 752 36 Uppsala, SWEDEN
 - Telephone: +46184712709
 - E-mail: jan-ove.ebbestad@em.uu.se
- *****

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) produced a paper on in the *Geological Society of America Bulletin* on the $\delta^{18}\text{O}$ study of Ordovician conodonts using the Cameca 7f/geo Secondary Ion Mass Spectrometer (SIMS). Collaborations with Matt SALTZMAN (The Ohio State University) continue, along with his Ph.D. students (Christopher CONWELL, Datu ADIATMA, and Teresa AVILA), on conodont biostratigraphy and radiogenic isotope chemostratigraphy of the Middle–Late Ordovician. Collaborative work with Sarah CARMICHAEL (Appalachian State University), Phoebe COHEN (Williams), Diana BOYER (Wintrop University), and Xiao-Ming LIU (University of North Carolina Chapel Hill) extend this work into studying “best practices” for identifying periods of anoxia during the Late Devonian.

Cole Edwards

- Department of Geological and Environmental Sciences, Appalachian State University, Boone, NC 28608, USA
 - Telephone: 828-262-7820
 - E-mail: edwardsct4@appstate.edu
- *****

Bob ELIAS (Canada), with co-authors Dong-Jin LEE and Brian PRATT, published a paper in *Geology*. In it, they demonstrated that Early Ordovician fossils identified as *Lichenaria* and previously accepted as the earliest tabulate corals actually belong to *Amsassia*, which is not a tabulate. The earliest definite tabulates appeared in the latest Middle Ordovician. A subsequent paper by LEE, ELIAS AND PRATT is available in FirstView from *Journal of Paleontology*: “*Amsassia* (calcareous alga) from the Lower Ordovician (Tremadocian) of western Newfoundland, and the biologic affinity and geologic history of the genus”. A related paper is in press in *Journal of Paleontology*. It deals with a new genus of calcareous algae from the Lower Ordovician (Floian) of western Newfoundland, and the earliest symbiotic intergrowth of modular species.

Bob Elias

- Department of Earth Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2, CANADA
 - Telephone: 204-474-8862
 - E-mail: Robert.Elias@umanitoba.ca
- *****

Andrej ERNST (Germany) is continuing his studies on Ordovician bryozoans worldwide. His last project "From high latitudes into the tropics: The role of palaeogeography for the biodiversification of Ordovician bryozoans of Baltoscandia", funded by DFG in 2018–2020 (ER 278/10-1), resulted in collection of a significant amount of bryozoan-rich samples from Ordovician localities in Estonia, Norway, Sweden, and Russia. Furthermore, relevant museum collections from Tallinn and Oslo were studied. From all the material 1,335 thin sections were prepared. The taxonomic study revealed 18 bryozoan species from the Darriwilian localities and 113 species from the Sandbian/Katian localities. Andrej ERNST collaborates with Björn KRÖGER on diversity changes of bryozoans, with Hans Arne NAKREM on bryozoan taxonomy, and with Olev VENN, Ursula TOOM, and Mark WILSON on ichnofossils interacting with bryozoans. The taxonomic description of the Darriwilian bryozoans from Baltica will appear soon (Ernst, in press). Another coming publication deals with the bryozoan fauna from Sandbian of western Argentina (Ernst & Carrera, in press).

Andrej Ernst

- Institute of Geology, University of Hamburg, Bundesstr. 55, D-20146 Hamburg, GERMANY
 - Telephone: 0049-40-42838 5018
 - E-mail: Andrej.Ernst@uni-hamburg.de
- *****

Frank R. ETTENSOHN (USA) continues his detailed work on the stratigraphy of the Upper Ordovician Lexington Limestone in central Kentucky, U.S.A. Previous work on the unit has suggested that the unit's complex facies relationships are related to basement structures, reactivated during the Taconian Orogeny. To further confirm this possibility, he is undertaking the three-dimensional mapping of Lexington members (facies) using GIS to determine if member boundaries coincide with the positions of known basement structures.

Frank R. Ettensohn

- Department of Earth & Environmental Sciences, University of Kentucky, Lexington, KY 40506, U.S.A.
 - Telephone: 859-257-1401 (leave message)
 - E-mail: fettens@uky.edu
- *****

David EVANS (UK) continues to study Ordovician cephalopods. Currently this includes completing a manuscript for a monograph on the Upper Ordovician cephalopods of Wales and England (delayed by lack of access to museum collections due to COVID) and a revision of the Cyrtocerinida (with Marcela CICHOWOLSKI, University of Buenos Aires).

David H. Evans

- 10 Liddymore Road, Watchet, Somerset TA23 0DQ, UNITED KINGDOM
 - Telephone: (44) 07565765957
 - E-mail: devanscephs@gmail.com
- *****

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

Xiang Fang

- State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology and Center for Excellence in Life and Paleoenvironment, Chinese Academy of Sciences, 39 East Beijing Road, 210008 Nanjing, CHINA
- Telephone: +86-25-83282166
- E-mail: xfang@nigpas.ac.cn

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

The conodont fauna of the reference succession of the regional British Llandeilian Stage of the Llanvirn Series, described in a classical study by Rhodes in 1953 using single element (form) taxonomy, has been reviewed, and additional taxonomic details on the marker genera *Amorphognathus* and *Eoplacognathus* have been provided (Ferretti & Bergström, 2022). Other recent papers have strictly focused on the effect of diagenesis on bioapatite mineralogy and crystallization patterns over geological time (Ferretti *et al.*, 2021a; Medici *et al.*, 2021). The mineralogical and chemical signatures of enigmatic microspherules commonly referred to in literature as “conodont pearls” have been investigated so to finally provide a response on the affinity of these spherules (Ferretti *et al.*, 2021b). 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).

Annalisa Ferretti

- Dipartimento di Scienze Chimiche e Geologiche, Università degli Studi di Modena e Reggio Emilia, via Campi 103, 41125 Modena, ITALY
- E-mail: ferretti@unimore.it

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

Barry G. Fordham

- Research School of Earth Sciences, Australian National University, Canberra, ACT 2601 AUSTRALIA
- Telephone: +61 (0)421 611 913
- E-mail: barry.fordham@anu.edu.au
- Website: earthsciences.anu.edu.au/people/visiting/dr-barry-fordham

Richard FORTEY (UK). The Covid pandemic continued to prevent ready access to the Natural History Museum in London, which slowed progress somewhat on ongoing projects. However several project advance to the submission stage, notably a report on a remarkable trinucleid trilobite from Peru (with Juan Carlos GUTTIEREZ MARCO) and the long term redescription of the trilobite types of F.R.C. REED from Burma (Myanmar). A Middle Ordovician fauna from the Amdeh Formation, Oman, was prepared for description. A new piece of work undertaken jointly with Greg EDGECOMBE on the appendages of an early Ordovician asaphid trilobite from Morocco was begun.

Richard Fortey

- Department of Earth Sciences, The Natural History Museum, Cromwell Road, London SW7 5BD, UK
 - E-mail: R.Fortey@nhm.ac.uk
- *****

Mansoureh GHOBADI POUR (Iran) is currently working on three chapters of a volume entitled ‘A Global Synthesis of the Ordovician System’ for *GSL Special Publication*, including ‘The Ordovician of the Middle East (Iran, Afghanistan, Pakistan)’, ‘The Ordovician of Central Asia (Kyrgyzstan, Tajikistan, Uzbekistan)’ and ‘Rise and fall of Ordovician marine biodiversity’ in cooperation with some other colleagues. She is also writing a book about Ordovician of Iran in Farsi, which is in a good progress. There are some trilobite collections from Kazakhstan and Uzbekistan awaiting for study in this year.

Mansoureh Ghobadi Pour

- Department of Geology, Faculty of Sciences, Golestan University, 49138-15739 Gorgan, IRAN
 - Department of Natural Sciences, National Museum of Wales, Cardiff CF10 3NP, UK
 - Telephone: +98 9132654300
 - fax: +98 171 4427176
 - E-mail: mghobadipour@yahoo.co.uk
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Jessica Carolina GÓMEZ (Argentina) is currently in the last year of a scholarship at the National Council of Scientific and Technical Research of Argentina, and in the last stage of her PhD Thesis, at the National University of San Juan, with Dr. Matilde BERESI (Advisor) (IANIGLA - CONICET- MENDOZA) and Dr. Silvio H. PERALTA (Advisor) (CIGEOBIO-INGEO, CONICET-San Juan). Sedimentary, paleobiologic, isotopic and paleoenvironmental events in the Hirnantian–Rhuddanian transition in the Eastern and Central San Juan Precordillera of Western Argentina are the main subjects of her thesis. The research focuses on high-resolution stratigraphic correlation elements: (a) characterization of diagnostic deposits such as lag deposits, phosphate lag, upwelling, and ironstone (Fe-phosphate oolites); (b) biostratigraphic elements, as the case of diagnostic faunal associations of the *Hirnantia* Fauna, the *M. persculptus* Zone, and palynomorphs (with Dr. Mercedes DI PASCUO, CONICET- ENTRE RÍOS-UADER); (c) isotopic anomalies (with Dr. Alcides SIAL, NEG-LABISE), Brazil; (d) condensed section analysis; and (e) regional correlation with homologous successions of northwestern Argentina, as the Zapla and Lipeón formations; and sections of South America. Actually, she participates to the project “High-resolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central

and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128, Dr. Silvio Peralta)”. She contributed to 8th Latin American Congress of Sedimentology. Parana, Argentina (with Silvio PERALTA; Matilde BERESI); and to the Virtual Annual Meeting of IGCP 653/Virtual Annual Meeting of IGCP 735. Lille, France (with Mercedes DI PASCUO and Silvio PERALTA).

Jessica Carolina Gómez

- CIGEOBIO-IN GEO, CCT-SAN JUAN. Ignacio de la Roza Avenue and Meglioli Street, 5400 Rivadavia, San Juan, ARGENTINA
 - Telephone: 54 358 4014175
 - E-mail: jessicagomez21@gmail.com
- *****

David A.T. HARPER (UK) has retired from his substantive role in Durham University and is now Emeritus Professor of Palaeontology. Research continues, and indeed is accelerating, on a range of Ordovician brachiopod and other faunas. A manuscript is in press in the *Irish Journal of Earth Sciences* with Robin COCKS on the brachiopod fauna of the Portrane Limestone (Ireland); this paper is essentially the (updated) final part of DH’s PhD supervisor, Tony WRIGHT’s own PhD thesis which was never published; it is part of a special issue to celebrate the life of Dr Matthew PARKES, DH’s first PhD student who died suddenly in 2020. A paper is in review with JIN Jisuo and Robert BLODGETT on the *Tcherskidium* brachiopod fauna from the Arctic. Collaboration continues with Yves CANDELA and Michal MERGL investigating the Lower Ordovician brachiopod fauna of the Fezouata Lagerstätte (Morocco); a more general, short paper (Saleh *et al.*) is in press on the significance of new and existing localities in the region. Together with Bernard MOTTEQUIN and Thomas SERVAIS, Upper Ordovician brachiopods from Belgium are under study and DH has contributed to a monograph on the highest Ordovician and lower Silurian geology of the Condroz Inlier, Belgium (Mortier *et al.*). A focus remains on the Great Ordovician biodiversification with a recently published paper on the bioregionalization of the Ordovician biodiversifications (with Thomas SERVAIS, Borja CASCALES-MIÑANA and David KROECK) and one highlighting the more gradual increase in biodiversity through the period (with Thomas SERVAIS and Borja CASCALES-MIÑANA). Investigation of the phylogeny of plectambonitoid brachiopods (with Yves CANDELA and ZHEN Guo) continues. A similar study is planned for the orthide brachiopods. 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. DH is involved in chapters on South Africa, the UK and Ireland, Greenland, Scandinavia, Palaeobiogeography and the history of the system.

David A.T. Harper

- Department of Earth Sciences, Durham University Durham DH1 3LE, UK
 - Westfield, Duns Road, Coldstream TD12 4DW, Scotland, UK
 - Telephone: 0044 7517147360
 - E-mail: david.harper@durham.ac.uk
- *****

Nexxys Carolina HERRERA SÁNCHEZ (Argentina) continues working on Early Paleozoic graptolites from the Central Andean Basin (northwestern Argentina and southern Bolivia). She especially works on taxonomy, traditional and quantitative biostratigraphy, and graptolite reflectance. In addition, she is discussing the first results of graptolite diversity for the Central Andean Basin using CONOP.

Nexxys Carolina Herrera Sánchez

- Centro de Investigaciones en Ciencias de la Tierra (CICTERA), CONICET-Universidad Nacional de Córdoba, Av. Vélez Sarsfield 1611, X5016GCA. Ciudad Universitaria, Córdoba, ARGENTINA.
- Telephone: 54-351-535800 (office code 30228)
- E-mail: nexxysherrera@gmail.com and nexxys.herrera@unc.edu.ar

Linda HINTS (Estonia). Since this year she has been a freelance paleontologist with the opportunity to continue working at the institute.

Finally, the manuscript of the Llandovery-Wenlock shelly fauna on outer shelf and slope environments in Estonia is almost completed together with colleagues Peep MÄNNIK, Helje PÄENASTE, Mike REICH (Germany) and Sergey ROSHNOV (Moscow).

Linda Hints

- Department of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, ESTONIA
- E-mail: lindahints@taltech.ee

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 studying chitinozoans and other organic-walled microfossils from Baltoscandia and elsewhere, focusing on taxonomy, biostratigraphy, biogeography and palaeoecology. A paper on Early and Middle Ordovician material from Latvia will be published shortly. In collaboration with Petra TONAROVA and Mats E. ERIKSSON, Olle is studying Paleozoic scolecodonts to provide new insights into the taxonomy, paleobiogeography and diversification history of Palaeozoic jaw-bearing polychaetes. At present, rich latest Ordovician collections from the Prague Basin and Baltoscandia are being examined. In Tallinn, a new doctoral project started to shed more light on the emergence of jawed polychaetes and their response to extinction events.

Olle is involved in studies on geochemistry and chemostratigraphy together with Tõnu MEIDL, 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. New intriguing data have been collected from the Ordovician of Latvia and Lithuania, and the first manuscripts on these are in progress. In addition, in 2021, a paper was published applying in-situ trace element mapping and U-Pb dating of carbonate minerals revealing the diagenetic history of the Ordovician sequence in Estonia.

Olle is responsible for the development of the national geocollections database and related services under a national research infrastructure project (various data are accessible at <https://geocollections.info>). He is currently also Editor-in-Chief of the *Estonian Journal of*

Earth Sciences, an open-access journal seeking contributions to Ordovician geology and fossils.

Olle Hints

- Department of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn ESTONIA
 - Telephone: +372 513 01 57
 - E-mail: olle.hints@taltech.ee
- *****

Lars HOLMER (Sweden) is continuing studies on Cambrian–Ordovician–Silurian brachiopods, and Baltic regional geology. In collaboration with Leonid POPOV, Mansoureh GHOBADI POUR, Heikki BAUERT, Zhifei ZHANG, and Olev VENN he is continuing studies on brachiopods from Baltoscandia, and across the world, focusing on taxonomy, phylogeny, biostratigraphy, biogeography and palaeoecology. On these topics several papers were published in 2021. In collaboration with Javier ÁLVARO, he is studying Cambrian–Ordovician occurrences of glendonites in Baltica.

Lars Holmer

- Uppsala University, Department of Earth Sciences / Palaeobiology Villav. 16, SE-75236 Uppsala, SWEDEN
 - Telephone: +46-18-4712761
 - E-mail: Lars.Holmer@pal.uu.se
- *****

Nigel HUGHES (USA) continues to co-lead IGCP668, Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics, which has close ties with IGCP653 and 735. Along with Paul MYROW and Birendra SINGH, he has been writing the chapter for the new Ordovician volume associated with these IGCP projects, and has been working with Richard FORTEY and Shelly WERNETTE on FRC REED's type material of Ordovician trilobites from the northern part of Shan State, Burma, and from Baoshan, China, that were originally described in the early part of the last century. Nigel was also the lead author on a paper that discussed late Cambrian and early Ordovician trilobites, brachiopods and the detrital zircon spectra from sandstones of those ages from the Sông Đà terrane of Việt Nam. Other relevant work is that with Jin-bo HOU and Melanie HOPKINS on the exopods of *Triarthrus eatoni*, and a “normative” paper making suggestions for standardizing descriptions of articulated trilobite ontogeny.

Nigel Hughes

- Dept. of Earth and Planetary Sciences, University of California, Riverside, CA 92521, USA
 - Telephone: 951 827 3098
 - E-mail: nigel.hughes@ucr.edu
- *****

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 Middle and 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.

Juwon Jeon

- Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Beijing East Road No. 39, 210008 Nanjing, CHINA
 - E-mail: jjeon@nigpas.ac.cn
- *****

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 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. Correcting the last year's report I can tell that the paper is in press now, i.e. should appear in March.

Dimitri Kaljo

- Department of Geology, Tallinn University of Technology, 5 Ehitajate tee, 19086 Tallinn, ESTONIA
 - Telephone: 372 56485523
 - E-mail: dimitri.kaljo@taltech.ee.
- *****

Cintia KAUFMANN (Argentina) continues her research about Middle Ordovician graptofaunas from Eastern and Central Precordillera of San Juan, Argentina with Gladys ORTEGA (CONICET- Universidad Nacional de Córdoba).

She is working at Instituto de Geología Dr. Emiliano Aparicio (Universidad Nacional de San Juan) with Laura Ines LEÓN. They are studying trace fossils of Ordovician age on carbonate units from Precordillera, San Juan, Argentina. She is working with Fernando LÓPEZ on some Upper Ordovician–Lower Silurian graptolite faunas from Central Precordillera (Tucunuco Group). Together with Dinia SCHMITTER and Laura Ines LEÓN, she is also working on geosite and geological heritage projects, located in places with important Ordovician successions and paleontological content. Most of their contributions were made in online meetings or virtual conferences in the last two years due to complications from the pandemic.

Cintia Kaufmann

- Instituto de Geología Dr. Emiliano Aparicio, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan, ARGENTINA
 - E-mail: cintiakaufmann@gmail.com
- *****

Petr KRAFT (Czech Republic) studied graptolites from the Prague Basin, especially Darriwilian dendroids, and continued in an extensive project of a systematic study and documentation of paleontologic localities in the Ordovician of the Prague Basin. The former study is supported by the Czech Science Foundation, the latter by the internal grant project of the West Bohemian Museum.

Petr Kraft

- Charles University, Faculty of Science, Institute of Geology and Palaeontology, Albertov 6
128 43 Praha 2, CZECH REPUBLIC
 - Telephone.: +420 22195 1459
 - E-mail: kraft@natur.cuni.cz
- *****

Tatiana KULASHOVA (Estonia) started a PhD project at the Department of Geology, Tallinn University of Technology, under the supervision of Olle HINTS. The project is devoted to Ordovician jaw-bearing polychaete worms, particularly their early evolution and diversification, and response to environmental perturbations and extinction events. Other acid-resistant microfossils, sedimentology and geochemistry will be studied alongside scolecodonts.

Tatiana Kulashova

- Department of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, ESTONIA
 - Telephone: +372 590 24 519
 - E-mail: tatiana.kulashova@taltech.ee
- *****

Lukáš LAIBL (Czech Republic) continues to work on the morphology, evolution, and development of various euarthropods from the Cambrian and Ordovician strata worldwide. With his colleagues from the University of Lausanne, Yunnan University, Lyon 1 University, University of Brest, and University Cadi-Ayyad, he investigated trilobites from the Fezouata Shale (Tremadocian, Morocco), and described a new euarthropod from the same site. Together with a colleague from Harvard University, he reinterpreted a strange euarthropod larva from the Ordovician strata of Siberia as being a planktonic larval stage of a trilobite. Currently, he works with his colleagues on the description of the early developmental stages of another euarthropod (the so-far undescribed marrellid “*Furca*”) from the Fezouata Shale, on the development of Fezouata Shale trilobites, and the exploitation of pelagic realm by trilobite larvae.

Lukáš Laibl

- Czech Academy of Sciences, Institute of Geology, Rozvojová 269, 165 00, Prague 6, CZECH REPUBLIC
 - Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6
128 43, Prague 2, CZECH REPUBLIC
 - E-mail: lukaslaibl@gmail.com
- *****

Jeong-Hyun LEE (South Korea) is working on Cambro-Ordovician reefs and related geological events. The current research topic includes Neoproterozoic and Cretaceous stromatolites, as well as Cambro-Ordovician sedimentary systems. In 2022, he will stay at the University of Tennessee as a visiting professor and continue to work on Cambro-Ordovician stromatolites in Korea, China, USA, and Canada.

Jeong-Hyun Lee

- Department of Geological Sciences, Chungnam National University, Daejeon 34134, SOUTH KOREA
 - Telephone: +82-42-821-6425
 - E-mail: jeonghyunlee@cnu.ac.kr
- *****

Bertrand LEFEBVRE (France) continues working on Ordovician echinoderm systematics, palaeoecology and paleobiogeography. Last year was very difficult for the 'Fezouata team' in Lyon, with Victoire LUCAS having to stop her PhD thesis (no field data acquired in 2020 and 2021, because of the pandemic), and mostly, the death of Bernard PITTET, who had been working extensively over the 10 previous years on the sedimentology of the Lower Ordovician succession in the Central Anti-Atlas. In 2021, Bertrand nevertheless remained involved in ongoing collaborations and publications on the Fezouata Biota with Farid SALEH and other colleagues from (mostly) Brest, Lausanne and Marrakesh. Decisive progress was made in 2021 and earliest 2022 to complete the final parts of volume 485 of the *Geological Society of London Special Publications* on the Tafilalt Biota (edited by Aaron W. HUNTER, Javier ÁLVARO, Bertrand LEFEBVRE, Peter VAN ROY and Samuel ZAMORA). The book is now in print and will be issued in 2022. Last year, with David A.T. HARPER, Ian PERCIVAL and Thomas SERVAIS, Bertrand was also involved in the elaboration of another editorial project in the *Geological Society of London Special Publications*, on 'A Global Synthesis of the Ordovician System'. With Yves CANDELA, Khadija EL HARIRI, Mansoureh GHOBADI POUR, Elena RAEVSKAYA, Oive TINN, Beatriz WAISFELD and Wenhui WANG, Bertrand is also one of the co-leaders of the new IGCP project 735 "Rocks and the Rise of Ordovician Life: Filling knowledge gaps in the Early Palaeozoic Biodiversification" (Rocks n' ROL), which was accepted by the IGCP board at the UNESCO in mid March 2021. The global sanitary situation and travel restrictions made the first year of the project complicated. Along with Thomas SERVAIS, David A.T. HARPER and Alycia STIGALL, Bertrand was strongly involved in the organization of the joint IGCP 653-735 annual meeting in Lille (France), that had to be organized online in September 2021. Two months later and in between two 'covid waves', Thomas SERVAIS (IGCP 653) and Bertrand (IGCP 735) could nevertheless organize a small, successful 'in person' Ordovician workshop, gathering about 30 participants in Lyon (France).

Bertrand Lefebvre

- UMR CNRS 5276 LGLTPE, bâtiment Géode, campus de la Doua, Université Lyon 1, 2 rue Raphaël Dubois, F-69622 Villeurbanne cedex, FRANCE
 - Telephone: 0033(0) 472 432 834
 - E-mail: bertrand.lefebvre@univ-lyon1.fr
- *****

Philippe LEGRAND (France) continues to work on the Ordovician and Silurian graptolites from the Tassili N'Ajjer oriental and the Silurian fauna of the Ougarta Range, Algeria.

Philippe Legrand

- E-mail: phillipe.legrand@wanadoo.fr
- *****

Stephen LESLIE (USA) is primarily working on Middle and Late Ordovician, and a bit on early Silurian, conodont biostratigraphy and integrating the biostratigraphy with studies of Ordovician paleoclimate change. It's been a rather slow year again with many obligations related to department administration. Work continues with Dan GOLDMAN integrating graptolite and conodont biostratigraphy in dark shale successions. Work also continues with Paul MYROW on Ordovician successions in Colorado, and with Achim HERRMANN testing the early Late Ordovician cool water carbonate hypothesis in the North American Midcontinent using oxygen isotopes from conodont apatite. This past year I have finished a project with Antun HUSINEC on Late Ordovician to Early Silurian conodont biostratigraphy and carbon isotope stratigraphy in the Williston Basin, that we hope will be published soon.

Stephen A. Leslie

- Department of Geology and Environmental Science, Engineering/Geosciences Building, Room 3228, 801 Carrier Drive, MSC 6903, Harrisonburg, VA 22807, USA
 - Telephone: 540-568-6144
 - Fax: 540-568-8058
 - E-mail: lesliesa@jmu.edu
- *****

Ming LI (China) continues her work on Early Ordovician (Tremadocian) graptolites systematics, phylogeny and biostratigraphy. From this year, the main work areas are from South China to North China. Focus on the taxonomy of platform facies graptolites and stratigraphic division.

Ming Li

- MNR Key Laboratory of Stratigraphy and Palaeontology, Institute of Geology, Chinese Academy of Geological Sciences, Bai Wanzhuang Road No.26, 100037 Beijing, P.R. CHINA
 - Telephone: +86-01-68999695
 - E-mail: 80854431@qq.com & liming@cags.ac.cn
- *****

Qi-jian LI (China) is mainly working on Ordovician–Silurian reefs and hypercalcified sponges (e.g. calathids, stromatoporoids and sphinctozoans). In 2021, he continued his sedimentological and paleoecological research on Ordovician reefs. Apart from the fossil materials, he also continues to collaborate on quantitative paleoecological analyses of reefs at the Ordovician–Silurian transition with several colleagues, mainly based on several databases. As a member in the advisory board of the Geobiodiversity Database (GBDB), he has worked with Dr. Na LIN on the download function of occurrence data. At the end of 2021, several

small test runs have been done for this function. Please contact him if any of you are interested in the occurrence data of the GBDB.

Qi-jian LI

- State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Beijing East Road No.39, 210008 Nanjing, P.R. CHINA
 - Telephone: +86-25-83282283 (new office number)
 - E-mail: qijianli@hotmail.com/ qjli@nigpas.ac.cn
- *****

Yan LIANG (China) continues her study on Ordovician chitinozoans mainly from South China and eastern Baltica. With the ongoing project supported by the National Natural Science Foundation of China, her recent research focus is the ultra-structure morphology of chitinozoans. Together with Wenhui WANG, Jaak NÖLVAK, Olle HINTS and colleagues from Central South University, they decoded the inter- and ultra-structure of the carina on *Cyathochitina*. This work is another try after the ultra-structure of the chitinozoan test wall which published last year in *Geology*. At the same time, studies on chitinozoan systematics and biostratigraphy are always under way. Together with Jaak NÖLVAK and Olle HINTS, they made a revision on a widely distributed Lower and Middle Ordovician chitinozoans—*Lagenochitina esthonica*. Two species were identified from the group based on morphological, biostratigraphic and palaeogeographic studies. They also reported a new enigmatic Middle Ordovician organic-walled microfossil, named as *Vikisphaera*, from Baltoscandia. Morphologies and distributions of the fossil were presented in detail and discussions on their possible affinity were made. Together with Peng TANG, Guang-xu WANG and colleagues from NIGPAS, they studied chitinozoans from the western margin of the Yangtze Platform and provided new insights for the age of Ordovician lithological units in this area.

Yan LIANG

- State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing 210008, CHINA
 - E-mail: liangyan@nigpas.ac.cn
- *****

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. Studies continue with my students and other cooperative researchers on geochemistry of the Ordovician carbonate and terrigenous siliciclastic and the Ordovician biostratigraphy and cyclostratigraphy in South China (in progress). The studies on the Phanerozoic microbialites are still in progress with Yoichi Ezaki, Natsuko ADACHI (Osaka City University), and Zhen Yan (Chinese Academy of Geological Sciences).

Jianbo LIU

- School of Earth and Space Sciences, Peking University, Beijing 100871, P. R. CHINA
- Telephone: +86-10-62759684
- Fax: +86-10-62751159
- E-mail: jbliu@pku.edu.cn

Elena V. LYKOVA (Russia) is working on Ordovician and Silurian graptolites, their taxonomy and biostratigraphy, from Gorny Altay and Salair (South of West Siberia).

Elena V. Lykova

- Laboratory of Paleozoic Paleontology and Stratigraphy, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of the Russian Academy of Sciences, Akad. Koptyug av., 3, 630090, Novosibirsk, RUSSIA
- E-mail: BukolovaEV@ipgg.sbras.ru

Jörg MALETZ (Germany) is working on several projects in the Ordovician and Silurian. A new project will cover the graptolite evolution of the late Cambrian (the Furongian Gap of some authors) centered on the graptolite fauna of the late Cambrian Guole Biota with ZHANG Yuandong and ZHU Xuejian (NIGPAS, Nanjing, China). The revision of the ‘Graptolite Treatise’ is under way, but will still take up most of my time, as all Treatise Online chapters have to be adjusted. I recently submitted a monograph on the important graptolite fauna of the Floian GSSP at Hunneberg, Sweden to *Fossils and Strata*.

Jörg Maletz

- Freie Universität Berlin, Institut für Geologische Wissenschaften, Malteser Str. 74-100, Haus C, Raum 005, D-12249 Berlin, GERMANY
- Telephone: +49 30 838 70 678
- E-mail: yorge@zedat.fu-berlin.de

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

- Institute of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, ESTONIA
- Telephone: + 372 58845082
- E-mail: peep.mannik@ttu.ee

Tim McCORMICK (UK) maintains key geoscience controlled vocabularies for the British Geological Survey, including the Lexicon of Named Rock Units (which includes definitions of c. 1,100 British Isles Ordovician lithostratigraphic and lithodemic terms), the Rock Classification Scheme and Geochronology Index. He teaches data management and database design in the UK and abroad, and he collaborates with other geological surveys to construct ‘geo-data centres’. He is also Treasurer and Membership Secretary of The Palaeontographical Society.

Tim McCormick

- British Geological Survey, Nicker Hill, Keyworth, Nottingham NG12 5GG, UK
- E-mail: t.mccormick@bgs.ac.uk
- Websites: <https://www.bgs.ac.uk/technologies/the-bgs-lexicon-of-named-rock-units/> and <https://data.bgs.ac.uk>; <https://www.palaeosoc.org>.

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. He retired to Victoria, BC in September 2017, but continues as a part-time volunteer with the GSC Calgary office. He is in email contact with the Calgary office about 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

- 816-160 Wilson St., Victoria, BC V9A 7P9, CANADA
- Telephone: Contact by e-mail or post (Victoria mailing address) only
- E-mail: sandy.mccracken@Nrcan-Rncan.gc.ca

Patrick McLAUGHLIN (USA). During 2021, his focus was primarily on Ordovician phosphate. This is a multi-year collaborative project funded by the US Geological Survey that will continue into fall 2023. Ordovician phosphorites and phosphatic limestones within the Upper Ordovician of the US midcontinent contain high concentrations of heavy REEs (see Emsbo *et al.*, 2015). The project is focused on regional geochemical reconnaissance of these deposits and the detailed characterization of their age and depositional settings. He is looking to make comparisons with phosphatic Ordovician rocks elsewhere, so please email him if you have ideas for collaboration or just samples to share.

In related news, he continues to enjoy co-advising University of Ghent students with Thijs VANDENBROUCKE studying Katian-Hirnantian chitinozoan faunas of the US midcontinent. Their PhD student, Cristiana DE JESUS PAULO ESTEVES, is moving forward with her study of samples from the type areas for the Maysvillian and Richmondian North American stages and they anticipate a manuscript submission very soon.

Finally, he was gratified to work with Matthias SINNESAEL and fellow Ordovician enthusiasts on a cyclostratigraphic study that was published in the journal *Geology*.

Patrick I. McLaughlin

- Illinois State Geological Survey, Prairie Research Institute, University of Illinois, Urbana-Champaign, 615 E. Peabody Drive, Champaign, IL 61820, USA
 - Telephone: (217) 333-4442
 - E-mail: pim@illinois.edu
- *****

Tõnu MEIDLA (Estonia) is working on different aspects of conodont stratigraphy (with P. T. PAISTE & P. MÄNNIK) and stable isotope stratigraphy (with AINSAAR, B. GUL, O. HINTS, K. KUNGLA, A. LEPLAND and P. PAISTE). A review paper on the Ordovician of Tornquist Sea margin of Baltica is in under preparation (co-authors: L. AINSAAR, A. DRONOV, O. HINTS, T. RAEVSKAYA, N. SENNIKOV, T. TOLMACHEVA and S. RADZEVIČIUS). Several papers on Ordovician ostracods are in progress (with M. WILLIAMS, D. SIVETER, A. SPIRIDONOV., V. PERRIER, S. GUITOR and other co-authors). A paper about stratigraphy and ostracods of the Ordovician in the Bothnian Sea area is in progress (with L. AINSAAR).

Tõnu Meidla

- Institute of Ecology and Earth Sciences, University of Tartu, 14A Ravila Street, Tartu 50411, ESTONIA
 - Telephone: +372 737 5895
 - E-mail: Tonu.Meidla@ut.ee
- *****

Michal MERGL (Czech Republic) is working on minute linguliformean brachiopods of the Tremadocian to Floian age from several new localities the Prague Basin, Czechia, but his interest covers also their evolutionary history up to the Eifelian. A newly observed faunistic association near the Dapingian/Darriwilian boundary with unique sponges and trilobites is currently studied.

Michal Mergl

- Centre of Biology, Geosciences and Environmental sciences, Faculty of Education, West Bohemia University at Plzeň, Klatovská 51, 306 19, Plzeň, Czech Republic
 - Telephone: +420-606665122
 - E-mail: mmergl@cbg.zcu.cz or Argyrotheca@seznam.cz
- *****

Ana MESTRE (Argentina) continues studying the biostratigraphy and taxonomy of the Lower – Middle Ordovician conodonts from the Precordillera. She is also interested to study the sedimentology, stratigraphy, and evolution of the Ordovician and Silurian Precordillera basins, developing carbonate microfacies analysis, especially on the Ordovician carbonate platform. She is working on conodont biostratigraphy and the U-Pb zircon dates from K-bentonite of Lower-Middle Ordovician from the Precordillera, as well as on minerals of the clay group of the Ordovician sedimentary succession from the Precordillera. All these topics are developed in collaboration with Drs. Susana HEREDIA, Juan Pablo MILANA, Daniel POIRÉ, Estefania ASURMENDI, Josefina CARLOROSI (minerals of the clay group) and Drs. Anders LINDSKOG, André Davin PAUL, Urs SCHALTEGGER (U-Pb zircon dates).

She is also interested in providing the biostratigraphy temporal constraint of the GOBE phases in the Ordovician of Precordillera. She developed collaborative studies on different Middle Ordovician microfossils (microbrachiopods and ostracods) together with colleagues Drs. Fernando LAVIE and María José SALAS. Lower-Middle Ordovician conodonts continue to be under study together with Dr. Josefina CARLOROSI, through the new collaborative project about comparison and correlation of the Ordovician conodonts from Argentine Precordillera, Famatina, and Eastern Cordillera. She also has a PhD student (Florencia MORENO), who recently finished a study on microfacies and conodont biostratigraphy of the Lower-Middle Ordovician San Juan Formation from the Central Precordillera.

Ana Mestre

- Laboratorio de Micropaleontología, CIGEOBIO-IIM-Facultad de Ingeniería-UNJS, Libertador San Martín 1109, San Juan-CP 5400, ARGENTINA.
 - E-mail: amestre@unsj.edu.ar
- *****

James F. MILLER (USA). Finishing a report with five co-authors using conodonts, brachiopods, carbon isotopes, and sequence stratigraphy of upper Cambrian and lowest Ordovician strata in western Utah and Nevada, USA. The objective is revision of lithostratigraphic assignment of strata that were poorly studied decades ago using almost no fossil collections. Working with Ray ETHINGTON, John REPETSKI, and Oli LEHNERT on naming and documenting the stratigraphic occurrences of new conodont taxa in the Lower Ordovician of central Texas, USA.

James F. Miller

- Geography, Geology & Planning, Missouri State University, Springfield, 65897 Missouri, USA
 - Telephone 417-882-3383
 - E-mail: jimmiller@missouristate.edu
- *****

Tatiana L. MODZALEVSKAYA (Russia) continues to work on the Upper Ordovician-Silurian-Lower Devonian brachiopods, and stratigraphy and fauna in thematic projects connected with European Arctic Russian regions. Her manuscript on “First Chonetoida from the Lower Devonian of Severnaya Zemlya: morphology and biogeography” will be published in the collected articles devoted to the two jubilees of her colleagues G.A. AFANAS'EVA and L.A. VISKOVA (Paleontological Institute, Moscow) during the year 2022.

Tatiana L. Modzalevskaya

- All-Russian Geological Research Institute (VSEGEI), Department of Stratigraphy and Palaeontology, Sredny pr. 74, St.Petersburg, 199106, RUSSIA
 - E-mail: TModzalevskaya@vsegei.ru (office), t_modz37@mail.ru (home)
- *****

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

Diego F. Muñoz

- Centro de Investigaciones en Ciencias de la Tierra (CICTERRA): CONICET-UNC, Edificio CICTERRA, Av. Vélez Sársfield 1611, 1º Piso of. 19, X5016CGA, Ciudad Universitaria, Córdoba, ARGENTINA
- Telephone: +54 351 535-3800 int. 30227
- E-mail: df.munoz@unc.edu.ar

Navid NAVIDI-IZAD (Iran) continues his work on biostratigraphy and paleobiogeography of the Ordovician palynology of northern Iran and other localities in Europe, North Africa and Asia. He attended the IGCP 653/IGCP 735 virtual annual meeting in September 13-16 that was held in Lille, France, with an abstract entitled “Revision of selected morphotypes of Ordovician acritarchs from northeastern Iran”. Studies in progress are including the taxonomic revision of some Early Ordovician acritarchs, and also a discussion on enigmatic microorganisms with unknown affinities that will be published next year(s).

Navid Navidi-Izad

- Department of Paleontology, Geological Survey of Iran, Tehran, IRAN
- Telephone: +98-919-7718296
- E-mail: n.navidi.izad@ut.ac.ir and navid.geo@gmail.com

Martina NOHEJLOVÁ (Czech Republic) continues her work on Ordovician echinoderms (eocrinoids, solutans) focusing on systematics, palaeoecology, palaeobiogeography and phylogeny. During the last year, she closely collaborated with Bertrand LEFEBVRE on the stylophoran material from the Czech Republic and Morocco (two published papers in the *GSL Special Publications* volume 485). She participated to the online meeting of the IGCP 653 in Lille, with a talk about an exceptionally preserved starfish bed from the Upper Ordovician of the Barrandian area. In November, she joined the IGCP 653/735 Ordovician Workshop. Together with Bertrand LEFEBVRE, Elise NARDIN and Gilles ESCARGUEL she is working on a new project about the biodiversification of Cambro-Ordovician echinoderms.

Martina Nohejlová

- Collections and Material Documentation Department, Czech Geological Survey, Klárov 3, 11821, Praha 1, CZECH REPUBLIC
- Telephone: +420257089431
- E-mail: martina.nohejlova@geology.cz

Leon NORMORE (Australia) continued work on the Ordovician stratigraphy of the Canning Basin in northern Western Australia. The Tremadocian to Floian Nambeet Formation has been subdivided into an upper mudstone dominated Samphire Marsh Member and a lower sandstone dominated Fly Flat Member with petroleum exploration well Olympic 1 as the type section for these new members (Dent *et al.*, 2021). The Olympic 1 intersection of the Nambeet Formation also recommended as a reference section due to better representation of the unit than at the existing type section in Samphire Marsh 1.

Lower – Middle Ordovician stable isotope trends for the Canning Basin have been correlated with the global generalized $\delta^{13}\text{C}$ curve, using the robust geochronology and conodont biostratigraphy framework provided in Olympic 1 (Dent *et al.*, 2021).

Release of the basic well completion report for stratigraphic drillhole Barnicarndy 1 which tested a previously undrilled tectonic unit of the western Canning Basin, resulting in 2100.5 m of core from 580 to 2685 m TD (Normore and Rapaic, 2020). This continuously cored drillhole includes 1730 m of Ordovician strata with two new Ordovician formations defined in this type section; the Barnicarndy Formation above the Nambeet Formation and the Yapukarninjarra Formation below (Normore *et al.*, 2021). Details and data from preliminary geochronological, biostratigraphic and chemostratigraphic analysis undertaken on the Ordovician cored section assisted in definition of the two new formations. Conventional and artificial neural network technology were applied to wireline logs for petrophysical and geochemical interpretation of the Barnicarndy 1 Ordovician section (Wang *et al.*, 2021).

Leon Normore

- Geological Survey and Resource Strategy Division, Department of Mines, Industry Regulation and Safety, 100 Plain Street East Perth WA 6004, AUSTRALIA
- Telephone: +61 8 9222 3326
- E-mail: leon.normore@dmirs.wa.gov.au
- Website: www.dmir.s.wa.gov.au

Olga T. OBUT (Russia) continues working on taxonomy and biostratigraphy of Paleozoic radiolarians and Ordovician conodonts from the western part of the Altai-Sayan Folded Belt (South of West Siberia). She is collaborating with the Laboratory of evolution of paleo-oceans and magmatism of the Novosibirsk State University (Russia) on stratigraphic investigation of Paleozoic sedimentary sequences of the Central Asia regions (Kazakhstan, Uzbekistan, Kirgizia).

Olga T. Obut

- Laboratory of Paleozoic Paleontology and Stratigraphy, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of the Russian Academy of Sciences, Akad. Koptyug av., 3, 630090, Novosibirsk, RUSSIA
- E-mail: obutot@ipgg.sbras.ru

Berkin OKTAY (Turkey) continues his research on acritarchs and chitinozoans of Turkey. He is currently included in a research project dealing with the Late Ordovician biostratigraphy of southeastern Turkey. He is especially interested in presenting Hirnantian–Katian chitinozoans using SEM. In addition palynofacies, palaeoenvironment and thermal maturity of the Ordovician sequences will be significant results in this work. Preliminary results of the

project were presented in 53rd Annual Meeting of the AASP-The Palynological Society Virtual Conference and IGCP 653/IGCP735 Virtual Annual Meeting in 2021.

Berkin Oktay

- Turkish Petroleum Corporation, Research and Development Center, 06530 Çankaya, Ankara, TURKEY
- E-mail: berkin_oktay@hotmail.com; berkino@tpao.gov.tr

Alan OWEN (UK). Considerable progress has been made on the description of the very diverse (40+ species) trilobite fauna of the upper Katian Slade and Redhill Mudstones of South Wales with Lucy McCOBB (National Museum of Wales, Cardiff) and Patrick McDERMOTT. Several other projects on British and Irish Ordovician trilobite faunas are high on the ‘to complete list’.

Alan W. Owen

- School of Geographical & Earth Sciences, University of Glasgow, Molema Building, Lilybank Gardens, Glasgow G12 8QQ, Scotland, U.K.
- E-mail: alan.owen@glasgow.ac.uk

Silvio PERALTA (Argentina) is currently working on the Ordovician–Silurian transition of the San Juan Precordillera, Argentina, as well also on the tectono-sedimentary evolution of the Hirnantian–Silurian basin of Precordillera in Western Argentina. This research is carried out together with Jessica GÓMEZ, by means of a research fellowship of the National Council of Scientific and Technical Research of Argentina (CONICET), with Dr. Matilde BERESI (Advisor) and Dr. Silvio H. PERALTA (Co-Advisor). The main subject of the work is performed on sedimentary, paleobiologic, isotopic and paleoenvironmental events at the Hirnantian–Rhuddanian transition in the San Juan Precordillera of Western Argentina.

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

Silvio is also chair of the Research Project “High-resolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128, Dr. Silvio Peralta)”. He published as co-author, some abstracts at the 8th Latin American Congress of Sedimentology. Parana, Argentina (with

Jessica GÓMEZ and Matilde BERESI); in the Virtual Annual Meeting of IGCP 653; Virtual Annual Meeting of IGCP 735. Lille, Francia (with Jessica GÓMEZ and Mercedes DI PASCUO).

Silvio H. Peralta

- National Council of Scientific and Technical Researches (CONICET), National University of San Juan, Ignacio de la Roza Avenue and Meglioli Street, (5400) Rivadavia-San Juan, ARGENTINA.
- Telephone: 54 264 4149068
- E-mail: speralta@unsj-cuim.edu.ar

Ian PERCIVAL (Australia) has been undertaking considerable effort behind the scenes, in conjunction with the other three hard-working editors of the *Global Synthesis of the Ordovician System* GSL Special Publication, to ensure that this monumental work gains momentum after some initial inertia. We shall all be very proud of this publication in mid-2023 if the enthusiasm shown by many authors is indicative of the final result. He presented a talk on deepwater Ordovician conodonts from New South Wales (with Yong Yi ZHEN) at the online conference of IGCP668 hosted by the University of Tsubuka, Japan in July 2021, and subsequently gave a keynote address on the Ordovician geology of Australia (with Yong Yi ZHEN and Leon NORMORE) at the online conference of IGCP653 & 735 in September 2021, held at the University of Lille, France. In his spare time Ian has been working on a couple of papers with different groups of colleagues that coincidentally described Ordovician faunas from the southern (Wang *et al.* 2021) and northern (Jell *et al.* 2021) extremities of the New England Orogen of eastern Australia.

Ian Percival

- Geological Survey of New South Wales, WB Clarke Geoscience Centre, 947-953 Londonderry Rd, Londonderry NSW 2753, AUSTRALIA
- E-mail: ianpercival1952@gmail.com

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

Sofia Pereira

- Centro de Geociências, Universidade de Coimbra, Rua Sílvio Lima, Univ. Coimbra - Pólo II 3030-790 Coimbra, PORTUGAL
- E-mail: ardi_eu@hotmail.com

Teresa PODHALAŃSKA (Poland) continues her work on Ordovician and Silurian stratigraphy, graptolites, and prospectivity of Lower Palaeozoic unconventional hydrocarbon systems in Poland.

Teresa Podhalańska

- Regional Geology Department, Polish Geological Institute - National Research Institute, 4 Rakowiecka St., 00-975 Warszawa, POLAND
- Telephone: (+48) 22 45 92 258; (+48) 22 45 92 001
- E-mail: teresa.podhalanska@pgi.gov.pl

Alexandre POHL (France). Continues using numerical climate models, guided by geological data, to better understand the climate of the Early Paleozoic. Current work focuses on the co-evolution of marine biodiversity and the physical environment, with special attention given to ocean oxygenation. Recently finished his Marie Curie Fellowship with Andy RIDGWELL at U. California Riverside; now working as a permanent CNRS researcher in France.

Alexandre Pohl

- Biogéosciences, 6 Boulevard Gabriel, 21000 Dijon, FRANCE
- E-mail : alexandre.pohl@u-bourgogne.fr
- Webpage : <https://alexpoohl.github.io/>

Marika POLECHOVA (Czech Republic) continues her work on the Ordovician bivalves focusing on systematics, palaeoecology, palaeobiogeography, and early diversification. She was working on the systematic revision of the Late Ordovician (Sandbian) bivalves from the Czech Republic (*Geobios*) and prepared a new revision of the Lower Ordovician bivalves from the Montagne Noire.

Marika Polechová

- Collections and Material Documentation Department, Czech Geological Survey, Klárov 3, 11821, Praha 1, CZECH REPUBLIC
- Telephone: +420257089478
- E-mail: marika.polechova@geology.cz

Leonid POPOV (United Kingdom) is currently working on the Ordovician brachiopod faunas of Uzbekistan with Irina KIM (Uzbek Geological Survey, Tashkent) and on the rhynchonelliform 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 is awaiting for publication. He is also involved in writing chapters on the Ordovician of Kazakhstan and Ordovician of Central Asia in cooperation with teams of local researchers.

Leonid E. Popov

- Department of Natural Sciences, National Museum of Wales, Cathays Park, Cardiff CF10 3NP, UK.
 - E-mail: lepbarry@yahoo.co.uk
- *****

Brian PRATT (Canada) continued his collaboration with Dong-Jin LEE and Bob ELIAS on what were long thought to be early tabulate corals, in the Lower Ordovician St. George Group of western Newfoundland, identified as *Lichenaria*. Using material from his MSc work in the late 1970s (Pratt and James, 1982) and augmented with more material he collected in 2000, these are revealed not to be corals, so this has up-ended traditional thinking about the origin of the tabulates. We suggest they are calcareous algae.

Graham YOUNG and Brian are describing the Tyndall Stone of Manitoba from the point of view as a famous Canadian dimension stone, but with some geology thrown in. This stone belongs to the Selkirk Member of the Red River Formation and is Late Ordovician (Katian) in age, and is correlative with dolomitic limestones that covered a large part of Laurentia.

Brian would like to draw Ordovician fans to his 2021 paper on a certain kind of wrinkle structure often termed Kinneyia. Although most of the examples he describes are Cambrian, this feature is also found in Ordovician sandstones. He argues that it formed intrastratally, i.e. under a shallow sediment cover, and therefore not a surface sculpture from microbial biomats which has been the accepted explanation for more than two decades. His interpretation is that it is a soft-sediment deformation feature due to low-magnitude earthquakes.

Brian Pratt

- Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan S7N 5E2, CANADA
 - E-mail: brian.pratt@usask.ca
- *****

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 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. In collaboration with Dr. Andrei DRONOV, she continues to study different aspects of microphytoplankton diversity and distribution in the Ordovician of the Siberian Platform (the Moyero River). 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 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.

Elena G. Raevskaia

- A.P. Karpinsky Russian Geological Research Institute, Sredny pr. 74, Saint Petersburg, 199106, RUSSIA
- Telephone: +7 (812) 412-66-67
- E-mail: Elena_Raevskaia@vsegei.ru and: lena.raevskaya@mail.ru

Mike REICH (Germany) recently moved back to northern Germany to start a new position at the State Natural History Museum in Braunschweig, where he is continuing to work on Ordovician and Silurian echinoderms (Holothuroidea, Ophiocistioidea, Cyclocystoidea, Echinoidea). A number of collaborative projects are in progress or finished including 1) Ordovician echinoids (with Jeffrey THOMPSON et al.); 2) Darriwilian and Katian sea cucumbers (with Manfred KUTSCHER); 3) Ordovician/Silurian cyclocystoids (with Timothy EWIN et al.); and 4) echinoderms in Llandovery/Wenlock biota of Estonia (with Linda HINTS, Sergey ROZHNOV et al.).

Mike Reich

- Staatliches Naturhistorisches Museum Braunschweig, Gaußstr. 22, D-38106 Braunschweig, GERMANY
 - Telephone: +49 (531) 1225-3001
 - E-mail: m.reich@3landesmuseen.de, and: mike.reich@lmu.de
- *****

John E. REPETSKI (USA) currently continues to work on conodonts and biostratigraphy of late Cambrian and Ordovician conodonts and biostratigraphy of North America and elsewhere, especially currently with trilobite colleagues J.F. TAYLOR and J.D. LOCH. Also, histological and morphological studies with colleagues D. MURDOCK and P. SMITH. Continuing work on conodonts from some impact structures, and conodont-based stratigraphic support for several USGS mapping projects. Recently, with colleagues Julie DUMOULIN (USGS-Anchorage) and Justin STRAUSS (Dartmouth College), we have written the chapter on 'Ordovician Rocks of Alaska' for the forthcoming *Geol. Soc. London* volume on Ordovician of the World.

Personal items of interest: Currently working at home because of pandemic, therefore processing lab, library facilities, etc. at USGS are not accessible at this time. With luck, this situation will improve during 2022.

John E. Repetski

- Geological Survey, Florence Bascom Geoscience Center, MS 926A National Center, Reston, VIRGINIA 20192, USA
 - 2600 Hickory Hollow Lane Oakton, VIRGINIA 22124, USA
 - Telephone: +1 703 648 5486 (office), +1 703-938-8879 (home)
 - E-mail: jrepetski@usgs.gov (office), jrepetski@cox.net (home)
- *****

Sara ROMERO (Spain). In September 2021, she started a PhD on the Middle and Upper Ordovician trilobites from the Iberian Range of NE Spain, mostly dealing with trilobite assemblages adapted to siliciclastic inshore environments (Villar del Salz, San Marcos, Bronchales and Orea formations in the Castilian branch; Castillejo and Fombuena formations of the Aragonese branch). A first study on the lower Sandbian trilobites from the Aragoncillo inlier was published with Juan Carlos GUTIÉRREZ-MARCO and is freely available at [https://sge.usal.es/archivos/REV/34\(2\)/RSGE34\(2\)_p_71_89.pdf](https://sge.usal.es/archivos/REV/34(2)/RSGE34(2)_p_71_89.pdf)

Sara Romero

- Departamento de Geodinámica, Estratigrafía y Paleontología, Facultad de Ciencias Geológicas, Universidad Complutense de Madrid, José Antonio Novais 12, 28040 Madrid, SPAIN
 - Telephone: 0034 689274108
 - E-mail: sarome01@ucm.es
- *****

Sergey ROZHNOV (Russia) is currently working on the description of new crinoids and a very unusual diploporitan from the Middle Ordovician of the Leningrad region. He is finishing articles on new cornutes and mitrates from the Volkovian regional stage and a new genus of pleurocystid rhombiferan from the Early Ordovician of the Leningrad Region. With his student Andrey KRUTYKH, they began processing lithistid and tetractinomorphic sponges (class Demospongea) from the Leningrad Region.

Sergey V. Rozhnov

- Borissiak Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya 123, Moscow, 117647, RUSSIA
 - Telephone: +7 (495) 339 98 88
 - Fax: +7 (495) 339 12 66
 - E-mail: Rozhnov@paleo.ru
- *****

Farid SALEH (China) continued investigations on the Fezouata Shale (Lower Ordovician, Morocco). He continues to work in close collaboration with the University of Lyon, the University of Lausanne, the University of Exeter, the University of Brest, the Sorbonne University, the University of Saskatchewan, and the University of Cadi Ayyad. Saleh *et al.* investigated body size variations in Fezouata Shale trilobites. Moreover, they were able to show that Fe had a continental origin in the Fezouata Shale, and was transported to the basin by rivers. This finding highlights that paleo-continental weathering facilitated the preservation of the diverse Fezouata Shale assemblage through pyrite precipitation, or by inducing bacterial membrane damage under oxic conditions. Saleh *et al.* also compared the preservation potential of the Fezouata Shale to the Walcott Quarry (Cambrian, Canada), and they showed that the Fezouata Shale better preserved the nektonic/planktonic community. They also published a review paper on the Fezouata Shale.

Farid Saleh

- Yunnan Key Laboratory for Palaeobiology, Institute of Palaeontology, Yunnan University, Chenggong Campus, Kunming 650504, Yunnan Province, CHINA
 - E-mail: farid.nassim.saleh@gmail.com
- *****

Matthew SALTZMAN (USA) is working on stable and radiogenic isotope studies in the Ordovician. Work was completed this year on a *Geology* paper first-authored by my PhD student Chris CONWELL on Nd isotope stratigraphy and cooling in the mid-Darriwilian (in press for 2022). My PhD student Teresa's work on Ordovician Sr and O isotopes (with Michael JOACHIMSKI) from the Arbuckle Mtns of Oklahoma has been submitted. PhD student Datu continues to collaborate on a Li isotope study in the Ordovician with Xiaoming LIU at UNC-Chapel Hill. We are also beginning Ca isotope work in the TIMS lab run by Liz GRIFFITH at Ohio State, and Datu analyzed some samples from Meiklejohn Peak, NV. The Ca work is focused on diagenetic versus global carbon cycle controls on the MDICE.

Matthew R. Saltzman

- School of Earth Sciences, 125 South Oval Mall, Ohio State University, Columbus OH 43210-1398, USA
 - Telephone: 614-292-0481
 - E-mail: saltzman.11@osu.edu
- *****

Birger SCHMITZ (Sweden). His research focuses on the terrestrial consequences of the breakup of the L-chondrite parent body in the asteroid belt at 466 Myrs ago. One aim is to locate in the strata at different sites the precise horizon where the first dust from the breakup is recorded. This will make it possible to establish whether the breakup triggered any major climatic, biotic or eustatic changes on Earth. There is also evidence in Earth's impact crater record of an asteroid shower to Earth following the breakup of L-chondrite parent body. The goal is to try to date more craters at a higher resolution to provide further insights on this.

Birger Schmitz,

- Astrogeobiology Laboratory, Department of Physics, Lund University, Lund, SWEDEN.
 - Telephone: +46-768-560140
 - E-mail: birger.schmitz@nuclear.lu.se
- *****

Nikolay V. SENNIKOV (Russia) continues working in the field of paleontology, biostratigraphy and paleogeography of Cambrian, Ordovician and Silurian sedimentary formations of various regions of Siberia, including the Russian Arctic islands, with special attention to reefal carbonate sediments.

The main area of his interests in paleontology are graptolites, which in recent years he studied together with Elena V. LYKOVA. Along with graptolites not long ago he started investigation in details of pterobranchia, algae and ichnofossils from the Lower Paleozoic. In collaboration with Olga T. OBUT, they study zonal stratigraphy of Ordovician conodonts, and together with Raliay A. KHABIBULINA, Ordovician–Silurian corals of the Altai-Sayan folded area.

In November 2021, they ran the All-Russian Memorial Colloquium "Paleozoic Zonal and Basin Stratigraphy, Micropaleontology and Paleogeography of Siberia" at the Institute of Petroleum Geology and Geophysics SB RAS, dedicated to the 110th anniversary of Alexander M. OBUT and the 85th anniversary of Alexander V. KANYGIN. Professors Aleksander M. OBUT and Aleksander V. KANYGIN were outstanding Russian paleontologists and biostratigraphers, whose research was connected with Ordovician of various geological regions of Russia.

Nikolay V. Sennikov

- Laboratory of Paleozoic Paleontology and Stratigraphy, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of the Russian Academy of Sciences, Akad. Koptyug av., 3, 630090, Novosibirsk, RUSSIA
 - Novosibirsk State University, Pirogova st., 1, Novosibirsk, 630090, RUSSIA
 - E-mail: sennikovnv@ipgg.sbras.ru
- *****

Thomas SERVAIS (France) continues working on Ordovician palynology, mainly on acritarchs (most of them are organic-walled phytoplankton), including the taxonomic revision of members of this informal group. In the context of the research on the oldest 'spores' and thus the first possible fossil record of land plants, an investigation of the acritarch taxa *Virgatasporites* and *Attritasporites* has been started, in collaboration with Navid NAVIDI-IZAD (Tehran, Iran) and Houcine BENACHOUR (Tlemcen, Algeria). Analyses of biodiversity, palaeogeography and palaeoecology of the GOBE continue with David A.T. HARPER (Durham, UK), Borja CASCALES-MIÑANA (Lille) and other colleagues. Regional studies are focused on the Ordovician of Belgium, Germany and France, with re-investigations of brachiopods (with Bernard MOTTEQUIN, Brussels, Belgium, Yves CANDELA, Edinburgh, Scotland, and David HARPER), trilobites (with Lukas LAIBL, Prague, Czech Republic) and other faunas. International collaboration continues with LIANG Yan, LI Jun, SHAN Longlong (who is currently staying during 12 months at Lille), YAN Kui, and ZHANG Yuandong (Nanjing, China) and with WANG Wenhui (Changsha, China), and others.

Thomas Servais

- UMR 8198 EVO ECO PALEO – Evolution, Ecologie et Paléontologie, CNRS - Université de Lille – Sciences et Technologies, Bâtiment SN5, F-59655 Villeneuve d'Ascq Cedex, FRANCE
 - Telephone: +33 (0)3 20 33 72 20
 - E-mail: thomas.servais@univ-lille.fr
- *****

Husain SHABBAR (India) received his PhD in Geology in December 2021; the title of the thesis was “Palaeobiodiversity of Ordovician-Silurian Periods of Spiti Basin, Himachal Pradesh, North-Western Himalaya, India: Palaeoclimatic and Palaeoecological Implications” supervised by Prof. Shreerup GOSWAMI, Head, Department of Earth Sciences, Sambalpur University and Dr (Mrs) Anju SAXENA, Scientist “E”, Gondwana Palaeobiology Lab, Birbal Sahni Institute of Palaeosciences (BSIP), India.

His doctorate work involved probing for evidence of early terrestrialisation of plants, undertaking the macrofossils and microfossils studies of the Ordovician–Silurian flora and fauna and their comparisons with the known floras and faunas of contemporaneous sequences in other parts of the world and reconstructing the palaeobiodiversity, evolutionary perspective and palaeoenvironmental changes of the area during the Ordovician–Silurian periods. He documented and described single taxa of gastropod and several species of brachiopods, tentaculitoids, calcareous marine macroalgae, cryptospores, acritarchs, chitinozoans, and melanosclerites for the first time from the Ordovician sediments of Tethyan Himalaya, India. The discovery of cryptospores, phytodebris-, tracheid- and cuticle-like sheets erected India as a new site, after Saudi Arabia, the Czech Republic and Argentina, yielding Middle Ordovician

signatures of early land plants. Furthermore, India has now become a new low-latitudinal Gondwanan site after the Canning Basin of Australia to contain the earliest chitinozoans. Husain has also erected two new species and one new genus of Ordovician marine macroalgae. His doctorate work also resolved the long-debated lower age limit of the Takche Formation and delineated the putative boundary between Ordovician and Silurian strata exposed in the Spiti, Tethyan Himalaya.

He is presently working as Principal Investigator in Gondwana Palaeobiology Lab at BSIP for a project funded by the Paleontological Society, USA. The main objective of the project is to reassess the biological affinity of the problematic and most debatable carbonaceous club-shaped impressions reported from the Ordovician of Spiti, Tethyan Himalaya. He is also working on palynostratigraphy of the Carboniferous strata of Spiti, Tethys Himalaya, India with Dr (Mrs) Anju SAXENA of BSIP.

He is actively seeking research scientist/postdoctoral position in Early-Middle Palaeozoic palaeontology and palynology or related fields. So please get in touch with him if you have any position.

Husain Shabbar

- Gondwana Palaeobiology Lab, Birbal Sahni Institute of Palaeosciences, INDIA
 - E-mail: shabbarnaqvi92@gmail.com
- *****

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

Matthias Sinnesael

- IMCCE Institut de Mecanique Celeste et de Calcul des Ephemerides, CNRS UMR 8028 - Observatoire de Paris, 77 avenue Denfert Rochereau, 75014 Paris, FRANCE
 - E-mail: matthias.sinnesael@obspm.fr
 - Website: <https://masinnes.wixsite.com/mattiassinnesael>
- *****

Patrick Mark SMITH (Australia) continued working on the Ordovician biostratigraphy in New South Wales and the Northern Territory in Australia. During 2021 Patrick was highly active doing fieldwork, participating in two fieldtrips to remote desert locations in Australia's outback. One trip explored near Broken Hill, New South Wales visiting the Ordovician sequences around Mutawintji National Park (and the surrounding nature reserves) with Yong Yi ZHEN and Peter JELL. The other visiting the Ordovician sequences in the Amadeus Basin, central Australia. Both trips proved to be highly productive, with large numbers of trilobite specimens collected. Some of these Patrick described during 2021 in a publication with John Laurie (of Geoscience Australia) on the Middle Ordovician Stairway Sandstone and Stokes Siltstone. This included two new genera and five new species; the stand out being the giant taxon, *Lycophron titan*, which is the largest trilobite so far documented from Australia and possibly the third largest trilobite in the world. Patrick also continues to work on projects revolving around various aspects of conodont and trilobite biostratigraphy of the Tremadocian, Darriwilian, and Katian of Western Australia, Northern Territory and New South Wales; including papers on the Nambeet Formation, Florina Formation, Nootumbulla Sandstone, Bynguano Quartzite, Scopes Range Formation, Rowena Formation and Gunningbland Formation. This is in concert with Heidi ALLEN of the Western Australian Geological Survey as well as Yong Yi ZHEN and Ian PERCIVAL of the New South Wales Geological Survey. Outside of his main biostratigraphic work Patrick also co-authored a publication on unusual trilobite malformations in Middle Ordovician trilobites from Wales, United Kingdom, with assistance from Russell BICKNELL at the University of New England, Armidale, Australia.

Patrick Mark Smith

- Australian Museum, Palaeontology collection, 1 William Street Sydney, NSW 2010.
AUSTRALIA
- Telephone: +61 2 9320 6132
- E-mail: Patrick.Smith@australian.museum

Erik SPERLING (USA) is continuing to work on environmental change during the early Paleozoic and how such changes affected animal life in the oceans. In 2021 we finished a detailed sedimentary geochemical study of the upper Cambrian-Middle Devonian Road River Group, a spectacular deep-water stratigraphic succession that we studied on the Peel River, Yukon, Canada. The study found that bottom waters in the Ordovician through early Devonian were commonly anoxic, and were characterized by non-sulfidic conditions; there was a distinct change towards increased euxinia in the Devonian, coeval with the spread of land plants. We did not observe a local redox change through the main pulses of the Ordovician radiation. This paper was published in *Science Advances* in collaboration with Justin STRAUSS (Dartmouth), Tiffani FRASER (YGS), and Michael MELCHIN (St. Francis Xavier). We are also working to measure and model both carbonate and shale uranium isotopes through the Ordovician radiation; this is a collaborative effort including many people and with the U isotope measurements being conducted with Noah PLANAVSKY (Yale). With respect to biotic response, we have been working to understand the ecophysiological impacts of lower atmospheric oxygen. A paper by graduate student Richard STOCKEY (Stanford), published in the journal PNAS, investigated the biological effects of low oxygen in the early Paleozoic. Using a combination of Earth system and ecophysiological models, the paper demonstrated that moderate temperature increases would have had a much more devastating impact on marine communities than during the later Paleozoic or Mesozoic when

oxygen levels were higher. This suggests that lower oxygen levels in the early Paleozoic could have been the cause of high early Paleozoic extinction rates recorded in the fossil record. Looking forward, my lab is further interested in exploring the impact of early land plants on the Earth system, and planning fieldwork in the McCann Hill Chert on the Alaska/Yukon border and on Bathurst Island, Nunavut, Canada.

Erik A. Sperling

- Department of Geological Sciences, Stanford University, 450 Jane Stanford Way, Building 320, Stanford, CA, 94305, USA
 - E-mail: esper@stanford.edu
- *****

Colin D. SPROAT (Canada) continues his work studying the evolution of Ordovician brachiopods, currently focusing on the early Atypidae. Although not as common as some of the other brachiopods that evolved during the GOBE, several evolutionary innovations first show up in this lineage such as early spiralia. He and one of his students have also branched off to study late Cambrian linguliformean brachiopods from the Rocky Mountains in western North America. He has also done some recent fieldwork taking another look at the Devonian brachiopods in Manitoba (western Canada), including the unusual giant *Stringocephalus* found there. As the world opens up again, he looks forward to continuing his work with colleagues in Nanjing studying a paleobiogeographically significant shallow-water brachiopod fauna that stretched across the plates that now comprise China and much of central Asia.

Colin D. Sproat

- Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, Saskatchewan, S7N 5E2, CANADA
 - Telephone: 1-306-966-5705
 - E-mail: c.sproat@usask.ca
- *****

Sarah STEWART (UK). At the moment, she is concentrating on collating data from the NMS fossil mollusc collection (including a large collection of Scottish Carboniferous and also Tertiary material from the Paris Basin and Italy) for inputting into the museum database, along with graptolites and the palaeontology thin section collection. She is also researching the history of some of these collections, particularly those acquired in the 1800's.

Sarah Stewart

- Department of Natural Sciences, National Museums Scotland, Chambers Street, Edinburgh EH1 1JF, Scotland, U.K.
 - Telephone: +44 (0)131 247 4218
 - E-mail: sarah.stewart@nms.ac.uk
- *****

Alycia L. STIGALL (USA) has been working on Ordovician projects in a variety of contexts from wrapping up the IGCP 653 project, ISOS initiatives, and continuing to examine feedback loops between biogeography, diversity, and paleoecology (mostly) in the Ordovician of Laurentia using articulated brachiopods. With her students, she currently has field projects ongoing in the Arbuckle Mountains of Oklahoma and Cincinnati Arch region along with lab-based ecological niche modelling work. They published a paper (Purcell & Stigall, 2021) in *Palaeogeography*, *Palaeoclimatology*, *Palaeoecology* that explores how biogeographic patterns impact speciation patterns during the Late Ordovician. Alycia is currently working on a synthesis of her work on the Richmondian Invasion from the past 15 so years. She is relocating to the University of Tennessee over the summer of 2022 and look forward to exploring the local Ordovician geology of eastern Tennessee.

Alycia Stigall

- Department of Geological Sciences and OHIO Center for Ecology and Evolutionary Studies, Ohio University, Athens, Ohio 45701, USA
 - After August 1st, 2022: Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, Tennessee, USA. Email TBD
 - E-mail: stigall@ohio.edu (until July 31st, 2022)
- *****

Svend STOUGE (Denmark) is continuing working on Cambrian and Ordovician conodonts from Baltica, Laurentia (Newfoundland and Greenland) and China. Currently working on integration of Cambrian conodont and trilobite zonations (with Arne T. NIELSEN). Also, a project on Svalbard conodonts is in progress based on own and older collections.

Svend has changed office with a location in the Botanical Garden, which is rather nice, but the contact e-mail addresses remain the same.

Svend Stouge

- Natural History Museum, University of Copenhagen, DK 1350 Copenhagen, DENMARK
 - Telephone: +45 31316264
 - E-mail: svends@smn.ku.dk and: svend.stouge@gmail.com
- *****

Justin STRAUSS (USA) is continuing to work on the Ordovician of Alaska and northern Canada. In 2021, he and colleagues published papers in *Science Advances* and *Geobiology* on geochemical data from the Road River Group of Yukon, Canada. He and his colleagues are currently working on ~4-5 more papers that explore this spectacular deep-marine succession. In addition, Justin' 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, and Justin and colleagues have a paper in review about the Ordovician Fire Bay Formation of Ellesmere Island, Canada. Finally, Justin is also continuing a >10-year old project studying the Cambrian–Ordovician faunas of the Brooks Range and Jones Ridge regions of Alaska with John TAYLOR (IUP) and John REPETSKI (USGS), which is slowly making progress towards publication.

Justin V. Strauss

- Department of Earth Sciences, Dartmouth College, HB6105 Fairchild Hall, Hanover, NH 03755, USA
 - Telephone: (603) 646-6954
 - E-mail: justin.v.strauss@dartmouth.edu
- *****

Paul K. STROTHER (USA) continues to work on the discovery and systematics of cryptospores and other marine and non-marine palynology of the lower Paleozoic. In 2021 he teamed up with Clinton FOSTER (Australian National University) to describe a Tremadocian cryptospore assemblage from the Canning Basin, West Australia. This work is primarily concerned with documenting the fossil record of land plant origins as evidenced in the palynological record. Collaborations with Marco VECOLI (Saudi Arabia) and others continue with work on non-marine palynology of the late Ordovician, including systematics and taxonomy of the Euglenophyceae. But ongoing collaborations with neontologists should help to shed light on the evolution of plant developmental systems that took place throughout the entirety of the Ordovician Period.

Paul K. Strother

- Department of Earth & Environmental Sciences, Boston College Weston Observatory, Weston MA 02493, USA
 - Telephone: +1 617 552 8395
 - E-mail: strother@bc.edu
- *****

John TAYLOR (USA) remained, as predicted in the last issue of *Ordovician News*, mired in work on Cambrian faunas throughout 2021. He did, however, free up a small amount of time in recent months to resume work on uppermost Furongian and Early Ordovician trilobite faunas from several areas of North America. He is optimistic that considerably more time can be devoted to the description of some of the Ordovician faunas from the Laurentian Skullrockian and Stairsian Stages later this year. Collaboration with fellow “Ordoviciophiles” John REPETSKI, James LOCH, Paul MYROW, Rob RIPPERDAN, and Justin STRAUSS on various projects continues.

John F. Taylor

- Geoscience Department, Indiana, PA 15705, USA
 - Telephone: (724) 397-2040
 - E-mail: jftaylor@iup.edu
- *****

James R. THOMKA (USA) continued research on stalked echinoderms, ichnofossils, and high-resolution cratonic sequence stratigraphy. Although 2021 was a productive year, most of my effort was directed toward finishing up various Silurian projects. Nevertheless, progress was made on several Ordovician initiatives. My student Parker LECLAIR and I have been working on the stratigraphy of the type Chazyan North American regional stage (Darriwilian-Sandbian), including development of a high-resolution magnetic susceptibility dataset for a rhythmic inter-mound succession. Another student, Alex MERCIER, has been working on

sea-level and magnetic susceptibility fluctuations spanning the Ordovician-Silurian boundary. I was part of a team investigating phosphatization of Ordovician crinoid material and how this can enhance understanding of the distribution of connective tissues in ancient pelmatozoans. Research is beginning on the diversity of echinoderm attachment structures on Chazyan carbonate buildups in Lake Champlain, as well as the microstratigraphy of crinoid ossicle occurrence in some Upper Ordovician claystones known as ‘butter shales.’

A review of parasitism of crinoids and other stalked echinoderms was published in 2021, co-authored with Carlton E. BRETT (University of Cincinnati). Emphasis was placed on parasitic pits developed in echinoderm endoskeletons (the ichnogenus *Tremichnus*) and platyceratid gastropods attached to echinoderm hosts. The oldest examples of both of these forms of biotic interactions are from the Ordovician and are discussed in the context of coevolution and evolutionary paleoecology. Numerous other examples of Ordovician parasitized pelmatozoans are used to document the history of symbiotic associations involving echinoderms.

James R. Thomka

- Center for Earth and Environmental Science, State University of New York at Plattsburgh, Plattsburgh, New York 12901, USA
 - Telephone: +1-630-935-2983
 - E-mail: jthom059@plattsburgh.edu
- *****

Oive TINN (Estonia) continues working on diverse fossils from the Ordovician and Silurian times.

Oive Tinn

- Department of Geology, Institute of Ecology and Earth Sciences, University of Tartu, 14A Ravila Street, Tartu 50411, ESTONIA
 - Telephone: +372 53331556
 - E-mail: Oive.Tinn@ut.ee
- *****

Tatiana TOLMACHEVA (Russia) tries to share official duties with conodont studies, and she continues investigation of Ordovician conodonts from the Siberian Platform under the project of the Russian Science Foundation with Andrei DRONOV on the uppermost Cambrian and Ordovician of the Moyero River in the Siberian Platform. The study focuses on taxonomic description, since the fauna of Siberia is very exotic. The Ordovician of Kazakhstan also continues to be the object of studies together with colleagues from the Geological Institute of the Russian Academy of Sciences (Kirill DEGRIAREV, Andrei TRETYAKOV).

Tatiana Tolmacheva

- A.P. Karpinsky Russian Geological Research Institute, Sredny pr. 74, 199106 Saint Petersburg, RUSSIA
 - Telephone: 7 (812) 3213022
 - E-mail: tatiana_tolmacheva@vsegei.ru
- *****

Petra TONAROVÁ (Czech Republic) is continuing in a study on Late Ordovician microfossils (especially scolecodonts and chitinozoans) from the Prague Basin. This research will be followed up by a detailed geochemical study of the section. She also works on the Ordovician/Silurian microfossil collections from Baltoscandia. The focus is paid to a new insight into the taxonomy, palaeobiogeography and diversification history of Palaeozoic jaw-bearing polychaetes. She collaborates with colleagues from the Tallinn University of Technology (Olle HINTS, Jaak NÖLVAK).

Petra Tonarová

- Czech Geological Survey, Geologická 6, 152 00 Prague 5, CZECH REPUBLIC
 - E-mail: petra.tonarova@geology.cz
- *****

Ursula TOOM (Estonia) continues studies on the bioerosion on Baltica in collaboration with Olev VINN, Dirk KNAUST, Andrei DRONOV, Mark A. WILSON and Anderi ERNST. Position of Chief Curator in Tallinn University of Technology offers various opportunities for cooperation. Joint studies together with colleagues from Estonia, Finland, Germany, Norway, Russia, China, Korea, U.K., USA, Poland, Sweden and Kazakhstan on evolution and taxonomy of the Early Palaeozoic faunas are going on. Under leadership of Professor Christopher R. C. PAUL studies of Baltic cystoids are in progress. In 2022 she is starting her postdoctoral studies in Krakow, under supervising Professor Alfred UCHMAN.

Ursula Toom

- Department of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn,
 - ESTONIA
 - Telephone: +372 5623 0497
 - E-mail: ursula.toom@taltech.ee
- *****

Blanca Azucena TORO (Argentina) is actively working on Early Paleozoic graptolites from western Argentina. Continues the training of PhD and postdoctoral students, and currently conducts two multidisciplinary projects recently approved by the Argentine Council for Research and Technology (PIP-CONICET) and the Argentine Agency for Promotion of Science and Technology (PICT-ANPCyT). One of these projects is mainly related to biostratigraphic correlations and paleobiogeography based on different fossils (graptolites, palynomorphs, conodonts, brachiopods and trace fossils) from northwestern Argentina, and involves colleagues from diverse Argentine universities. A second project is focused to evaluate novel results of pioneering graptolite research applications for Northwestern and Precordillera Argentina, as reflectance, paleoecology, and diversity, in comparison with independent results coming from a multidisciplinary group of colleagues from Argentina and other countries.

Blanca Azucena Toro

- Centro de Investigaciones en Ciencias de la Tierra (CICTERRA), CONICET-Universidad Nacional de Córdoba, Av. Vélez Sarsfield 1611, X5016GCA. Ciudad Universitaria, Córdoba, ARGENTINA.
- Telephone: 54-351-535800 (office code 30220)
- E-mail: btorogr@mendoza-conicet.gov.ar, and: blancatoro@gmail.edu.ar (new)

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 focussing on geochemistry and palynology of the Upper Ordovician - lower Silurian in N. America (in collaboration with Poul EMSBO, USGS; Patrick McLAUGHLIN, IGS 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 at IGS and Poul EMSBO at USGS). 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. Other students in the lab work in Silurian and Triassic/Jurassic projects. Follow the lab on: instragram @paleo_ugent

Thijs R.A. Vandenbroucke

- Department of Geology, Ghent University, Krijgslaan 281, Building S8, B-9000 Ghent, BELGIUM
 - Telephone: +32 (0)9 264 45 15
 - E-mail: Thijs.Vandenbroucke@UGent.be
 - Website: www.earthweb.UGent.be
- *****

Peter VAN ROY (Belgium) remains focused on early metazoan evolution in general, and panarthropod origins, relationships and biology in particular. In addition to several smaller projects, his main areas of activity are the Early Ordovician Fezouata and Late Ordovician Tafilalt Biotas of Morocco, and exceptionally preserved faunas from the Bohemian Ordovician. 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; in collaboration with Štěpán RAK, Petr BUDIL and Oldřich FATKA, a manuscript dealing with the redescription of *Triopius draboviensis* is currently in press. Together with Lorenzo LUSTRÌ, Pierre GUERIAU and Allison DALEY, he also co-authored the description of a new basal chelicerate from the Fezouata Biota which is presently also in review. Another collaboration with Bertrand LEFEBVRE, Samuel ZAMORA, Juan Carlos GUTIÉRREZ-MARCO and Martina NOHEJLOVÁ resulted in a review of the Tafilalt Biota, which was recently accepted for publication. A paper dealing with two thylacocephalans from the Upper Ordovician of Bohemia with Štěpán RAK, Petr BUDIL and Oldřich FATKA as co-authors was published in 2021.

Peter Van Roy

- Department of Geology, Ghent University, Krijgslaan 281, Building S8, B-9000 Ghent, BELGIUM
 - Telephone: +32 497 42 73 05
 - E-mail: peter.vanroy@ugent.be
- *****

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

Jacques Verniers

- Department of Geology, Ghent University, Krijgslaan 281, Building S8, B-9000 Ghent, BELGIUM
- E-mail: Jacques.Verniers@Ugent.be

Olev VENN (Estonia) is working on the evolution of symbiosis, predation, bioerosion and encrustation in the Ordovician. He is also working on the palaeontology of problematic tubeworms from the Palaeozoic (e.g. cornulitids, tentaculitids, microconchids, *Sphenothonallus* etc.) and evolution of tubeworm biomimeticization. His other research interests include trace fossils of the Ordovician of Estonia and beyond. Since October 2021, he is editor of the *Journal of Paleontology*, so all your papers on the Ordovician paleontology are very welcome at the journal.

Olev Vinn

- Department of Geology, University of Tartu Ravila 14A, 50411 Tartu, ESTONIA
- E-mail: olev.vinn@ut.ee

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

Gustavo G. Voldman

- Centro de Investigaciones en Ciencias de la Tierra, Av. Vélez Sarsfield 1611, Córdoba X5016GCA, ARGENTINA
- E-mail: gvoldman@unc.edu.ar

Beatriz G. WAISFELD (Argentina) continues work on Lower Paleozoic trilobites from the Central Andean Basin mainly focused on taxonomy, biostratigraphy, and paleoecology. She is involved in a long-term study of Late Cambrian – Early Ordovician diversification patterns and ecosystems structure in Northwest Argentina together with Argentine colleagues studying different invertebrate groups. A joint international cooperation programme with colleagues from the University of Lille and the Centro de Investigaciones en Ciencias de la Tierra (CICTERA, National University of Córdoba) will end in 2022. It involves the study of trilobite taxonomic diversity and morphological disparity in the context of the Ordovician Radiation and the Middle Paleozoic Marine Revolution. A similar project is now funded by the National Council for Scientific and Technological Research (CONICET). She is also studying, along with Juan Carlos GUTIÉRREZ-MARCO (Spain) and Emilio

VACCARI (CICTERA), a Floian to Darriwilian trilobite fauna from southwest Perú with interesting links with that of the northwest of Argentina. As well, joint studies on trilobites and associated trace fossil in late Cambrian – Early Ordovician marginal-marine settings from NW Argentina go on with Gabriela MÁNGANO and Luis BUATOIS.

Beatriz G. Waisfeld

- Centro de Investigaciones en Ciencias de la Tierra (CICTERA), CONICET-Universidad Nacional de Córdoba, Av. Vélez Sarsfield 1611, Edificio CICTERA, Ciudad Universitaria, Córdoba, X5016GCA, ARGENTINA
- Telephone: 54-351-535800
- E-mail: bwaisfeld@unc.edu.ar

Guangxu WANG (China). Three Ordovician papers (two on Late Ordovician corals from eastern Australia and Tarim and one on Ordovician stratigraphy of the western Yangtze region, South China) were published in collaboration with colleagues in 2021. He is currently working on monographs of the Ordovician-Silurian boundary rugosans and Llandovery (early Silurian) cystiphyllid corals in South China.

Wang Guangxu

- State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (CAS), 39 East Beijing Road, Nanjing 210008 CHINA
- Telephone: +86-25-83282129
- E-mail: gxwang@nigpas.ac.cn

Wenhui WANG (China). In the past year (2021), Wenhui WANG and her student have been involved in graptolite and palynological studies around the Ordovician–Silurian boundary (OSB).

She and her students collected OSB graptolites in the northern margin of the Yangtze Platform in Hubei Province in hope of building the biozonal framework. She and her colleagues used computational fluid dynamics (CFD) analysis to study unique structures of one chitinozoan genus and found that the formation of the carina might have improved the hydrodynamic properties and floating ability of the vesicle by dispersal in different hydrodynamic regimes. This work adds to the understanding of the biological affinity of the cryptic organisms. They will focus on all the chitinozoan genera in the next step. Her student studied OSB melanosclerites from Estonia and add new information to the knowledge of Ordovician radiation. She and her student are also interested in finding the relationships of volcanic events with the climate and LOME. High-resolution measurements of mercury (Hg) concentrations and redox sensitive elements analysis were conducted in the strata of Ordovician-Silurian age which is interbedded by volcanic ash layers in South China. These works will help to further understand the triggering mechanism of LOME.

Wenhui WANG

- School of Geosciences and Info-Physics, Central South University, Changsha, CHINA
- Telephone: +86 13951830656
- E-mail: wwhever@126.com

Xiaofeng WANG (China). In the past year, 2021, his Ordovician group composed of six colleagues from China, Denmark and Germany continued to summarize the comprehensive research results concerning the global high-precision Ordovician division and correlative signals for the lower boundary of the Ordovician System, and both taxonomy and biostratigraphy of Tremadocian graptolites. A monograph entitled "The New Global Auxiliary Boundary Stratotype section and point (ASSP): the Xiaoyangqiao section in Northern China", supported by National Publishing Foundation, will be published by Hubei Science and Technology Press in early 2022. He also devoted his time to the conservation of rare geological relics and the scientific popularization of stratigraphy and paleontology, leading to publication of the books "Hubei Paleontology", "Hubei Fossils" and "Precise and rare fossil group in Hubei Province, China".

Xiaofeng Wang

- Wuhan Center of China Geological Survey (Wuhan Institute of Geology & Mineral Resources), Wuhan, CHINA
 - E-mail: ycwangxiaofeng@163.com
- *****

Xin WEI (China) is a postdoctoral scholar (2020–2022) at Peking University in collaboration with Prof. LIU Jianbo. Xin is interested in the macroevolution, taxonomy, palaeoecology and biogeography of Ordovician trilobites, especially two major bioevents, *i.e.*, the Great Ordovician Biodiversification Event and end-Ordovician mass extinction. Now he is working on the Middle-Upper Ordovician trilobites of South China, together with Prof. LIU Jianbo (Peking University), Prof. ZHAN Renbin (NIGPAS), Prof. ZHOU Zhiqiang (Xi'an Institute of Geology and Mineral Resources) and Associate Professor WANG Guangxu (NIGPAS). Recently, with his collaborators, he collected abundant trilobite samples from the Shihtien Fm. (Middle Ordovician) and Pupiao Fm. (Upper Ordovician) in Baoshan, western Yunnan of China (Sibumasu Terrane), which will be investigated in the near future.

Xin WEI

- School of Earth and Space Sciences, Peking University, Beijing 100871, P. R. CHINA
 - E-mail: xwei@pku.edu.cn and: xwei@nigpas.ac.cn
- *****

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

Charles Wellman

- School of Biosciences, University of Sheffield, Alfred Denny Building, Western Bank, Sheffield S10 2TN, UK
 - Telephone: 0114 222 3689
 - E-mail: c.wellman@sheffield.ac.uk
- *****

Kui YAN (China) still focused on the Ordovician acritarchs in China last year. He also started to work on Late Cambrian to Early Ordovician acritarchs from North China. In June, his colleagues and he went to North Hebei and Liaoning for field trip. They visited several Furongian (Cambrian) to Lower Ordovician sections and collected samples for acritarchs and conodonts. Last September, their group went to Shandong to visit Cambrian sections. In the same year, he attended the online meeting for the end of IGCP 653 and the beginning of IGCP 735. Last December, his student Longlong SHAN went to Lille for his one year collaboration with Thomas SERVAIS.

Yan Kui

- Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing, CHINA
 - Telephone: 86-25-83282214
 - E-mail: kuiyan@nigpas.ac.cn
- *****

Graham YOUNG (Canada) is 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 he is collaborating with David RUDKIN, Michael CUGGY, and others to study arthropods from the same locality and from the Airport Cove site on the Hudson Bay coast.

Graham Young

- Manitoba Museum 190 Rupert Avenue Winnipeg, MB R3B 0N2, CANADA
 - Telephone: (204) 988-0648
 - Fax: (204) 942-3679
 - E-mail: gyoung@manitobamuseum.ca
- *****

Seth A. YOUNG (USA) continues to investigate and reconstruct paleoenvironmental conditions, that include marine oxygen levels at both local and global scales from late Cambrian, Ordovician, and Silurian stratigraphic successions. Current and ongoing projects are focused on intervals just prior to, during, and after the Ordovician radiation of marine life; and throughout multiple intervals of biotic extinction and recovery within the Silurian. This work takes place in multiple basins from around the globe including: the Great Basin (Nevada, USA), Appalachian Basin (Tennessee/Virginia, USA), USA Midcontinent (Tennessee), Sweden, Estonia, Latvia, and Czech Republic. These various projects in the early-mid Paleozoic are ongoing collaborations with Jeremy OWENS (FSU), Benjamin GILL (VTU), Sara PRUSS (SC), Per AHLBERG (LU), Mats ERIKSSON (LU), Tim LYONS (UCR), Olle HINTS (TUT), Dimitri KALJO (TUT), Tonu MARTMA (TUT), Matthew R. SALTZMAN (OSU), Stig M. BERGSTROM (OSU), Emma HAMMERLUND (LU), Paula NOBLE (UNR), Mu LIU (IGG-CAS), and Jiri FRYDA (CGS). In the last year Seth published with his current PhD student, Nevin KOZIK, new local and global paleoredox reconstructions throughout the Late Ordovician including the LOME interval from successions in the Great Basin (Nevada, USA), Anticosti Island (Canada), Baltic Basin (Estonia) in *AGU Advances*. Additionally, he published with his former PhD student (Chelsie BOWMAN, currently postdoc at PSU) on regional marine redox reconstructions of the Baltic

Basin during the late Silurian Lau Event in *Palaeogeography, Palaeoclimatology, Palaeoecology*.

Dr. Seth A. Young

- Department of Earth, Ocean, & Atmospheric Science, Florida State University Tallahassee, FL 32306-4520, USA
 - E-mail: sayoung2@fsu.edu
- *****

Carolina ZABINI (Brazil) continues her research on “inarticulated” brachiopods and fossil diagenesis of the Hirnantian fauna, Paraná Basin, Brazil. With the recent approved project, we are willing to contact researchers of Argentina, Peru, Bolivia, and Paraguay to investigate possible correlations on this part of Gondwana.

New Project, recently approved: “Paleobiodiversity of the Lower Paleozoic of the Paraná Basin and their relationship with coeval Gondwana fauna and flora”.

Funding agency: FAPESP 2021/12304-0

Carolina Zabini

- Geosciences Institute (IG), Geology and Natural Resources Department (DGRN), UNICAMP, Campinas, São Paulo, BRAZIL
 - Telephone: + 55 19 35214573
 - E-mail: cazabini@unicamp.br
- *****

Renbin ZHAN (China) was working on some Middle Ordovician faunas and their sedimentary environments while collaborating with his domestic and international colleagues in 2021. Some of the preliminary results show that the Middle Ordovician biodiversification in South China was manifested not only by the radiation of the *Saucrorthis* brachiopod fauna but also by the booming of other benthic shelly faunas with different palaeogeographic and palaeoenvironmental backgrounds. Besides, in 2021, ZHAN Renbin, together with his good friend Dr. ZHANG Yuandong, had compiled a huge monograph introducing all 77 chronostratigraphical “Golden Spikes” formally ratified by the International Commission on Stratigraphy (ICS) till the end of 2021. It was formally published in Chinese in November 2021 by the Jiangsu Phoenix Publishing House of Science and Technology. In this monograph, those “Golden Spikes” being studied and to be ratified are also briefly introduced.

Zhan Renbin

- State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing 210008, CHINA
 - E-mail: rbzhan@nigpas.ac.cn
- *****

Shunxin ZHANG (Canada) has continued working in Canadian Arctic area in 2021, but 100% from home without any fieldwork, owing to the COVID-19 pandemic. She has mainly focused on three projects:

- 1) Shallow water anoxia in the Hudson Bay Basin during the Late Ordovician. This project is based on her previously published Late Ordovician conodonts from Southampton Island, in which she has used statistical analysis as a tool to identify conodont communities in the Upper Ordovician sequence and to provide evidence for anoxic shallow water origin of organic-rich black shales in the Hudson Bay Basin in the Late Ordovician, in collaboration with Dr. BARNES.
- 2) Ordovician conodont biostratigraphy of northwestern Baffin Island. This project is based on the data collected from previous field season.
- 3) Ordovician conodont biostratigraphy and revised lithostratigraphy in the fault and fold zones of the Boothia Uplift, south-western Boothia Peninsula. This project is also based on the data collected from previous field season.

Shunxin Zhang

- Canada-Nunavut Geoscience Office, PO Box 2319, 1106 Inuksugait IV, 1st floor, Iqaluit, Nunavut X0A 0H0, CANADA
- Telephone: 1-867-975-4579
- Fax: 1-867-979-0708
- E-mail: shunxin.zhang@NRCan-RNCan.gc.ca

Yuandong ZHANG (China) is continuously working on:

- (1) An integrated stratigraphy of graptolite, conodont, chitinozoan, acritarch, radiolarians, and carbon isotope chemostratigraphy, and cyclostratigraphy of the Ordovician in China. This work aims at a refined stratigraphic correlation of the Ordovician in China based mainly on biostratigraphic and chemostratigraphic records. Among the latest and most significant products is the publication of book "*Ordovician Stratigraphy and Index Fossils of China*" (2021, in Chinese) by Zhejiang University Press and Elsevier. 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. Recently, Yuandong is working with his colleagues on "*Regional synthesis of the Ordovician geology and stratigraphy of China*" (Chapter 13 of book *A Global Synthesis of the Ordovician System (Part 2)*).
- (2) Hirnantian Konservat-Lagerstätte in Anji, Zhejiang Province, China—Anji Biota, in cooperation with Joe BOTTING and Lucy MUIR (UK), financially supported by President's International Fellowship Initiatives (PIFI) program and a recently approved NSFC grant (2018-2021). This sponge-dominated Konservat-Lagerstätte, discovered in late 2012, is typified by the abundant and highly diverse articulate sponges (over 100 species) often with soft tissues, in association of graptolites, nautiloids, arthropods, echinoderms, etc. The Anji Fauna is preserved within a nine meter-thick black shale, underlain and overlain by hugely-thick siltstone 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 in the aftermath of the Hirnantian Mass Extinction.

(3) Origination of the Palaeozoic Evolutionary Fauna: a case study in South China. This work, financially supported by an initiative fund from CAS and a major grant from the National Natural Science Foundation of China (NSFC, *Origination of Palaeozoic Evolutionary Fauna*, 2021-2025), is derived of IGCP Project 653 “The Onset of the GOBE”, and now in close correlation with the undergoing IGCP 735 “Rocks and Rise of Ordovician Life”. This work brings together some world-renowned palaeontologists on Ordovician and Cambrian fossil groups, along with some sedimentologists and geochemists, including Thomas SERVAIS, Axel MUNNECKE, Timothy W. LYONS, Yongyi ZHEN, etc., to focus on the early occurrence records of graptolites, conodonts, chitinozoans, cephalopods, radiolarians, and the potential coincident changes of geochemical proxies for redox and oxygenations in South China. Among the latest publications of this work is the Special Issue (Title: *Marine oxygenation, de-oxygenation, and life during the early Paleozoic*) in *Palaeogeography, Palaeoclimatology, Palaeoecology* (2021).

Yuandong Zhang

- Nanjing Institute of Geology and Palaeontology, 39 East Beijing Road, Nanjing 210008, CHINA
 - Telephone: 0086-25-83282145
 - Fax: 0086-25-83357026, 0086-25-83282145
 - E-mail: ydzhang@nigpas.ac.cn
- *****

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 2021, he has been working with the Palaeontology Team of the Geological Survey of New South Wales and in collaboration with colleagues from the Australian Museum and other institutions on several projects documenting the geology and biostratigraphy of New South Wales. Yong Yi published several research articles in 2021, including two important studies in a special issue of *Journal of Earth Science* on Conodonta, one documenting the Middle Ordovician conodont biostratigraphy of Australasia (Australia and New Zealand) and another on the Ordovician conodonts from deep-water turbiditic sequences in New South Wales. A major research documenting subsurface Upper Ordovician conodonts, corals and stromatoporoids from the northern part of the Junee–Narramine Volcanic Belt in central New South Wales in collaboration with mining company exploration geologists now in press with *Australian Journal of Earth Sciences*. Despite of the prolonged lockdowns and travel restrictions throughout much of 2021 due to Covid-19 epidemic, Yong Yi and Patrick SMITH from Australian Museum managed a short field work in far western New South Wales to collect several Cambrian and lowest Ordovician sites in April 2021.

Yong Yi Zhen

- Geological Survey of New South Wales, W.B. Clarke Geoscience Centre, 947-953 Londonderry Rd, Londonderry, NSW 2753, AUSTRALIA
 - E-mail: yong-yi.zhen@planning.nsw.gov.au
- *****

RECENT ORDOVICIAN RESEARCH PUBLICATIONS

A

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- AMORIM, P. & COUTO, H. 2021. Geological Mapping of Rates and São Félix of Laúndos Region (Northern Portugal). *IOP Conference Series: Earth and Environmental Sciences*, **906** 012120.
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- BICKNELL, R.D.C., SMITH, P.M., BRUTHANSOVA, J., & HOLLAND, B. in press. Malformed trilobites from the Ordovician and Devonian. *Paläontologische Zeitschrift*, doi.org/10.1007/s12542-12021-00572-12549.
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