ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
INTERNATIONAL COMMISSION ON STRATIGRAPHY

Number 37 (for 2019)

Edited by Ian G. Percival

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Ordovician Subcommission website: http://ordovician.stratigraphy.org

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Cover photo

View of the Upper Ordovician (Katian) succession in the Belubula River valley, adjacent to Fossil Hill and Cliefden Caves in central western New South Wales, Australia. Malongulli Trig, the hill in the background, is capped by Upper Devonian sandstone unconformably overlying Angullong Volcanics (upper Katian) that overlies spiculitic siltstones and minor allochthonous limestones of the deep-water Malongulli Formation forming the lower slopes. In the foreground, lower to middle Katian limestones of the Cliefden Caves Limestone Group are well exposed on "The Island" that is almost entirely encircled by the abandoned valley of the Belubula River. This fertile land, now under crops, would have been inundated by a proposed reservoir had a dam been constructed on the Belubula River downstream of this site. Some of the Cliefden Caves would also have been flooded, and access to important Ordovician fossil sites in the area restricted. Fortunately, this threat has now been averted (Percival *et al*. 2019). Photography by Ian Percival.

Ordovician News Number 37 for 2019 (distributed March 2020)

ORDOVICIAN NEWS Number 37 (for 2019)

Chairman's Message

Dear Colleagues,
In the year 2020 the Ordovician System formally reaches 60! It was officially ratified during the 21st International Geological Congress held in Copenhagen in 1960. Our system is one of the youngest when compared with others. In spite of great progress being achieved over recent decades there is still much to do.

Last year the 13th International Symposium on the Ordovician System together with the Main Annual Meeting of IGCP 653 Project was successfully held in Novosibirsk (Russia) in July 18-22. Associated geological excursions were organized in the St.Petersburg Region (Russian Platform), Podkamennaya Tunguska (Siberian Platform) and Altai Mountains. The Proceedings volume and Field Guides can be found on the website of IGCP 653 Project. I am happy to announce that the next (14th) International Symposium on the Ordovician System will be held in Estonia in the year 2023.

Other Ordovician-focussed meetings held during 2019 took place at the North American Paleontological Convention (NAPC) in June 23-27 at Riverside, California, USA; the Geological Society of America Annual Meeting in September 20-25 at Phoenix, Arizona, USA and the Palaeontological Association Annual Meeting at Valencia (Spain) in December. In 2019 the Ordovician Subcommission ratified the new ASSP for the base of the Ordovician System in Xiaoyangqiao section at Dayangcha, North China. I would like to thank all the authors of the proposal – Wang Xiaofeng, Svend Stouge, Jörg Maletz, Gabriela Bagnoli, Qi Yuping, Elena Raevskaya, Wang Chuanshang and Yan Chunbo – for their scrupulous work over almost 20 years. It is a prominent example of international cooperation and successful work of Ordovician stratigraphers in the Post-GSSP epoch.

Commencing this year, according to the new ICS statutes, the Ordovician Subcommission (along with all other subcommissions) has had to be substantially reorganised. I will be standing down as Chair and Voting Member of the Subcommission and Thomas Servais will retire as Vice-Chair. The following members of the Subcommission will have served out their terms of office: Guillermo Albanesi (Argentina), Olle Hints (Estonia), Stephen Leslie (USA), Arne Nielsen (Denmark), Ian Percival (Australia), Artur Sá (Portugal), Matthew Saltzman (USA), Thijs Vandenbroucke (Belgium), Mark Williams (UK) and Zhang Yuandong (China). I cordially thank them for their service to the Subcommission.

The new incoming members to replace them are: Sachiko Agematsu-Watanabe (Japan), Lars Holmer (Sweden), Bertrand Lefebvre (France), Pat McLaughlin (USA), Tõnu Meidla (Estonia), Elena Raevskaya (Russia), Alycia Stigall (USA), Wang Wenhui (China), Charles Wellman (UK), Seth Young (USA), and Yong Yi Zhen (Australia). The Subcommission has expanded with two additional members, André Desrochers (Canada) and Leon Normore (Australia). Thomas Servais is nominated as incoming Chair and Zhan Renbin is Vice-Chair. Seven Voting Members continue on. The new Subcommission has a great balance of scientific expertise, experience, regional representation and increased gender equality.

The new Executive and Voting Members of the Subcommission were due to be ratified by ICS during the 36th International Geological Congress in New Delhi from 2-8 March, 2020. However, due to the outbreak of the coronavirus COVID-19 pandemic, the Congress has been postponed to November, 2020. We are now waiting for clarification from ICS as to how to proceed with the terms of office. Many other scientific conferences all

around the world are also under the threat of postponement this year, including the official unveiling ceremony at the new ASSP for the base of the Ordovician System at Dayangcha (North China) during May 14-16, and the Closing Meeting of IGCP 653 from June 8-12, in Copenhagen, Denmark. We are still planning to go ahead with the 11th Baltic Stratigraphical Conference in August 24-27 in St.Petersburg (Russia) with a field trip to classical Ordovician outcrops in the region, but at present it is difficult to predict when the pandemic will be over.

Meanwhile I would like to suggest that the deadline for submission of revised manuscripts for inclusion in the book *A Global Synthesis of the Ordovician System* be extended to 30th September 2020. With cancellation of planned meetings and other activities postponed by COVID-19, we hopefully will have the opportunity to finish our long-term project.

I wish you all good health, optimism and continued progress in Ordovician research.

Andrei Dronov
Chair, Subcommission on Ordovician Stratigraphy

Vice-Chairman's Message

Dear Colleagues,
As indicated in the Chairman's message, an election procedure and a vote by the current titular (voting) members (2016-2020) took place, nominating me as the next chairman (2020-2024) and Zhan Renbin (Nanjing, China) as the next vice-chairman. Please, allow me to also write a few lines.

You are holding in your hands (or you are looking on your computer screen at) the 37th issue of *Ordovician News*. This is the last newsletter to be edited by the Secretary of the Subcommission on Ordovician Stratigraphy, Ian Percival. My sincere thanks to Ian for editing not only this issue, but also for compiling previous issues of *Ordovician News* since Number 26 in 2008. He did, as you know, over the years, a fantastic job, by collecting the information from you, in particular by hunting news from the (titular) members of the Subcommission (that do not always reply…). Ian was Secretary of the Ordovician Subcommission since 2008, when he was appointed by the Chairman David Harper. Ian served as Secretary for two terms with David Harper as Chairman (2008-2012 and 2012-2016), and during one term with Andrei Dronov (2016-2020) as Chairman. Many thanks, Ian, for your great contribution to the Subcommission, and to the Ordovician in general!

As indicated in the Chairman's message, the International Geological Congress in India (originally planned to take place in March 2020) has been postponed. The official meetings of the International Committee of Stratigraphy (ICS) did thus not place, and Andrei Dronov will remain Chairman of the Subcommission until the official ratification of the new Executive of the Ordovician Subcommission.

As incoming Chairman, I wish to thank Andrei Dronov for his work as Chairman during the last four years, and also for all his activities as member of the Subcommission since 2000, when he first became a titular member, i.e., over a period of 20 years! Andrei was during all these years one of the leading forces of Ordovician research in Russia. These magnificent efforts culminated in the co-organization of the 13th International Symposium on the Ordovician System held in Novosibirsk in July 18-22, 2019, with associated excursions in the St. Petersburg Region, parts of the Siberian Platform and the Altai Mountains. Thanks to Andrei and his Russian colleagues, in particular Olga Obut and Nikolai Sennikov, for the organization of the meeting, that was also the main meeting of IGCP 653 in 2019.

The current executive committee of the Subcommission (2016-2020), composed of the Chairman Andrei Dronov, Secretary Ian Percival, and myself as Vice-Chairman, had to re-arrange somewhat the Subcommission, following the new statutes of the International Commission onStratigraphy (ICS) that have to be followed by all subcommissions of the ICS. Members of the Subcommission can now stay no longer than three terms as Voting Members. By applying this new rule, a major turnover of the Voting Members took place during 2020, and a new team will start working as Voting Members to continue to set guidelines for Ordovician research during the years 2020-2024.

The composition of the new group of Voting (titular) Members for the period 2020-2024 was discussed with all current 2016-2020 Voting Members, who were asked to make proposals of candidates to replace them. As a result, we slightly increased the number of Voting Members to the allowable maximum of 20. We have now a much better gender ratio (although it is not yet perfect), with seven female scientists being now Voting Members. We also took the opportunity to include scientists from all continents (and palaeocontinents), with Ordovician specialists representing not only a large(r) variety of fossil groups, but also an increasing panel of other disciplines, including sedimentology, sequence stratigraphy, (isotope) geochemistry, geochronology, and others.

Unfortunately, it is difficult to schedule conferences and other events for this year. Several of the meetings and congresses focused on the Ordovician will be postponed (or cancelled) due to the COVID-19 outbreak. The official ceremony to inaugurate the new ASSP for the base of the Ordovician System at Dayangcha, China, originally planned for May 14-16, 2020, is now postponed. It is also very likely that the 'Closing Meeting' of IGCP 653 in Copenhagen, Denmark, planned for June 8-12, 2020, will not take place then, but hopefully will be rescheduled later this year. We also hope that the 11th Baltic Stratigraphical Conference will take place in St. Petersburg, Russia from August 24-27, 2020 (see notice in this issue).

Please note that an 'absolutely final meeting' of IGCP 653 is scheduled for 2021. IGCP 653 is running from 2016 to 2020, and thus it is currently in its final year. But the co-leaders will apply for an extension, so that 2021 will be 'OET' (on extended term). The final meeting is now scheduled in the new LILLIAD Congress Center at Lille University, in the week of September 13th, 2021 (indoor sessions from Tuesday, September 14th to Thursday, September 16th), with pre- and post-congress excursions to the Lower Palaeozoic of Belgium (Brabant Massif, Condroz inlier, Ardenne inliers, including the Stavelot 'Massif') and to the Ordovician (and Silurian) of Wales and the Welsh Borderland, UK (Tremadoc, Arenig, Llandeilo, Caradoc, etc.).

The planned meeting in Lille in September 2021 lies just in the middle of the time interval between the 13th International Symposium on the Ordovician System in Novosibirsk in 2019 and the 14th ISOS in Tallinn, Estonia in 2023, and we hope to see many Ordovician workers at Lille.

During the next four years (2020-2024), with the help of the incoming Vice-Chair, Zhan Renbin, we will continue the dynamism of the Ordovician Subcommission. The next edition of *Ordovician News* (number 38 for 2020) will be edited by the new Secretary/Editor. This latter position is traditionally filled by the selection of the incoming Chair, and is not elected. So, I am very happy that Bertrand Lefebvre (CNRS, Université de Lyon1, France) accepted my invitation to serve as Subcommission Secretary for the next four years and to take over the time-consuming task of editing the next issues of *Ordovician News*.

With best regards,
Thomas Servais
Vice-Chair, Subcommission on Ordovician Stratigraphy

Editor's (final) message

Ordovician News No. 37 will be the 12th and last issue that I will be editing, due to my retirement this year as Secretary of the Subcommission on Ordovician Stratigraphy. It has been my pleasure to compile and edit the newsletter since I took over the role from Guillermo Albanesi, the previous Secretary/Editor, in mid-2008. Fortunately in the age of computers, the internet and digital delivery, producing each edition (now the size of a small scientific paper, and possibly involving as many hours' work) is so much easier than when *Ordovician News* first appeared in 1983.

Allow me to provide you with a brief history of the evolution of *Ordovician News*, because its current format owes a great deal to its predecessors. The editor of the first six issues, with their distinctive bright pink cover, was Barry Webby, then at the University of Sydney, Australia. Coincidentally, Barry had been supervisor of my Bachelor of Science (Honours) degree and my subsequent Ph.D (on Ordovician brachiopods of New South Wales). In the days before computers and email, these early issues were painstakingly produced by retyping contributions sent to Barry by airmail, with a booklet of 24-36 pages being printed, stapled along the spine and distributed by surface mail around the world.

Barry continued as Secretary of the Ordovician Subcommission, and editor of *Ordovician News* until 1988 when he became Chairman, and selected Henry Williams (Memorial University of Newfoundland) as Secretary and Editor. Henry put his own stamp on the newsletter by changing the cover design and making changes in the layout, helped by advancing technology – he requested that longer contributions be supplied on floppy disks and diskettes. The general format instituted by Barry Webby was retained, with many issues dominated by reports of the deliberations of boundary working groups. The newsletter was the main medium of dissemination of conference announcements and reports to international readers, along with an increasingly expanding section devoted to research reports by Titular and Corresponding Members of the Subcommission. Listing of the email addresses of contributors first appeared in *Ordovician News* No. 11 in 1994, and emails subsequently became the preferred and then the sole medium by which contributions were received. Henry produced a total of nine issues, before moving from academia into the oil and gas industry in 1998 (he retained a strong interest in the Ordovician and has contributed a research report to the current issue).

Guillermo Albanesi of Argentina, then studying with Chris Barnes in Canada, was persuaded to become the Acting Secretary of the Subcommission, and of course the position of Editor was integral to that. Guillermo took to this with enthusiasm, completely revamping the size (to Foolscap/A4) and format of the newsletter while retaining the essential components – the personal reports section expanded as many more researchers sent in research contributions, and the bibliography compiling papers published in the preceding year grew rapidly. The newsletter was now entirely compiled digitally and distributed to email addresses with only a few exceptions, until the costs of overseas postage became too expensive for the latter. Colour appeared, initially only on the cover but later within conference announcements and reports. The first issue edited by Guillermo, No. 16 in 1999, was 64 pages, but before long issues around 100 pages became the norm. A total of ten issues were edited by Guillermo, concluding with No. 25 in 2008.

So now it is time to hand over to the incoming Secretary/Editor, and I am very pleased to be leaving this task in the capable hands of Bertrand Lefebrve (University of Lyon, France). Will he put his personal touch on *Ordovician News*, as preceding editors have done? Most likely, as improvements and efficiencies are always possible. Will the newsletter continue to be a valuable source of information on all aspects of Ordovician research? Undoubtedly!

Many thanks to all who have contributed to *Ordovician News* over the past 12 years. You have made the newsletter – I have merely compiled your reports and edited them for consistency. I would particularly like to thank Olle Hints (Tallinn, Estonia), webmaster to the Subcommission in recent years, who has now digitised all the early printed issues and placed a complete set of previous newsletters on the website http://ordovician.stratigraphy.org for download. I found this resource of all issues of *Ordovician News* invaluable in compiling this article. They provide a fascinating insight into the development of the criteria for setting the globally-recognised boundaries and internal subdivisions of the Ordovician System (GSSPs). The research reports of luminaries of Ordovician scholarship, many of whom are no longer with us, are well worth reading. As a record of the changing geopolitical and scientific landscape the early issues of the newsletter are a goldmine – contrast for example just six names of Ordovician workers from China being listed in the early 1980s, with the prominence of reports from Chinese palaeontologists in the current *Ordovician News*.

It has also been a privilege to work with the other members of the Subcommission Executive (David Harper and Andrei Dronov as Chairmen, and Thomas Servais as the current Vice-Chair), and all the Voting Members who served concurrently with me during the period 2008-2020.

I shall conclude with some words (below) that Dave Harper sent in and insisted that I print (despite my embarrassment) – thank you Dave.

Regards,

Ian Percival
Secretary of the Subcommission on Ordovician Stratigraphy
Editor, *Ordovician News*

This an historic issue, marking the retirement of its editor and Secretary of the Subcommission on Ordovician Stratigraphy, Ian Percival, from these posts. I worked with Ian for some eight years whilst Chair of the Subcommission. I wish to record my deep gratitude and huge admiration for Ian's work. Apart from keeping me in line (not an easy task), Ian developed new standards for the Subcommission's newsletter, bringing the highest editorial and production qualities to this key publication; in addition he displayed an unrivalled tenacity in capturing colleagues' research in progress and publications, making the 'News' the go to publication for all matters Ordovician. Not only that but Ian delved deep into the statutes of the ICS to ensure that all actions were properly executed and the working of the Subcommission was/is beyond reproach. Much of the current high visibility of our system internationally is built on Ian's careful, detailed and persistent work. Sincere thanks Ian for a job well done.

David Harper
Former Chair of the Subcommission on Ordovician Stratigraphy
Current Chair, International Commission on Stratigraphy

2019 ANNUAL REPORT OF THE ORDOVICIAN SUBCOMMISSION TO ICS

1. TITLE OF CONSTITUENT BODY
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2. **OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY**
The Subcommission promotes international cooperation on all aspects of Ordovician geology, specifically stratigraphy. Its global network involves academia, government institutions and industry.
Specific objectives are:
a. To delimit and subdivide the Ordovician System (and Period) as a part of the overall ICS mission to elaborate the standard global stratigraphic scale. This work aims to establish boundaries (GSSPs and ASSPs), correlation of major subdivisions (Stages and Series) globally and regionally, and to periodically review the effectiveness and utility of these decisions.
b. To promote regular international meetings on all aspects of Ordovician geology, especially those devoted to clarifying stratigraphic procedures, nomenclature and methods for use in establishing a unified global time scale and to prepare correlation charts with explanatory notes (the main phase of this latter task is now completed).
c. To encourage, promote, and support research on all aspects of Ordovician geology worldwide and to provide outlets, including an annual newsletter (*Ordovician News*), international meetings, and a web page, for promoting discussions and reporting results of this research.
d. To encourage, promote, and support interdisciplinary research on the Ordovician global Earth system, addressing topics that require high-resolution, global correlation.
e. The ultimate goal of the Subcommission is to provide a high-resolution geological time scale that will be a critical foundation for interdisciplinary research on the global Earth system during the Ordovician Period. The work is broadly based and must include specialists in palaeontology, all subdisciplines of stratigraphy (bio-, litho-, chemo-, and magneto-),

sedimentology, geochemistry, and tectonics. With a large network including active participants from more than 25 countries, the Subcommission thus involves much of the global geological community.

3. ORGANISATION - interface with other international projects / groups

The Subcommission on Ordovician Stratigraphy (SOS) comprises an Executive (Chair, Vice-Chair and Secretary), plus 15 other Voting Members. There are over 300 Corresponding Members.

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

The Subcommission on Ordovician Stratigraphy closely cooperates with the IGCP 653 project "The onset of the Great Ordovician Biodiversification Event". The Annual Meeting of IGCP 653 for 2019 was held in Novosibirsk, Russia, coincident with the 13th International Symposium on the Ordovician System.

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 2019

- The 13th International Symposium on the Ordovician System was held in Novosibirsk, Russia during July 2019.
- The Subcommission supported the Annual meeting of IGCP 653 during the 13th ISOS in Novosibirsk.
- A second Auxiliary Boundary Stratigraphic Section and Point (ASSP) for the base of the Ordovician System in the Dayangcha section (Northern China) was proposed by Wang Xiao-feng and colleagues. The proposal was voted on by the Subcommission under ICS Rules, and was approved by a majority (>60%) of Voting Members. All Voting Members of the Subcommission cast a valid vote.
- In accordance with ICS Rules, about 2/3 of the current Voting Members of SOS will retire in March 2020. Replacement candidates were proposed to the Voting Membership which voted to select a new Executive and Voting Members for the term 2020-2024. The Voting Membership was increased to 20.
- *Ordovician News* 36 (for 2018) was published in March 2019 and is available from the ISOS webpage (http://ordovician.stratigraphy.org/).

6. **SUMMARY OF EXPENDITURE IN 2019 (in USD):**

a) contribution towards air fares ($220), accommodation ($320) & registration costs ($460 incl. field trips as co-leader) for A. Dronov to attend 13th ISOS: total = $1000

b) Participation by A. Dronov at STRATI 2019 in Milan, representing the Ordovician Subcommission: $470 registration costs + $530 flights: total = $1000

c) T. Servais expenses ($500) in meeting D. Harper in Durham UK to discuss Subcommission matters post-2019, particularly the Ordovician Global Synthesis book

d) T. Servais expenses ($500) to discuss duties of incoming Secretary B. Lefebvre

7. **SUMMARY OF INCOME IN 2019:** same as next item (ICS was the sole source of income)

8. **BUDGET FROM ICS IN 2019:**
USD 3000

9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2020):

- SOS will support the Annual Meeting of the IGCP 653 project to be held in Copenhagen (June 2020)
- Further work is needed to compile an updated summary on Ordovician regional stratigraphy and geology: *A Global Synthesis of the Ordovician System*.
- Data will be gathered for *Ordovician News* 37 (to be published in March 2020).

10. KEY OBJECTIVES AND WORK PLAN FOR THE PERIOD 2016-2020

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 2016-2020.

- To compile and publish an updated summary on Ordovician regional stratigraphy and geology: *A Global Synthesis of the Ordovician System*. Special attention is going to be paid to precise correlation of the Ordovician depositional sequences and sea level curves as well as stable isotope and regional biodiversity curves. Though work has been proceeding on this aim, regrettably it is at a glacial pace.
- To better correlate Ordovician depositional sequences throughout the World.
- To design and execute a program of radiogenic dating of key Ordovician horizons (using Pb-Pb isotopes and CA-IDTIMS dating of zircons).
- The Ordovician website will be updated including development of a database for GSSPs and ASSPs.

11. BUDGET AND ICS COMPONENT REQUESTED FOR 2020 (in USD):

1. Support for attendance and participation of Subcommission officers A. Dronov & T. Servais at 36th IGC in New Delhi (March 2020): $4000 (incl. $850 registration, $750 airfares, $400 accommodation each)
2. Support for attendance and participation of Subcommission officers T. Servais & B. Lefebvre at IGCP 653 Annual Meeting in Copenhagen (June 2020): $1500 USD (incl. $150 registration & $600 rail travel and accommodation costs each)
3. Support for T. Servais to attend opening of ASSP in Dayangcha, China & participation in associated conference: $500
4. Travel subsidies for contributors and editors to attend meeting in China to finalise preparation of "*A Global Synthesis of the Ordovician System"*: $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 2019-2020 BUDGET: 7000 USD
REQUESTED FROM ICS: 7000 USD

Potential funding sources outside IUGS: None.
Subcommission officers are mainly supported by their research projects for most of their activities.

APPENDIX – Names and Addresses of Current Executive Officers and Voting Members)

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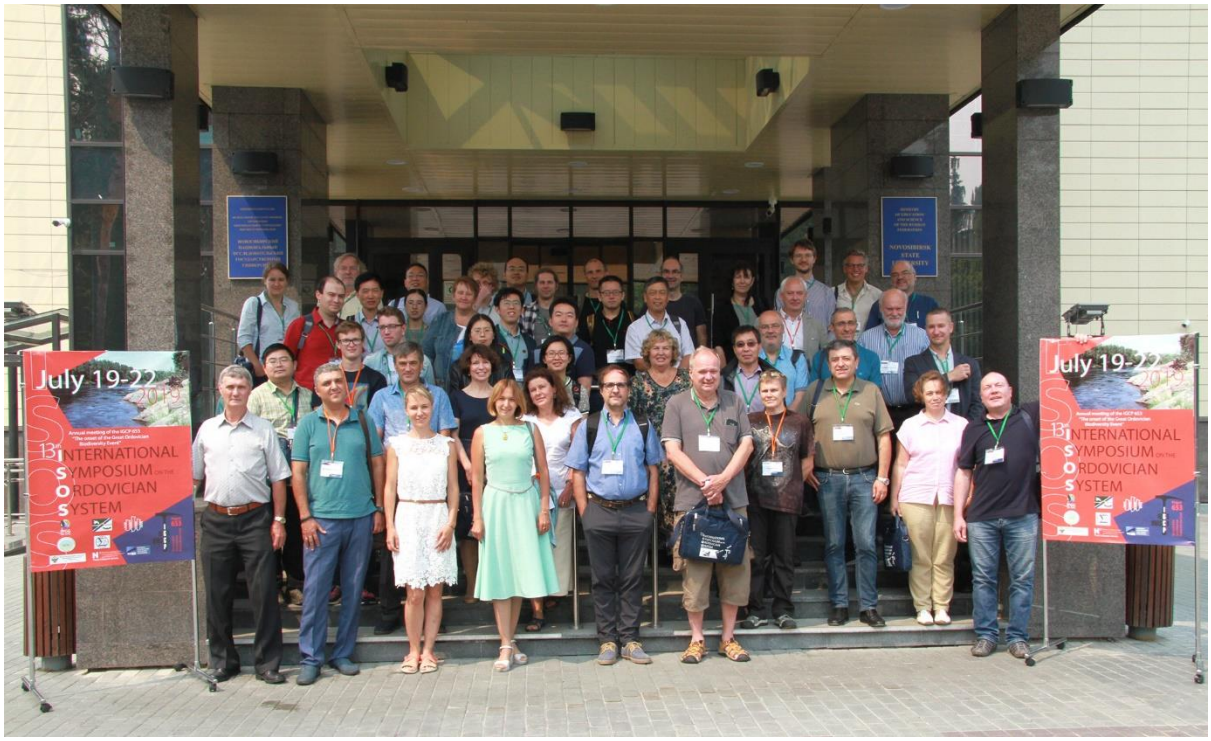
CONFERENCE REPORTS

13th International Symposium on the Ordovician System – Novosibirsk, July 2019



Over 70 participants from some 15 countries gathered in Novosibirsk for the 13th International Symposium on the Ordovician System and the 3rd annual meeting of IGCP 653 'The onset of the Great Ordovician Biodiversification Event'. It is 140 years since Charles Lapworth established the Ordovician arising out of the conflict between Adam Sedgwick and Roderick Murchison and their respective Cambrian and Silurian systems, and 45 years since the first Ordovician Symposium in Birmingham under the auspices of Sir Alwyn Williams. The former established the preliminary boundaries of the Ordovician in England and Wales while the latter set in train the global series and stages we use today.

During almost a full working week some 55 oral and 30 poster presentations educated, informed and at times entertained an audience that included some 40 foreign and 30 domestic researchers; the latter represented 12 research institutions, geological surveys and universities from across the Russian Federation. Delegates had the opportunity to visit three museums: Central Siberian Geological Museum (IGM SB RAS), Paleontological Museum "GEOCHRON" (IPGG SB RAS), Museum of Earth's History (NSU); and in addition a visit was arranged to the center for drill core collections (IPGG SB RAS). Several participants studied some key fossils, including types, at the Paleontological Museum.

These are the hard facts. But what did we learn? During four days of intensive lectures and poster sessions, the mornings and afternoons were prefaced by a wide range of keynote lectures including (i) *Charles Lapworth and the founding of the Ordovician*, (ii) *an integrative stratigraphy for the Ordovician of China, bioturbation,* (iii) *bioerosion and ecospace utilization during the Early Palaeozoic*, (iv) *Ordovician conodonts in the Russian Arctic*, (v) *the evolution of the Paleo-Asian Ocean during the Ordovician*, (vi) *Late Ordovician brachiopod evolution in Laurentia* and (vii) *the Ordovician substrate revolution*. A highlight was Alexandr Kanygin (the doyen of the Ordovician of Siberia) and his

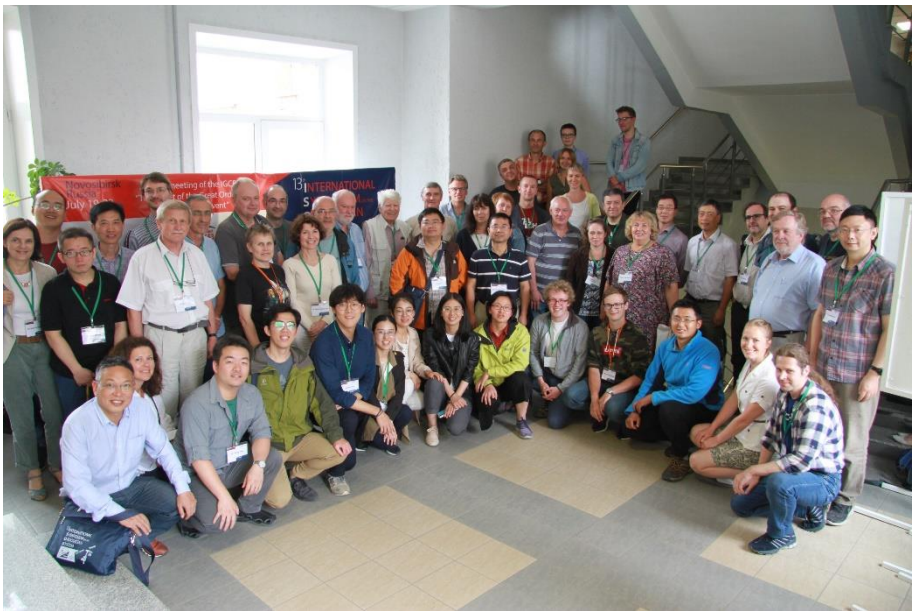
colleagues' overview of the palaeontology and stratigraphy of this massive palaeocontinent. Many of the subsequent talks show-cased new data, new analyses and new ideas, many from younger presenters. There are many areas yet to be explored, new data to be captured and a wealth of Ordovician still to be properly documented through multidisciplinary lenses. It was refreshing to enjoy so many field-based studies.

But that's not all. The visits to the museums were inspirational breaks from the lecture halls, grandstanding some super fossils, rocks and minerals together with a spectacular journey through earth history, beautifully narrated through some wonderful displays and exhibits. About 80 delegates attended the pre (Gorny Altai, SW Siberia, July 9-18 and St. Petersburg area, July, 15-17) and post-conference (Podkamennaya Tunguska River, Siberian Platform, July, 23-30) excursions. A unique opportunity to sample Russia's diverse Ordovician on two palaeoplates. The conference dinner was quite unforgettable. Great food, vodka and wine, many great speeches with short representations throughout the evening from each country (and indeed palaeoplate) reinforcing the truly international nature of Ordovician research and researchers. Our Siberian hosts demonstrated their openness, fine hospitality and warm friendship. Dancing of various styles at a variety of tempos punctuated the evening. And, the Irish pub does dispense some excellent Guinness!

There was a short IGCP business meeting, well attended and with some useful discussion. Next year the final meeting of the project will be in early June, in the Natural History Museum of Denmark, University of Copenhagen with fieldtrips in and around Scandinavia; more details to follow soon As is the tradition, we will apply for a further year and an absolutely final meeting is scheduled for the University of Lille in the summer of 2021. The next ISOS meeting in Estonia, ISOS14, was enthusiastically endorsed by the meeting, for 2023.

A huge vote of thanks to our many Russian colleagues who made this memorable meeting such a great success. The atmosphere in and around Akademgorodok was very special and an ideal environment to meet both old and new colleagues, and discuss and present the very best of Ordovician research. Special thanks go to Olga Obut and Nikolai Sennikov together Andrei Dronov and their colleagues for providing all the delegates with such a unique experience. Очень большое спасибо.

David Harper, Olga Obut and Yuandong Zhang (co-leaders, IGCP 653)



CONFERENCE ANNOUNCEMENTS

GEOLOGY OF REEFS

Syktyvkar, Komi Republic, Russia

N.P. Yushkin Institute of Geology FRC Komi SC UB of the Russian Academy of Sciences

June 23-25, 2020

Topics of the Meeting

- Basic concepts and diagnostic features of organogenous structures;
- Biodiversity and evolution of reef ecosystems;
- Genetic diversity of organogenous structures;
- Microbial carbonates as components of organogenous structures;
- The role of microbiota and fluids in the formation of carbonate buildups;
- A complex analysis of reef formation areas.

Youth School

The leaders are Anna Antoshkina and Valentina Zhemchugova.

Practical Seminar

"Diversity of genetic types of rocks of organogenic buildups", with viewing of thin-sections and samples collections.
The leaders — Nataliya Matveeva and Lyuba Shmeleva.

Field Trip

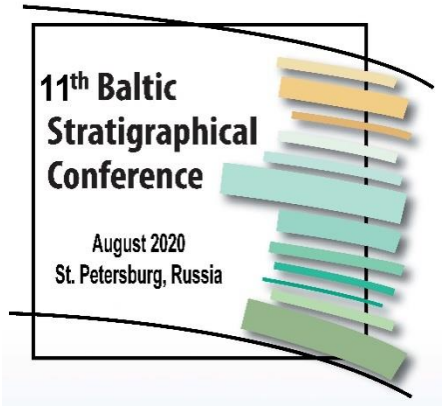
"Paleozoic organogenous buildups of the Ilych River basin, Northern Urals". June 26-July 04, 2020.
Number of participants is 9 people. Estimated cost is 650 EUR.
Trip leader — Evgenij Ponomarenko.

Registration fee: 30 EUR.
The abstract submission is free of any charge
Website of the Meeting "Geology of reefs": http://conf.uran.ru/Default.aspx?cid=reefs

Contact Information:

Antoshkina@geo.komisc.ru – Co-chair
esponomarenko@geo.komisc.ru – Field Trip
nakaneva@geo.komisc.ru – Practical Seminar

Second Announcement



THE 11TH BALTIC STRATIGRAPHICAL CONFERENCE (BSC)

August 24 – 27, 2020

Saint Petersburg, Russia

The Baltic Stratigraphic Association (BSA) united the stratigraphic commissions of Estonia, Latvia, Lithuania, NW Russia, and Poland organizes international conferences every three years since 1991. The BSA conferences focused on various aspects of regional geology and stratigraphy. Ten conferences already have been held by BSA in Tallinn (1991, 1996, 2008), Vilnius (1993, 2002, 2014), Riga/Jurmala (1999, 2011), St. Petersburg (2005) and Chęciny, Poland (2017).

It is our pleasure to announce that the 11th Baltic Stratigraphic Conference will take place in Saint Petersburg, Russia. The organizing institution is A.P. Karpinski Research Geological Institute (Sredny prospect, 74, Saint Petersburg).

All topics related to geology and stratigraphy of the Baltic region and adjacent areas are welcome. Depending on the number of participants and presentations different sessions could be organized. Preliminary topics are:

- Regional stratigraphical schemes
- Lithostratigraphy
- Biostratigraphy
- Event stratigraphy
- Sequence stratigraphy
- Chemostratigraphy and isotope stratigraphy
- Palaeontology and biodiversification
- Palaeoecology, palaeogeography and palaeoclimate reconstructions
- Quaternary geology
- Geoheritage
- History of Geological Science

Pre- and post-conference field trips are planned:

- A. Lower Palaeozoic of St. Petersburg Region;
- B. Devonian of the Pskov and Novgorod regions;
- C. Carboniferous of the Novgorod Region;
- D. Quaternary of St. Petersburg Region.

Registration:

If you are interested in participating, please return the preliminary registration form via e-mail to Irina Evdokimova (Irina_Evdokimova@vsegei.ru).

Registration fees:

Early registration fee (to be paid until 15th July 2020)	150 EUR
Late registration fee (after 15th July 2020)	170 EUR
Student fee	70 EUR
Conference Dinner	30 EUR

Abstracts for oral and poster presentations:

Abstracts volume will be published before the beginning of the conference. The length of abstracts is limited to two A4 page, 1.5 spaced, 12 pt Arial, with 2.5 cm margins with references and figures. Further details will be given in the First Circular.

Important deadlines:

Preliminary registrations open from	November 10, 2019
First circular	March 31, 2020
Deadline for early registration fee	July 15th, 2020
Deadline for abstracts	May 20, 2020
Second circular with detailed programme	August 1, 2020

Organizing Committee:

Alexander Ivanov
Andrey Dronov
Tatiana Tolmacheva
Irina Evdokimova
Olga Kossovaya

Contact persons:

Irina Evdokimova (Irina_Evdokimova@vsegei.ru)
Alexander Ivanov (IvanovA-Paleo@yandex.ru)
Tatiana Tolmacheva (Tatiana_Tolmacheva@vsegei.ru)

More information will be given in the First Circular in March 2020 and on Website: https://vsegei.ru/ru/conf/events/

11TH BALTIC STRATIGRAPHICAL CONFERENCE

August 24 – 27, 2020
Saint Petersburg, Russia

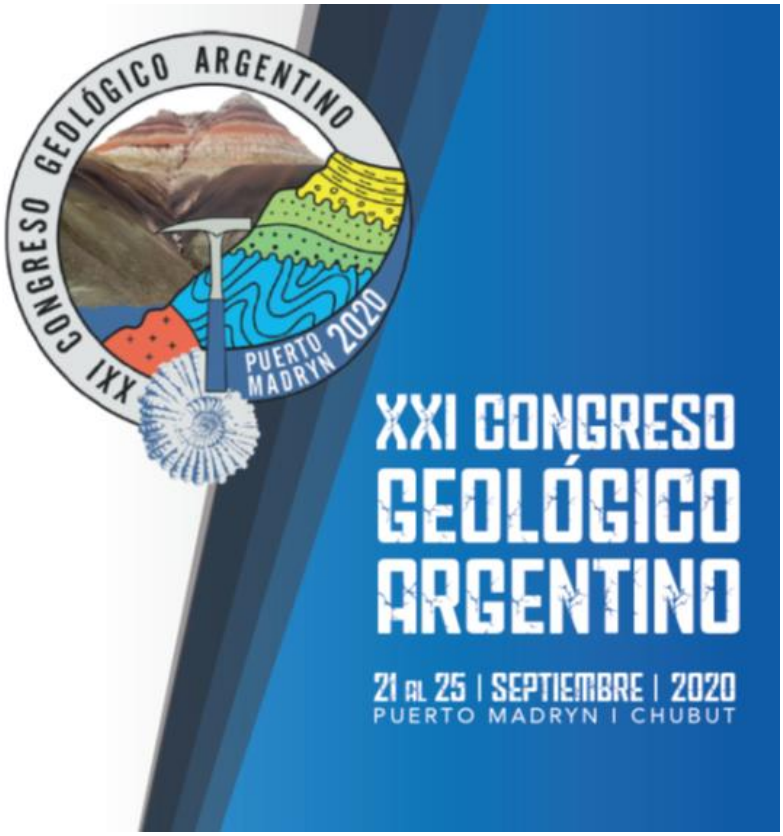
Registration Form

Mrs. or Mr.	
Title	
First name	
Family name	
Institution	
Street & No	
Postal (zip) code	
City	
Country	
Phone	
Fax	
E-mail	

I would like to present	
Oral presentation (preliminary title) YES/NO	**Poster (preliminary title)** YES/NO
Preliminary title:	

Pre- or post-conference field trip	YES/NO
Name of field trip	

If you are interested in participation, please return the preliminary registration form via e-mail to Irina Evdokimova (Irina_Evdokimova@vsegei.ru)



The **XXI Argentine Geological Congress** will be held between September 21 and 25, 2020 in the City of Puerto Madryn, Chubut Province, Argentina.

Under the slogan "Geology and development, challenges of the 21st century", this congress will address issues related to the comprehensive understanding of the natural environment to optimize its use in a framework of socio-cultural harmony. The geological themes will include four days of technical exhibitions and keynote lectures, as well as pre and post-congress courses and field trips.

The official language of the Congress is Spanish, but papers in English and Portuguese will be accepted.

Details of Thematic Sessions, Symposia, registration fees and abstract requirements are contained in the Second Circular available from the Congress website (see below).
Abstract submission due 15th April 2020.
Website: http://www.congresogeologico.org.ar/

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

During the 13th International Symposium on the Ordovician System in Novosibirsk, Russia, in July 2019, the next meeting was proposed, and agreed by the delegates, to take place in Estonia in 2023.

It will be after 41 years and 10 meetings that the major event for all friends of the Ordovician System will return to Baltica. The last time was in August 1982 in Norway, organised by Prof. David Bruton and his colleagues from the Palaeontological Museum in Oslo. Over 150 scientists from 22 countries attended the meeting back then and we expect no less participants for the upcoming event in 2023.

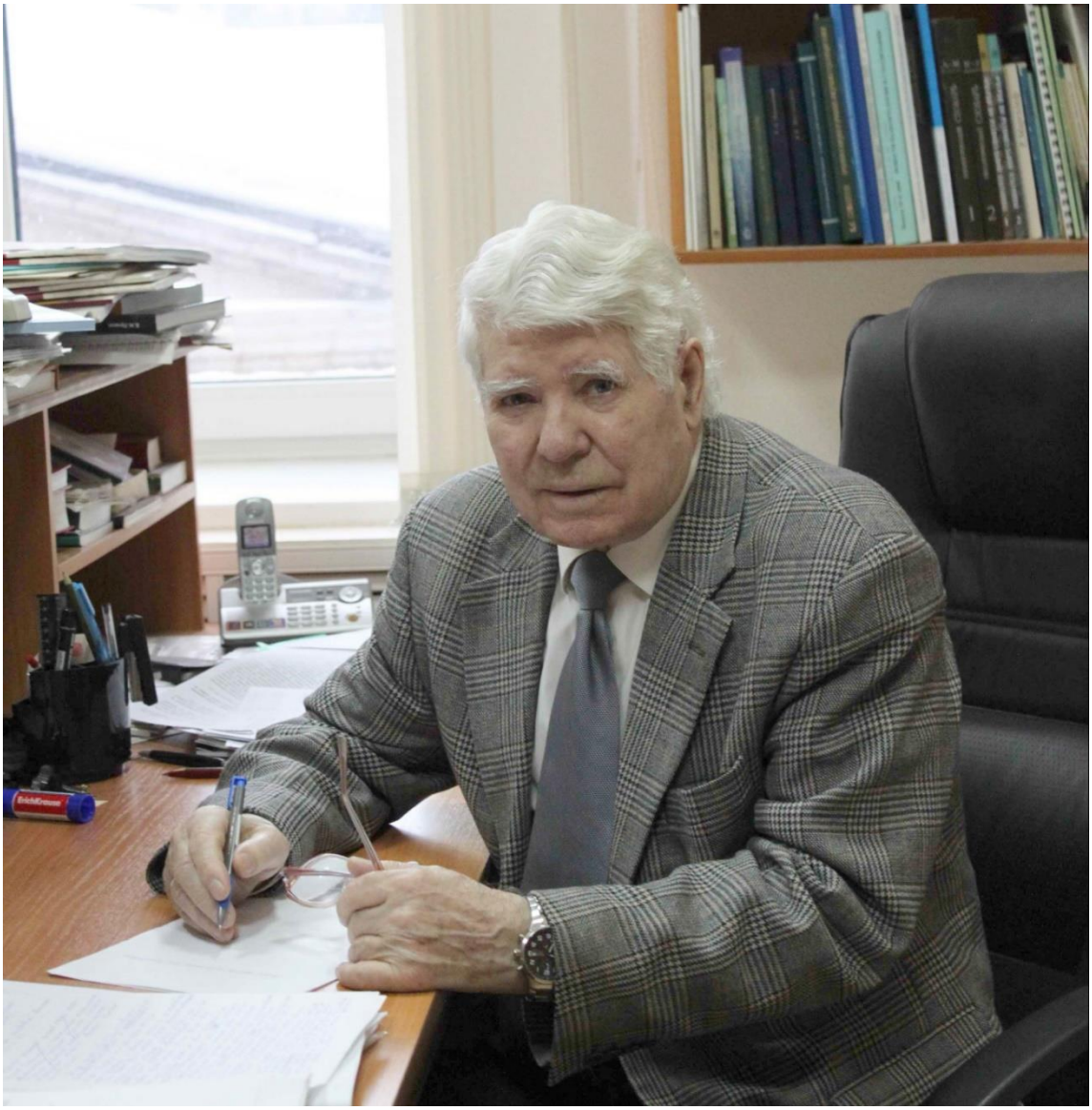
Estonia is an appropriate place for an Ordovician meeting as the Ordovician rocks occur throughout the country and crop out within 1/3 of its territory. The conference venue, the capital city Tallinn, is largely located on Ordovician strata and its medieval old town is built from the Middle Ordovician limestone (which, by the way, is the national stone in Estonia) and belongs to the UNESCO World Heritage. The Ordovician rocks of Estonia have been attracting geology students since the early 18th 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 Ordovician studies.

The conference will take place in June or July 2023 and will be complemented by a pre-conference excursion to Sweden, organised in cooperation with Jan Ove Ebbestad (Uppsala University), one-day mid-conference excursion, and a post-conference field trip introducing all classic Ordovician successions in the eastern Baltic region. A continuation of the field trip to St. Petersburg Region, Russia, is an option to discuss.

The 14th ISOS will be organised jointly by the University of Tartu, Tallinn University of Technology and Geological Survey of Estonia. Conference website will be launched and preliminary dates for the meeting fixed later in 2020. In case of questions, please do not hesitate to contact us:

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

OBITUARY for Aleksandr V. Kanygin (1936-2020)



It is with deep regret we report the death of Professor Alexander V. Kanygin, Fellow of the Russian Academy of Sciences, Senior Researcher in the Trofimuk Institute of Petroleum Geology and Geophysics of the Siberian Branch of Russian Academy of Sciences in Novosibirsk, on January 28th, 2020 at the age of 84. He was a palaeontologist and stratigrapher of highest national and international reputation, specialist on the Ordovician of the Siberian platform and Russian North-East.

Alexander V. Kanygin was born in Omsk (Western Siberia) on January 10th, 1936. After finishing his education in Moscow State University (Geological Faculty) he worked for two years as a mapping geologist in southern Siberia. In 1960 he became a PhD student in the Institute of Petroleum Geology and Geophysics and after defending his PhD dissertation, continued his career as a Scientific Researcher in this Institute. In 1987 he defended his Doctor of Science dissertation and in 1988 become a Professor. In 1991 he was elected as a Corresponding Member to the Russian Academy of Sciences. He was head of the Laboratory of Micropalaeontology in 1975-1995 and head of the Laboratory of Palaeontology and Stratigraphy of the Paleozoic in 1995-2009. In 1987-2005 he worked as head of the Sector of Palaeontology and Stratigraphy of the Institute.

Alexander Kanygin was an author of pioneering investigations on the Ordovician ostracods in the territory of Siberian platform and surrounding folded belts. His studies allowed the correlation of Ordovician shallow-water epicontinental successions of the Siberian platform with relatively deep-water and slope successions of the surrounding areas. He was also interested in palaeogeographical and biogeographical reconstructions, especially in the Russian North-East. He was a leading participant and scientific editor of numerous collective monographs on the Ordovician of the Siberian platform. He was in charge of preparation and editing of the Ordovician volume in the nine-volume series "Stratigraphy of oil and gas basins of Siberia", which was published in 2007. Based on this summary a new edition of the Ordovician stratigraphic schemes of Siberia was prepared in 2012.
In the early 1970s in cooperation with Yu. I. Tesakov, A.V. Kanygin organized a complex program for studying the evolution of ancient ecosystems based on materials from the Ordovician and Silurian sedimentary basins of the Siberian platform. The studies were conducted under umbrella of the International Project "Ecostratigraphy" of the IUGS. Many specialists on palaeontology, sedimentology and stratigraphy from different scientific Institutes of Russian Federation took part in it. A.V. Kanygin was a curator of the Ordovician part of this work.

Alexander Kanygin was engaged in extensive geological work in systematic palaeontology (ostracods), stratigraphy and palaeogeography. His main interests were in studies on Ordovician Biodiversification, biotic crises and evolution of biosphere especially during Early Paleozoic time. Due to these studies A.V. Kanygin became a well established and respected palaeontologist and stratigrapher who made a valuable contribution to the understanding of Ordovician ostracode biostratigraphy, biofacies and regional geology of the Siberian Platform and Russian North-East territories. He became a widely recognized leader and head of the Siberian school of Ordovician biostratigraphers.

A.V. Kanygin contributed also as a supervisor of many PhD studies on the Ordovician of the Siberian Platform. In 2000-2016 he was head of the Department of Historical Geology and Palaeontology of the Faculty of Geology and Geography of Novosibirsk State University. He gave lectures on the courses "Principles of Stratigraphy" and "Geological History of Biosphere". He was a Chairman of the Dissertation Council on the specialty "Palaeontology and Stratigraphy" of the Institute of Petroleum Geology and Geophysics of the Siberian Branch of Russian Academy of Sciences in Novosibirsk, member of the Expert Council of the Russian Foundation for Basic Research, and member of the Editorial Board of the "Geology and Geophysics" scientific journal.

During the last two decades of his life Alexander Kanygin was a permanent leader of several RFBR Projects focused on complex studies of different aspects of the Ordovician geology and stratigraphy of the Siberian Platform which were conducted in close coordination with International IGCP Projects 410, 503, 591 and 653. He was a Co-chairman of the Organizing Committee of the 13th International Symposium on the Ordovician System which was held in July, 2019 in Novosibirsk.

For his great scientific achievements A.V. Kanygin was awarded a medal "For services for the Motherland" of the second degree.

In spite of heavy illness, which he suffered for a number of years, Alexander Kanygin remained optimistic and productive until the last days of his life. We remember him not only as a distinguished Ordovician geologist but also as a good friend and intelligent person with a good sense of humor. We miss him in our job and our life.

N.V. Sennikov, A.V. Dronov, T. Yu. Tolmacheva, S.V. Rozhnov, A.V. Timokhin, B.N. Shurygin, O.T. Obut, T.V. Gonta, L.M. Melnikova, B.L. Nikitenko, P.A. Yan, O.S. Dzuba, D.V. Grazhdankin

Obituary for Anastasia G. Yadrenkina (1935-2018)

With great sorrow we have to report that Dr. Anastasia G. Yadrenkina, a well-known geologist and palaeontologist, specialist on the Ordovician brachiopods, who passed away on 5th of November 2018 at the age of 83.

Anastasia Yadrenkina was born on 22nd of October 1935 in the village of Voroshilovka in the Yaroslavl region northeast of Moscow. She finished school in the town of Lomonosov (formerly Oranienbaum) of the St.Petersburg (Leningrad) region and attended the Geological Faculty of Leningrad State University, where she completed undergraduate education and obtained her MA degree in geological mapping and research of mineral resources. In 1958 she started her professional career as a geologist of the Ob-Irtysh expedition in the city of Tomsk (Western Siberia). Professor L.L. Khalfin from the Polytechnic Institute became her scientific supervisor. On 22nd of May 1968 she defended her PhD thesis "Brachiopods and stratigraphy of the Upper Cambrian and Ordovician of north-west of the Siberian Platform".

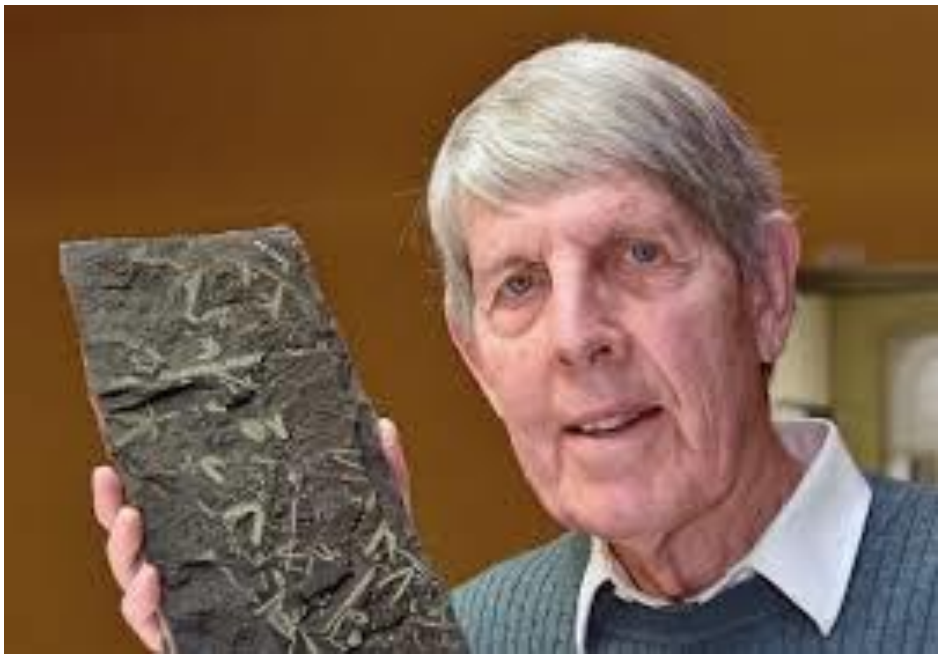
On 20th of June 1968 A.G. Yadrenkina started her work in Siberian Research Institute of Geology, Geophysics and Mineral Resources (SNNIIGiMS) in Novosibirsk. In August 2003 she became head of the Laboratory of the Ordovician and Silurian deposits of the Sector of Palaeontology and Stratigraphy. Since that time she was a curator of all the projects on studies of the Ordovician and Silurian brachiopods of Siberian Platform. She summarized all the data on stratigraphic distribution of the Ordovician brachiopods collected from the early 50th of the XX century from the natural outcrops and boreholes on the Siberian platform and elaborated a new refined stratigraphic chart which was presented in 2014 for the Stratigraphic Committee of Russia.

Anastasia Yadrenkina was an author and co-author of more than 100 publications including 10 monographs. She was a co-author of famous nine-volume series "Stratigraphy of oil and gas basins of Siberia" and a monograph "Ordovician Stratigraphy of the USSR". She was a permanent member of the Siberian Regional Stratigraphic Commission, Scientific Council of the SNNIIGiMS and Special Scientific Council for defending of PhD theses.

Anastasia Yadrenkina was a born leader; extremely honest and purposeful. She was always surrounded by many colleagues who were happy to help and be engaged into her projects. All her paleontological collections were always kept in a perfect order and all her scientific reports were usually finished and sent well in advance any deadlines. Her enthusiasm and optimism will be missed by all who knew her.

A.V. Zvereva, A.V. Dronov, O.A. Maslova

Obituary for Roger Alan Cooper (1939-2020)



Roger Alan Cooper, who has died after a brave battle against cancer, was an esteemed specialist in Ordovician graptolites and Cambrian trilobites. He was a widely respected expert on the geological evolution of New Zealand, his home for almost all his life. As a global authority on the Ordovician timescale he was instrumental in developing methods of precise biostratigraphic correlation that are used worldwide.

Roger was born in New Zealand on 12 March 1939. He attended Victoria University at Wellington, where his undergraduate studies were influenced by Prof. Harold Wellman, a renowned enthusiast in structural and field mapping. Roger's thesis for his Master of Science in Geology degree, submitted in 1962, was on 'The Geology of the Upper Takaka-Riwaka District, North-West Nelson'. This rugged area, in the northern part of the South Island of New Zealand, became the focus of several of his later studies.

In 1963, Roger commenced employment with the New Zealand Geological Survey, part of the NZ DSIR (Department of Scientific & Industrial Research, later to become the Institute of Geological and Nuclear Sciences, and then GNS Science). He was to remain with the Geological Survey all his working life (42 years), on retirement being appointed Emeritus Research Scientist (Paleontology). There were several stints overseas during this time – for a short time in the mid-1960s, Roger worked in Borneo as a field geologist on a United Nations Development programme. His first wife Dorothy (Dot) Berry completed her degree in biology after their marriage and then joined Roger in Borneo, assisting in geological surveying there and also developing a love of orchids in which she became an authority. Later, Roger also spent some time in the UK at Cambridge and London, on a Nuffield Science Foundation Fellowship.

Roger's Ph.D study (1966-1969) on Ordovician graptolites of the Aorangi Mine area, Wangapeka Valley and Hailes Knob in north-west Nelson Province, was supervised by Tony Wright at Victoria University, Wellington. Roger delineated 11 graptolite zones in this region, which has the most complete Ordovician sections in the country, and was able to precisely tie these into the well-known graptolite successions in Victoria, Australia. This landmark study was subsequently published by DSIR as a monograph in 1979.

Roger published more than 115 scientific papers and monographs, on themes as diverse as (1) graptoloids, their biostratigraphy, evolution, extinction, biogeography and palaeoecology, (2) Cambrian trilobites and agnostoids, (3) biostratigraphy and biogeographic implications of a range of groups that he was not a specialist of (such as conodonts, brachiopods and micromolluscs) but for which he supplied the essential locality and stratigraphic information for his co-authors, (4) calibration of the global Cambrian and Ordovician timescales using innovative quantitative methods (in collaboration with Pete Sadler of UC Riverside), (5) the geological evolution and tectonic development of New Zealand and more specifically the palaeo-continent of Zealandia, and (6) research into the impacts of mid-Cenozoic drowning of Zealandia on New Zealand's unique terrestrial biota. His research spanned the globe, with locations as widely separated as Antarctica, New Zealand and Spitzbergen.

He led, and was the principal author of, a comprehensive revision of the entire New Zealand geological time scale, making it a precise standard against which rates of geological and evolutionary processes across the entire south-west Pacific can be compared. [Cooper, R.A. (2004). The New Zealand Geological Timescale. *Institute of Geological and Nuclear Sciences Monograph* 22, 1-284].

Roger was elected a Fellow of the Royal Society of New Zealand (more recently renamed Royal Society Te Apārangi) in 1988 and was awarded the New Zealand Science and Technology Silver Medal by that Society in 2003. In 2017 he was the recipient of the Society's Hutton Medal, awarded "for his contributions to understanding the geological foundations and the earliest organisms of Zealandia and beyond and for his role in maintaining and developing paleobiology expertise in New Zealand".

He was awarded the Doctor of Science degree by Victoria University in 1993 based on his outstanding scholarship and scientific publications.

Roger served on the executive of the International Palaeontological Association as Vice President. He played a leading role in the Working Group of the Subcommission on Ordovician Stratigraphy set up to study and select candidate sections for the establishment of the GSSP for the Cambrian-Ordovician boundary.

In recent years Roger was afflicted with cancer. Unable to stop the progress of his illness by conventional means, he visited China for treatment that unfortunately was unsuccessful. Roger died peacefully at Te Omanga Hospice in Lower Hutt, New Zealand on 2 March 2020, aged almost 80 years. He leaves behind his wife Robyn, children Alan, Julie, Aaron, and Katrina, and eight grandchildren.

Roger was a gentleman and a scholar who was widely respected in New Zealand, Australia and around the world. He will be sadly missed by the global palaeontological community, particularly among specialists in graptoloids, and Cambrian and Ordovician biostratigraphy and biogeography. His passing is a great loss to his colleagues refining the geological timescale by developing high precision methods in correlation.

Ian Percival

RESEARCH REPORTS

Sachiko AGEMATSU (Japan) is interested in the Lower and Middle Palaeozoic biostratigraphy and microfossils in Southeast Asia. She is one of the project coordinators of IGCP 668: Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamics. This IGCP project aims to reveal relationships between palaeoenvironmental changes and evolutionary events during the late Cambrian to early Ordovician, including intervals of evolutionary "boom and bust", that are recorded on the Sibumasu terrane. In 2019, we held the joint IGCP meeting at the North American Paleontological Convention (Riverside, California, USA).

Sachiko Agematsu
Earth Evolution Science
Life and Environmental Sciences
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Guillermo ALBANESI (Argentina) is working on conodonts from the lower Paleozoic of South America. Research projects from the Precordillera, Eastern Cordillera, Famatina, Sierras Subandinas, and Puna of northwestern Argentina continue with G. Ortega, former PhD students, and colleagues from Argentina and other countries. M. Mango, G. Della Costa and F. López are working under my direction by means of CONICET scholarships. Their investigations deal with conodont biostratigraphy, paleoenvironments and evolution from carbonate and siliciclastic sequences of the Ordovician in the Precordillera. Graduate student E. Rueda is beginning her CONICET research in the current year, studying Ordovician conodonts from the Eastern Cordillera.

I am Professor of Paleontology and the director of the “Centro de Investigaciones Geológicas Aplicadas” (CIGEA, http://www.efn.uncor.edu/investigacion/CIGEA) at the Facultad de Ciencias Exactas, Físicas y Naturales (FCEFyN), Universidad Nacional de Córdoba (UNC), which includes a micropaleontology laboratory especially equipped for conodont preparation. As CONICET researcher I work at the CICTERRA (CONICET-UNC, http://cicterra.conicet.unc.edu.ar/es/) in the university campus, and the conodont collections are housed at the Museo de Paleontología (FCEFyN, UNC).

Guillermo Luis Albanesi
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ARGENTINA
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Anna ANTOSHKINA (Russia) is working on the Upper Ordovician paleogeography and reefs of the Urals. I am also interested in sequence stratigraphy and evolution of the Lower

Paleozoic sedimentary basin in the north-eastern part of the European Platform. The projects — Ordovician–Silurian boundary, Hirnantian, Katian reefs exposed on the Northern and Subpolar Urals together with my post graduate student Lyuba Shmeleva are continuing. I and Lyuba Shmeleva plan collaboration studies in the project entitled: "The sedimentology and palaeoecology of Late Ordovician sphinctozoan-bearing reefs" with Dr. Li Qijian (Nanjing Institute of Geology and Palaeontology, Nanjing, China). The sedimentology and palaeoecology of the Late Ordovician sphinctozoan-bearing reefs are still poorly understood. I and Lyubov' Shmeleva have well-preserved materials from the Northern Urals, which provide one of the best examples from Russia to compare with the cases from South China. Besides, I together with my colleagues from the Institute and other organizations continue a complex study with modern physics methods of various thin-grained rocks, ooids, nodules in Paleozoic and Phanerozoic deposits of the Urals and adjacent territories.

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Chris BARNES (Canada) is continuing his conodont paleontology/stratigraphy/isotope geochemistry research. The main projects being: a) Ordovician paleotemperature record for tracking the Argentine Precordillera across Iapetus Ocean determined from SHRIMP oxygen isotope measurements from conodonts (with Albanesi (CONICET, Cordoba), Trotter (UWA), Williams (ANU), and Bergström (OSU)); b) analysis of the effects of climate, eustasy and tectonics on conodont evolution and ecology during the early Paleozoic from the major database developed from a half-century of sampling throughout Canadian part of Laurentia; c) Global Ordovician Biodiversification Event (GOBE), with emphasis on Laurentian conodont and isotopic data; d) Ordovician and Silurian conodont biostratigraphy, bioevents, eustasy and thermal maturation.

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Matilde Sylvia BERESI (Argentina). I continue working on Lower-middle Ordovician carbonate microfacies and algae from the Precordillera platform.

I'm working with my PhD student Jéssica Gómez and Dr Silvio Peralta (CONICET, Univ. Nac San Juan) on the sedimentology of widespread siliciclastic lithologies as oolitic levels post-glacial Hirnantian in the San Juan Precordillera, western Argentina.

I am involved with exceptionally preserved sponges and chancelloriids from the Cambrian platform of the Sonora, Mexico. I have described, together with Dr. B. Buitrón (UNAM) and Dr. F. Cuen (Univ.SONORA), the first chancelloriid scleritomes from the middle Cambrian carbonates of Central Sonora. We are currently working on projects

focused on stratigraphy and the diversity and paleoecology of invertebrate faunas of the middle Cambrian and lower Ordovician of the Sonora.

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Stig M. BERGSTROM (USA). Although long formally retired, Stig continues geological research and cooperation with colleagues around the world on a variety of projects. As has been the case in the past few years, he has spent much time during 2019 on global $\delta^{13}C$ chemostratigraphy and its relations to conodont and graptolite biostratigraphy. Currently active projects focus on Baltoscandia, North America and Argentina. During 2019 he was senior author of three papers and co-author of two others. A couple of other articles have been submitted and two others are in an advanced stage of preparation. A very enjoyable event during 2019 was a two-day gathering at the Ohio State University organised by Steve Leslie and Matt Saltzman to celebrate Stig's career as a university teacher and geological researcher. It attracted about 50 former students, research associates and other friends, and was doubtless the largest gathering of Ordovician researchers in Columbus since the Ordovician Symposium there in 1969. It started out with a general reception on Friday evening at Stig's home with body-warming liquids, followed by a few hours-long mini-symposium on Saturday morning with topically quite varied state-of-the-art presentations by Loren Babcock, Steve Leslie, Stan Finney, Brad Cramer, Chuck Mitchell, Mark Kleffner, Dan Goldman, Brian Huber, Seth Young, Birger Schmitz and Mats Eriksson. After charter-lunch in the shadow of the recently installed Antarctic dinosaur in the lobby of Orton Hall, the participants had the opportunity to privately discuss matters of mutual interest in the afternoon. Many of those present had not met for decades and greatly enjoyed seeing old friends from their university days.

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Carlton E. BRETT (USA) during 2019 continued research on several projects related to Ordovician stratigraphy and paleoecology with present and former students. Major research projects continued in four areas, as discussed below.

A) Late Ordovician Cincinnatian Stratigraphy and Paleoecology: Ohio-Indiana-Kentucky

During 2019 I completed a synthesis paper summarizing two decades of research with a number of students and colleagues, on the Ordovician of Ohio, Kentucky, and Indiana. A paper just published in *Palaeo*-3, presents a fully revised sequence stratigraphy of of the

upper Katian (Cincinnatian) of the Cincinnati Arch (Brett et al., 2020). This effort also involved substantial field work to shore up uncertain aspects of this framework in 2019 especially in the highest beds of the Cincinnatian: Whitewater and Elkhorn formations. These proved successful in testing new hypotheses about lateral facies changes and correlations. This paper builds on, updates, and revises the long-standing sequence stratigraphy of Holland and Patzkowsky. In upcoming research, will next attempt to extend this framework into Tennessee and the Mississippi Valley.

a) Late Sandbian-Katian Sequences across a platform to basin transect

PhD student Allison Young and I are continuing to work on correlation of the upper Sandbian-lower Katian (Chatfieldian-Edenian in North American terminology) Lexington Limestone and Kope Formation of the shallow water Lexington Platform and its transition into dark, shale-rich facies of the "Point Pleasant" and "Utica" formations in the deeper water Sebree Trough north of Cincinnati. Newly obtained drill cores from Ohio and Indiana are providing new data on submarine erosion and filling of this feature that will have strong implications for the tectonic origin of this topographic feature.

We are also extending our detailed correlations the lower Katian Lexington and Point Pleasant formations field southward into both eastern Tennessee and the Nashville Dome, using a combination of gamma ray, chemo-, C-isotope, and sequence stratigraphy. In 2019, we also completed detailed documentation of new roadcuts near Tazewell, Tennessee and sampled these at 50 cm spacing for carbon isotopic analysis.

b) Upper Ordovician Sandbian-Katian of southern Ontario Research on the Upper Ordovician Mohawkian Series (upper Sandbian-lower Katian) of southern Ontario was largely concluded in 2019, with the publication of a paper in *Canadian Journal of Earth Sciences* with former student Tim Paton that presents the first high resolution isotope curve, completely revises the stratigraphy of the Bobcaygeon Formation (lower Trenton) of Ontario and newly correlates it with successions in the Cincinnati Arch (Paton and Brett, 2019a, b).

c) Comparative Stratinomy and Paleoecology of Upper Ordovician Hardgrounds: Tim Paton and I also made comparative studies of hardgrounds (cemented sea floors) spectacularly encrusted by intact fossil communities from the Ordovician in Ontario, Kentucky, and Tennessee; a synthesis paper on the morphology and genesis of the hardgrounds was published in *Palaios* (Paton et al., 2019).

We also intend to submit a second proposal to *National Geographic Society* within the next year or so to support a substantially larger project to test some of the preliminary hypotheses regarding taphonomy, paleoecology and paleobiology developed during the course of our work.

d) Research on Ordovician-Silurian boundary on Ontario, New York, and Ohio

This year major efforts were focused on aspects of end Ordovician- earliest Silurian stratigraphy in Ontario in conjunction with graduate student Cole Farnam. Cole and I did fieldwork in the Bruce peninsula and Manitoulin Island in Ontario, to identify important linkages of depositional sequences and bioevents between the Cincinnati Arch and the Ontario platform and Michigan Basin. Preliminary C isotopic studies have identified the Hirnantian isotopic excursion in strata formerly considered to be Silurian. This not only indicates that the well-known Cherokee unconformity probably lies within the Upper Ordovician and marks the sea level lowstand associated with the major phase of very late, but not latest Ordovician.

Stratigraphic Nomenclature As Chair of the North American Commission on Stratigraphic Nomenclature (NACSN; 2017-2018), I worked on developing the category of submembers as a formal subdivision to give a broader hierarchy of stratigraphic units: Formation-Members-Submembers-Beds-Bed. At the 2019 meeting in Phoenix, AZ this proposal was unanimously

approved. With commissioner Marie-Pierre Aubry and others, I am also working on formalization of the rank of subseries and the term biochron.
A larger initiative is the development of a study group on chemostratigraphy. At the Phoenix GSA meeting NACSN also hosted a GSA poster session on Chemostratigraphy with some 20 presentations and posters. Recently, we submitted a proposal for a standardized and classification of chemostratigraphic terminology to the journal *Stratigraphy*.

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Yves CANDELA (Scotland) continues working with David Harper (Durham University) and Michal Mergl (University of West Bohemia, Pilsen) on the Lower Ordovician brachiopod faunas of the Fezouata Lagerstätte (Morocco). Some good progress has been made. Last year I have published on matters regarding the Silurian period. I am currently working on an assemblage of machaeridians from the Sandbian of Scotland, collected by the late Archie Lamont. Consuelo Sendino (NHM, London) is also involved in this project. 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 my time is dedicated to the curation of the collection in my care.

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Josefina M.T. CARLOROSI (Argentina) continues 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. I am collaborating on taxonomical investigation of Ordovician conodonts from Peru with Juan Carlos Gutierrez-Marco and Graciela Sarmiento. Currently in collaboration with Ana Mestre, I am conducting a research project (funded by CONICET) studying Lower Ordovician conodont biostratigraphic correlations between the Eastern Cordillera and Precordillera. Additionally, joint studies of the graptolite and conodont fauna from different locations of the Argentinean Puna are being carried out with Susana Heredia and Blanca Toro and their team. I am part of Laboratorio de Micropaleontología (CONICET – CIGEOBIO - UNSJ), a working group focused on Ordovician conodonts of Argentina composed of Dr. Susana Heredia, Dr. Ana Mestre and Ph.D students. At the moment I participate in projects that are studying different Ordovician fossil groups of Northwestern Argentina in collaboration with

Drs. Franco Tortello, Susana Esteban and Maria del Milagro Vergel. Since 2019 I have participated as a volunteer in teaching tasks in the Paleontology Department of the Facultad de Ciencias Naturales, Universidad Nacional de Tucumán. At the same time, I am part of the INSUGEO staff and carrying out the task of Editor of the magazine *Serie Correlación Geológica* (SCG).

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Marcelo G. CARRERA (Argentina) is actively working on the evolutionary history of Paleozoic sponges and bryozoans (taxonomy, paleoecology and paleobiogeographic significance). In particular, I'm currently studying new findings related to Lower Ordovician reefs from western Argentina and I have just finished a paper related to the Ordovician sponges from the Lenoir Limestones in Tennessee. I am also studying Lower Ordovician sponges from Northwestern Argentina.

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CHEN Xu (China) in recent years has been leading a research project working on Ordovician - Silurian shale gas bearing strata from the Yangtze region. The project team includes 15 research fellows from Petroleum China, China Petrochemical Cooperation, and China Geological Survey.

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Euan CLARKSON (UK) At nearly 83 I'm still active in trilobite research, in two main fields. Firstly, on trilobite vision with Brigitte Schoenemann (Cologne) especially with recently discovered internal structures of trilobite eyes which is proving remarkably interesting. Secondly, I'm mainly involved with Furongian olenid ontogenies but also with Ordovician trilobites; an extended revision of Frank Raw's Tremadocian *Leptoplastides salteri* ontogeny of 1925 "A revised ontogeny of *Leptoplastides salteri*," by Kristina Manson and Euan Clarkson has already been published on line in *Transactions of the Royal Society of*

Edinburgh. Earth and Environmental Sciences (2018), but will appear in print very soon, as I have been assured.

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Robin COCKS (England). 2019 was a rather fragmented year. A paper with Leonid Popov (Cardiff and Iran) on Welsh Arenig brachiopods and stratigraphy was completed and published, indicating that the area was then still part of the higher-latitudes Mediterranean Province. Work on a substantial new later Ordovician brachiopod fauna from the Chu-Ili Terrane of Kazakhstan was carried forward, and that terrane is proving to be a significant evolutionary hotspot for brachiopods in the late Darriwilian and early Sandbian. The first part of the year saw the final production of the substantial Llandovery Brachiopods of England and Wales monograph, which was published in April; and work progressed on papers with Trond Torsvik (Oslo) on the causes of Lower Palaeozoic climate change and to what extent those changes were influenced by the developing global palaeogeography, and with Trond and Wolfgang Franke (Geissen) as to whether or not Precambrian zircons can be usefully employed in elucidating Lower Palaeozoic palaeogeography.

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John COPE (UK) reports just one publication on the Ordovician in 2019 (as he has been largely involved in things Jurassic for the past couple of years).

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Helena COUTO (Portugal) is working on the study of Palaeozoic stratigraphy, palaeontology and gold and antimony mineralizations in Baixo-Douro area (North Portugal). These studies aim to contribute 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 Cambrian, Ordovician, Silurian, Devonian and Carboniferous. The paper published in *The Science of Nature* in 2019, concerning soft-bodied specimens from the Valongo Formation, fills a gap in the fossil record for the Middle Ordovician.

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André DESROCHERS (Canada) is working on the Upper Ordovician to Lower Silurian strata of the Anticosti Island in Eastern Canada. My research program focuses on high-resolution stratigraphic studies integrating carbonate sedimentology, sequence stratigraphy, biostratigraphy, and chemostratigraphy. A number of collaborative projects are in progress including i) testing global anoxia an alternative cause for the Hirnantian mass extinction (with Julie De Weirdt, Thijs Vanderbrouke and others), ii) time-series analyses derived from high-resolution stable isotope data of the Upper Ordovician Anticosti succession (with Matthias Sinnesael and others), iii) stratigraphy and timing of the End Ordovician mass extinction (with Joshua Zimmt and Seth Finnegan), iv) sedimentology and paleoecology of Telychian encrinites (with Bill Ausich, Selina Cole, and David Wright), and v) multiple high resolution chemostratigraphy records of Early Silurian carbon excursion events and the stable 405 ky eccentricity cycle to refine the Silurian timescale (with Michiel Arts, Anne-Christine da Silva and Matthias Sinnesael), and vi) role of ocean phosphate changes in the Ordovician glaciations and mass extinction event (with Matthew Dodd).

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Andrei DRONOV (Russia) continued his work on facies, sea-level changes, biotic and abiotic events on the Siberian and Russian platforms during the Ordovician. In 2019, we started a new 3-year project “Regional and Global Aspects of the Great Ordovician Biodiversification Event on the Siberian and Russian platforms”. The project’s team includes Alexander Timokhin, Taras Gonta, Olga Maslova, Veronica Kushlina, Alexey Zaitsev, Elena Raevskaya and Tatiana Tolmacheva. Under the umbrella of this project, we continue investigations of the Siberian K-bentonite beds conducted in collaboration with Warren Huff and studies of carbon isotope chemostratigraphy of the Ordovician of Tungus basin in cooperation with Boris Pokrovsky, Oliver Lehnert and Peep Männik. Studies of extraterrestrial chromates in the Darriwilian sections of St. Petersburg region and Siberia together with Birger Schmitz are also on the agenda as well as investigation of Ordovician trace fossils in cooperation with Radek Mikuláš and Dirk Knaust. In 2020 we are planning

field work in Northeastern Siberia (Ordovician of the Moyerokan and Moyero River sections).

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Jan Ove R. EBBESTAD (Sweden) continues working on Ordovician gastropods and tergomyans from peri-Gondwana settings (Morocco, Spain, South America, Iran), collaborating mainly with Juan Carlos Gutiérrez-Marco (Madrid), Mansoureh Ghobadi Pour (Gorgán), and Leonid Popov (Cardiff). A new record of the gastropod *Phragmolites* is reported from Peru. Continuing work on the molluscan fauna of the Ordovician Boda Limestone of the Siljan area is developing in collaboration with Alexander Gubanov (Uppsala), Anette Högström (Tromsø) and Yutaro Suzuki (Shizuoka). Two major works on the Late Ordovician trilobites from the Taimyr peninsula, Arctic Russia in collaboration with Richard Fortey (London) are published. A catalogue of the specimens described by Wahlenberg (1818) in *Petrificata Telluris Svecanae* is being prepared in collaboration with Vivianne Berg-Madsen (Uppsala). This very early work contains a number of Ordovician type specimens, and the material and types have hitherto been poorly known.

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Cole EDWARDS (USA) continues to work on Ordovician stable and radiogenic isotope stratigraphy. Ongoing projects with David Fike at Washington University in St. Louis continue to explore sulfur isotope methodology as applied to a high-resolution stratigraphic record of the Lower-Middle Ordovician, published this year in *Chemical Geology*. Collaborations with Matt Saltzman (Ohio State), Page Quinton (SUNY Potsdam), and David Fike continue on $\delta^{18}O$ study of Ordovician conodonts using the Cameca 7f/geo Secondary Ion Mass Spectrometer (SIMS), work that should be published in 2020. A review of the link between oxygen levels and biodiversification was published in *Palaeoworld* this year. Current and future collaborative work with Sarah Carmichael (Appalachian State University) and Diana Boyer (Winthrop University) will use similar approaches to identify intervals of anoxia as possible drivers of the Late Devonian mass extinction from sections exposed in the Great Basin region, western USA.

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Bob ELIAS (Canada) has papers in preparation on various aspects of Ordovician tabulate corals and coral-like fossils, with Dong-Jin Lee and other colleagues.

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

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

Recent papers have strictly focused on the effect of diagenesis on bioapatite mineralogy and crystallization patterns (e.g. Medici *et al.*, 2020). She has also co-guest edited with Alyssa Bancroft and John Repetski the Special Issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* "GECkO: Global Events impacting COnodont evolution", a collection of 19 conodont contributions, including six Ordovician papers.

Finally, a paper describing Leonardo da Vinci's contribution to stratigraphy, of broad interest to any stratigrapher, has been recently published in *Newsletters on Stratigraphy*.

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Barry FORDHAM (Australia) hopes to get back to a small collection of Ordovician conodonts from the Yarrol Province of eastern Queensland, one day ...

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Richard FORTEY (UK): This year saw the completion and publication of the work on the Ordovician of the Taimyr Peninsula jointly with Jan Ove Ebbestad – after a gestation of more than 20 years. An ongoing project on the Burmese types of F.R.C. Reed continues. Another long term project on the Ordovician of the Sultanate of Oman with Alan Heward and colleagues also progresses – three papers headed by Alan have appeared since 2009, and a fourth is in prospect. As an additional project, Diana Clements discovered a lost collection of Ordovician trilobites from the Nares expedition to the Canadian Arctic and Greenland (1875-6) in the NHM collections. This should reach publication in 2020.

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Mansoureh GHOBADI POUR (Iran) continues her work on palaeontology and biostratigraphy of Iran and Central Asia. She is also involved in work on various topics of the Cambrian (Furongian) to Ordovician (Tremadocian) geology and palaeontology of Baltoscandia carried out in cooperation with Lars E. Holmer, Leonid Popov, Javier Alvaro, Heikki Bauert and others. Work in progress includes a general revision of the Ordovician stratigraphy of Iran and the Late Ordovician raphiophorid fauna of Central Kazakhstan.

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Daniel GOLDMAN (USA), working with Peter Sadler and Stephen Leslie, completed the Ordovician Chapter for the upcoming Geologic Time Scale 2020. The revised Ordovician time scale uses a substantial number of new radiometric dates that have been published since

2012 to present independently calibrated sets of biozones from carbonate and clastic facies sections. Readers will be able to compare graptolite and conodont-based timescales, and better judge the uncertainties around stage boundary ages. They have also provided more extensive correlation charts and summaries of the advances in chemostratigraphy that have been made in the last 8 years.

He has been working with Guillermo Albanesi and Gladys Ortega on the integration of graptolite and conodont biostratigraphy from the Argentine Precordillera; and with Gladys Ortega and Cyntia Kaufmann on graptolites from the Villicum Range. He is also working with Liang Yan, Olle Hints, Peng Tang, Chengyang Cai, Ke Pang, Jaak Nõlvak, Joseph Bernardo, and Wenhui Wang on exceptionally preserved chitinozoans that were fossilized while undergoing reproduction.

Finally, he is starting a new project with Mike Melchin and Chuck Mitchell on graptolites from western Laurentia.

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Jessica Carolina GOMEZ (Argentina). Currently, I'm working on sedimentology, stratigraphy, biostratigraphy and sequence stratigraphy of the conglomerates and oolite post-Hirnantian glaciation deposits but also in facies association on Hirnantian-Rhuddanian boundaryin the San Juan Precordillera, Argentina. This year, I'm going into the 3th year of a PhD at National San Juan University with Dr Silvio Peralta (CIGEOBIO-INGEO, CONICET San Juan) and Dr Matilde Beresi (IANIGLA - CONICET Mendoza). I have participated in the project 'Biofacies and paleoenvironments in the Hirnantian-Rhuddanian limit of the Argentine Precordillera: Characterization of Hirnantian glacimarine event', with Dr Silvio Peralta. Recently we have published an article on this at the 13th International Symposium on the Ordovician System, in Novosibirsk, Russia.

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Juan Carlos GUTIÉRREZ-MARCO (Spain) continues to work on Ordovician stratigraphy and fossils from high palaeolatitudinal Gondwanan settings of SW Europe, North Africa and northern and central South America.

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David A.T. HARPER (U.K.) reports that research continues on a variety of Ordovician brachiopod and other faunas. In particular he is collaborating with Yves Candela and Michal Mergl investigating the Lower Ordovician brachiopod fauna of the Fezouata Lagerstätte (Morocco), Robin Cocks on the brachiopod fauna of the Portrane Limestone (Ireland) and Thomas Servais and Bernard Mottequin on the Upper Ordovician brachiopods from Belgium. Papers are in press, with firstly Svend Stouge and colleagues (*Geological Magazine*) and secondly Yong-Yi Zhen and colleagues (*Gondwana Research*) on various aspects of the conodont faunas, their biostratigraphy and biogeography from the 'Roof of the World' in southern Tibet. A substantial review paper on the *Hirnantia* brachiopod fauna by an author team led by Rong Jiayu has been submitted. David has completed a short encyclopaedia entry on the end Ordovician extinctions for the Elsevier Encyclopedia of Geology (2nd ed.). And finally, the 2nd edition of Benton and Harper, *Introduction to Paleobiology and the Fossil Record* will be published in April, including many topics of interest to Ordovician workers.

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Susana HEREDIA (Argentina) reports that 2019 has been a productive year with several published studies. The Micropaleontology Lab researchers are mainly focused on the study of conodont biostratigraphy from the Cambrian, Ordovician, Silurian and Lower Devonian of Argentina. Susana is still working on biostratigraphy and taxonomy of Ordovician conodonts from different areas of Northwest Argentina (Cordillera Oriental), Famatina Ranges, and Precordillera outcrops. All these matters are developed in collaboration with Dr. Ana Mestre and Dr. Josefina Carlorosi. Lower and Middle Ordovician conodonts from Northern Precordillera are under study with Dr. Tatiana Soria. Upper Ordovician Conodonts from Precordillera are still under study. Susana share interests on Ordovician matters with Drs. Guillermo Aceñolaza, Juan Pablo Milana, and Daniel Poire. Dr. Carlo Corradini is collaborating and working (2014-2020) with the Micropaleontology Lab on developing Silurian-Devonian conodonts from the Central Precordillera, as result Lic. María José Gómez is finishing her Silurian-Devonian conodont Ph.D project. Florencia Moreno is also finishing her Ph.D project on Upper Floian- Lower Darriwilian conodonts and carbonate sedimentology.

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Nexxys Carolina HERRERA SÁNCHEZ (Argentina) continues working on her doctoral thesis, supervised by Dra. Blanca A. Toro, about Ordovician graptolites from the Central Andean Basin (northwestern Argentina and southern Bolivia). Her work is mainly focused on taxonomical revisions of problematic taxa and the comparison of the biostratigraphic results obtained by conventional and quantitative methodology. In addition, she cooperates in the analysis of the first results regarding graptolite reflectance for the Central Andean Basin.

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Linda HINTS (Estonia) continues work with palaeontological collection database at the Institute of Geology. Last year my colleague Peep Männik suggested to look at some Llandovery-Silurian samples, which he has washed for study of conodonts. It was a wonderful material of different fossil groups, including those which are poorly known from the Baltic Silurian (echinozoans, sponges, corals and others) beside the brachiopods and trilobites (studied by Helje Pärnaste). Hopefully these materials will be published together with conodonts.

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Olle HINTS (Estonia) is continuing studies on Ordovician–Silurian microfossils, geochemistry and Baltic regional geology and stratigraphy. In collaboration with Yan Liang, Wang Wenhui and Jaak Nõlvak he is continuing studies on chitinozoans and other organic-walled microfossils from Baltoscandia as well as South China, focusing on biostratigraphy, biogeography and palaeoecology. On these topics several papers were published in 2019. In collaboration with Petra Tonarová and Mats E. Eriksson he is studying Ordovician and Silurian scolecodonts to provide new insights into the taxonomy, paleobiogeography and diversification history of Palaeozoic jaw-bearing polychaetes. Olle is involved in studies on chemostratigraphy together with Tõnu Meidla, 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. The current focus is on carbon isotopic composition of organic matter and the first results were presented at the 13th ISOS in Novosibirsk. Together with Ursula Toom he is involved in Baltic Ordovician trace fossil research. Olle is also responsible for the development of national geocollections database and related services under a national research infrastructure project (various data are accessible at: https://geocollections.info).

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Lars HOLMER (Sweden) continues studies of Early Palaeozoic brachiopods, especially lingulates. A paper was published investigating *Aulonotreta*, an Ordovician lingulate from Baltoscandia.

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Warren HUFF (USA): 2019 has been an unprecedented year for me in many respects. As an emeritus faculty member, I enjoy pursuing a variety of interests that I've had for some time. For example, I've enjoyed working with colleagues in our departments of Anthropology and Geography on the occurrence and distribution of volcanic minerals in Chaco Canyon, New Mexico and their archaeological significance. Several papers have been published and another is currently in review. In addition, I am preparing a chapter on the contribution of explosive volcanism to the sedimentary record for a geology/geography textbook that a former colleague is editing.

I was extremely pleased to have one of our former undergraduates, Jeff Hannon, return to UC to pursue a PhD on Cretaceous bentonites in the western US. Jeff is exploring new frontiers in bentonite studies by applying stable isotopic and trace element studies to determine the magmatic and tectonic history of these widespread beds. Some other highlights of the year included participation in the Annual Meeting of the Clay Minerals Society, which was held in Champaign, Illinois and participation in the Annual GSA meeting in Indianapolis, Indiana. I continue as an associate editor for both the *American Mineralogist* and *Clays and Clay Minerals* as well as serving in my final year as Secretary to the Clay Minerals Society.

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Juwan JEON (South Korea) is working on Ordovician stromatoporoids and now is commencing a master's degree program in Nanjing Institute of Geology and Palaeontology (NIGPAS) under supervision of Prof. Zhang Yuandong and Dr. Liang Kun. During his MSc, he will study the taxonomy of Late Ordovician stromatoporoids from the Xiazhen Formation of South China and their implications for paleobiogeography and paleoecology. He is particularly interested in stromatoporoid diversification during the Great Ordovician Biodiversification Event and the faunal transition of stromatoporoids during the Ordovician – Silurian interval.

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Dimitri KALJO (Estonia) continued some studies on the Ordovician and Silurian bio- and chemostratigraphy of Baltica as an emeritus member at the geology department of the Taltech. Beginning with March 2019 I don't have any official commitments but personal contacts and cooperation with some colleagues from USA and Europe still work.

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Tarmo KIIPLI (Estonia) published two articles about the Ordovician in 2019. Both were electronically available from Dec. 2019. In 2019-2020 I am working on applied geology project dealing with phosphorite resources and black shales of the Ordovician of Estonia.

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Petr KRAFT (Czech Republic) started to work on a small project on dendroid graptolites. He continues working on a project focused on shells as a substrate for colonization and bioerosion. Results from this work were published in two papers based on fossils from the Prague Basin, Czech Republic, especially from the Darriwilian Šárka Formation. He also continues his long-lasting research project supported by the West Bohemian Museum on systematic field documentation of palaeontologic localities in the Ordovician of the Prague Basin as a source of new material.

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Bertrand LEFEBVRE (France) continues his work on Ordovician echinoderm systematics, phylogeny, palaeobiogeography and palaeoecology with publications in progress on Late Ordovician stylophorans from Morocco (Tafilalt Biota, GSL Special Publications volume 485), the Czech Republic (new echinoderm Lagerstätten from Bohemia; in collaboration with Martina Nohejlová, Elise Nardin, Oldrich Fatka, Petr Budil, Ondrej Zicha and Libor Kasicka), and North America (in collaboration with Tom Guensburg). He is also still actively working on several projects focusing on the Lower Ordovician Fezouata Lagerstätte (Morocco), in particular through the supervision of the ongoing PhD thesis of Farid Saleh at Lyon 1 University. Farid obtained excellent results on taphonomic processes responsible for preservation in the Fezouata Biota. Bertrand is also involved in projects on Ordovician echinoderm faunas from Algeria (with Yamouna Makhlouf) and Spain (with Juan-Carlos Gutiérrez-Marco). Other activities include ongoing collaborations on various fossil groups from the Lower Ordovician of the Montagne Noire, southern France, e.g. on onychochilid molluscs (with Jan-Ove Ebbestad) and conulariids (with Heyo Van Iten).

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Stephen LESLIE (USA) is primarily working on Middle and Late Ordovician 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 and also on the GTS 2020 Ordovician chapter with Goldman and Peter Sadler. Work also continues Paul Myrow on Ordovician successions in China and the Himalaya, 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 year I hope to expand work into the Williston Basin, and renew work in the Northwest Territories and Ireland.

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Lixia LI (China) continues to work on Paleozoic sponges and Ordovician graptolites from South China. Her research activities in 2019 were mainly on taxonomy and palaeoecology of sponges from Ordovician-Silurian boundary section in South China. There was good progress in the study of systematic palaeontology of the sponges and the oldest known fossil of Rossellids (Hexactinellida, Porifera) from the Ordovician–Silurian transition of South China was published in *Paläontologische Zeitschrift*. She carried out a new project about the non-lithistid sponges before and after the Late Ordovician Mass Extinction from South China, and cooperated with Prof. Joachim Reitner (Göttingen University). Furthermore, she is also working on the Early-Middle Ordovician graptolites from South China, mainly focusing on graptolite taxonomy and biostratigraphy. One paper focusing on the Early-Middle Ordovician graptolite *Phyllograptus* from the Jiangnan Slope of South China has been published in *Acta Palaeontologica Sinica*.

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Qi-jian LI (China) is mainly working on Ordovician-Silurian reefs and hypercalcified sponges (e.g. calathids, stromatoporoids and sphinctozoans). In 2019, I continued my sedimentological and paleoecological research on Ordovician reefs. Apart from the materials from South China, Tarim, Malaysia and Thailand, I carried out a new project with Prof. Andrei Dronov and Prof. Anna Antoshkina, targeting the Ordovician reefs in Siberia. Moreover, I am now working on some Early Silurian reefs of South China, in collaboration with Prof. Axel Munnecke, Dr Stephen Kershaw and Dr. Andrej Ernst. I also continue my collaborations focused on quantitative paleoecological analyses of reefs at the Ordovician-Silurian transition with several colleagues.

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LIANG Yan (China) continued her work on Ordovician chitinozoans. She finished her two-year's post-doc project at Tallinn University of Technology in mid-2019 with Prof. Olle Hints and Dr. Jaak Nõlvak, and is now an associate researcher at NIGPAS. She participated in the 13th ISOS jointed with the Annual Meeting of IGCP 653 held in Novosibirsk, Russia, and particularly enjoyed the associated field trips to the Altai Mountains and the Podkamennaya Tunguska & Stolbovaya Rivers of the Siberian Platform. She invited Jaak and Olle to visit NIGPAS in November and they had academic discussions, a field trip to the Hunan Province, and further plans for the upcoming years. Her research is mainly focusing on the lower and middle Ordovician chitinozoan assemblages, biostratigraphy, palaeogeography and also tries to explore the biological affinity of this enigmatic group. New data of chitinozoans from this period were reported from the upper part and the western margin of the Yangtze Platform, South China, and the Jägala waterfall section, northern Estonia. The results have been published and provide new insight into the biostratigraphical correlations and the early diversification of chitinozoans. At the same time, based on the wonderful data collected in the upper Ordovician in Oklahoma, USA by Prof. Daniel Goldman, a new study calls into question the prevailing "egg hypothesis" by documenting that the magnitude of size variation in chitinozoan populations is inconsistent with the measurements reported from the modern and fossil eggs of aquatic invertebrates, and instead suggested that chitinozoans were independent microorganisms. Further study will be continued and will be supported by a newly founded project by the National Natural Science Foundation of China to further explore the morphology, morphological function and the biological affinity of chitinozoans.

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Gerardo Andrés LO VALVO (Argentina) has recently completed his Degree Thesis about the Early Palaeozoic graptolites from the Eastern Puna (Argentina). Currently, he is preparing the main results from this research to be published in *Ameghiniana*. He also just obtained a scholarship from the ANCyT (Argentine Agency for Promotion of Science and Technology), to work on his Ph.D Thesis on paleoecology and morphological diversity of the Ordovician

graptolite faunas from the Central Andean Basin, supervised by Dra. Blanca A. Toro and Dr. Diego Balseiro.

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Elena V. LYKOVA (Russia) continues studies of the Ordovician graptolites from the Altai-Sayan Folded Area.

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Jörg MALETZ (Germany) is working on the Ordovician successions of a number of drill cores of southern Sweden with Per Ahlberg (Lund, Sweden). He is also working on the Auxilliary Boundary Stratotype Section and Point (ASSP) for the base of the Ordovician System at Dayangcha, Yilin Province, China together with a number of co-authors and plans to revise the graptolite taxonomy and biostratigraphy of the early Tremadocian graptolite genus *Rhabdinopora*. Further plans include work on the graptolite fauna of the late Cambrian Guole Biota with Zhang Yuandong and Zhu Xuejian (NIGPAS, Nanjing, China). Progress on the ‚Graptolite Treatise' has continued in 2019 and a few more chapters are nearing completion.

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Peep MÄNNIK (Estonia) is working on evolution, taxonomy and palaeoecology of conodonts, conodont-based high-resolution stratigraphy, bioevents and palaeogeography. He is also interested in sequence stratigraphy and evolution of sedimentary basins. Joint studies together with colleagues from Estonia, Germany, Iran, Poland, Russia, Sweden, U.K. and

USA on evolution and high-resolution stratigraphy of the Early Palaeozoic faunas and sedimentary basins on different palaeocontinents are going on.

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

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Patrick McLAUGHLIN (USA). It's been several years since my last correspondence, though I'm thankful to Carl Brett for keeping you up to date on our collaborative work. My move from the Wisconsin to Indiana Geological Survey five years ago brought many changes and I'm glad to report my collaborative research on the Ordovician received a boost as a result. Ongoing collaborations with Alyssa Bancroft, Poul Emsbo, Thijs Vandenbrooke, Carl Brett and others span the Upper Ordovician across major portions of the Illinois, Michigan, and Appalachian basins. I am glad to report that we've made some major biostratigraphic discoveries recently and our chemostratigraphic databases are swelling rapidly. We've been lucky to have a number of talented students working with us from the University of Ghent and University of Cincinnati. We are very pleased to welcome Cristiana Esteves, a new PhD student at U Ghent, as the newest member of our research collaborative. Another new collaborator is Jahan Ramezani at the MIT radiogenic isotope lab. Our work with Jahan has yielded a series of new CA-TIMS Pb-U zircon ages for both Ordovician and Silurian bentonites. We are working diligently to move these findings into publication and appreciate your patience.

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Tõnu MEIDLA (Estonia) is working on different aspects of litho- and biostratigraphy, ostracods and stable isotopes in the Ordovician of Estonia, Latvia and Lithuania (together with L. Ainsaar, O. Tinn, L. Lang, K. Truuver, T. Paiste, T. Ani, K. Kungla, S. Radzevičius) and Anticosti (together with A. Desrochers, Z. Taha, V. Perrier, M. Williams, D. Siveter). I hold the position of Professor of Palaeontology and Stratigraphy at the University of Tartu (Institute of Ecology and Earth Sciences), Estonia, and head the national (inter-university) Doctoral School of Ecology and Earth Sciences. I started publising about the aspects related to Ordovician stratigraphy in 1983. My Ordovician papers are addressing palaeontology, palaeoecology, biostratigraphy and biogeography (mainly ostracods), regional stratigraphy and stable carbon isotopic stratigraphy. I am the Chair of Estonian Commission on Stratigraphy affiliated with the Geological Society of Estonia.

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Ana MESTRE (Argentina) continues studying the biostratigraphy, taxonomy and biofacies of the Lower – Middle Ordovician conodonts from the Precordillera. Also, I'm studying the stratigraphy and evolution of Ordovician and Silurian sedimentary Precordillera basin. I'm working on taxonomy and evolution of Lower-Middle Ordovician conodonts from the Precordillera and developing carbonate microfacies analysis on the Ordovician carbonate platform. All these topics are developed in collaboration with Dr. Susana Heredia. Lower Ordovician conodonts are under study together with the Dr. Josefina Carlorosi, through the collaborative project about comparison and correlation of the Floian conodonts from Argentine Precordillera and Eastern Cordillera. Also, I have a PhD student (Florencia Moreno) who is developing a study on microfacies and conodont biostratigraphy of the Lower-Middle Ordovician San Juan Formation from the Central Precordillera.

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Jim MILLER (USA) continues working on upper Cambrian and Lower Ordovician conodonts from the Ibex Area, western Utah, USA. Much of the work is directed at defining the base of Cambrian Stage 10, the stage that is directly below the Ordovician. My proposed stratotype sections are at the FAD of *Eoconodontus notchpeakensis* (Miller 1969). Also working with Laura Speir and Paul Myrow on two conodont geochemistry projects in which I furnish the conodonts.

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Charles (Chuck) MITCHELL (USA) retired from UB at the end of 2019. I am still working on several projects, principally 1) Depositional and tectonic history of the Taconic foreland basin; 2) graptolite mass extinction and paleoenvironmental change during the Late Ordovician mass extinction; graptolite systematics and 3) taxonomy of various Mid to Late Ordovician graptolite faunas. All of this work is collaborative, including several graduate students who are finishing up their degrees and long-term collaborators Dan Goldman, Mike Melchin, Robert Jacobi, Chris Holmden, Juan-Carlos Gutierrez Marco, Chen Xu and others.

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Tatiana L. MODZALEVSKAYA (Russia) continues to work on the Upper Ordovician-Silurian-Lower Devonian brachiopods and stratigraphy in thematic projects connected with analysis of Regional scales of Eurasian Russian regions. I took part in the 13th International Symposium on the Ordovician System: Novosibirsk, Russia (July 19-22, 2019), presenting a poster on “Brachiopods of Ordovician and Silurian boundary deposits in the Arctic”.

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Axel MUNNECKE (Germany) reports that he hasn't done much in the Ordovician last year; however he co-authored several recently-published papers, that are at least somehow related to the Ordovician in areas ranging from the Baltic Basin to the high Himalaya in Tibet.

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Diego Fernando MUÑOZ (Argentina) is a researcher at Centro de Investigaciones en Ciencias de la Tierra (CICTERRA -CONICET and Universidad Nacional de Córdoba) investigating Lower Ordovician deposits of NW Argentina. During his PhD, he studied systematics, taphonomy, diversity and palaeogeography of brachiopods. Then he became an ichnologist in training, mainly studying marine siliciclastic trace fossils, particularly cruzianids, supervised by Dr M.G. Mángano and Dr B.G. Waisfeld. He is particularly interested in the relationship between the occurrences between trace fossils and their probable producers and in studying the ichnological record from a paleobiological perspective. Regarding the ichnology studies, he has been working in the last years with radial to rosette trace fossils. Furthermore, he is in collaboration with colleagues studying graptolite and trilobite Ordovician biostratigraphy of the "Central Andean Basin".

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Navid NAVIDI-IZAD (Iran) is currently a PhD student at the Department of Earth Sciences, Kharazmi University, Tehran, Iran. I am working on the biostratigraphy, palaeoecology and palaeobiogeography of the lower Palaeozoic (Upper Cambrian-Ordovician) palynomorphs of northern Iran and I will finish my PhD in early 2020. In June 2018 I went to the Evo-Eco-Paléo unit of University of Lille, France, for an 8-month sabbatical leave until January 2019. In this year, together with Dr. Thomas Servais, Dr. Hossein Hashemi, Dr. Yan Kui and David Kröck, we made a systematic revision on the Middle – Upper Ordovician acritarch genus *Orthosphaeridium* recovered from northeastern Iran and South China. Also I collaborating with David Kröck and Houcine Benachour to revision of the Cambrian - Ordovician acritarch genera *Vulcanisphaera* and *Saharidia*. Another paper is discussing about Upper Ordovician colonial palynomorphs from northeastern Iran. This paper is written in collaboration with Dr. Thomas Servais, Dr. Hossein Hashemi, Dr. Charles Wellman and Dr. Borja Cascales-Miñana. In November 2019, I attended the 1st Asian Palaeontological Congress in Beijing, China.

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Brian NORFORD (Canada) is close to completing a monograph of the Canadian trimerellid brachiopods with lots of silicified specimens. He has also been working with Bob Frey, who has completed description of a rich Ordovician nautiloid cephalopod fauna southeastern British Columbia (for a paper now in press) – Brian provided the stratigraphic and environmental setting, including recognition of yet another unconformity within the Ashgill.

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Leon NORMORE (Australia) is working on geochronology, chemostratigraphy, biostratigraphy, source rock analysis, data distribution and 3D outcrop modelling in the Ordovician strata of Australia. Work with colleagues from the Geological Survey of Western Australia (GSWA); Louisa Dent, Alex Zhan and Peter Haines and the Geological Survey of New South Wales; Yong Yi Zhen and Ian Percival (retired) has focussed on outcrop and subsurface Ordovician rocks of the Canning Basin in the northern part of Western Australia.

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Olga T. OBUT (Russia) continues her studies of the Ordovician sedimentary strata of the Altai-Sayan Folded Area and Central Asia – microfossils (radiolarians, conodonts) and biostratigraphy.

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Alan OWEN (UK). The issue of *Fossils and Strata* edited with David Bruton (Oslo) arising from the 6th International Conference on Trilobites and their Relatives was published in early 2019. It includes several papers on Ordovician trilobites. The description of trilobites from the Upper Ordovician Slade and Redhill Mudstones of South Wales with Lucy McCobb (National Museum of Wales, Cardiff) and Patrick McDermott continues apace and a paper on the taphonomy of the trilobites in an echinoderm Lagerstätte in the formation was included in

the *Fossils and Strata* volume. Progress is being made on the description of the trilobites from the Hirnantian of the Scottish Southern Uplands with Keith Ingham (Glasgow) and the description of several Irish Ordovician trilobite faunas has moved up the "to do list" as has an analysis of Ordovician deep water trilobite faunas.

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Dmitry A. PECHERICHENKO (Russia) is an MS student at the Novosibirsk State University, studying Ordovician conodonts from the Gorny Altai.

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Ian PERCIVAL (Australia) officially retired from the role of Palaeontologist with the Geological Survey of NSW in mid-2018, and is now an Honorary Research Associate. My research continues to concentrate on Early Palaeozoic conodonts and brachiopods, working mainly with Yong Yi Zhen on faunas from New South Wales and Western Australia (in collaboration with the Geological Survey of WA). In 2019 I co-authored several papers on the palaeontological and sedimentological significance of Ordovician strata in the Cliefden Caves and Fossil Hill area of central NSW that appeared in a special issue of *Australian Journal of Earth Sciences* focussing on geoheritage. I visited the Nanjing Institute of Geology & Palaeontology in October 2019 to work with Guangxu Wang on several projects involving study of Late Ordovician biotas, extinction mechanisms and stratigraphy across the Ordovician-Silurian boundary. I am editor of *Australasian Palaeontological Memoirs* and on the editorial board of *Palaeoworld*, in addition to editing *Ordovician News* (for the final time).

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Leonid POPOV (United Kingdom) continues to work on the Ordovician palaeontology and biostratigraphy of Central Asia, Baltoscandia and the Middle East. Current research is

focused on the Late Ordovician brachiopod faunas of Zerafshan Range (Uzbekistan) in cooperation with Irina Kim (Geological Survey of Uzbekistan). Recently completed research includes monographic studies of the Mid to Late Ordovician brachiopods from the West Balkhash and Betpak-Dala regions, and Late Ordovician Brachiopods from Ishim region, both Kazakhstan.

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Elena RAEVSKAYA (Russia) works on Ordovician acritarchs from different regions of Russia focusing on its taxonomy, biostratigraphy and paleobiogeography. Since many years she participates in consecutive multidisciplinary projects (under leadership of Andrei Dronov) supported by Russian Foundation for Basic Researches and partly by IGCP projects aimed to study evolution of the Ordovician basins from Siberian and East-European platforms and search for reliable correlative markers of biotic and abiotic events. Under umbrella of the newly started 3- year project titled as "Regional and Global Aspects of the Great Ordovician Biodiversification Event on the Siberian and Russian platforms" she continues to study in different aspects microphytoplankon diversity and distribution. Together with an international team including Xiao-Feng Wang, Yu-Ping Qi, Chuan-Shang Wang, Chun-Bo Yan, Svend Stouge, Jörg Maletz, Gabriella Bagnoli, she examined the Cambrian-Ordovician boundary interval in the Xiaoyangqiao section at Dayangcha of North China to propose that as an Auxilliary Stratigraphic Section and Point (ASSP) for the base of the Ordovician System, which was then approved and formally adopted by the ISOS.
At present she is a Vice President of the Paleontological Society of Russia.
Her current position is a Head of the Stratigraphy Department and a Deputy Director of JSC "Geologorazvedka" of the Russian Geological Survey JSC "ROSGEO".

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John REPETSKI (USA) reports that his Ordovician work continued to be chiefly on conodont biostratigraphy, CAI and systematics, USA and elsewhere, with numerous colleagues: compiling CAI maps and biostratigraphy of eastern U.S. basins; biostratigraphic support for USGS and other mapping projects; paleobiogeographic studies relating North American Lower Paleozoic faunas to those of other paleocontinents; conodont studies of impact structures; also age-dating of faunas and studies of Cambrian and Ordovician phosphatic problematica.

During 2019, with John Taylor (Indiana Univ. of Pennsylvania) and Justin Strauss (Dartmouth College), we continued refining the biostratigraphy for the Cambro-Ordovician section in easternmost Alaska using conodonts and trilobites; and with J. Taylor and Jim Loch (Univ. of Central Missouri), engaged in study of agnostoids and accompanying conodonts in the search for a good GSSP for Cambrian (Furongian) Stage 10. Finally, along with co-editors Annalisa Ferretti (Modena) and Alyssa Bancroft (Indiana Univ., Bloomington), we completed the final stages of editing the PPP volume resulting from the GECkO symposium "Global events impacting conodont evolution," at ICOS-IV. Several of the papers in this volume concern the Ordovician. The volume should be published during 2020. Thanks to all the authors for their patience and good work.

I enjoy continuing Emeritus status with USGS. We relocated the conodont preparation labs in 2019, but at least we will still have labs operating. I still find time for research on numerous "left over" projects from previous years (="Lazarus projects"?), and to help curate and protect the conodont legacy of the USGS. Fortunately, our good colleagues Nancy and Rob Stamm, Randy Orndorff, and David Weary here at USGS-Reston are still actively employing conodonts in their projects. Randy and Dave are mapping areas with abundant Ordovician strata, and problems, so Ordovician activities promise to continue.

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Matthew SALTZMAN (USA) is continuing to work on stable and radiogenic isotope studies in the Ordovician. Work was completed this year on a *Palaeo-cubed* paper on Darriwilian-Sandbian stable isotope studies in the Appalachians that was first-authored by my Master's student Datu Adiatma for the GOBE edited volume. Datu also collaborated with other PhD students in my research group Chris Conwell and Teresa Avila as well as others to convene a session at GSA in Phoenix "The Ordovician Earth: Integrated Perspectives on the Fossil and Rock Records". Datu is continuing on for his PhD in the Ordovician at Ohio State, joining current PhD student Chris Conwell who is examining Sr-Nd isotope trends in the Ordovician and integrating this with oxygen isotope data from conodonts (in collaboration with Cole Edwards and Dave Fike). Datu will be pursuing a Li isotope study in the Ordovician in collaboration with Xiaoming Liu at UNC-Chapel Hill. Teresa's work in the Ordovician will conclude with her Master's work and she will start a Devonian project for her PhD. I remain interested in Nd isotope stratigraphy and have a nice data set from Clear Spring, MD that is in preparation - my ongoing administrative role as Director of our School at Ohio State is, however, not helping! I have also been collaborating with former PhD students Cole Edwards and Seth Young, including papers published this year with Cole on carbonate-associated sulfate (CAS) extraction methods for sulfur isotope stratigraphy and with Seth's graduate student Nevin Kozik on Darriwilian–Sandbian paired carbon and sulfur isotope stratigraphy. I am also collaborating with Feifei Zhang (Nanjing), Richard Stockey (Stanford), and many others on a U isotope project through the GOBE that will be presented by Feifei at Goldschmidt 2020.

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Nikolay V. SENNIKOV (Russia) continues investigation of the geological structure, sedimentary environments and biostratigraphy of the Ordovician strata of the Altai-Sayan Folded Area.

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Thomas SERVAIS (France) is research director at the CNRS, based at the University of Lille. He works on the evolution of the marine microphytoplankton (acritarchs). His research is mainly focused on the Great Ordovician Biodiversification Event (GOBE) within the frame of the IGCP project dedicated to the onset of this event (www.igcp653.org). As one of the co-leaders of the project, he will organize the 'absolutely final meeting' of the project, when it is (hopefully) on extended term in 2021 (see elsewhere in the newsletter). This meeting is now scheduled for September 13-16, 2021, at Lille University, with pre- and post-congress excursions to Belgium and Wales. Several publications in 2019 were focused on Ordovician research. The term 'Furongian gap' was discussed in a paper of Harper et al. (2019) in the special issue that was based on presentations of the IGCP 653 annual meeting in Yichang (Zhang, Harper, Servais, eds. Palaeoworld, 2019). The work on the concept of the GOBE (that is not an 'event'…) continues with David Harper (Durham University, UK) and others. Collaboration with colleagues from the Nanjing Institute resulted in articles on Ordovician chitinozoan (Liang et al. 2019) and acritarch (Yan et al. 2020) biostratigraphy and palaeoecology. Research continues in collaboration with several Chinese colleagues : Li Jun, Liang Yan, Yan Kui (all Nanjing Institute of Geology and Palaeontology) and Wang Wenhui (Central South University, Changsha) on both acritarch and chitinozoan research. Shan Longlong (also Nanjing) starts a new PhD subject on the Cambrian-Ordovician acritarchs from North China in collaboration with Lille University. In late 2019 David Kröck finished his PhD at Lille, on the analyses of Palaeozoic phytoplankton diversity. Several papers are in preparation. In this context, Kröck et al. (2019) documented the biostratigraphy and palaeogeography of Ordovician acritarchs from Colombia. Other papers (currently in press) revise several important Ordovician acritarchs, such as *Vulcanisphaera* and *Peteinosphaeridium*. The special issue (Stigall et al., eds. Palaeo3, 2019) based on the Annual Meeting of IGCP 653 in Athens, Ohio, includes a review paper on the 'GOBE of land plants' (Servais et al. 2019), illustrating the strong increase of the diversity of (non vascular) plants on the continents at a global level during the Ordovician. The research stay at Lille of the PhD student Navid Navidi (Teheran, Iran) resulted in the revision of the Ordovician acritarch

genus *Orthosphaeridium*, and the description of colonial palynomorphs from Iran (papers published in 2020). Houcine Benachour is involved in another PhD project at Lille, in collaboration with Tlemcen University, Algeria. This study is focused on the Ordovician of the Moroccan-Oranese Meseta. The project also involves a collaboration with Mustapha Akodad (Nador, Morocco) and a revision of the Ordovician stratigraphy of north-eastern Morocco and north-western Algeria. Research on the Fezouata Lagerstätte (Morocco) continues with Bertrand Lefebvre (Lyon, France) and Khajida El Hariri (Marrakech, Morocco). The research on the understanding of the phytoplankton in the evolution and development of (early) marine ecosystems continues with Ron Martin (University of Delaware, USA).

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Tatyana A. SHCHERBANENKO (Russia) has commenced a study of Ordovician brachiopods from the Gorny Altai.

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Lawrence SHERWIN (Australia) was on sick leave for much of the earlier half of 2019. He remains an honorary associate of the Geological Survey of New South Wales. He has nearly completed a paper on a very Late Ordovician to possible Early Silurian graptolite fauna from the Cotton Formation near Forbes, NSW.
The Orange office of the Geological Survey is expected to move some time during 2020 but the postal and email addresses should remain unchanged unless there is another departmental restructuring.

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Lyuba SHMELEVA (Russia) and her supervisor Dr. Anna Antoshkina plan collaboration studies in the project entitled: “The sedimentology and palaeoecology of Late Ordovician

sphinctozoan-bearing reefs" with Dr. Li Qijian (Nanjing Institute of Geology and Palaeontology, Nanjing, China). We have well-preserved materials from the Northern Urals, which provide one of the best examples to compare with the cases from South China. Anna Antoshkina's previous work on the Ordovician reefs will be a significant contribution to the planned joint project.

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Colin SPROAT (Canada) has resumed his research on the Early Paleozoic epicontinental brachiopod faunas of North America, focusing initially on quantifying the evolution and paleoecology of several key brachiopod lineages. He is also continuing his work, in collaboration with Renbin Zhan and Yuchen Zhang, documenting a shallow water brachiopod fauna in northwest China and using this fauna to better understand the paleogeography of the plates that now comprise China.

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Alycia L. STIGALL (USA) continues studying ancient species invasions and Ordovician brachiopod biogeography, evolution, and paleoecology with an emphasis on clades with North American members. I am particularly interested in teasing apart speciation and biogeographic patterns during the GOBE and Richmondian Invasion intervals. Within that context, I am a co-leader of the IGCP 653 project on the GOBE. I am particularly pleased that the special issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* that Christian Rasmussen, Rebecca Freeman, Cole Edwards and I edited (related to the 2018 IGCP 653 meeting in Athens, Ohio) is now available online: https://www.sciencedirect.com/journal/palaeogeography-palaeoclimatology-palaeoecology/special-issue/10LQ9R6FQ5K. Within the volume, my co-editors and I present a synthetic analysis of the biotic and abiotic factors of the GOBE (Stigall et al. 2019), which we hope will be a useful contribution to the conversation about causes, timing, and drivers. My students and I continue to use phylogenetic biogeography and ecological niche modelling methods to better constrain speciation during this interval, and look forward to sharing more results on this work in the upcoming year. Finally, I oversee the website for IGCP 653, so please email me with any posts, information, or opportunities that you would like to share with the group or your related articles when they are published so I can include them.

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Justin STRAUSS (USA) is continuing to work on the Cambrian–Ordovician of Alaska and Yukon in collaboration with John Taylor (IUP Emeritus), John Repetski (USGS Emeritus), Michael Melchin (St. Francis Xavier), Tiffani Fraser (YGS), David Moynihan (YGS), and Erik Sperling (Stanford). At the moment, we have one paper in review refining the nomenclature and depositional history of the Road River Group in Yukon, Canada, and we have 4-5 more papers in preparation that explore the redox geochemistry of this spectacular deep-marine succession. This work follows up on a > 10-year project studying the Cambrian–Ordovician faunas of the Jones Ridge region with Taylor and Repetski, which is slowly making progress towards publication. In addition, Strauss' postdoctoral scholar (Akshay Mehra) and PhD student (James Busch) are working on a shelf-slope transect across the Ordovician–Silurian boundary interval in Yukon, Canada, which will result in a number of publications integrating sequence stratigraphy, sedimentology, and biostratigraphy. Our aim to combine these newer datasets into a larger review of the Cambrian–Ordovician system of Yukon and Alaska that will hopefully come together in the near future.

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John TAYLOR (USA) once again found most of his time consumed by work on rich Cambrian trilobite and agnostoid faunas from western North America, but some progress was made on Late Ordovician material from the Bouvette Formation in the Yukon collected by Justin Strauss and his team at Dartmouth College. In addition to the new species of *Hypodicranotus* mentioned in the last issue of Ordovician News, the Bouvette faunas include nicely preserved and abundant material of *Remopleurides,* along with a few other taxa. He still remains (naively?) hopeful that the coming year will see progress on Early Ordovician faunas from the Jones Ridge Formation and the Nanook Limestone in northern Alaska, and/or coeval faunas from earlier projects in the Appalachians, southwestern USA, and northern Rocky Mountains with John Repetski, James Loch, Paul Myrow, and Rob Ripperdan.

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Tatiana TOLMACHEVA (Russia) continues to work on the Ordovician stratigraphy and conodonts of Kazakhstan with group of Geological Institute RAS (Moscow), leaded by Kirill Degtyarev. The study of conodonts chiefly aims age determination of siliceous-volcanogenic units in ophiolite complexes from different tectonic zones of Kazakhstan. These studies also accompanied by taxonomic work on conodont complexes from shallow carbonate rocks of Kazakhstan. Parallel to this, a study of carbonate rock faunas from the Mendeleev Rise (Arctic Ocean) continued during the past year. A second article on this topic has been published recently. Among the ongoing projects is the processing of the Mirny Creek section carbonate samples (Omulev Mts, NE Russia), collected by Dronov in 2019. Zhang & Barnes (2007) and Kaljo et al. (2012) previously published some data on this section; the new samples were picked from the least studied for conodonts Katian to Sandbian interval. During the XIII Symposium on the Ordovician System (Novosibirsk, Russia) a field excursion (with Andrey Dronov) has been carried out on July 15-17 on the Ordovician sections around St Petersburg. Over the past year, a lot of work has been done in the Russian Stratigraphic Committee, including the preparation of the new edition of the Stratigraphic Code of Russia.

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Blanca Azucena TORO (Argentina) continues working on Early Paleozoic graptolites from the Central Andean Basin. Her research is mainly focused on taxonomy, biostratigraphy and paleoecology. Additionally, she is involved in the revision of classical graptolite collections housed in formal Argentine institutions, in multidisciplinary projects to cooperate with colleagues from Argentina and Germany, and also dedicated to training PHD students in different subjects relating to her expertise.

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M. Franco TORTELLO (Argentina) continues working with Susana Esteban (University of Tucumán) on Tremadocian trilobite biostratigraphy and paleoenvironments of northwestern Argentina. An article on the trilobites and sedimentary settings from the *Bienvillia tetragonalis* Zone (lower upper Tremadocian) of Iturbe, Cordillera Oriental of Jujuy, is in press in *Ameghiniana*. Together with Josefina Carlorosi (University of Tucumán)

a conodont-trilobite assemblage, including *Cordylodus angulatus* and *Kainella* (upper lower Tremadocian), has been reported from the Iruya area (*Andean Geology*, January 2019).

Additionally, a systematic revision of Cambrian trilobites from the Argentinian Precordillera is in progress.

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Fons VANDENBERG (Australia): My work for the last 5 years or so has involved taxonomy and biostratigraphy of Ordovician graptolites held in the collection of the Melbourne Museum. My more recent papers (see Bibliography of Ordovician research papers in this newsletter), published in the *Royal Society of Victoria Proceedings*, are open access and are available from the following web page: https://www.publish.csiro.au/rs

In addition to journal papers, 33 of my illustrations of graptolite types from the Ordovician of Victoria and New Zealand were published in the *Atlas of Graptolite Type Specimens* Folio 3 (2018). (Earlier illustrations were published in folios 1 and 2). Under the name F. VandenBerg, these include:
Expansograptus aureus (T. S. Hall, 1914) (3.11); *E. dilatans* (T.S. Hall, 1914) (3.26); *E. latens* (T.S. Hall, 1914) (3.45); *E. asperus* (Harris & Thomas, 1938) (3.8); *E. v-deflexus* (Harris, 1924) (3.96); *E. vicinus* (Harris & Thomas, 1938) (3.97);
Azygograptus attenuates Skwarko, 1962 (3.9); *A. novozelandicus* Skwarko, 1962 (3.60);
Acrograptus cognatus (Harris & Thomas, 1935) (3.15); *A.*? *cobbensis* (Keble & Benson, 1928) (3.14);
Anomalograptus? insuetus Keble & Benson, 1928 (3.41); *A.*? *tabidus* Keble & Benson, 1928 (3.85);
Isograptus caduceus pertensus Harris, 1933 (3.69);
Arienigraptus tau (Harris, 1933) (3.88);
Glossograptus tepungai (Skwarko, 1962) (3.90);
Nemagraptus gracilis aotearoaensis Skwarko, 1962 (3.5);
Dicellograptus gravis Keble & Harris, 1925 (3.35); *D. intermedius* Skwarko, 1962 (3.42); *D. russonioides* Skwarko, 1962 (3.76);
Dicranograptus hians T.S. Hall, 1905 (3.36); *D. semispinifer* T.S. Hall, 1906 (3.77);
Archiclimacograptus decoratus (Harris & Thomas, 1935) (3.23); *A. differtus* Harris & Thomas, 1935 (3.25);
Amplexograptus ingens T.S. Hall, 1906 (3.39); *A. tardus* (T.S. Hall, 1907) (3.87);
Orthograptus quadrimucronatus montanus Harris & Thomas, 1955 (3.56); *O. thielei* (T. S. Hall, 1905) (3.91);
Climacograptus? *uncinatus* Keble & Harris, 1934 (3.93);
Diplacanthograptus wellingtonensis (T.S. Hall, 1905) (3.100);
Pseudoclimacograptus (s.l.) *modicellus* (Harris & Thomas, 1935) (3.55);
Normalograptus coitus (Keble & Benson, 1928) (3.16); *N. spiculatus* (Keble & Benson, 1928) (3.82);
Monograptus spiralis permensus Keble & Harris, 1934 (3.67).

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Please note my new email address – do not use others you may have listed for me, as one of those was recently hacked.

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Thijs VANDENBROUCKE (Belgium) remains interested in reconstructing the Ordovician palaeoclimate and palaeo-environment, using fossil proxies.

Julie De Weirdt continues her PhD research project with me at UGent, focussing on geochemistry and palynology of the Upper Ordovician - lower Silurian in N. America (in collaboration with Poul Emsbo, USGS; Patrick McLaughlin, IGWS and André Desrochers, UOttawa). Cristiana Esteves just started her PhD research project focussing on the chitinozoan biostratigraphy of the Katian Maquoketa Group in the USA (in collaboration with Patrick McLaughlin & Alyssa Bancroft at IGWS, and Poul Emsbo at USGS). MSc student Cecile-Marie Lissens is finalizing her work on the chitinozoans from the Katian Penwhapple Formation in the Scottish Girvan District and started a new project on stable carbon isotopes of Ordovician chitinozoans (in collaboration with USGS and Utrecht University). Dr. Thomas Wong Hearing has joined the lab, and whilst focusing on reconstructing Cambrian climates, is also pursuing his interests in Ordovician graptolites. Finally, I am also happy to announce that Matthias Sinnesael has successfully defended his PhD project (co-supervised with Philippe Claeys at the VUB, Belgium) on astronomical forcing during the Late Ordovician and moved on to a postdoc position at the Durham University (UK).

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

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Gustavo G. VOLDMAN (Argentina) continues working on taxonomy, biostratigraphy, and thermal alteration studies of lower Paleozoic conodonts from Gondwana, mostly the Argentine Precordillera and NW Argentina. He also participates in multidisciplinary projects to study the lower Paleozoic basin evolution of the Precordillera. A study on Katian conodonts from N Spain has been recently published in Bulletin of Geosciences, resulting from his visiting research fellowship at the Universidad de Oviedo.

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WANG Guangxu (China). In 2019, a global review of benthic faunas across the Ordovician and Silurian transition in collaboration with Renbin Zhan (NIGPAS) and Ian Percival (Geological Survey of NSW) was published in *Earth-Science Reviews*. In this paper, we recognize three successive Transitional Benthic Faunas (TBFs 1–3) within the Hirnantian, resulting in an integrated, higher-resolution timescale and hence a reinterpretation of the timing and evolutionary pattern of the end-Ordovician mass extinction. A manuscript on corals from the top of the Malachis Hill Formation (latest Katian) of central NSW, which represent the sole occurrence of C/S Fauna IV of the regional biostratigraphic scheme, was finalised in collaboration with Ian Percival and Yong-Yi Zhen (Geological Survey of NSW). Good progress was also made with them in describing a slightly older (late Katian) coral fauna from the 'Trelawney beds' of northern NSW. In addition, a paper on stratigraphic revision of the O-S boundary rocks in the Meitan area of South China has been submitted for publication with *Geological Journal*. Ian Percival was hosted for a three-week visit to Nanjing in October, with one short field trip being made and two manuscripts finalised.

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Wenhui WANG (China) received her PhD in Paleontology and Stratigraphy at Nanjing University, China in 2013. After having been an assistant researcher at that same institution until 2016, she is now an associate professor at Central South University in Changsha, China. Her research interests include two parts. One is Palaeozoic graptolitic palaeontology and stratigraphy, and she is now working on several localities yielding graptolites from south China near the Cambrian/Ordovician and Ordovician/Silurian boundaries. Another part of her research interest is on studies of early Palaeozoic palynology. Recently, Wenhui has

collaborated with several teams of palynologists and published papers on both acritarch and chitinozoan investigations from South China.

In the past year (2019), she has been involved in palynological (chitinozoans and acritarchs) study around the Ordovician-Silurian boundary with Paul Myrow (USA) and Thomas Servais (France). Primary results of chitinozoans show that the samples represent an age around late Ordovician to earliest Silurian. Also, an integrated study on both graptolites and chitinozoans from South China show that the distributions of both groups are eco-dependent but show different onshore–offshore diversity trends. Chitinozoans are more diverse nearer to shore whereas graptolites are more diverse offshore, preferring slope facies. Recently, she is working on the ultrastructures of carinae with Liang Yan (China) and Olle Hints and Jaak Nõlvak from Estonia.

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WANG Xiaofeng (China). In 2019, I was mainly dealing with two research projects related to Ordovician, together with Svend Stouge, Jorg Maletz, Wang Chuanshang (graptolites), Yan Chunbo (conodonts) and others. One is to continue to complete the restudy of a high-resolution integrated bio-, sequence-, chemo- and magneto-stratigraphic research of the Xiaoyangqiao section, Dayangcha, Jilin, China and its precise comparison to the Green Point GSSP section, Newfoundland, Canada. The Xiaoyangqiao section holds a well-preserved, perfect and diverse fossil record of conodonts, graptolites, trilobites and acritarchs across the Cambrian-Ordovician boundary for worldwide correlation. Our study indicated that the current boundary horizon defined in the Green Point GSSP section is corresponding to the upper *C. intermedius* Zone, ca 1m below the first planktic graptolite *R. proparabola* levels, and 1.5 m below the base of *Cordylodus lindstromi* Zone in the Xiaoyangqiao section, along with the negative $\delta^{13}C_{carb}$-isotope and REE excursion identified and easy to be correlated globally (Wang et al., 2019. Now the Xiaoyangqiao section has been approved as ASSP for the base of the Ordovician System by International Committee of Ordovician System. A brief ceremony was to have been held on May 14-16 this year in the Baishan-Xiaoyangqiao section, together with a seminar on classification of standard strata of various geological ages in China, organized by the Chinese Commission of Stratigraphy. I am very sorry to announce that this unveiling ceremony of the Xiaoyangqiao section has had to be postponed until this autumn (perhaps even next year) due to the disruption caused by the coronavirus pandemic. The rescheduled time will be discussed with participants and the China Commission of Stratigraphy before a decision.

Following the requirements of the Chinese Commission of Stratigraphy, this international group started another new research project on the regional classification and comparison standard of Silurian System in China. The focus is on investigating and studying several represented boundary sections bearing graptolites, chitinozoans or conodonts, across series or stage, especially for the Mid-Llandovery to Pridoli interval, in order to fill and improve the classification and correlative criteria for the series and stage boundaries and

further solve the problem of precise division and comparison of choronostratigraphic unit boundaries between different tectonic- palaeogeographical regions in China.

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Charles WELLMAN (UK) continues his research on early land plants and the terrestrial microbiota that existed on land before the land plants evolved. He is currently involved in collaborative work on Ordovician palynomorph assemblages from Oman, Saudi Arabia and South Africa, with recent fieldwork conducted on the Cape Supergroup around the Cape Basin of South Africa.

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Henry WILLIAMS (Canada) took a welcome break from Cretaceous offshore eastern Newfoundland oil exploration in order to identify graptolites collected by Ryan Lacombe while completing his MSc thesis on the Port au Port Peninsula of western Newfoundland, supervised by John Waldron (University of Alberta). These are an important tool in both untangling the stratigraphy of mélanges and allowing a detailed correlation of Darriwilian foreland basin sediments formerly mapped as Humber Arm Allochthon. The mélange interpretation (Tremadocian-Floian) was published in *Gondwana Research* last year, while the Darriwilian study has been submitted to *American Journal of Science*. I have also been helping a few other geologists with Ordovician graptolite identification in my spare time, including Morten Smelror (Norwegian Geological Survey) and Stephen Pollock (University of Southern Maine).

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David WRIGHT (USA) collaborated with Selina Cole & Bill Ausich on two papers published in 2019 documenting crinoids from the Katian age Brechin Lagerstätte of Ontario.

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Rongchang WU (China) is working on Ordovician stratigraphy and conodonts. Currently, my research is focused on the Early and Middle Ordovician conodonts and carbon chemostratigraphy in South China. Another project has been focusing on the late Cambrian-Ordovician-Silurian palaeoclimatic and palaeoenvironmental changes by use of conodont apatite oxygen isotope, carbon isotope and microfacies analysis.

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YAN Kui (China) works mainly on Upper Ordovician acritarchs in Tarim and Early Ordovician acritarchs in South China. In July 2019, I attended the 13th ISOS and IGCP 653 annual meeting in Novosibirsk, Russia, and visited Cambrian-Ordovician strata from the Saint Petersburg area and Ordovician strata from the Tungus Basin in Siberian Platform. In August, my student Longlong Shan and I visited the Dayangcha section in northern China and collected samples for his PhD research. In November, I attended the 1st Asian Palaeontological Congress in Beijing.

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Seth A. YOUNG (USA) is continuing to investigate and reconstruct marine redox conditions on both local and global scales from late Cambrian, Ordovician, and Silurian stratigraphic successions from the Great Basin (Nevada, USA), Appalachian Basin (Virginia/West Virgina, USA), USA Midcontinent (Tennessee), Sweden, Estonia, Latvia, and Czech Republic. These various projects in the early-mid Paleozoic are ongoing collaborations with Jeremy Owens (FSU), Benjamin Gill (VTU), Per Ahlberg (LU), Mats Eriksson (LU), Olle Hints (TUT), Dimitri Kaljo (TUT), Tonu Martma (TUT), Matthew R. Saltzman (OSU), Stig M. Bergström (OSU), Emma Hammerlund (LU), Paula Noble (UNR), Sarah Pruss (SC), Mu Liu (IGG-CAS), and Jiri Fryda (CGS). Last year I published with my PhD student, Nevin Kozik, new Middle-Upper Ordovician C and S isotope chemostratigraphy from a very expansive carbonate sequence within the southern Appalachian Basin (USA) in *Palaeogeography, Palaeoclimatology, Palaeoecology.* Additionally, I published with my postdoc, Anders Lindskog, two other Lower-Middle Ordovician C and O isotope chemostratigraphy related papers in *Lethaia* from successions in Sweden and Iowa,

respectively. At the moment I have currently one manuscript in review documenting local to regional marine redox changes within the Baltic Basin (Sweden, Latvia) spanning the LOME interval continuing through several early Silurian extinction intervals. I have active projects reconstructing both local and global marine redox conditions spanning the GOBE interval using novel proxies (e.g., I/Ca, Tl isotopes, Fe speciation, trace metals) in both Appalachian and Baltic basins.

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ZHAN Renbin (China) was paying attention to two things concerning the Ordovician study during 2019, the GOBE (Great Ordovician Biodiversification Even) and the EOME (end Ordovician mass extinction), based on the material from China. Together with his domestic and foreign collaborators, they had got some new achievements on both academic problems. Particularly they have got four reliable isotope ages from a single Ordovician-Silurian boundary section in northeastern Yunnan Province (western South China palaeoplate). Using these absolute ages and also taking into account the sedimentation rate at that section, they have obtained new dates for the base and the top boundaries of the Hirnantian Stage. Furthermore, for the first time, they have proposed that the EOME happened within 0.2 M and the O/S boundary is 442.67±0.24 Ma in age, 1.13 million years younger than the age given in the International Stratigraphical Chart (2018 version) with a much higher accuracy (or much smaller deviation). Their study effectively and convincingly explains the mechanism of the end Ordovician glaciation causing the EOME.

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Shunxin ZHANG (Canada) has carried out the following projects in the Canadian Arctic area in 2019: 1) the Ordovician stratigraphy and biostratigraphy on northern Baffin Island; 2) the Ordovician stratigraphy and biostratigraphy on Boothia Peninsula; 3) the Late Ordovician–early Silurian conodonts from carbonate xenoliths preserved in the kimberlites on the Hall Peninsula, southern Baffin Island.

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Yuandong ZHANG (China) is continuously working on:

(1) An integrated stratigraphy of graptolite, conodont, chitinozoan, acritarch, radiolarians, and carbon isotope chemostratigraphy, and cyclostratigraphy of the Ordovician in China (a NSFC grant and a grant from the Ministry of Science and Technology of China, 2014-2019). This work aims at a refined stratigraphic correlation of the Ordovician in China based mainly on biostratigraphic and chemostratigraphic records. Among the latest and most significant products will be the publication of book "Integrative Stratigraphy and Index Fossil Atlas of Ordovician in China" by Zhejiang University Press and Elsevier, which is scheduled for the summer of 2020. 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 some 160 plates of index fossils including graptolites, conodonts, trilobites, brachiopods, cephalopods, acritarches, chitinozoans, radiolarians, corals and stromatoporoids.

(2) Geological characteristics of Palaeozoic black shales in China. This has been the main tasks of a project supported by the Chinese Academy of Sciences (2014-2018) and one of the recently launched National Science and Technology Major Projects (2017-2019). As results of the projects, over 5000 m of drill cores for the most potential gas shale in China (Lower Cambrian, and Upper Katian–Llandovery) have been obtained and accumulated in the past years for multi-disciplinary analysis. The cores are opened to global scientists for study and sampling, and from which some samples have been collected for geochemical and microfacies analysis. Those who are interested in this work or aim at some other related approaches, please contact the project leader (Zhang Yuandong).

(3) Hirnantian Conservat-Lagerstätte in Anji (Anji Fauna), Zhejiang Province, in cooperation with Joe Botting and Lucy Muir of UK, financially supported by President's International Fellowship Initiatives (PIFI) program and a recently approved NSFC grant (2018-2021). This sponge-dominated lagerstätte, discovered in late 2012, is typified by the abundant and highly diverse articulate sponges (over 100 species) often with soft tissues, in association of graptolites, nautiloids, arthropods, echinoderms, etc. The Anji Fauna is preserved within a 9-meter-thick black shale, underlain and overlain by siltstone and sandstones, in the Wenchang Formation of clastic faices. Up to date, over 5000 specimens have been collected from seven sections in the Anji County. As constrained by the associated graptolites, the fauna is of latest Hirnantian age. A preliminary study indicates that this extraordinarily diverse, sponge-dominated community thrived immediately after the Hirnantian mass extinction in South China.

(4) IGCP Project 653 "The Onset of the GOBE". Under the frame work of this project, my proposed research project on the "Origination and evolution of early planktonic and nektonic ecosystems" based on the geological records in South China, have been granted by Chinese Academy of Sciences (2018-2022). This work focuses on the early occurrence records of graptolites, conodonts, chitinozoans, cephalopods, radiolarians, and the potential coincident changes of geochemical proxies for redox and oxygenations. Among the latest products of this CAS project is the editing special issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* on marine oxygenation, de-oxygenation, and life during the early Paleozoic, which is scheduled for publication in 2020.

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Yong Yi ZHEN (Australia) is working on various projects in research of the Ordovician biostratigraphic and palaeobiogeographic applications based mainly on the studies of conodonts, corals and stromatoporoids. During 2019, he successfully completed a major data entry project of the conodont specimens preserved in 6000+ chert thin sections, mostly sampled from Ordovician turbidites in the Lachlan Orogen of New South Wales. Over 4000 better preserved specimens have been photographed, which will form part of the Digital Fossil Atlas of NSW. The conodonts recovered from these chert thin sections are studied and prepared for publication jointly with Ian Percival. Other projects of the Ordovician work include (1) documentation of Middle Ordovician (Goldwyer and Nita formations) conodonts from subsurface Canning Basin including revision of those described by Watson in 1988; and (2) documentation of conodont faunas from the northern-central Xizang (Tibet) jointly with colleagues from Nanjing Institute of Geology and Palaeontology.

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ORDOVICIAN RESEARCH PUBLICATIONS 2019-early 2020

[note that while the following compilation predominantly lists papers concerned solely with Ordovician topics, for completeness and comparison it also includes some publications dealing with studies of Furongian and Llandovery biota and stratigraphy. Some papers published in prior years are also included where these were not cited in previous issues of *Ordovician News*]

A

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