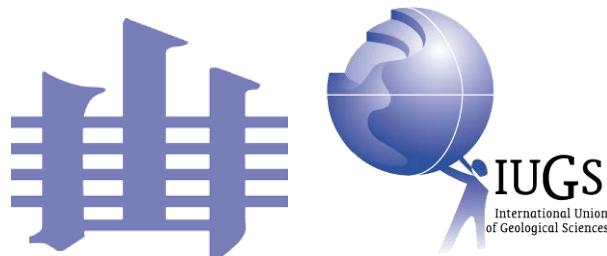


ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
INTERNATIONAL COMMISSION ON STRATIGRAPHY

Number 34 (for 2016)

Edited by Ian G. Percival



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Cover photo

A panoramic view of the Gudongkou Reservoir section, Xingshan county, Hubei Province, China (Lower Ordovician at left, Upper Cambrian to right). Photographed by Mr. Luan Xiaocong in November, 2016; image provided courtesy of Zhan Renbin, NIGPAS. This section is one of several to be visited during the post-conference excursion for the Annual Meeting of IGCP 653 in October 2017. For further details of this meeting, see pp. 29-33 of this newsletter.

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ORDOVICIAN NEWS Number 34 (for 2016)

Chairman's Message

Dear Colleagues,

As we all know, our previous chairman David Harper assumed the role of Chair of the International Commission on Stratigraphy during the 35th International Geological Congress in Cape Town in September 2016. It is a reflection of his impressive achievements as a Head of our Subcommission and points to the progress made in refining global Ordovician stratigraphy in recent years. For me it is a great honor and personal privilege to become his successor in the post of Chair of the Subcommission on Ordovician Stratigraphy.

It is already eight years since the new Global Time Scale for the Ordovician system has been completed and formally adopted during the 33rd International Geological Congress in Oslo. It has proved to be an effective and successful instrument for global chronostratigraphic correlation. However, for further advancement and increased precision in correlation we need to pay more attention to regional stratigraphy, regional scales and regional chronostratigraphic schemes. Regional scales are usually much more precise than the global standard could ever be, and sometimes direct correlation is possible even between regions now widely separated. Regional schemes reflect details of geological history of the regions and often reveal important information on local and regional biotic and abiotic events that could not be themselves traced globally, although they influence and/or trigger processes of changes, which later manifest globally. There is also a growing awareness that many biotic, chemical and physical changes are not always synchronous, and that there are strong local and regional signals that often depart from global compilations.

In the light of these observations it seems logical to continue work initiated during an Ordovician Subcommission-sponsored symposium that took place at the International Geological Congress held in Brisbane, Australia in 2012, by compiling 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. New data on regional zircon U-Pb dating are also very welcome. The book will stand as the authoritative source of information on Ordovician regional geology to an international audience and emphasize the great regional diversity of the Ordovician System within a global framework. Editorial staff of the Geological Society of London support publication of the proposed volume in the Society's *Special Paper* series. Our target should be to compile and publish the book by the time of the 13th International Symposium on the Ordovician System in Novosibirsk in 2019.

Thanks to the current Vice-Chairman of the Subcommission, Thomas Servais, and other leaders of the team, the Ordovician community is now involved in a new IGCP 653 project: *The onset of the Great Ordovician Biodiversification*. That project can be considered a direct successor of IGCP 410: *The Great Ordovician Biodiversification Event*, IGCP 503: *Ordovician Palaeogeography and Palaeoclimate*, and to some extent IGCP 591: *The Early to Middle Paleozoic Revolution*. It will definitely complement and support the work of the Subcommission. The opening meeting was organized by David Harper in Van Mildert College of Durham University, UK from 25th September – 1st October 2016. The next Main Annual Meeting will be held in Yichang, China 8th – 12th October 2017. Further details are available on pp.29-33 in this newsletter. The other important event, the Dayangcha

International Workshop on the Cambrian – Ordovician boundary (DIWCOP), will be held in Changchun, NE China during September 20-25, 2017. More details are given on pp.21-28 of this issue of *Ordovician News*. The Subcommission will support all these forthcoming meetings. Further information is located on Subcommission's webpage (<http://ordovician.stratigraphy.org>), launched by Olle Hints in late 2012, and also on the IGCP 653 project website (www.igcp653.org) maintained by Alycia Stigall.

I would like to highlight two recent publications on Ordovician meteorites, records of extraterrestrial chromite and new zircon U-Pb data that might require significant revision of the Ordovician timescale and exploration of new approaches and methods that could affect Ordovician chronostratigraphy in the near future. These are the articles of Lindskog *et al.*, 2017 in *Nature Communications* (DOI: 10.1038/ncomms14066) and Heck *et al.*, 2017 in *Nature Astronomy* (DOI: 10.1038/s41550-016-0035). Irrespective of the connection or disconnection of the Great Ordovician Biodiversification Event to an L-chondrite parent body breakup, the new methods of astrostratigraphy could complement existing bio-, chemo-, magneto- and sequence stratigraphies.

Finally, I thank all the members of the Subcommission and particularly David Harper (past Chair), Ian Percival (Secretary) and Thomas Servais (Vice-Chair) for your support and your continued important input. I hope as many of us as possible will meet in Yichang, China between 8th and 12th of October this year for the Second Annual Meeting of the IGCP 653 project.

With all good wishes,

Andrei Dronov

Chair, Subcommission on Ordovician Stratigraphy



**International Commission on Stratigraphy
Subcommission on Ordovician Stratigraphy**

ANNUAL REPORT 2016

1. Name of constituent body:

Subcommission on Ordovician Stratigraphy (SOS)

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2. Overall objectives, and Fit within IUGS science policy:

The Subcommission promotes international cooperation on all aspects of Ordovician geology, specifically stratigraphy. It has a global network involving both academia 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 the boundaries (GSSPs), the correlation of the subdivisions (Stages and Series), the nomenclature of the subdivisions and 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, *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.
- d. 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 broad 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. Summary table of Ordovician subdivisions

SYSTEM	GLOBAL SERIES	GLOBAL STAGES	KEY GRAPTOLITE/ CONODONT(C) BIOHORIZONS
ORDOVICIAN	UPPER	HIRNANTIAN	<i>A. ascensus</i> (GSSP-Dob's Linn)
		KATIAN	<i>N. extraordinarius</i> (GSSP-Wangjawan North)
		SANDBIAN	<i>D. caudatus</i> (GSSP-Black Knob Ridge)
	MIDDLE	DARRIWILIAN	<i>N. gracilis</i> (GSSP-Fågelsång)
		DAPINGIAN	<i>U. austrodentatus</i> (GSSP-Huangnitang)
	LOWER	FLOIAN	<i>B. triangularis</i> (C), (GSSP-Huanghuachang)
		TREMADOCIAN	<i>T. approximatus</i> (GSSP-Diabasbrottet)
			<i>I. fluctivagus</i> (C) (GSSP-Green Point)

4. Organization

- a. Subcommission Executive (from August 2012-August 2016)
 - Chairman, David A.T. Harper (UK)
 - Vice Chairman, Andrei Dronov (Russia)
 - Secretary, Ian G. Percival (Australia)

[Note from September 2016: Chairman, Andrei Dronov (Russia), Vice Chairman, Thomas Servais (France) and Secretary, Ian G. Percival (Australia)]

15 other Voting Members
Over 100 Corresponding Members

The new Subcommission not only includes a broad national representation and coverage of key fossil groups but also specialists in interdisciplinary fields such as geochemistry and sedimentology.

G.L. Albanesi (Argentina)
M.S. Beresi (Argentina)
A.V. Dronov (Russia)
P. Kraft (Czech Republic)
D. Goldman (USA)
M. Ghobadi Pour (Iran)
O. Hints (Estonia)
S. Leslie (USA)
A.T. Nielsen (Denmark)
I.G. Percival (Australia)
M.R. Saltzman (USA)
A. Sa (Portugal)

T. Servais (France)
T. Tolmacheva (Russia)
T. Vandebroucke (Belgium)
M. Williams (UK)
Zhan Renbin (China)
Zhang Yuandong (China).

5. Interfaces with other international projects

IGCP Project 591: ‘The early to middle Palaeozoic revolution’. This project involving some 400 participants from nearly 40 countries has a strong Ordovician component and is supported by the subcommission. The project has already featured at international congresses in Spain, the UK, China, Sweden, Canada and the USA. The final meeting was held in Ghent during July 2016.

IGCP 653, successor project to 410 and 503: A successful application was made to the IGCP to support a new project entitled ‘The onset of the Great Ordovician Biodiversification Event’, led by Thomas Servais. The opening meeting of IGCP 653 was held in Durham, UK during September 2016.

6. Chief accomplishments and products in 2016 cycle

- Colleagues voted by a super majority to support the establishment of an ASSP for the base of the Ordovician at Lawson Cove (see Miller, J.F. *et al.*, 2016: *Stratigraphy* 12, 219-236).
- A new IGCP project, 653, ‘Onset of the Great Ordovician Biodiversification Event’ was established in early 2016 and a series of events (in cooperation with ISOS) is already planned (see <http://www.igcp653.org/>).
- Ordovician News 33 was published and is available from the ISOS webpage (<http://ordovician.stratigraphy.org/>).
- ISOS supported the closing meeting of IGCP 591 in Ghent during July 2016 and the opening meeting of IGCP 653 in Durham, UK during September 2016.
- Two officers (Harper and Dronov) attended the 35th International Geological Congress in Cape Town.

7. Chief problems encountered in 2016

Critical to the development of the research on the system is the improvement of regional chronostratigraphies, isotope curves, palaeogeographies and zonal schemes. The coming years will see an emphasis on renewed data collection and its integration with the global standard. But this will require global participation of all our regional groups. It is also clear that the system has few reliable, absolute dates. This forms part of the ISOS sponsored project with StarPlan in the University of Copenhagen.

8. Summary of expenditure for 2015-2016

TOTAL INCOME (from ICS): USD 3035

- a. Support for attendance of colleagues at IGC Cape Town: USD 2500.
- b. Support of colleagues’ attendance at jointly supported IGCP meetings in Ghent and Durham: USD 535.

TOTAL EXPENDITURE USD 3035

9. Work plan, critical milestones, anticipated results and communications to be achieved next year

- To design and execute a programme of radiogenic dating of key Ordovician horizons (using Pb-Pb isotopes) in collaboration with Dr James Connolly and the state-of-the-art StarPlan laboratory in the University of Copenhagen. **Work has already commenced on some key sections in Baltoscandia, Russia and Scotland.**
- Will stimulate where relevant the production of revised regional correlation charts on the basis of new regional stratigraphic data and their relationship to the newly-established international stages. In additional regional isotope and sea-level data will be added. **A final line-up of chapters has been agreed; these will be progressed to publication as a Special Paper, Geological Society.**
- A thematic set in *Lethaia* dedicated to the ‘Onset of the Great Ordovician Biodiversification Event’ will be published in late 2017 supported jointly by IGCP 653 and ISOS.
- The Ordovician website will be updated including the development of a database for GSSPs.
- Data will be gathered for *Ordovician News* 34.

10. Budget and ICS component requested for 2016-2017

1. Meetings for contributors and editors of ‘Global Ordovician Stratigraphy book’: 2500 USD
2. Support for attendance and participation of subcommission officers at ISOS/IGCP meeting in Yichang, China (October 2017): 2500 USD.

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 2016-2017 BUDGET: 5000 USD

REQUESTED FROM ICS: **5000 USD**

Potential funding sources outside IUGS:

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

CONFERENCE REPORTS

International Geoscience Programme Project 591
Closing Meeting report
‘The Early to Mid Palaeozoic Revolution’
5-9 July 2016 at Ghent University, Belgium



Context

The IGCP 591 project “The early to middle Palaeozoic revolution: Bridging the Gap between the Great Ordovician Biodiversification Event and the Devonian Terrestrial Revolution” was an international collaboration programme (IUGS/UNESCO) that ran from 2011 until 2016. It brought together 432 enthusiasts from 41 countries and focused on the Early Ordovician to Early Devonian. This interval contains significant palaeoclimate and palaeobiological events in Earth history, including palaeobiodiversity events and/or perturbations to the global carbon cycle. It also contains the acme and amelioration of the Early Palaeozoic Ice Age and the roots of the invasion of life onto land. The Earth did not go quietly into the middle Palaeozoic

and the primary research objective of IGCP 591 was to investigate this dynamic and important interval in the history and evolution of life and our planet.

The closing meeting of the IGCP 591 project (5-9 July 2016, Ghent, Belgium) focussed on “A combined data-model approach to understand the early to middle Palaeozoic Revolution”. The meeting was co-organised with the International Subcommissions on Cambrian, Ordovician, Silurian and Devonian Stratigraphy and IGCP 596. Contributions at the meeting documented major steps in the evolution of Phanerozoic climate, its links to biotic change, and the ways in which these climates can be tracked by fossil proxies and simulated by advanced numerical computer models. As such, it formed an efficient platform to summarise the scientific progress made during the 6-year long programme. The successor programme IGCP 653 was introduced at the meeting, as were a few other proposals for future spin-off collaboration programmes.

Technical sessions

A total of 138 participants registered for the meeting and attended the technical sessions on 6, 7 and 9 July 2017. These included sessions on Ocean geochemistry and Ocean Anoxic Events through time, Palaeozoic climate and environments: models and data, Palaeozoic cyclostratigraphy and astrochronology, Large scale biodiversity patterns and palaeo-ecology, Graptolite biostratigraphy, Silurian boundaries and GSSPs, Regional Geology and general stratigraphy, Micropalaeontology (palynology & conodonts), and Palaeogeography.

The 5 Key note addresses were delivered by: Dr. Poul Emsbo (United States Geological Survey), Prof. Timothy Lenton (University of Exeter, UK), Dr. David De Vleesschouwer (Marum/Bremen University, Germany), Prof. Stephen Hesselbo (University of Exeter, UK) and Dr. Seth Finnegan (University of California, Berkeley, USA)

Two additional invited lectures were by: Dr. Emma Hammarlund (University of Southern Denmark) and Dr. Yannick Donnadieu (CNRS, Aix-Marseille Université, France). The full programme contained 74 regular oral presentations and 35 poster presentations. The meeting concluded with a panel discussion on the outcome and results of the 6-year project and perspectives for future projects across the research community.

Workshops

Pre-meeting workshop on 5 July 2016: GCM climate models in deep-time

This was a short course/workshop on climate modeling convened by Dr. Yannick Donnadieu. This workshop provided a practical introduction to various aspects of climate modelling, targeted at an audience of data-gatherers, showcasing how models work exactly, what we can and cannot do with/learn from climate models, and how data can be integrated most efficiently. The instructors for this short course were: Prof. Alan Haywood (University of Leeds, UK), Dr. David Ferreira (University of Reading, UK), Dr. Jorge Alvarez Solas (Universidad Complutense de Madrid, Spain) and Dr. Didier Roche (CEA/CNRS-INSU/UVSQ, Gif-sur-Yvette, France).

Mid-meeting workshop on 8 July 2016 (AM): A Short Course on the Construction of High-precision Astronomically-calibrated Time Scales

This was a mid-meeting workshop led by Prof. Stephen Meyers (University of Wisconsin, USA). This short course examined the application of astrochronology to enhance the accuracy and precision of geologic time scales. Astrochronology uses the geologic record of climate oscillations—those ascribed to periodic changes in the Earth’s orbit and rotation—to

measure the passage of time from rhythmic layers in strata. We discussed the potential for developing a complete astronomically-tuned Phanerozoic time scale, the fundamental challenges to achieving this goal, and potential solutions to address these challenges.

Mid-meeting workshop on 8 July 2016 (PM): Numerical Biochronology: Sequencing Large Numbers of Palaeobiologic First- and Last-Appearance Events

Instructor: Prof. Peter Sadler, University of California Riverside, USA. The workshop reviewed the logic of a range of computer algorithms available for correlation and seriation of biostratigraphic and chemostratigraphic events. These algorithms implement familiar ground rules from biostratigraphy to generate time lines with finer resolution than traditional biozones. Hands-on application to real Palaeozoic data sets allowed the participants to explore a range of options in the CONOP (CONstrained OPtimization) software.

Field Trip: 10-15 July 2016: Revolutions that made the Palaeozoic world: Revealed in the ancient strata of Wales

This field trip provided an introduction to Lower Palaeozoic Welsh Basin geology and was led by Prof. Mark Williams (University of Leicester, UK), Dr. Jeremy Davies (University of Aberystwyth, UK), Dr. Rob Hillier (National Museum of Wales, UK), Keith Nicholls (University of Chester, UK) and Thijs Vandenbroucke (Ghent University). Wales is the birthplace of lower Palaeozoic geology. 28 participants from all over the world visited some of the classical sites that contributed to the development of the Cambrian, Ordovician and Silurian systems, all of which are named from Wales. We visited rock successions that show the birth of the Welsh Basin on the margins of Gondwana during the early Cambrian, the journey of Wales through the Iapetus Ocean in the Ordovician, and the collision of Avalonia with Laurentia, and demise of the basin during the Silurian. We investigated the effects of a developing Cambrian marine metazoan biosphere, massive climate change at the end of the Ordovician, and the development of terrestrial ecosystems in the Silurian and Devonian. The field trip was a fantastic way to conclude a very successful project.

Thijs Vandenbroucke, Julie De Weirdt & Brad Cramer





Pre-meeting climate modelling workshop – ‘GCM climate models in deep-time’



Technical sessions at UGent – Closing Meeting of IGCP Project 591

CONFERENCE ANNOUNCEMENTS

The **6th International Conference on Trilobites and their Relatives** will take place from 7-10 July 2017 in Tallinn, Estonia. The conference website: <http://trilobite-conference.com> provides full details. Scientific sessions include one on the Great Ordovician Biodiversification Event under the auspices of IGCP 653, organised by Dr Alan Owen (Glasgow University) and Prof David Bruton (University of Oslo). Many aspects of the Ordovician of Estonia will be explored during the two conference fieldtrips which will follow in the footsteps of the great Carl Friedrich Schmidt (1832-1908) who – 120 years ago in 1897 – led a field excursion in Estonia as part of the International Geological Congress held in St. Petersburg.

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4th International Conodont Symposium “Progress on Conodont Investigation” **Valencia, Spain June 20-25, 2017**

Two Special Sessions of interest to Ordovician workers are scheduled as part of the 4th ICOS.

- **IGCP 653 sponsored theme: ‘The rise of Conodonts prior to and during the Great Ordovician Biodiversification Event’** co-ordinated by Ian Percival & Yong Yi Zhen
- **‘GECKO: Global Events impacting Conodont evolution’** co-ordinated by Annalisa Ferretti, Alyssa Bancroft & John Repetski

Regarding the session ‘GECKO: Global Events impacting Conodont evolution’ our intention is to publish a Special Issue with the most significant contributions arising from the meeting, complemented by specific research articles in order to guarantee a full coverage of the subject. **Any related Ordovician contribution also extra-congress is welcome! This is your invitation to contribute to the planned Special Issue – please contact Annalisa Ferretti if interested.**

Keynote Speaker: Mark Purnell (University of Leicester)

Background: Conodont elements are the only mineralized skeletal remains of a soft-bodied, nektonic, extinct early chordate that inhabited the ancient oceans for about 300 million years (from the late Cambrian through the Triassic). The utility of conodonts in biostratigraphic correlation has been well demonstrated, but it has also resulted in the general notion that conodonts are just a chronostratigraphic tool, an index fossil. The effectiveness of conodont elements as chronostratigraphic markers coupled with the search for the biological affinities of the conodont animal, has often obscured the fact that conodonts not only witnessed all major global changes during their 300 million year existence, but that they were also affected by these changes. The range of conodonts spans an interval of Earth’s history in which there were major chemical perturbations to the ocean-atmosphere system and major bauplans evolved as life emerged from the water and invaded the land. During this time predation strategies triggered defensive responses initiating “arms races” within niches and three major extinction events (two of which were among the largest in Earth’s history) resulted in complete restructuring of biologic communities. With such a tremendous explosion of environmental changes and resultant biologic adaptations, conodonts have generally been considered to be static entities dwelling within the confines of their oceanic environment, a “constant” in an ever-evolving world. Are we not, perhaps, “fossilized” in perpetuating this idea?

The GECKO Session will seek to take the concept of conodont animals beyond the simple idea that their primary utility is to serve as biostratigraphic markers and geochemical archives and to again begin looking at their temporal complexity and their potential to reflect events that occurred at a global scale. In other words, our goal is to systematically examine the entire conodont record in search of evidence of *conodont-based bioevents*. Are there indications in the conodont record reflecting major events in the lineage of this group? Not only the usual changes in diversity and abundance close to oceanic perturbations and related to extinction/radiation events, but also events at higher levels (morphological changes, new environmental adaptations, new apparatus structures, possible trophic shifts, etc.). This topic is far from new (O.H. Walliser explored this argument several times), but we will try to re-propose the question focusing on conodonts as living animals and not simply phosphatic elements used to correlate specific intervals of Earth's history or processed for thermal maturity or isotopic analyses. We will certainly also focus on changes related to extinction events, but seeing these throughout the entirety of the conodont record and comparing e.g., Ordovician to Permian data will be even more rewarding and informative than going through the conodont record in a step-wise fashion.

Some of the Specific Topics to be explored are listed below:

- Conodont diversity from the late Cambrian to Late Triassic. How do changes in niche space (e.g., environment, food sources) affect the evolution of conodonts?
- Evolution, evolutionary rates and power of resolution.
- Facies-controlled and time-controlled conodont taxa.
- Apparatus architecture through time.
- The effect of chemical perturbations in the ocean-atmosphere system on conodont diversity.
- Recurrence and resurrection of morphological types in elemental shaping.
- Mineralogy and crystallization patterns in conodont evolution.
- Predation or defense as evolutionary pulse in conodont evolution?
- “Refugia” or Lazarus taxa among conodonts?
- Conodont taxonomy and taxonomic rank of conodont ‘species’.
- The Apocalypse: what went wrong?



10th Baltic Stratigraphic Conference

12-14 September 2017
Chęciny, Poland

Second Circular

We cordially invite you to participate in the **10th Baltic Stratigraphic Conference** that will take place in the Holy Cross Mountains in Poland, in the premises of the European Centre for Geological Education (ECGE), owned by the University of Warsaw and located in the old quarry on Rzepka Hill near the historical town of Chęciny. Our meeting, held in the heart of present day Europe and geologically on the margin of the East European Craton should enhance scientific discussions and be an opportunity for exchange of views between experienced scientists, young researchers and students. We will be very pleased to host you between September 12th and 14th 2017. We plan a key-lecture, thematic talks and a poster session. We also offer the participation in pre- and/or post-conference excursions into the geology of the area. Additionally, our conference will be an official meeting of the IGCP 653 project, and therefore financial support for students or scientists from developing countries is planned (more details will be supplied soon on the conference web-page). From February 20th we would like you to confirm your participation using on-line registration at <http://konferencje.eceg.uw.edu.pl/en/home>.

Important deadlines:

15.05.2017 Deadline for regular registration; deadline for regular payment of conference fee; deadline for payment of excursion(s) fee(s)

31.05.2017 Deadline for submission of abstracts

15.06.2017 Deadline for late registration. New registrations will not be accepted after this date. Deadline for late payment of conference fee; deadline for late payment of excursion(s) fee(s)

20.06.2017 Third circular with detailed programme

Registration:

To register for the conference please use the following link: <http://konferencje.eceg.uw.edu.pl/en/home>

After completing the registration process each participant will obtain an e-mail confirming the registration, with details of the payment by bank transfer. To avoid further complications, please remember to supply all the relevant data that will be needed on the VAT invoices, such as the VAT identification number.

Provisional programme

September 10th

15.00-19.00 arrival and registration of conference participants taking part in the pre-conference excursion

September 11th to 12th

Pre-conference excursion: Pre-Variscan evolution of the Holy Cross Mountains – lower Palaeozoic to Middle Devonian

Excursion fee: **150 euro or 680 pln (180 euro or 800 pln** if you prefer a single room); includes transportation, accommodation in ECGE for two nights (10/11 and 11/12) and meals

Field trip coordinator: **Wojciech Kozłowski** (wojciech.kozlowski@uw.edu.pl)

Maximum number of participants: **40**

Minimum number of participants: **5**

- Variscan unconformity in Zachełmie Quarry – Eifelian dolomites contacting with Buntsandstein (Lower Triassic) facies
- Emsian siliciclastic facies of the Łysogóry Region (Bukowa Góra Quarry)
- Viewpoint at Miejska Hill near Bodzentyn; presentation of the geological cross-section across the Łysogóry Region
- Upper Silurian of the Łysogóry Region (exposures in the Wilkowska valley) – evolution of a distal Caledonian foreland basin
- Silurian of the Bardo Syncline (Kielce Region) – evolution of a proximal Caledonian foreland basin
- Ordovician of the Kielce Region (Zalesie/Międzygórz/Chojnów Dół – optionally)
- Cambrian of the Kielce Region (Ujazdek-Dziewiątka/Sterczyna – optionally)

September 12th

Afternoon hours – arrival and registration of conference participants not taking part in the pre-conference excursion

An ice-breaker party for all participants is planned for the late evening

September 13th to 14th

Key-lecture, talks and poster sessions, committee meetings.

Depending on the number of declarations, the talks will be presented in one or two parallel sessions.

A special poster session is planned for the first day. The conference dinner will also take place on the first day. There will be a possibility to spend another night at ECGE (14/15) upon earlier reservation; an additional fee will have to be paid for the meals and accommodation in this case (this does not apply to the participants of the post-conference excursion, who have it included in the excursion fee).

September 15th to 16th

Post-conference field trip: Top geological sites of the Holy Cross Mountains

Excursion fee: **150 euro or 680 pln (180 euro or 800 pln** if you prefer a single room); includes transportation, accommodation for two nights (14/15 and 15/16) and meals

Field trip coordinator: **Stanisław Skompski** (skompski@uw.edu.pl)

Maximum number of participants: **40**

Minimum number of participants: **10**

On both days, the departure will be at 8.00 after breakfast. The final list of the sites that you will visit during this excursion depends on the number of participants.

- Łysogóry (main range of the Holy Cross Mountains) – periglacial weathering of Cambrian quartzites

- Śląchowice – Variscan deformation structures
- Kadzielnia – Frasnian buildup, tectonic disintegration of the carbonate platform
- Kowala – Frasnian/Famennian drowning of the carbonate platform
- Józefka – Devonian brachiopod mass accumulations; Buntsandstein (Lower Triassic) cover
- Gałędzice – Devonian to Permian evolution of the Holy Cross Mountains
- Tumlin – Buntsandstein (Lower Triassic) dune field
- Małogoszcz/Wolica (optionally) – Jurassic carbonate platform
- Miocene infill of the Fore-Carpathian Foredeep Basin

Depending on the declarations, the excursion will end at Kielce Railway Station in the evening of 16th September and/or at ECGE, where there will be a possibility to spend another night (16/17) upon earlier reservation; in this case, an additional fee will have to be paid for the meals and accommodation.

Payments

<u>Regular registration fee</u> (to be paid before May 15, 2017) includes: attendance in all sessions, 2 nights (12/13 and 13/14) in double or single room, full meals, coffee breaks, ice-breaker party, conference dinner, abstract book, excursion guide book	150 EUR for double room/ 180 EUR for single room	680 PLN for double room/ 800 PLN for single room
<u>Late registration fee</u> (after May 15, 2017)	180 EUR for double room/ 210 EUR for single room	800 PLN for double room/ 920 PLN for single room
<u>Student fee</u> (only in double rooms)	80 EUR	360 PLN
<u>Pre-conference excursion</u> (including 2 nights: 10/11 and 11/12 in double or single room)	150 EUR for double room/ 180 EUR for single room	680 PLN for double room/ 800 PLN for single room
<u>Post-conference excursion</u> (including 2 nights: 14/15 and 15/16 in double or single room)	150 EUR for double room/ 180 EUR for single room	680 PLN for double room/ 800 PLN for single room
<u>Additional night at ECGE</u> (14/15 for those not participating in the post-conference excursion or 16/17 for those participating in the post-conference excursion in double or single room), including evening meal and breakfast	20 EUR for double room/ 35 EUR for single room	90 PLN for double room/ 150 PLN for single room

Presentations

The official language of the conference is English. The abstracts will be published in a special conference volume distributed during the conference.

Abstracts should be submitted on-line. The length of abstracts is 2 pages A4 in total (including title, authors, addresses, e-mails, text, figure/s and references). Please use 11 pt Times New Roman, single-spacing and 2.5 cm margins; illustrations should be submitted as separate jpg. files in the resolution of 600 dpi; grey-scale and/or colour illustrations are allowed.

Upon receiving the abstracts, the organizing committee reserves the right to transfer oral presentations into poster presentations, of which the participants will be duly informed.

Transportation

Kielce, the major town of the Holy Cross Mountains area, can be reached by train or by bus from Warsaw or Cracow. The town of Chęciny is located about 15 km to the south of Kielce and you may travel there from the Main Railway Station at Kielce by local bus no. 31, a minibus or a taxi. Depending on the declarations, we are ready to organize transportation from the Kielce Main Railway Station on the relevant days. We would like to inform those travelling by car that ECGE has its own free-of-charge parking, where you will be able to leave your car during the conference.

Accommodation

The European Centre for Geological Education offers double rooms with bathrooms. Single rooms are also available, but an additional payment of 15 EUR/60 PLN per night is required (see above).

Organizing institutions:

Faculty of Geology, University of Warsaw
Polish Geological Institute – National Research Institute
Institute of Palaeobiology, Polish Academy of Sciences
Polish Geological Society
European Centre for Geological Education

Organizing committee:

Wojciech Kozłowski (FG UW)
Stanisław Skompski (FG UW)
Anna Żylińska (FG UW)
Anna Kozłowska (IP PAS)
Ewa Olempska (IP PAS)
Zbigniew Szczepanik (PGI-NRI)
Wiesław Trela (PGI-NRI)
Michał Cyglicki (FG UW)
Anna Jezierska (FG UW)
Radosław Staniszewski (FG UW)
Lidia Zenkner (FG UW)

Conference web-page and e-mail address:

<http://konferencje.eceg.uw.edu.pl/en/home>
10bsc.geol@uw.edu.pl

Second circular

ORDOVICIAN GEODYNAMICS:

The Sardic Phase in the Pyrenees, Mouthoumet and Montagne Noire massifs

4-9 September 2017, Figueres, Catalonia

1. General Information

The presence of the Sardic Phase and associated Middle Ordovician stratigraphic gaps has been reported in the Eastern Pyrenees, the Mouthoumet massif and the Cabrières klippe of the southern Montagne Noire. Late Ordovician fault-controlled subsidence and the record of rifting volcanism were coeval, in some areas, with the onset of the Hirnantian glaciation. As a result, the Upper Ordovician of SW Europe offers a complex mixture of erosive unconformities and intrusion of acidic plutons (Pyrenees), followed by the breakdown of platforms in horsts and (half-)grabens and the onset of rifting branches (Mouthoumet and Montagne Noire), onlapping patterns and final sealing of Sardic palaeotopographies during Silurian and Early Devonian times.

The meeting addresses the dynamics of Lower Palaeozoic (Cambrian-to-Silurian) sedimentary basins and aims to bring together a wide range of studies focusing on geodynamics, tectonics, volcanism, sedimentary geometries, event stratigraphy and chronostratigraphic correlation. We aim to balance the study of geodynamic processes recorded throughout North Gondwana (SW Europe) with worldwide analogues.

We welcome all contributions integrating Lower Palaeozoic geodynamic discussions, including volcanic, structural and (chrono)stratigraphic data.

2. Organizing Committee

J. Javier Álvaro, Geosciences Institute, Madrid
Josep Maria Casas, University of Barcelona
Sébastien Clausen, University of Lille I
Jorge Colmenar, Natural History Museum of Denmark
Bernard Laumonier, University of Nancy
Joan Martí, Institute of Earth Sciences “Jaume Almera”, Barcelona
Enrique Villas, University of Zaragoza

3. Sponsors

Bureau de Recherches Géologiques et Minières (*BRGM*)
Groupe Français du Paléozoïque (*GFP*)
IGCP 653: The onset of the Great Ordovician Biodiversification Event
Instituto de Geociencias (*IGEO* – CSIC/UCM)
Instituto Geológico y Minero de España (*IGME*)
Sociedad Geológica de España (*SGE*)
Société Géologique de France (*SGF*)
Universitat de Barcelona
Université de Lille I

4. Travel and Accommodations

The *Girona-Costa Brava* (with connections to Bremen, Bristol, Bruxelles, Dublin, Frankfurt, London, Manchester and Paris) and *Perpignan* (with connections to Dublin, Madrid, Nantes, Paris, Lille, Bruxelles, London, Birmingham and Southampton) airports are close to Figueres. There is a direct bus (*Sagales*) from the former to Figueres. From Perpignan, the easiest connection is by train.

Participants will be required to arrange their arrival on their own. After the fieldtrip the bus will bring participants to Perpignan train station and Girona. If necessary, we can book for you a hotel there for the last night.

Figueres (in Spanish, Figueras) is the capital of the Alt Empordà district (Girona) close to the Spanish/French border. It is the birthplace of Salvador Dalí and houses the Teatre-Museu Gala-Salvador Dalí, which holds the largest collection of major surrealistic works by Dalí in a single location.

5. Registration FEE

Information for payment will be sent to you after receiving the registration confirmation (see below, between red lines). No manual registration will be available. Registration with payment will be open from mid-February to 1st May 2017.

Meeting in Figueres

Before 1st May 2017: 200 euros. This includes:

- Attendance at the Welcome Reception
- Meeting attendance
- Delegate bag including the congress material
- Programme, abstract and field-trip access

- Accommodation in Hotel Travé [Balmes 70, Figueres, tel.: (+34)972500612] in double room
- Breakfast and meals
- Coffee/tea breaks
- Registration and icebreaker will take place the 3rd September after 19 h
- A room will be available to mount posters
- Visit to Museum Gala-Salvador Dalí

Fieldtrip throughout the Eastern Pyrenees and the Mounhoumet and Montagne noire massifs, Catalonia and Occitanie

Before 1st May 2017: 380 euros. This includes:

- Travel by mini-bus from Figueres to Bellver de Cerdagna (1st night), Estagel (2nd night) and Béziers (3rd night) and return to Figueres with stop at Perpignan train station.
- Visit to geological stops.
- All meals and hotels (double room).

The maximum number of participants in the fieldtrip is limited to 50 persons

6. Fieldtrip stops

• 6th September – Fieldtrip to eastern Pyrenees, Catalonia.

STOP 6a. Ribes granophyre (458 ± 3 Ma): an undeformed, fine-grained, leucocratic granitic body with a microscopic granophytic texture crops out at the base of the Upper Ordovician along the Sardic unconformity that separates the Upper Ordovician from underlying Ediacaran–Lower Ordovician metasediments. Although it is locally affected by faults along the contact with host rocks, it is possible to observe intrusive to concordant contacts suggesting a laccolithic emplacement for this subvolcanic body.

STOP 6b. Surroundings of Ribes de Freser: Upper Ordovician volcanism. Lithic-rich, partially welded ignimbrite of dacitic composition (Pyroclastic Density Current) is interbedded in the upper part of the Upper Ordovician succession. The deposits are characterized by a high content in lithic clasts of small size (< 1 cm) and lapilli-sized flattened pumices (fiammes) completely devitrified and transformed into chlorite and clay minerals. The presence of these materials in the Upper Ordovician succession indicates a highly explosive subaerial felsic volcanism coeval with detrital sedimentation.

STOP 6c. Ribes-Bruguera road: Upper Ordovician limestones. The Upper Ordovician limestones attain a maximum thickness along the roads close to Bruguera and El Baell, south of Ribes. Three different thickening-upward limestone levels can be recognized in a 300 m-thick succession made up of limestones and marly-limestones (“schistes troués”).

STOP 6d. Sardic unconformity at La Molina station (optional, depending on fieldtrip schedule): Upper Ordovician unconformity overlain by the reddish-purple, unfossiliferous, conglomerates of the la Rabassa Formation. A synsedimentary hydrothermal activity is related to development of normal faults giving rise to quartz veins incorporated as quartz pebbles in the Rabassa conglomerates.

• 7th September – Fieldtrip to eastern Pyrenees, Occitanie.

STOP 7a. The Upper Ordovician succession north of Bellver (Talltendre area): five formations can be recognized across the area exhibiting some lithologic variations, which broadly constitute a fining-upward sequence with an interlayered limestone key level and marked thickness variations between 100 and 1000 m related to synsedimentary faulting activity.

STOP 7b. Graus de Canaveilles along the Conflent valley: classical stop with old model involving a “Cadomian” granitic basement (Carança orthogneiss) “overlain” by the

Canaveilles Series. This model was ruled out after radiometric ages of Middle-Upper Ordovician (Sardic) granites.

STOP 7c. The Canigó granitic orthogneiss along the D6 road between Saorra and Pi: the Canigó gneiss derives from an Ordovician intrusive (462-471 Ma) and forms a 2000 m thick body with laccolithic morphology. A porphyritic rapakiwi texture is common in the G-2 type gneiss.

• **8th September – Fieldtrip to Mouthoumet massif, Occitanie.**

STOP 8a. Surroundings of Montjoi village, Mouthoumet parauthochton: Lower Ordovician Davejean Volcanic Complex (rhyolitic tuffs) embedded in shales of the Davejean Group; Montjoi Formation with shale/limestone interbeds rich in echinoderms and brachiopods of late Katian age, unconformably overlain by the Marmairane Formation (Hirnantian diamictites) displaying unsorted siliciclastic strata.

STOP 8b. Marmaraine creek, close to Villerouge-Termenès, Félines-Palairac slice: Villerouge Formation with mafic lava and pyroclastic flows and laharic mudflows of tholeiitic affinity, capped by sandstones of the lower Katian Gascagne Formation and fossiliferous green shales of the Hirnantian Marmairane Formation.

• **9th September – Fieldtrip to Cabrières klippe, Montagne Noire, Occitanie.**

STOP 9a. Riobelou valley, Mont Peyroux nappe, southern flank: stratotype of the Cluse de l'Orb Formation (representative of the “Armorican Quartzite”-style sediments) sandwiched between the underlying La Maurerie Formation and the overlying Setso and Foulon formations, along the D14 road (between Roquebrun and Lugné).

STOP 9b. Landeyran valley, Mont Peyroux nappe, southern flank: fossiliferous shales of the Floian Landeyran Formation and angular discordance with Devonian “mur quartzeux”.

Panorama from L'Escougoussou village and fossil sampling along the D-136 road.

STOP 9c. Gorges d'Héric, Caroux Dome, Axial Zone: augen gneiss of the Somail Formation, rich in alkali feldspar and mica porphyroblasts, representative of metamorphic aureoles surrounding Sardic (Katian in age) granitoids.

STOP 9d. Grand Glauzy hill, Cabrières klippe, southern flank: Roque de Bandies Formation (polymictic and volcanosedimentary breccias capped by basaltic lava flows with tholeiitic affinity), Glauzy Formation (interbedded shales and fossiliferous sandstones forming two shallowing-upward sequences rich in brachiopods and trilobites, early Katian in age) and Gabian Formation (bryozoan and echinoderm-rich limestones and marlstones, late Katian in age), overlain by the Hirnantian erosive unconformity.

7. Publications

1. Abstracts (title, authors, addresses, text and references – less than 500 words).

Deadline 15th June 2017. Please, send them to jj.alvaro@csic.es

2. Field-Guide and Abstracts will be published in *Géologie de la France*.

3. Proceedings of the meeting will be published in a special volume of *Journal of Iberian Geology* (JCR: 1.8). See instructions for authors in:

<http://revistas.ucm.es/index.php/jige/about/submissions>

Deadline for submission: 01.12.2017.

Official language for the meeting and proceedings: English.

8. If you are interested, please, paste the following text into an e-mail, indicate “yes” or “no” after each heading, and send it as soon as possible to jj.alvaro@csic.es. The fieldtrip will have a limited number of participants so early registration is encouraged.

Name and complete address (including email)

Attend to scientific sessions in Figueres: YES / NO (Fees: 200 euros)

Attend post-conference fieldtrip: YES / NO (Fees: 380 euros)

Submit Abstract(s) to Abstract Volume: YES / NO

If YES: Preliminary Title(s) and select Talk/Poster

Bring accompanying person: YES / NO

Submit thematic paper to special volume of *Journal of Iberian Geology*: YES / NO

If YES: Preliminary Title and Authors

9. Contact

- Questions about the meeting or scientific sessions – J. Javier Álvaro (jj.alvaro@csic.es).
- Questions about fees and VISA or transfer payment – Sébastien Clausen (Sebastien.Clausen@univ-lille1.fr). Information for payment will be sent to you **AFTER** receiving the above registration confirmation (between red lines). Please, note that the number of places for the fieldtrip is limited: the places will be booked in the order of payment date and kept only for those who pay the fees before 1st May 2017.
- Updating news will be available at the official webpage of the meeting – Jorge Colmenar (jorgecolmenarlallena@gmail.com).

10. Important deadlines

Registration Payment: May 1st, 2017

Abstract Submission: June 15th, 2017

3rd circular with last arrangements: September 1st, 2017

Proceedings submission: December 1st, 2017

The organizing committee

Dayangcha International Workshop on the Cambrian-Ordovician boundary (DIWCOB) (September 20- 25, 2017 Changchun NE China)

First Circular

Rationale

In the past 16 years, there have been tremendous advances in understanding of the Cambrian-Ordovician boundary on the basis of the study of the GSSP fixed at Green Point, Newfoundland in 2001. New discoveries and knowledge of fossils (conodonts, graptolites, trilobites etc.), radiometric dates and chemo-stratigraphic data have been published at an unprecedented pace. In the meantime, because each research group has been working more or less independently, there have been numerous discrepancies and inconsistencies with regard to important biomarkers of the Cambrian-Ordovician boundary and its relation to

chemostratigraphic excursions, and sequence stratigraphic surfaces. This workshop is motivated by the need to resolve these discrepancies and to discuss the feasibility of re-defining a set of criteria for subdivision and correlation of the Cambrian-Ordovician boundary, in China and beyond.

The workshop, supported by NSFC and Ministry of Science and Technology of China (NCSC), will be organized by National Commission on Stratigraphy of China (NCSC), Jilin Provincial Bureau of Land and Resources (JPBLR) and Wuhan Center for Geological Survey (WCGS) (Institute of Geology and Mineral Resources (WIGMR) and hosted by the Research Center of Paleontology and Stratigraphy (RCPS) of Jilin University together with Baishan City Bureau (BCBLR) and Jiangyuan District Bureau of Land and Resources (JDBLR). It will be held from 20-25 September, 2017 at Jilin University, Changchun, NE China. A full two-day indoor meeting will cover all aspects of research on the Cambrian-Ordovician boundary, and the following field excursion of three days will travel to Jiangyuan area of Baishan City to examine the Dayangcha section (potential GSSP for the Cambrian-Ordovician boundary) and another relevant sections nearby, where participants can discuss and identify critical problems that need to be resolved and evaluate possible criteria for subdivision and correlation of the Cambrian-Ordovician boundary. It is hoped that our efforts will better coordinate the development of tools and criteria for study of global Cambrian-Ordovician boundary sections.

Organizing and Scientific Committee

Professor Stanley C. Finney, Department of Geological Sciences

California State University - Long Beach, USA

Professor David A.T. Harper, Department of Earth Sciences and Principal, Van Mildert College, Durham University, Durham UK

Professor Shanchi Peng, Nanjing Institute for Geology and Palaeontology, China

Professor Zejiu Wang, NCSC, Beijing, China

Professor Gabriella Bagnoli, University of Pisa, Italy

Professor Huazhou Yao, WCGS, Wuhan, China

Professor Chunlin Sun, RCPS, Jilin University, Changchun, China

Additional field trip leaders

Professor Svend Stouge, University of Copenhagen, Denmark

Professor Jörg Maletz, Free University, Germany

Professor Xiaofeng Wang, WCGS, Wuhan, China

Professor Chuanshan Wang, WCGS, China

Dr. Chunpo Yan, WCGS, Wuhan, China

Miss Wei Sun, RCPS, Jilin University, Changchun, China

Host city

Changchun, Capital of Jilin province, located on northeastern China is known as the spring city of the Northland, internationalized metropolis in Northeast Asia, China's biggest automobile industrial city and international films city.

The Organizing Committee would like to invite all researchers with an interest in the stratigraphy, sedimentology, geochemistry and palaeobiology around the Cambrian-Ordovician boundary to participate in the Dayangcha International Workshop on the Cambrian-Ordovician boundary.

A full two--day conference program will cover all aspects of the Cambrian-Ordovician boundary geobiology, and will include sightseeing to visit the puppet emperor's Palace inside Changchun.

Venue

Topical sessions will be held at the Jilin University.

Travel and accommodation

Changchun is well connected by air and by high speed train to Beijing, Shanghai, Guangzhou, Hong Kong and other provincial capital cities of China. The Organizers will arrange students to meet you in Changchun airport or railway station if participants inform us in advance of your exact arrival date and time.



Geological palace of Jilin University

Symposium Schedule and Topics

I、Registration

September 20 (exact location to be advised in Second Circular)

II、Indoor Meeting : September 21- 22

1. Report and discussion topics suggested

The meeting schedule will ensure that each participant has 15-20 minutes reporting time followed by 5 minutes discussion. We hope that each participant will be able to report at the meeting on progress and problems in your research on the above topic, or in a related field (latest Cambrian and Early Ordovician) that you have studied in recent years. Specific reporting time will be informed when receive your receipt.

2. September 22 afternoon: Sightseeing - visiting the last emperor's Palace or other places



The last emperor's Palace

III、Field Workshop (September 23-25)

(Schedule subject to change as required)

Sep. 23: Travel to Jiangyuan County of Baishan City

Sep. 24 morning: Field work in the Dayangcha section, to examine the litho-, bio-, chemo-and sequence-stratigraphic succession, including the boundary level with characteristic conodonts and graptolites described in the field guidebook.

Sep. 24 afternoon: Field work in the Erdoupuzi area to examine the beds bearing graptolites of *Psigraptus* biozone, and visit to quarry focusing on lithological features of Early Tremadocian, bearing conodonts, graptolite and trilobites etc.

Sep. 25: Field work to Changbaishan to examine the Cambrian-Ordovician boundary on the way to the largest Crater Lake in China--- the famous Changbaishan Tianchi (in the Changbai mountain volcanic cone on top of the main peak), recognized by the Guinness Book of Records as the World's highest Volcano Lake. You will see peaks everywhere around the Lake, and a clear green pond that is the source of Songhua River, Tumen River and Yalu River and then travel back to Changchun in the evening.

Registration and abstract submission

Registration and abstract submission will open on January 10, 2017. Please fill out the attached expression of interest form and email it to Miss Zhang Miao at 171581744@qq.com or Prof. Wang Xiaofeng (ycwangxiaofeng@163.com)

All participants will be invited to submit abstract(s) for posters and oral presentations from January 10, 2017 onwards. Authors are responsible for the scientific content of their abstracts.

The deadline for registration and abstract submission will be 31 May, 2017.

Registration fee

Registration will be about 4000 Chinese Yuan or USD **600** per person for 5 days (each day for USD 120). Final rates will be provided in a subsequent circular, and are anticipated, but cannot be guaranteed, to be less than the preliminary estimates given here.

Workshop fees will cover the participant's costs of accommodation, attending the conference and field trips, entitling them to attend the welcome reception, conference sessions, morning and afternoon refreshments, conference dinner, abstract submission, and related field trip and conference information.

Student and early bird rates will be offered. We anticipate being able to offer a limited number of financial assistance packages to student attendees dependent upon availability of funds. If you are interested in applying for one of these, please complete the form below and return it to Miss. Zhang Miao (email: 171581744@qq.com) or Prof. Wang Xiaofeng (ycwangxiaofeng@163.com)

Accompanying delegates will get half-price discount for the registration fee.

Provisional program

An Icebreaker Reception will be held on the evening of 20th September 2017.

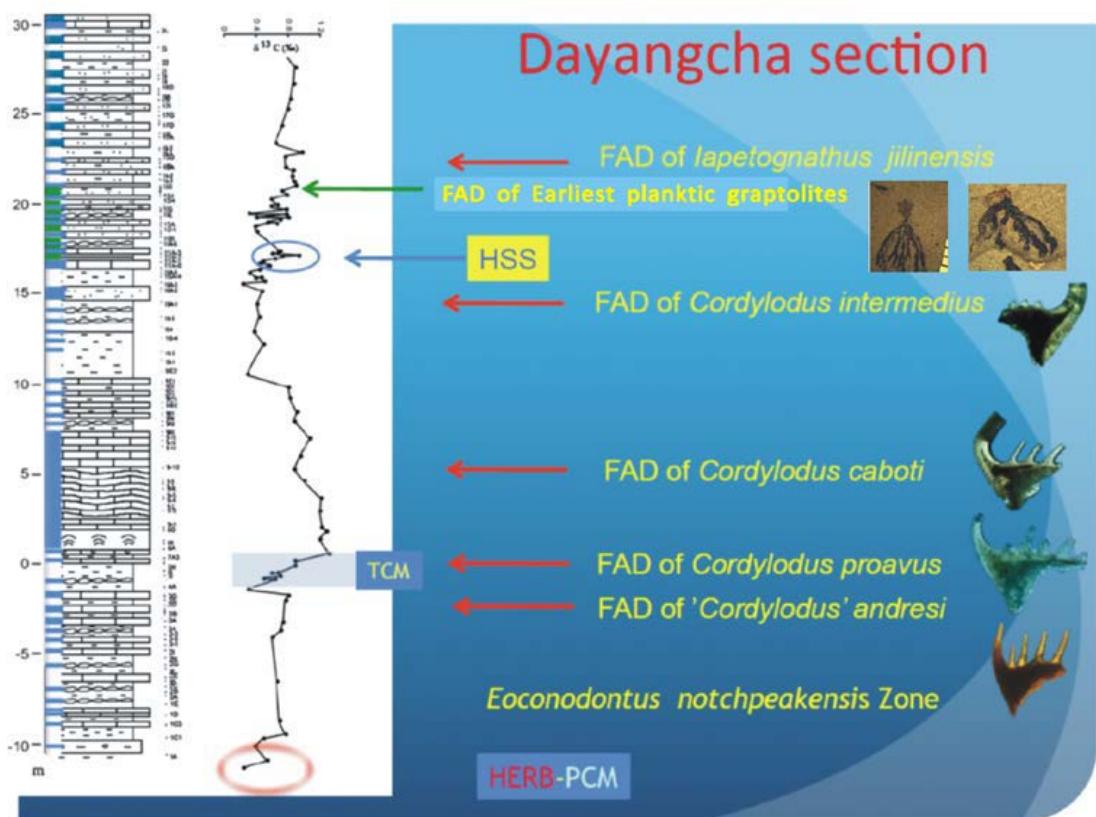
The Symposium will take place on 21st and 22nd September 2017.

Themed symposia will focus on the Cambrian-Ordovician boundary and Ordovician palaeontology, stratigraphy and geochemistry. Further specific themes will be announced based on responses to this First Circular.

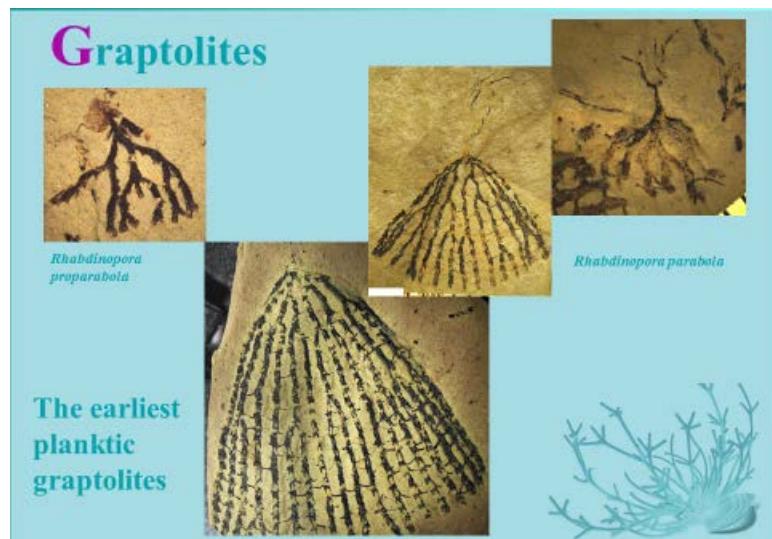
Presentations on current research will be in the form of 15-20 minute talks, and poster displays. Talks and posters are to be presented in English.



Dayangcha section



Showing complete conodont succession and its relation with $\delta^{13}\text{C}$ excursions



The earliest planktic graptolites recorded from the Dayancha section



Tianchi in Changbai Mountains, located in the southeast of Jilin Province, is a lake in China and North Korea. Water up to 2150 m above sea level, is known as "the sky pond"



Geologists (Maletz J., Stouge S., Wang Xiaofeng, Tang Zhihua and Wang Chuanshan working around Tianchi, the largest Crater Lake in China

Dayangcha International Workshop on the Cambrian-Ordovician boundary (DIWCOB)
September 20- 25, 2017 Changchun NE China

Expression of interest form

*Title

*First name

*Surname

*Institution

Contact postal address (including country)

Contact e-mail address

I am [if applicable]

A full-time student (please provide your institution and name of supervisor)

I will be bringing a partner or accompanying delegate or delegates

Name(s) :

I anticipate contributing a talk/poster [please indicate which] with the provisional title/topic:

Please return completed form to Miss Zhang Miao (email: 171581744@qq.com) or Prof. Wang Xiaofeng (ycwangxiaofeng@163.com)

Dayangcha International Workshop on the Cambrian-Ordovician boundary (DIWCOB)
September 20- 25, 2017 Changchun NE China

Financial Assistance Form

1. Applicant's Name:

2. Nationality:

3. Institution and E-mail Address:

4. Are you a PhD student [] or a post-doctoral fellow []? If so, please indicate your advisor:

And ask your advisor to provide a support letter to be emailed to Miss Zhang Miao (email: 171581744@qq.com) or Prof. Wang Xiaofeng (ycwangxiaofeng@163.com) before April 1st 2017

5. Are you planning to give an oral presentation at the meeting?
Yes [] No []

6. Please briefly describe your financial needs to participate in this meeting and the relevance of this meeting to your research:

7. Signature/date:

Please return this form before April 1st 2017 to Miss Zhang Miao at 171581744@qq.com or Prof. Wang Xiaofeng (ycwangxiaofeng@163.com)



International Geoscience Programme Project 653 — Annual Meeting 2017



Filling the gap between Cambrian Explosion and the GOBE
8 October – 12 October, 2017
Yichang, China

First Circular

Sponsors

National Natural Science Foundation of China
State Key Laboratory of Palaeobiology and Stratigraphy (Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences)
Key Laboratory of Economic Stratigraphy and Palaeogeography of Chinese Academy of Sciences (Nanjing Institute of Geology and Palaeontology)

Time

8 October (Sunday) – 12 October (Thursday), 2017

Venue

Taohualing Hotel, Yichang City, Hubei Province, China

General Information

Yichang, located in western Hubei Province, central China, is one of the major cities in the Yangtze Gorges area. The city has a long and glorious history since the Han Dynasty (over two thousand years ago). It has now developed into a modern city of industry, business and tourism, with a population of 4 million. Among the most popular tourism sites near the city, are the spectacular Yangtze Gorges and the Yangtze Gorges Dam (hitherto the largest dam in the world).

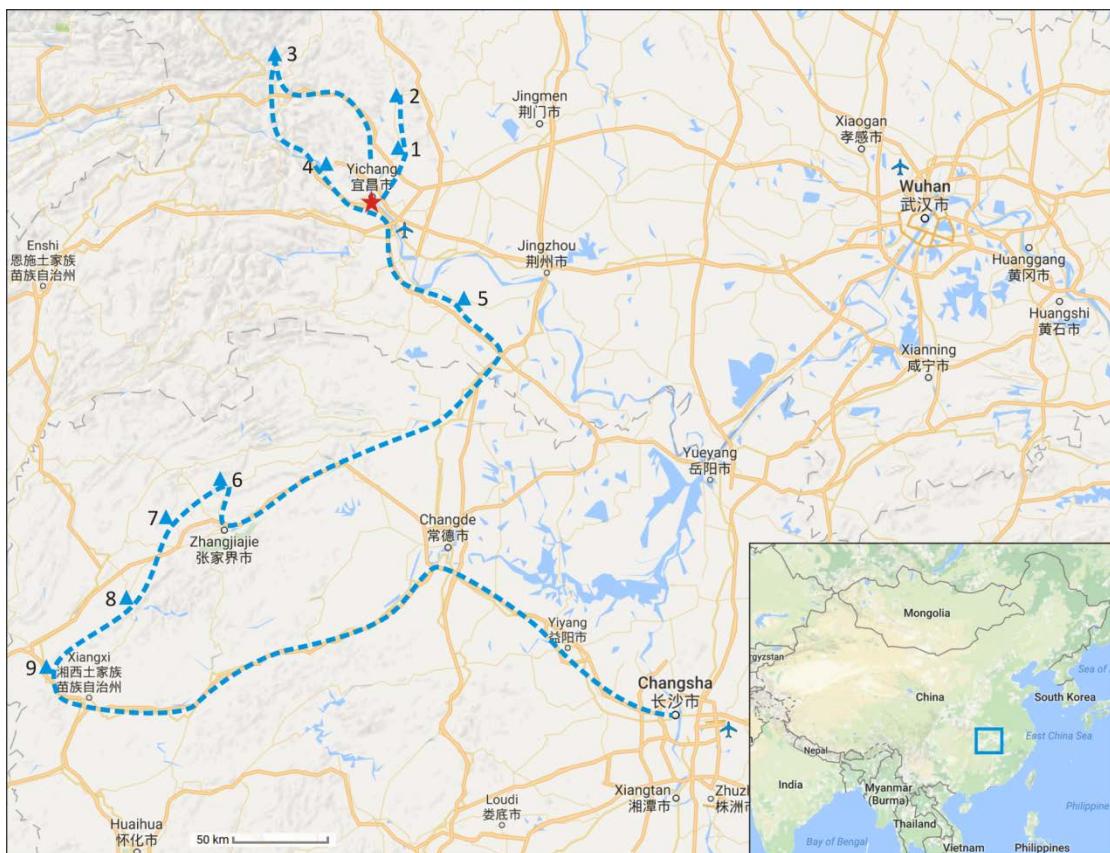
Yangtze Gorges area was the birthplace and cradle of modern Chinese geology, where J.S. Lee and A.W. Grabau conducted and published their geological investigations in 1920s. The area yields many classic geologic sections of Neoproterozoic to Permian ages, among which include the GSSPs of Dapingian and Hirnantian Stages (Ordovician). The Cambrian and Ordovician rocks in the area are of typical shallow-water, platform facies, which consist of carbonates and shales. This area is also a

classical area of practical courses in teaching field geology for university students due to the complete marine stratigraphic records of the Cryogenian to Triassic.

The annual meeting of IGCP 653, entitled 'Filling the gap between Cambrian Explosion and the GOBE', will investigate the initiating causes and processes that produced the rapid diversification of marine organisms during the Ordovician Period, known as the 'Great Ordovician Biodiversification Event' (GOBE). Because the timing of the radiations varied among biotic clades and palaeocontinents and may have its roots in the Cambrian, stratigraphic sections ranging from Guzhangian (Series 3, Cambrian) to Middle Ordovician will be visited during the post-conference field excursion. A workshop on the Burgess Shale-type Guole Lagerstätte of the Jiangshanian (Furongian) age from Guangxi Autonomous Region, South China will be organized during the meeting for participants to examine specimens of trilobites, non-trilobites arthropods, brachiopods, graptolites, Cnidarians, echinoderms, hyoliths, palaeoscolecid worms, algae, etc. from the site.

The meeting in Yichang includes three days of indoor scientific sessions for delegates to present their latest research and a full day mid-conference field trip to the GSSPs of Dapingian and Hirnantian Stages including a historical site of local *Hulu* ethnic minority (ca. 2200 BC) near the Yichang city.

Welcome to Yichang!



★Yichang City, Hubei Province, China. 1. GSSP of Dapingian Stage at Huanghuachang, Yichang, Hubei Province; 2. GSSP of Hirnantian Stage at Wangjiawan, Yichang, Hubei Province; 3. Gudongkou Reservoir Bank section, Xingshan County, Hubei Province; 4. Yangtze Gorges National Geopark and Yangtze Gorges Dam, Zigui, Hubei Province; 5. Liujiachang and Xiangshuidong sections, Songzi County, Hubei Province; 6. UNESCO Global Geopark, Zhangjiajie, Hunan Province; 7. Mayang section, Yongshun, Hunan Province; 8. GSSP of Guzhangian Stage (Series 3, Cambrian) at Luoyixi, Guzhang, Hunan Province; 9. GSSP of Paibian Stage (Furongian, Cambrian) at Paibi, Huayuan, Hunan Province.



Provisional programme

Oct. 8 (Sunday), 2017: Arrival, registration (ice breaker).
Oct. 9 (Monday), 2017: Oral and poster presentations.
Oct. 10 (Tuesday), 2017: Oral and poster presentations, workshop.
Oct. 11 (Wednesday), 2017: Mid-conference field trip.
Oct. 12 (Thursday), 2017: Oral and poster presentations, conference banquet.
Oct. 13—Oct. 18, 2017: Post-conference field excursion in Hubei and Hunan Provinces.
Oct. 19 (Thursday), 2017: Departures.

Mid-conference Field Trip

A one-day mid-conference field trip will be organized to visit the Furongian to Middle Ordovician successions, the GSSPs of Dapingian and Hirnantian stages near the Yichang city (sites 1 and 2 on the index map), and a few historical and scenery sites of Yangtze Gorges.

Post-conference Field Excursion

A six-day post-conference field excursion (Oct. 13 to Oct. 18, 2017) will be arranged to investigate a number of classic sections of the Guzhangian (Series 3, Cambrian) to Upper Ordovician around the Yangtze Gorges area (sites 3 through 9 on the index map). These sections include at least the Gudongkou section (Xingshan, Hubei), Liujiachang section (Songzi, Hubei), Mayang section (Yongshun, Hunan), and the GSSPs of Paibian Stage (Furongian Series, Huanyuan, Hunan) and Guzhangian Stage (Series 3 of Cambrian, Guzhang, Hunan). Participants will be able to find fossils of trilobites, brachiopods, graptolites, bryozoans, nautiloids, echinoderms, etc. During the excursion, visits to the Yangtze Gorges National Geopark and the Zhangjiajie UNESCO Global Geopark, will be arranged optionally if time permits. The excursion will start in Yichang on Oct. 13, and end in Changsha City (capital of Hunan Province) on Oct. 18 (probably late afternoon), where there are many direct international flights to Thailand, Vietnam, Japan, South Korea, United States (Los Angles), Germany (Frankfurt), and Hong Kong, etc.





Registration Fees (estimates) and Payment

*Note that all the registration fees here are estimates, and the final registration fees and methods of payment will be posted in the Second Circular on April 1, 2017

The registration fee for the scientific sessions (covering icebreaker, conference dinner, coffee breaks, programme and abstract volume, all meals (lunch and dinner), mid-conference field trip, short courses, conference backpack) is estimated at \$300-350.

Accommodations: \$60-70 per double-room per day in the Taohualing Hotel (5-star, conference rate, including breakfast). We recommend staying at the conference hotel, and we have already reserved dozens of rooms for conference delegates.

The registration fee for the post-conference field excursion in Hubei and Hunan Provinces is estimated at \$850-950, which covers the field guide, hotels (three stars or higher), meals, transportation, and the tickets to geoparks, and historical sites of Oct. 13 to Oct. 18.

Publications

A volume including the conference programme and abstracts will be available at the meeting. A thematic issue in '*Palaeoworld*' may be arranged to publish short papers presented to the meeting (under negotiation with the journal editors) in early 2018. Deadlines for registration and submitting abstracts will be given in **Second Circular**.

Travel and accommodations

Yichang is ca. 300 km west of Wuhan City, the capital of Hubei Province (three-hour drive through freeway), and is easily accessible by air, train or car. There are many direct international flights every week from Moscow, Tokyo, Bangkok, Rome, Dubai etc. to Wuhan City. There are also direct flights from many domestic cities to Yichang, including Beijing, Shanghai, Nanjing, Hangzhou etc. Another option is the high-speed train (200-250 km/hour) connecting Yichang with Wuhan, Shanghai, Nanjing, Chongqing and Chengdu cities. We will arrange cars to pick up delegates arriving in and departing from Wuhan.

For accommodations, we have already reserved dozens of rooms in the five-star Taohualing Hotel (ca. 60-70 US dollars per room for conference rate) for delegates. For those prefer to stay elsewhere, there are over ten hotels ranking three stars or higher in Yichang City from which to choose. Most of them are within ten kilometers from the venue in the downtown. Information about additional hotel options will be provided in the second circular.

Important dates

December 19, 2016: Distribution of First Circular

March 2017: Website of the conference available for information and registration

April 1, 2017: Distribution of Second Circular

September 15, 2017: Distribution of Last Circular

Scientific Committee

Thomas SERVAIS (Chair, Lille, France)
David A.T. HARPER (Durham, UK)
Olga T. OBUT (Novosibirsk, Russia)
Christian M.Ø. RASMUSSEN (Copenhagen, Denmark)
Alycia L. STIGALL (Athens, Ohio, USA)
ZHANG Yuandong (Nanjing, China)

Organizing Committee

ZHANG Yuandong (Chair), Nanjing Institute of Geology and Palaeontology, China
ZHAN Renbin (Vice-Chair), Nanjing Institute of Geology and Palaeontology, China
LIU Jianbo (Vice-Chair), Peking University, China
FAN Junxuan (Secretary General), Nanjing Institute of Geology and Palaeontology, China
WU Rongchang, Nanjing Institute of Geology and Palaeontology, China
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YAN Kui, Nanjing Institute of Geology and Palaeontology, China
TANG Peng, Nanjing Institute of Geology and Palaeontology, China
WANG Wenhui, Central South University, China
LI Qijian, Nanjing Institute of Geology and Palaeontology, China
ZHANG Linna, Nanjing Institute of Geology and Palaeontology, China
HOU Xudong, Nanjing Institute of Geology and Palaeontology, China

Contact information

Any questions or suggestions related to the meeting and field trips should be directed to:

Dr. FAN Junxuan (Nanjing Institute of Geology and Palaeontology): fanjunxuan@gmail.com
Dr. ZHANG Yuandong (Nanjing Institute of Geology and Palaeontology): ydzhang@nigpas.ac.cn

Detailed costs and registration information will be posted in the second circular distributed on April 1, 2017. Please register your interests by filling in and ticking (✓) the form below and send to

IGCP653.China2017@nigpas.ac.cn

IGCP653 Annual Meeting 2017 (Oct. 8 to 12, 2017, Yichang, China)		
Name:		
Occupation:		
Institution:		
E-mail address:		
I will participate in the conference and the post-conference field excursion	surely	
	probably	
	possibly	
I will participate in the conference (scientific sessions and mid-conference field trip)	surely	
	probably	
	possibly	

13th INTERNATIONAL SYMPOSIUM ON THE ORDOVICIAN SYSTEM

Novosibirsk, Russia (July 12-17, 2019)

First Circular

We are delighted to announce that the **Thirteenth International Symposium on the Ordovician System** will be held from July 12th to July 17th, 2019 in Novosibirsk (Russia). The Symposium will be hosted at a most extraordinary district of Novosibirsk located about 30 km to the south of the city center on the shore of an artificial “Ob’ Sea”. Officially, it is called the Novosibirsk Scientific Center, but people call it simply Academy Town (Akademgorodok). Akademgorodok began its history in 1958 and now it is a world-renowned scientific center. Its core constitutes buildings of Novosibirsk State University and scientific research institutes of the Siberian branch of the Russian Academy of Sciences. Akademgorodok is an isolated district of Novosibirsk, located in a natural forest in the outskirts of the city. Scientific sessions will be organized in the conference hall of the House of Scientists (“Dom Uchenykh”) and the conference hall of the Trofimuk Institute of Petroleum Geology and Geophysics (Fig. 1). Hotel, conference halls, cafes, restaurants, and shore of the Ob’ Sea are all within walking distance from any point of the Akademgorodok.



Fig.1. Main building of the Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences

Significant and Important Dates:

- **March 2017:** First Circular appears in *Ordovician News*
- **March 2018:** Second Circular appears in *Ordovician News*
- **September 2018:** Registrations for the Symposium are expected to open
- **15 February 2019:** Deadline for submission of abstracts
- **March/April 2019:** Third Circular appears in *Ordovician News* with final Program and Arrival Instructions

Organizing Committee:

- NIKOLAY V. SENNIKOV, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk. Co-Chairman.

- ANDREI V. DRONOV, Geological Institute of Russian Academy of Sciences, Moscow. Co-Chairman.
 - ALEXANDR V. KANYGIN, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk. Deputy Chairman.
- TATIANA Yu. TOLMACHEVA, Russian Research Geological Institute (VSEGEI), St. Petersburg. Deputy Chairman.
- SERGEI V. ROZHNOV, Boryssiak Paleontological Institute of Russian Academy of Sciences, Moscow. Deputy Chairman.
- OLGA T. OBUT, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk. Secretary.
- ALEXANDR V. TIMOKHIN, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk.
 - TARAS V. GONTA, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk.
 - ELENA G. RAEVSKAYA, FGUNPP “Geologorazvedka”, St. Petersburg.
 - ELENA V. LYKOVA, Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk.

Accommodation:

Accommodation for all participants will be organized in the hotel “Zolotaya Dolina” (Golden Valley) in a walking distance (10 min) from the House of Scientists (“Dom Uchenykh”) and the main building of the Trofimuk Institute of Petroleum Geology and Geophysics where scientific sessions are to be held.

- Deluxe 130-100 Euro per night
- Single room 35-40 Euro
- Shared room 30-35 Euro
- Meals in Akademgorodok 30-50 Euro per day
- For students, rooms at the Novosibirsk State University hostel could be booked - price of single room (breakfast is not included): 15 Euro

Please note that costs for accommodation, excursions etc. are estimates only. They could change in the next 3 years with inflation and depend on the general economic and political situation. Final costs will be provided in the subsequent Circulars.

Travel:

Buses with departure every half an hour (100 min, 2 Euro) provide travel from Tolmachevo Airport (Tolmachevo-Novosibirsk city-Akademgorodok). Direct taxi from the Airport (50km) is the fastest way (45 min, about 30 Euro). A special minibus will also be organized from the Institute to meet participants of the Symposium.

Field Excursions:

Selection of Novosibirsk for the Symposium provides a good opportunity to learn more about the Ordovician geology of both the Siberian Platform and Altai Mountains. We also added to the program one pre-Symposium excursion to the St. Petersburg region. Therefore, those of the participants who attend both pre-Symposium and post-Symposium excursions on the platforms (Russian and Siberian respectively) will have a chance to compare sea-level story, long-term lithological changes and faunal differences in the two Ordovician palaeocontinents.

Pre-Symposium field trip 1. July 8-10, 2019 (3 days). **Ordovician of St. Petersburg region.** Co-leaders: T.Yu. Tolmacheva and A.V. Dronov.

Excursion starts and ends in St. Petersburg. Participants will have an opportunity to examine classical Ordovician sections connected with names of R. Murchison, Ch. Pander, A.

Volborth and many other famous scientists. We will study Cambrian and basal Ordovician (Tremadocian) siliciclastics including traces of permafrost on the Middle/Upper Cambrian boundary. The cool-water carbonate succession (Floian –Lower Sandbian) and warm-water carbonates (Upper Sandbian –Katian) including supratidal sebkha dolomites, unusual for the other parts of the Ordovician basin of Baltoscandia, will be demonstrated and discussed.

Ordovician limestones of St. Petersburg region are extremely fossiliferous. Rich fauna include trilobites, brachiopods, cephalopods, gastropods, bryozoans etc. Discussions at most stops will include summary of conodont, trilobite, brachiopod and graptolite biostratigraphic investigations as well as palaeoclimatic, sequence stratigraphic, facial and palaeobathimetric interpretations. Special attention will be made to trace fossils distribution and their potential for regional high-resolution correlation. Unique cool-water Middle Ordovician reefs (Hecker-type mud mounds) will be demonstrated and studied in detail.

The first and second days will be devoted to the Cambrian, Lower and Middle Ordovician of the Eastern part of St. Petersburg Region. The localities to be visited during the first day include Tosna River and Sablinka River canyons, Sablino caves, “Pander’s anticline” (Popovka River canyon), Putilovo quarry and Lava River canyon. That night participants will spend in the town of Volkhov on the Volkhov River in the eastern part of St. Petersburg Region. The localities to be visited in the second day include Volkhov River valley, Babino quarry (Fig. 2), Lynna and Says River valleys (Fig. 3). Tourist stops during the excursion include Fortress in Old Ladoga (the first capital of Russia) and Viking burial mounds on the banks of Volkhov River. At the end of the day participants returns to St. Petersburg and spend a night there. The third day will be devoted to the Lower, Middle and Upper Ordovician of the western part of St. Petersburg Region. Localities to be visited include Kaskovo quarry, Elizavetino quarry, Alekseevka quarry, Suma river canyon and Pechurki quarry. We return to St. Petersburg the evening of July 10, and on July 11th participants will fly to Novosibirsk. For the flight St. Petersburg – Novosibirsk participants need to make their own arrangements.

Field trip fee covers guidebook, transportation, all meals and accommodation in hotels during the excursion. Registration is 300 Euro for a minimum of 8 and maximum 40 participants. In July, the day temperature in St. Petersburg region is usually between +17°C and +27°C. Occasionally there could be rain.



Fig.2. Freshly exposed wall of the Dikari Limestone (Lower Dapingian) in the Babino quarry



Fig.3. Classical outcrop of the Middle Ordovician (Upper Dapingian-Lower Darriwilian) on Lynna River

Pre-Symposium field trip 2. July 4-11, 2019 (8 days). **Ordovician of the Altai Mountains.** Co-leaders: N.V. Sennikov, O.T. Obut and E.V. Lykova.

The field trip is planned to demonstrate the most important Ordovician localities of the Gorny Altai Mountains. Excursion starts and ends in Novosibirsk (Akademgorodok). The first and last days are mainly driving. Distance from Novosibirsk to the first field camp in North-Western Altai is about 500 km. Transportation in the field will be by bus, 4WD tracks and jeeps. Altai is usually called the Siberian Switzerland for its beauty (Fig. 4) but it is not high mountains. Altitude on the route of the excursion will be between 500 m and 1500 m above sea level. Mountains are covered by taiga forest and mountain meadows. Exposures are mainly along the river banks, road cuts, on mountain slopes (fig. 5) and in active quarries. Participants of the excursion will have an opportunity to examine all the Ordovician succession of the Gorny Altai Mountains represented in different shallow to deep-water facies including: 1) delta front; 2) inner shelf (ramp); 3) inner slope of the carbonate platform (Fig. 5); 4) central part and outer slope of the carbonate platform; 5) deep-water shelf; 6) continental slope; 7) open ocean deposits and sea mounts. The fossils are represented by graptolites, conodonts, chitinozoans, radiolarians, trilobites, ostracods, brachiopods, gastropods, crinoids, scolecodonts, tabulate and rugose corals, bryozoans and algae.



Fig.4. Upper Ordovician reef limestones, Gorny Altai



Fig.5. Middle Ordovician succession of repetitive limestone and shale, Gorny Altai

Tourist sites on the route include:

- 1) Kolyvan' stone factory founded in 1802 which is famous for its giant jasper vases now stored in Paris and St. Petersburg (Hermitage).
- 2) Denisova Cave which represents one of the most ancient dwelling places of humans in Siberia (more than 200 000 years B.C.).
- 3) Scythian burial mounds (IV-II centuries B.C.).
- 4) Boat trip along Teletskoe Lake, which is known as "Altaian Baikal".

Typical temperatures for July in Gorny Altai are about +20-25°C, rarely +30°C during the day and +5-15°C at night. Occasional rain is possible. Heavy dew is typical in the mornings. It is planned to stay in four field camps (tourist campings) during the excursion with a distances between camps of about 250-400 km. Participants are advised to bring field boots, warm sweaters, raincoats, umbrellas as well as caps and swimming suits. The tents, sleeping bags and other camp facilities will be provided by the organizers.

Field trip fee (800 Euro) covers guidebook, all meals, accommodation in field camps and campings and transportation during the excursion. This field trip is restricted to minimum 8 and a maximum 25 participants.

Mid-Symposium field trip. July 14-15, 2019 (2 days). **Ordovician of the Salair Range.**

Co-leaders: N.V. Sennikov and O.T. Obut.

Beginning and end of the excursion is in Novosibirsk (Akademgorodok). The excursion will demonstrate Cambrian, Lower to Middle Ordovician (Tremadocian, Floian, Dapingian and Darriwilian) and Silurian successions of the Salair Range that is represented in shelf facies including terrigenous and carbonate including carbonate with reef buildups. Fossils include brachiopods, trilobites, archaeocyathids, graptolites and corals. Field guide, transportation and accommodation for one night (in a hotel in Gurievsk town or Belovo) are covered by registration fee. The weather and other natural conditions recall the pre-Symposium Altai excursion.

Post-Symposium field trip. July 17-24, 2019 (7-8 days). **Ordovician of the Siberian Platform: Podkamennaya Tunguska and Stolbovaya Rivers.** Co-leaders: A.V. Dronov, A.V. Timokhin and T.V. Gonta.

Excursion starts in Novosibirsk and ends in Krasnoyarsk. Late in the evening of July 17 we will take a night train Novosibirsk – Krasnoyarsk (800 km). On July 18, we will fly from Krasnoyarsk to the town of Bor (600 km) on the Yenisei River opposite to the mouth of Podkamennaya Tunguska River. The same day the flight by helicopter from Bor to the field camp (120 km) on the Stolbovaya River, tributary of Podkamennaya Tunguska will be organized. For transportation between the outcrops during the excursion, rubber boats and motorboats will be used. Accommodations are in field camps (Fig. 6). Motorboats will arrange the way back to Bor downstream to Podkamennaya Tunguska at the end of the excursion (July 23). Organizers will provide flight back from Bor to Krasnoyarsk (July 24), but for the hotel in Krasnoyarsk participants need to make their own arrangements.



Fig.6. Field camp. Tributary of Podkamennaya Tunguska River

Participants of the excursion will have an opportunity to visit important Ordovician localities of the Tungus Basin on the banks of Podkamennaya Tunguska and Stolbovaya Rivers. They will see the Lower Darriwilian tropical carbonates with stromatolite buildups and oolitic grainstone that represent the uppermost part of the “Great Siberian Carbonate Bank” analogue of the Great American Carbonate Bank. The Upper Darriwilian shallow water quartz sandstones of the Baykit formation with *Skolithos*, *Kouphihnium* and giant Siberian *Rusophycus* trace fossils will be examined in several outcrops. The Lower Sandbian phosphate conglomerates of Ust’Stolbovaya formation overlying Baykit sandstone and marking the beginning of the Upper Ordovician transgression associated with upwelling of the cool-water oceanic waters into the epicontinental Tungus Basin as well as the cool-water carbonate series (Sandbian –Katian) will be also examined in several localities. The Upper Ordovician K-bentonite layers within the cool-water tempestites of Mangazea and Dolbor formations will be traced and studied at several localities along the Podkamennaya Tunguska and Stolbovaya Rivers (Fig. 7). These deposits are also rich in body fossils, which include trilobites, brachiopods, bryozoans, crinoids, ostracods, corals and gastropods etc, as well as in trace fossils including *Rhizocorallium*, *Halopoa*, and *Balanoglossites* etc. At some of the outcrops, contact with the Lower Silurian deposits will be seen. Discussions at most stops will include summary on biostratigraphic investigations as well as palaeoclimatic, facial and palaeobathimetric interpretations. Sea-level changes and sequence stratigraphy will be discussed as well.



Fig.7. Upper Ordovician cool-water carbonates with K-bentonite beds. Stolbovaya River

In July, the day temperature in this part of Siberia is usually between +17°C and +25°C. Occasionally there could be rain. Participants are advised to bring field boots, warm sweaters, raincoats, umbrellas as well as caps and swimming suits. The tents, sleeping bags and other camp facilities including repellents against mosquitos will be provided by the organizers. Field trip fee (1500 Euro) covers guidebook, all meals, accommodation in field camps and transportation during the excursion. This field trip is restricted to minimum 10 and maximum 20 participants.

Additional Possibility:

Post-Symposium field trip 2. July 18-25, 2019 (8 days). Ordovician of the Siberian Platform: Kulyumbe River section.



Fig.8. Ordovician outcrops on the Kulyumbe River

Excursion starts and ends in Novosibirsk. It requires a flight to Norilsk and back and helicopter flight from Norilsk to Kulyumbe River (about 40 minutes) and back. The

Kulyumbe River section is one of the most complete and well exposed (however, rarely visited) Ordovician section in the entire Siberian Platform. It provides a good opportunity to study depositional cycles and facies of Upper Cambrian, Lower and Middle Ordovician and the lower part of the Upper Ordovician deposits (Fig. 8). The whole transition from the Lower and lower Middle Ordovician tropical carbonate platform to the upper Middle and Upper Ordovician cool-water carbonate ramp could be demonstrated. Special attention will be attributed to the position of the Cambrian/Ordovician boundary, sea-level story and distribution of trace fossils. Weather conditions in July are roughly the same as on Podkamennaya Tunguska and Stolbovaya Rivers.

Field trip fee is 2000 Euro for a minimum of 10 and maximum 15 participants. It covers all transportation, accommodation, meals and guidebook.

Expression of Interest:

Please indicate your interest in attending a particular field excursion, especially in the case of excursions to Kulyumbe River and to St. Petersburg region, as early as possible. It will help the organizing committee to decide if there is sufficient interest to run these excursions.

Please send your expression of interest to Andrei Dronov: dronov@ginras.ru

Social and Cultural Highlights:

For accompanying persons during the Symposium a boat trip on the Ob' River could be recommended. The other tourist attractions are listed in the outlines of the field trips.

Publication:

A proceedings volume of the Symposium and additional materials on the Ordovician Geology of Russia will be published in a monographic series of the Trofimuk Institute of Petroleum Geology and Geophysics, Russian Academy of Sciences. After the meeting, all the materials will be freely accessible through the web page.

Costing:

Registration fees:

- General participants: 350 Euro
- Student participant: 200 Euro

Registration fee covers costs of publication, conference bag, coffee breaks, symposium excursion (full accommodation and meals) and social activities.

Conference Dinner: 50 Euro

Pre-Symposium field trip 1. Ordovician of St. Petersburg region (3 days); 300 Euro (covers field guide, transportation, all meals and accommodation).

Pre-Symposium field trip 2. Ordovician of Gorny Altai (8 days); 800 Euro (covers field guide, transportation, all meals and 6 nights' accommodation).

Mid-Symposium field trip. Ordovician of Salair Range (2 days); included in the registration fee; 150 Euro for accompanying persons.

Post-Symposium field trip. Ordovician of the Siberian Platform: Podkamennaya Tunguska and Stolbovaya Rivers (8 days); 1500 Euro (covers field guide, transportation, all meals and accommodation).

Additional Post-Symposium field trip. Ordovician of the Siberian Platform: Kulyumbe River section. (8 days); 2000 Euro (covers field guide, transportation, all meals and accommodation).

Supporting organizations, Universities & Institutions:

- International Subcommission on Ordovician Stratigraphy (ICS-IUGS)
- Interdepartmental Stratigraphic Committee of Russia
- Russian Academy of Sciences
- Russian Foundation for Basic Research
- Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Novosibirsk (Russia)
- Novosibirsk State University, Novosibirsk (Russia)
- Geological Institute of Russian Academy of Sciences, Moscow (Russia)
- Boryssia Paleontological Institute of Russian Academy of Sciences, Moscow (Russia)
- Russian Research Geological Institute (VSEGEI), St. Petersburg (Russia)

Sponsorship:

- Russian Academy of Sciences
- Russian Foundation for Basic Research

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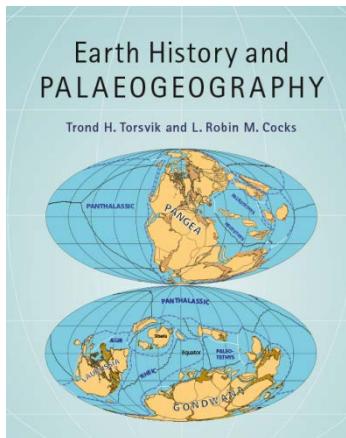
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Andrei Dronov, Co-chair, 13th ISOS

PUBLICATION OF INTEREST TO ORDOVICIAN RESEARCHERS



Torsvik, T.H. & Cocks, L.R.M. 2017. *Earth History and Palaeogeography*. Cambridge University Press, Cambridge. 317 pp.
For further details refer to: www.ca.bridge.org/9781107139961
(type in 'Torsvik and Cocks' in the search box).

Reproduced below is one of the new figures from the Ordovician chapter.

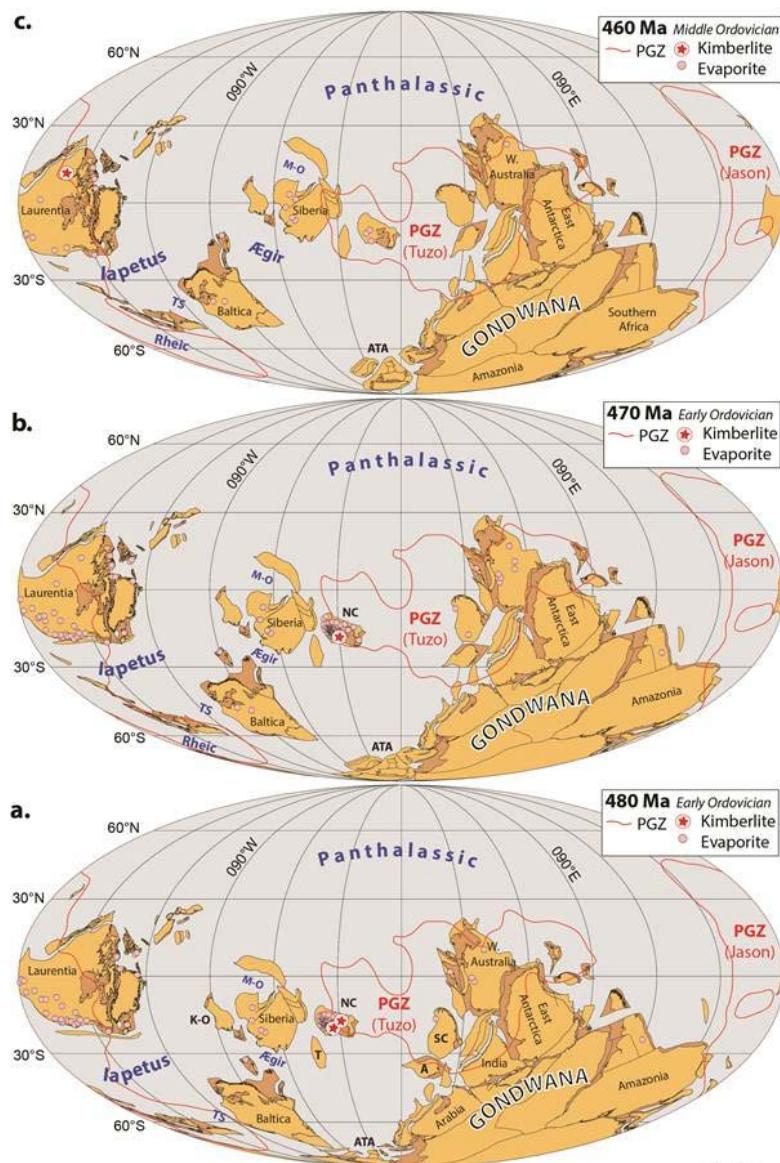
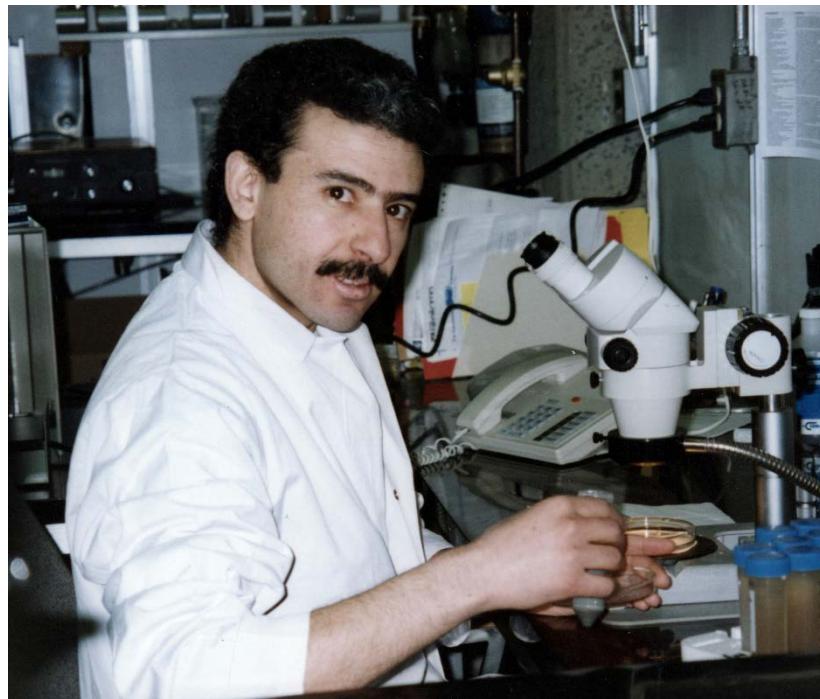


Fig. 6.1

IN MEMORIAM

Azzedine Soufiane
1959–2017



Azzedine Soufiane died on January 29, 2017 while trying to disarm the shooter at the Ste-Foy mosque massacre in Quebec City. He was 57 years old, having been born on October 10, 1959, at Khouribga, south-east of Casablanca, Morocco.

Azzedine came to Canada in 1988 thanks to an International Development Research Centre (IDRC) scholarship and the support of the *Office National de Recherches et d'Exploitation Pétrolières (ONAREP)* to attend the *Université du Québec à Montréal*. In 1991 he received his M.Sc. degree in geology on the basis on his work on Ordovician and Silurian chitinozoans from the Tadla basin in Morocco.

In 1992 he joined the *Institut national de la recherche scientifique (INRS)* in Quebec as a research assistant, and in the following ten years he undertook a number of projects on the Ordovician and Silurian chitinozoans of Anticosti Island, Arctic Canada, Nevada and Nova Scotia. This work produced more than fifteen papers and oral communications. In 1999 he enrolled at the INRS for a Ph.D. degree to better integrate the knowledge he had acquired in palynostratigraphy.

In 2004, because of family obligations and an unfavorable labor market, he left a promising scientific career to open a Mediterranean grocery and a halal butcher shop attuned to the needs of the local Moslem community.

Azzedine was appreciated by his colleagues. He was a rigorous and meticulous scientist, unpretentious and always helpful. The Quebec community unanimously acknowledged his generosity, open-mindedness and other human qualities.

Azzedine is survived by his wife and three children, 6, 13 and 15 years old.

[contributed by Aicha Achab, Esther Asselin and John Riva]

RESEARCH REPORTS & Contact details (in alphabetical order)

Guillermo ALBANESI (Argentina) studies conodonts from the lower Paleozoic of South America, including taxonomy, biostratigraphy, chemostratigraphy, events, and paleothermometry. Diverse projects from the Precordillera, Eastern Cordillera, Famatina, Sierras Subandinas, and Puna of northwestern Argentina are carried out with Gladys Ortega, Gustavo Voldman, Fernando Zeballo, and colleagues from Argentina and other countries. Graduate students F. Serra, N. Feltes, M. Mango, G. Della Costa, and F. Moreno, are continuing investigations on conodont biostratigraphy, paleoenvironments and evolution from carbonate and siliciclastic sequences of the Argentine Ordovician System under his direction, supported by CONICET scholarships. Guillermo is completing a project on O isotopes from conodonts of the Argentine Precordillera regarding their paleobiogeographic implications, in collaboration with specialists from Australia, Canada and USA. Another international project about Lower Paleozoic melanges and chronostratigraphic controls by conodont records is being finished with colleagues from Spain and Italy.

He is 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 laboratory of micropaleontology especially equipped for conodont works. His current place of work is at the CICTERRA (CONICET-UNC, <http://cicterra.conicet.unc.edu.ar/es/>) in the university campus, and maintains a repository space for the conodont collections at the Museo de Paleontología. He is the present director of the Doctoral career in Earth Sciences at the FCEFyN, UNC.

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Chris Barnes (Canada) is continuing Ordovician conodont paleontology/stratigraphy/isotope geochemistry research. The main current projects being: a) Ordovician and Silurian paleotemperature record determined from SHRIMP oxygen isotope measurements from conodonts (with Julie Trotter (UWA), Ian Williams (ANU) and Guillermo Albanesi (CONICET, Cordoba)); b) Ordovician and Silurian conodont biostratigraphy, bioevents, and thermal maturation studies, Canadian Arctic Islands (with Zhang (GSC) and Jowett (Tallisman Exploration)); participation in IGCP 653 Onset of GOBE.

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Juan L. BENEDETTO (Argentina) is working on the taxonomy, biogeography and phylogeny of Lower Ordovician brachiopods from the Central Andean basin of NW Argentina. Jointly with doctoral student Fernando Lavié I am studying the lingulate faunas from the Santa Rosita and Acoite formations, and those from the Suri Formation of the Famatina Range. A major project, which is being carried out in collaboration with F. Lavie, is focused on the taxonomy, paleoecology and biogeography of lingulate brachiopods from the San Juan Formation (upper Tremadocian-Darriwilian) and other Ordovician Middle-Upper Ordovician carbonate units of the Precordillera. A taxonomic paper including obolids, trematids, siphonotretids and craniids from the San Juan Formation (Darriwilian) has been recently published. Together with Diego Muñoz I finished a work on the biogeography of the genus *Apheoorthina* in which the main factors influencing large-scale dispersal pathways around Gondwana such as larval capacity for dispersal and oceanic currents are analyzed. Also being written is a joint paper with D. Muñoz on the taxonomy and stratigraphic distribution of the punctate orthide *Lipanorthis*, which is one of the most conspicuous taxa in the Tremadocian-Floian strata of NW Argentina. Finally, I am undertaking a taxonomic revision of the plectambonitoid *Ahtiella* in the three major Ordovician basins of Argentina (Precordillera, Famatina and Central Andes). This study attempts to reconstruct the phylogenetic lineage leading to the origin of the genus *Ahtiella* based on the excellent fossil record of the Famatina Range. As a result, an alternative phylogenetic hypothesis is provided in order to improve our knowledge about the long-standing and not yet resolved issue of the origin and diversification of the plectambonitoid strophomenides.

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Matilde S. BERESI (Argentina) is continuing work on Cambrian and Middle Ordovician stratigraphy of the carbonate platform, of the Precordillera, western Argentina. Taxonomy includes spicule assemblages, sponge faunas and chancellorids together with colleagues from United Kingdom and Mexico; two papers are in progress. Together with V. Luchinina I am describing Ordovician algae and calcimicrobes from many carbonate sections of the Precordillera. J. Botting, L. Muir (UK) and I are finishing up a manuscript on climate change and sponges in the past (Springer).

Dr. Matilde Sylvia BERESI

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Stig M. BERGSTROM (USA). Although long retired, I continue working daily on Lower Paleozoic research in my university office. I have currently projects underway in North America, Baltoscandia, China, Argentina, and the British Isles. Many deal with ^{13}C

chemostratigraphy and its implications but I am also involved in local and regional biostratigraphy, conodonts, graptolites and some other subjects. The past year has been good publicationwise with 9 articles, three abstracts, and three other publications. About four additional articles are in press or ready to be submitted. A particularly happy event during 2016 was the publication of the large monograph by Chen Xu and others entitled 'Darriwilian to Katian (Ordovician) graptolites from northwest China' in which I have been heavily involved in two chapters and spent much time on the entire volume during the past few years.

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Alain BLIECK (France) is presently working on mostly Early Devonian vertebrates (heterostracan pteraspidomorphs and others), but is still interested in Ordovician and Silurian ones. The work on the Handbook of Palaeoichthyology (Verlag Dr. Friedrich Pfeil, Germany) has been reactivated by collaboration with Prof. David K. Elliott (NAU, Flagstaff, Arizona). Papers are in progress on a revised phylogeny of cyathaspid heterostracans, on new tesseraspid heterostracan material from Severnaya Zemlya (Russia), and a review of all known Ordovician to Devonian pteraspidomorphs.

Dr. Alain BLIECK

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Carlton E. BRETT (USA) continued in 2016 to work on several projects related to Ordovician stratigraphy and paleoecology with present and former students. We continued to work on high-resolution stratigraphy, depositional cycles and paleoenvironments of the Upper Ordovician in the Cincinnati region and elsewhere. Major research projects continued in two major areas as discussed below.

A) Integrated Stratigraphy of lower Katian Platform to Basinal Sediments in Eastern North America

In 2016 several different projects continued to focus on the uppermost Sandbian-lower Katian interval. This is a critical interval because it includes the prominent Guttenberg C isotope

excursion the most widespread K-bentonite beds in the Ordovician, of the Ordovician signaling the onset of the later tectophase of the Taconic Orogeny, a major sequence boundary (M4/M5 boundary), and biotic turnover.

1) I am continuing to work PhD student Allison Young and Dr. Patrick McLaughlin, Indiana Geological Survey on correlation of the upper Sandbian-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. Newly studied drill cores from Ohio and Indiana are providing new information on submarine erosion and filling of this feature that will have strong implications for the erosional origin of this topographic feature. The results of these studies, together with a field trip, were presented at the AAPG eastern section meeting at Lexington, KY by Allison and Dr. Ben Dattilo (Indiana-Purdue University, Fort Wayne; Allison also received a best student paper award from AAPG for her talk on this topic). In addition, we spent two days in the field near Lexington with Dr. Charles Mitchell (SUNY Buffalo) studying outcrops of the Lexington Limestone near Frankfort, KY and prospecting for graptolites; Allison was successful in finding a shaly horizon within the Devils Hollow Member that yielded identifiable graptolites, which are presently under study by Chuck Mitchell.

2) A project with UC Masters student Tim Paton and Canadian researcher, George Kampouris, funded by a National Geographic Society grant, documented a sequence of spectacular hummocky hardgrounds and their intact fossil communities from the early Katian Bobcaygeon Formation. We focused on an area that is soon to be destroyed by quarrying. We were able to document the complex history of these seafloors and salvage much critical material. Mounded hardgrounds were only partially buried and scouring effects exhumed older surfaces. Thus the mounds underwent multiple episodes of obrution (sediment smothering) that preserved intact and *in situ* remains of bryozoans and delicate echinoderms including asteroids (starfish), crinoids, notably the unusual large crinoid, *Cleioocrinus*, with columns up to a meter long, rhombiferans and edrioasteroids.

In addition, we have now obtained C isotope chemostratigraphy data that documents the occurrence of these encrusted surfaces about 8 m above GICE (Guttenburg isotope) excursion; additional high resolution sampling will attempt to place the occurrence in relationship to a recently discovered higher isotope excursion (herein termed the Macedonia excursion). Samples have been submitted for isotopic analysis. We are testing whether or not these skeletal colonization surfaces are related to events of bioherm development in the very earliest Katian in other parts of the world, including Estonia and Sweden.

We also initiated study of the stratigraphy of the Bobcaygeon Formation and related early Katian units between the Lake Simcoe area near Toronto and the Ottawa region about 360 m to the east. Preliminary work looks quite promising.

3) We also began comparative studies of similar but older mounds from the latest Sandbian Curdsville Limestone in Kentucky. These mounds provide a unique opportunity to test for the stasis/evolution of these discrete highly analogous communities through a time span intermediate in scale between typical ecological and most evolutionary paleoecological studies. In addition, Tim Paton discovered new occurrences of edrioasteroids in very high density associations on flat hardgrounds in the middle Lexington limestone (lower Katian) in Kentucky. We are currently working on the systematics and paleoecology of these unusual hardground communities with Dr. Colin Sumrall (University of Tennessee at Knoxville).

4) Another, related, new project, initiated in 2016, with Tim Paton and Allison Young, involves comparative sequence and chemostratigraphic studies of the upper Sandbian and early Katian Nashville Group in the area of Nashville, central Tennessee and equivalent "Martinsburg" Formation in eastern Tennessee. Preliminary studies indicate the persistence

of intermediate and even small- scale sequences (4th- and 5th-order cycles) and bioevents of the Lexington Platform in Kentucky into these disparate areas. We have sampled these sections for carbonate carbon isotopes in order to independently test our sequence and event correlations.

B) Revised Correlations and Sequence Stratigraphy of the North American Cincinnati Series (upper Katian)

We continued our work on microstratigraphy of the Upper Ordovician in the Cincinnati region. I am now working with graduate students Christopher Aucoin (PhD pre-candidate) and Cameron Schwalbach, as well as Kyle Hartshorn (Cincinnati engineer and avocational paleontologist), Dr. Patrick McLaughlin (Indiana Geological Survey) and Dr. Ben Dattilo (Indiana Purdue University, Fort Wayne) on sequence and event stratigraphy of the Upper Ordovician Richmond Group. We are beginning to work on the highest parts of the Cincinnati and attempting to recognize remnant Hirnantian strata below the widespread Cherokee unconformity.

In 2016, Christopher Aucoin extended his study of the sequence stratigraphy and bioevents of the upper Katian (upper Cincinnati) Richmond Group and the so-called Richmondian invasion. As a part of a Fulbright Fellowship with Dr. André Desrochers at University of Ottawa, Chris extended this research into southern Ontario. This work includes analysis of carbon isotopes in drill cores through the Upper Ordovician in drill cores from the Ottawa Basin. He is making good progress in linking patterns unconformity bound sequences and biotic events seen in the Cincinnati Arch, with those of southern Ontario, a topic that has not been tackled in any detail, since the classic work of Foerste about 100 years ago.

We also extended these studies to the Nashville Dome in Tennessee. Here we were able to recognize intermediate scale cycles nested within Holland and Patzkowski's third order Cincinnati sequences and also note several correlative epiboles between the Cincinnati Arch and Nashville Dome area indicating that both of these regions were affected synchronously by similar environmental perturbations despite being separated by about 300 km.

Dr. Ben Dattilo, Dr. Rebecca Freeman (University of Kentucky) and I are continuing to investigate the hypothesis that phosphatic enrichment in the Cincinnati is the result of multiple episodes of storm reworking and enrichment of organic-derived phosphates.

The results of these major studies are being synthesized in a completely revised Upper Ordovician Cincinnati sequence stratigraphy, which builds on the seminal work of Holland and Patzkowsky and subdivides the Cincinnati into a number of new high- resolution sequences. I am working on a new volume of papers resulting from several recent field conferences on the Katian of the Cincinnati Arch region. Graduate student Allison Young and I attended the excellent conference of the final meeting of IGCP 591 Middle Paleozoic Events and joint International Subcommission on Ordovician Stratigraphy (ISOS) in Ghent, Belgium and presented two talks and a poster. Dr. Pat McLaughlin, Dr. Poul Emsbo (US Geological Survey Denver) and I presented a series of inter-linked talks relating regional stratigraphy, biotic events, and brine enrichment episodes in the mid Paleozoic at this meeting and also talks at the Geological Society of America.

C) Comparative Sequence and Event Stratigraphy: South China

A new initiative begun in 2016 involved comparative studies of stratigraphy and facies in southern China. To this end, I collaborated with Dr. Zhan Renbin (NIGPAS Nanjing) and graduate student Luan Xiaocong on examination and interpretation of sections and drill core covering the Dapingian through Hirnantian in the Hubei, Sichuan, and eastern Yunnan provinces.

A purpose of this project was to examine strata of similar biostratigraphic positions for common patterns of sequence stratigraphy and carbon isotopic signatures. This work

includes studying outcrop and core from both countries with sample collection of carbon isotopes, chemical analyses through X-ray fluorescence, microfacies analyses through thin sections, and fossil content. This work is ongoing, but preliminary data are promising for global correlation. We are also pursuing the topic of time-specific facies, particularly the presence of similar red limestones in the late Dapingian and Darriwillian interval in China and Baltica. Luan Xiaocong has made very detailed studies of the petrography of these facies, which are being placed in a sequence stratigraphic context.

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Yves CANDELA (Scotland) is working with David Harper (Durham University) on the Lower Ordovician brachiopod faunas of the Fezouata Shale, Morocco. This research was sparked by the visit (July 2016) to the collections of the Université Claude Bernard Lyon 1, facilitated by Bertrand Lefebvre and Emmanuel Robert. The analytical aspects of the research are dealt with Lore Troalen (NMS Edinburgh). Preliminary results were presented at the 60th Palaeontological Association Annual Meeting in Lyon (December 2016).

I am also still working with David Harper on the description of brachiopod (linguliforms) and associated faunas from the Glenkiln Shales (Sandbian) and the Raven Gill Formation (Floian), along the Wandel Burn and its attributes, SE Scotland. Publications for 2016-17 concern the Silurian period.

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Marcelo G. CARRERA (Argentina) is actively working on the evolutionary history of lower Paleozoic sponges and the taxonomy, paleoecology and paleobiogeographic significance of the bryozoan fauna of the Argentine Precordillera. A paper has just been published from our project (with R. Astini and F. Gomez) on Lower Ordovician reefs from western Argentina.

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Robin COCKS (England) had a full year, starting with submission of the palaeogeography book with Trond Torsvik (Oslo) at the end of January to Cambridge University Press, who published it (dated 2017) in December. Within it there are many new global and local Ordovician maps and data. Apart from correcting the proofs and making the index for that book in June, most of the year has been spent on the near-final stages of his long-standing *Palaeontographical Society Monograph* on the Early Silurian (Llandovery) brachiopods of England and Wales, which should be completed very soon. He also continued work with Leonid Popov and together we submitted a paper on the Katian palaeogeography of the Kazakh terranes, including the distribution of brachiopods within them, which is undergoing editorial revision in *Acta Geologica Polonica*, as well as a paper just submitted on the first Dapingian brachiopod fauna known from Iran. He spoke at the IGCP 591 Closing Meeting at Ghent in July, and also spent a week in August planning further work with Trond Torsvik, who is currently spending a sabbatical year in Berlin.

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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 contributing for a better knowledge of the Palaeozoic stratigraphy 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 transition (including rifting processes), Lower Ordovician oolitic ironstones bearing volcanogenic prints with organic matter, hydrocarbons, fossil algæ and bryozoa (that exert a control of gold mineralization), on the Upper Ordovician deposits related to the Late Ordovician glaciation and on Silurian-Devonian transition.

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Andrei DRONOV (Russia) continued his work on facies, sea-level changes, biotic and abiotic events on the Siberian and Russian platforms during the Ordovician. In the year 2016, we started a 3- year project “Major biotic and abiotic events of regional and global scale in the Ordovician of Siberian and Russian platforms”. The project’s team includes Alexander Kanygin, Alexander Timokhin, Taras Gonta, Olga Maslova, Veronica Kushlina, Alexey Zaitsev, Elena Raevskaya and Tatiana Tolmacheva. Under umbrella of this new project, we continue our studies initiated earlier. 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. Studies of extraterrestrial chromates in the Darriwilian sections of St. Petersburg region and Siberia together with Birger Schmitz are also in the agenda as well as investigation of the Ordovician trace fossils in cooperation with Radek Mikuláš and Dirk Knaust. A paper on specific trace fossils made by columnar stromatoporoids in the Upper Ordovician of Siberia is in preparation (with Veronica Kushlina and David Harper). Together with Axel Munnecke, we are also working on the unique Middle Ordovician *Moyeronia-Angarella* buildups from the Tungus basin. For the year 2017, we are planning an expedition to the Podkamennaya Tunguska River in order to study localities and prepare outcrops and logistics for field excursions associated with the 13th International Symposium on the Ordovician System, to be held in July 2019 in Novosibirsk.

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Jan Ove EBESTAD (Sweden). Research during 2017 will span a broad range of taxa, stratigraphy and areas. My molluscan studies involve an exciting collection of rostroconchs from erratics in the Netherlands, collected by Freek Rehbergen, which Freek and I are

describing together with Alexander Gubanov. Alexander and I are as well on the way with describing the gastropods and tergomyan molluscs from the Boda Limestone of Sweden. In addition I am looking closer at peri-Gondwana material in collaboration with Mansoureh Ghobadi Pour and Leonid Popov as well as Juan Carlos Gutierrez-Marco. My arthropod studies are now focused on a major revision of Ordovician trilobites from the Taimyr Peninsula in collaboration with Richard Fortey. New and old material is being studied.

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Cole EDWARDS (USA) is working 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. Collaborations with Matt Saltzman (Ohio State), Page Quinton (SUNY Potsdam), and David Fike continue on $d^{18}\text{O}$ study of Ordovician conodonts using the Cameca 7f/geo Secondary Ion Mass Spectrometer (SIMS). Work continues on oxygenation as a driver of the Great Ordovician Biodiversification Event, using changes in the global carbon cycle to inform two modeling approaches. We presented these results as an abstract at the annual GSA meeting in Denver, co-authored by Matt Saltzman and Dana Royer (Wesleyan University). A new research direction incorporating trace elements (iodine) as a direct proxy for seawater anoxia with Zunli Lu (Syracuse) continues to show promising results in the Lower Ordovician and should (hopefully) be published in a high-impact journal in the coming months of 2017.

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Bob ELIAS (Canada), together with students and colleagues, is continuing to study the Upper Ordovician and Ordovician-Silurian boundary interval in the Williston and Hudson Bay basins. In particular, carbon isotope curves and conodonts are being used to identify Hirnantian strata and the position of the O-S boundary.

Papers on various aspects of Ordovician tabulate corals from China, and coral-like fossils from Korea and China, were published in 2016 with Dong-Jin Lee and Mirinae Lee (Andong National University, Korea), Kun Liang (Nanjing Institute of Geology and Palaeontology), and Ning Sun (China University of Geosciences). Further studies are in progress.

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Ray ETHINGTON (USA) had one paper published in 2016. My old bones are unable to return to the desert country of western US but I have collections that accumulated in past visits to those places and I continue work on them most week days.

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Frank ETTENSOHN (USA): My students and I continue our long-standing work on the Upper Ordovician Lexington Limestone and equivalents in Kentucky and surrounding states. We are mainly concentrating on facies distribution and development, basement structural control of facies, and seismites. I am also working on large-scale tectonic control of Late Ordovician black-shale development in the Appalachian Basin.

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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 currently going on.

A revision on the significance of conodonts in Ordovician chronostratigraphy (with Stig Bergström) has been recently published (Bergström & Ferretti) within a Thematic Issue (Balini, Ferretti, Finney & Monechi, eds, *Lethaia*) exploring the significance of fossils in modern chronostratigraphy, 150 years after the death of Albert Oppel.

Exceptionally preserved conodont apparatuses with hyaline elements are described from the middle-upper Darriwilian (Middle Ordovician, Whiterockian) Winneshiek Konservat-Lagerstätte in northeastern Iowa (Liu *et al.*). Apparatus structures for *Archeognathus primus* Cullison, 1938 and *Iowagnathus grandis* new genus new species are proposed and the new family Iowagnathidae in Conodonta is introduced.

An updated conodont biostratigraphy of the Rauchkofel Boden Section, a classical reference section for the Carnic Alps, is presented (Schönlaub *et al.*). Twenty-five conodont Zones are documented, spanning from the Katian (Upper Ordovician) to the Pragian (Lower Devonian), following latest developments in conodont taxonomy and biostratigraphy, as well as in chronostratigraphy, and the recent introduction of a new lithostratigraphic outline of the Carnic Alps.

A study on a conodont collection from Anglesey (northwestern Wales) and its geological implications has been recently submitted (Bergström & Ferretti). The fauna documents the *Baltoniodus variabilis* Subzone of the *Amorphognathus tvaerensis* Zone, and aims to be of some help in deciphering the geology of some Darriwilian–Sandbian (Ordovician) ‘ghost’ formations in the UK and North America using olistoliths in marine debris flows.

Finally, peculiar apatite overgrowths observed on the oral surface of Late Ordovician conodonts from the Vaux Limestone exposed in Normandy have been preliminary described (Ferretti *et al.*). A more comprehensive study, focusing on their nature and global significance, has been recently submitted.

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Richard FORTEY (United Kingdom) is currently working on Ordovician trilobites from the Taimyr Peninsula jointly with J.O. Ebbestad (Uppsala) and continuing work on Moroccan trilobite faunas (with G. Edgecombe).

Richard Fortey

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G. Robert GANIS (USA) is working on graptolite fauna from the Martinsburg Formation (Sandbian- Katian) in Pennsylvania and unusual associated problematic fossils.

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Mansoureh GHOBADI POUR (Iran) continues her work on the Ordovician biostratigraphy and faunas of Central Asia and the Middle East in cooperation with Leonid Popov, Javier Alvaro, Lars E. Holmer, Mohammad Kebria-ee Zadeh and other colleagues. The work on the Lower and Middle Ordovician trilobite faunas of Alborz on the Katian trilobites of the West Balkhash and Ishim regions in Kazakhstan is in a good progress.

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Daniel GOLDMAN (USA) continued in 2016 to work on a large graptolite biogeography project with Chuck Mitchell, James Boyle, Dave Sheets, Shuang-Ye Wu, Chen Qing, Roger Cooper, and Peter Sadler. We have compiled a comprehensive stratigraphic and biogeographic database that will be used to examine questions regarding the relationship between geographic range and stratigraphic duration in graptolites. I also co-authored a book on Darriwilian to Katian graptolites from Northwest China with my colleagues from the Nanjing Institute of Geology and Palaeontology including Chen Xu, Zhang Yuandong, Fan Junxuan, Chen Qing, and Ma Xuan. Stig Bergstrom also collaborated on this book. I want to thank my Nanjing colleagues for inviting me to part of this interesting and productive project. Finally, I was invited to be the senior author of the Ordovician chapter for the revised Geologic Timescale 2020. My co-authors will be Peter Sadler and Steve Leslie.

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Juan Carlos GUTIÉRREZ-MARCO (Spain) is working on a number of Ordovician issues in Southwestern Europe, North Africa and South America, involving current co-operation with Enrique Villas, Graciela N. Sarmiento, Isabel Rábano, Jorge Esteve and Josep Roqué (Spain), Artur A. Sá (Portugal), Bertrand Lefebvre and Daniel Vizcaíno (France), Jorge Colmenar (Denmark), Olev Vinn (Estonia), Björn Kröger (Finland), Jan Ove Ebbestad (Sweden), Petr Štorch (Czech Republic), César Chacaltana (Peru), Josefina Carlorosi and Marcelo G. Carrera (Argentina), Enrique Bernárdez (Chile), María Fernanda Almanza (Colombia), Heyo Van Iten and Stan C. Finney (USA) and Diego C. García-Bellido (Australia).

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David A.T. HARPER (U.K.) reports that research continues on a variety of Ordovician brachiopod faunas with Yves Candela, Huang Bing, Matthew Parkes, Rong Jiayu, Timothy Topper and Zhan Renbin.

The successful initial meeting of IGCP 653 in Van Mildert College, Durham University attracted some 40 participants (<http://www.igcp653.org>). A thematic issue of *Lethaia* (edited by David Harper and Thomas Servais) arising from the meeting will contain

some 12 manuscripts on global aspects of the Great Ordovician Biodiversification Event. A substantial monographic work on the brachiopods of the Tramore Limestone and related units in Ireland (Maria Liljeroth, David Harper, Hilary Carlisle and Arne Nielsen) is in press in *Fossils and Strata* and a shorter paper on the younger Raheen brachiopods (with Matthew Parkes and Zhan Renbin) is in press in the *Irish Journal of Earth Sciences*.

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Susana HEREDIA (Argentina) continues working on biostratigraphy and taxonomy of Ordovician conodonts from different areas of Northwest Argentina (Cordillera Oriental), Famatina Ranges, Precordillera and the Ponón Trehué outcrops. She is working on taxonomy and biofacies of Middle Ordovician conodonts (*Lenodus-Eoplacognathus* species) from the Precordillera. Upper Ordovician Conodonts from Precordillera are still under study. All these matters are developed in collaboration with Dr. Ana Mestre and PhD student Geol. Cintia Kaufmann. Lower and Middle Ordovician conodonts from Northern Precordillera are under study with PhD student Tatiana Soria. Susana shares interests on Ordovician matters with Drs. Guillermo Aceñolaza and Juan Pablo Milana. Dr. Carlo Corradini is collaborating (2014-2016) with the Micropaleontology Lab on developing Silurian conodonts from the Central Precordillera, and Lic. María José Gómez has started a Silurian conodont Ph.D project.

Dr. Susana Heredia

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Linda HINTS (Estonia): Besides part time work with the database of the Ordovician samples and specimens at our institute, I continue the study of brachiopod faunas in the East Baltic.

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Olle HINTS (Estonia) is continuing studies on Ordovician–Silurian microfossils (scolecodonts, chitinozoans, conodonts), geochemistry and Baltic regional geology and stratigraphy. In collaboration with Petra Tonarová and Mats Eriksson he is studying Ordovician and Silurian scolecodonts to provide new insights into taxonomy, paleobiogeography and diversification history of Palaeozoic jaw-bearing polychaetes. In 2016 two reports on scolecodonts from Laurentia were published together with André Desrochers and Laurenz Schröer, and work is in progress with other new collections of Ordovician material, notably from Argentina (together with Claudia Rubinstein), Siberia (together with Peep Männik and Andrei Dronov) and Baltoscandia. In collaboration with Liina Antonovits, Garmen Bauert, Jaak Nõlvak and Viiu Nestor he is working on compilation of database on Baltoscandian chitinozoans (available at <http://chitinozoa.net>) and analysing it with CONOP9. Since 2015 Olle is also involved in a project with Tõnu Martma, DImitri Kaljo and Heikki Bauert, focusing on carbon isotopes of the Baltic Ordovician–Silurian succession. New high-resolution data from the GICE interval and from the Llandovery were presented in 2016. In collaboration with Axel Munnecke work is in progress on further testing isotopic composition of different organic-walled microfossil groups.

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Lars E. HOLMER (Sweden) is working on the palaeobiology of Ordovician linguliform brachiopods from East Baltic, Sweden and China. This study is being carried out in collaboration with Leonid Popov (Cardiff) and Mansoureh Ghobadi Pour (Gorgan), who are on a sabbatical leave in Uppsala during 2017. Part of the study was carried out in collaboration with Zhifei Zhang (Xi'an). The studies also include the doctoral student Zhiliang Zhang, who is currently on a research stay in Uppsala during 2017.

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Warren HUFF (USA) continues to work on K-bentonites of all ages. As an overview of K-bentonites in the geologic record I summarized much of their history in a review paper published in 2016. For the Ordovician, much of what we have learned about these deposits began with work by Allen and Ross and Nelson and others in the 1920s. But even their work was preceded by Ulrich in the 1880s who described a thick bed of clay of uncertain origin in the upper part of what is now known as the Tyrone Limestone, near High Bridge, Kentucky. Once the volcanogenic nature of these deposits was established a substantial body of literature began to appear proposing tectonic and stratigraphic models that attempted to explain their occurrence and distribution.

One of the great pleasures of my academic career is that every spring I offer a seminar in clay mineralogy where we do a research project. For 2017 I have a succession of K-bentonites from the Ordovician-Silurian stratotype at Dob's Linn in the Southern Uplands of Scotland, and the students will do a systematic study of chemistry, mineralogy and age dating that we hope will build on previous reports that characterize this interval. Our results will be presented at the annual fall meeting of the Geological Society of America.

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Dimitri KALJO (Estonia) continued studies on the Ordovician and Silurian bio- and chemostratigraphy of Baltica as a part time emeritus member at our institute and as the editor-in-chief of the *Estonian Journal of Earth Sciences*. A team of colleagues (including myself) last year finished a complex study about the Puhmu core section (Upper Ordovician with a bit of the lowermost Silurian), its bio- and chemostratigraphy (results in press).

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Petr KRAFT (Czech Republic) continues his research in the Ordovician of the Prague Basin, Czech Republic, especially under the project of the West Bohemian Museum. I also continue my collaborations focused especially on graptolites with several colleagues.

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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. He is working with Achim Herrmann (Louisiana State University), Ken MacLeod (University of Missouri), and Page Quinton (SUNY Potsdam) testing the early Late Ordovician cool water carbonate hypothesis in the North American Midcontinent using oxygen isotopes from conodont apatite. Also he is involved with Matt Saltzman (The Ohio State University) and Cole Edwards (Appalachian State University) on a project related to Sr and Nd isotope stratigraphy of the Ordovician, particularly focused on the continuity of deposition through the Darriwilian and early Sandbian in the Central Appalachians. This work is collaborative with Stig Bergstrom, as well as John Repetski (USGS) and Seth Young (Indiana University). Steve is working with Dan Goldman (University of Dayton) integrating graptolite and conodont biostratigraphy in dark shale successions.

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Lixia LI (China) continues to work on the Palaeozoic sponges from South China. My research activities in 2016 were on various aspects of taxonomy, palaeoecology and taphonomy of sponges from Ordovician-Silurian boundary sections in South China, which is also the topic of my postdoctoral program. Now, I am a research assistant at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences. There is a good progress in the study of systematic palaeontology of the sponges we have found last year. This work will be carried out in cooperation with Prof. Joachim Reitner from Göttingen University. The manuscript will be submitted in early 2017. Two another papers have been published about the Early-Middle Ordovician graptolites from the Ningkuo Formation of South China, focusing on the graptolite diversity changes during the Great Ordovician

Biodiversification Event, and the Middle Ordovician graptolitic biostratigraphy in the Jiangnan Slope of South China. I attended the symposium on Life and Earth Processes in Germany whilst working with colleagues there on Palaeozoic sponges.

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Qi-jian LI (China) is mainly working on Ordovician reefs and hypercalcified sponges (e.g. calathids, stromatoporoids and sphinctozoans). In 2016, I continued my systematic and paleoecological work on calathids. In collaboration with Prof. Axel Munnecke and Dr. Andrej Ernst, I am now working on some Early Silurian reefs of South China. I also continue my collaborations focused on quantitative paleoecological analyses of reefs at the Ordovician-Silurian transition with several colleagues.

Qi-jian LI

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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. His studies continue under project “Environmental and faunal changes in the pre-Hirnantian Late Ordovician: a prelude to the end-Ordovician mass extinction? A Baltoscandian perspective”. Also, joint studies together with colleagues from Estonia, Germany, Iran, 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 concentrating on good Ordovician-Silurian collections from Hudson Bay and Moose River basins, Ontario and Manitoba. I am in pre-retirement phase, having moved with my wife from Calgary to Victoria, British Columbia. I work full-time, but expect to retire by mid-summer. I work at home (not in the GSC Sidney office), having moved my microscope and samples with me. I am in contact with the Calgary office daily, and continue to monitor lab processing and budgeting. Sofie Gouwy, our post-doctoral fellow, continues her work in Calgary and has taken over most of the conodont reporting for the time intervals I used to work on.

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Tõnu MEIDL (Estonia) is working on different aspects of stratigraphy, ostracods and stable isotopes in the Ordovician-Silurian boundary interval of the Baltic States, Sweden, Latvia and Lithuania (together with L. Ainsaar, O. Tinn, L. Lang, K. Truuver, V. Perrier, S. Radzevičius) and Anticosti (together with A. Desrochers, Z. Taha, V. Perrier, M. Williams, D. Siveter).

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Michal MERGL (Czech Republic) is working on brachiopod fauna of the latest Katian from the Prague Basin of the Czech Republic. There are few new taxa but increase of data about the already described brachiopods of the deep water *Foliomena* fauna and *Mucronaspis* Fauna is suggested. New information about the earliest the *Hirnantia* fauna likely will be observed. I also have some interest in nileid trilobites of the Tremadocian-Darriwilian interval. Now I am mostly focused to Devonian organophosphatic brachiopods, especially evolutionary history of siphonotretids and the genus *Paterula*. I would appreciate any data or sampled material of post-Eifelian phosphatic microbrachiopods (*Opsiconidion*, minute obolids and discinoids), especially those from residues after sampling for conodonts.

Most of my pdf publications are accessible on http://www.cbg.zcu.cz/OB/zam/me_publn.php

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Jim MILLER (United States) is a member of the Cambrian Stage 10 Working Group and is working on definition of the base of the highest stage of the Cambrian. He and co-authors have proposed to place that boundary at the lowest occurrence of the conodont *Eoconodontus notchpeakensis* (Miller, 1969), at the base of the *Eoconodontus* Zone. These authors have proposed three sections in the Ibex Area of western Utah, USA, and have information about conodonts, trilobites, brachiopods, carbon-isotope stratigraphy, and sequence stratigraphy.

Jim and a different set of co-authors published a paper in which they proposed an *Auxiliary boundary Stratotype Section and Point* (ASSP) for the base of the Ordovician System at the lowest occurrence of the conodont *Iapetognathus fluctivagus* Nicoll, Miller, Nowlan, Repetski, and Ethington 1999, at the base of the *Iapetognathus* Zone in the Lawson Cove section in the Ibex Area, western Utah, USA. Included is information about conodonts, trilobites, brachiopods, graptolites, carbon-isotope stratigraphy, and sequence stratigraphy. The paper was published in *Stratigraphy* in 2016; interested persons can request a PDF from Miller via E-mail. The Subcommission on Ordovician Stratigraphy has formally accepted this proposal.

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Tatiana L. MODZALEVSKAYA (Russia) continues to work on Upper Ordovician-Silurian-Lower Devonian brachiopods and stratigraphy in thematic projects connected with analysis of regional timescales of Eurasian Russian regions. My manuscript on Upper Ordovician and Silurian brachiopods from Kotel'ny Island (Novosibirsk Islands, Arctic Russia) was completed and has been submitted for publication.

Together with other colleagues I have started a new project of compiling an electronic reference book on guide forms of Upper Ordovician-Silurian fossil faunas.

A presentation by N.V. Sennikov, O.T. Obut, A.V. Nimokhin, T.L.Modzalevskaya, T.V. Gonta & E.V. Lykova on “Fauna communities, lithological specifics and paleogeographical conditions of Pritelez Zone Ordovician sediments” will be submitted to the Paleontological Society in April, 2017.

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Diego Fernando MUÑOZ (Argentina) is a postdoc student at Centro de Investigaciones en Ciencias de la Tierra (CICTERRA - CONICET and Universidad Nacional de Córdoba) on Lower Ordovician deposits of NW Argentina. He was studying Systematics, Taphonomy, Diversity and Palaeogeography of Brachiopods and he's begining to study trace fossils in the same deposits. Muñoz had published with colleagues about linluloidean and orthid brachiopods. A revision of the *Lipanorthis* genus, which is present in Tremadocian and Floian deposits of the Santa Victoria Group, is in the final stages of preparation. More results (Taphonomy, Diversity, Palaeogeography, Ontogeny) from his PhD will be send to publication in the near future.

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Arne Thorshøj NIELSEN (Denmark) is still working mainly in the Cambrian, but I have participated in a few research projects on the Ordovician in 2016. A student of mine has undertaken a study of *Chasmops*(s.l.) from the Ordovician of the Oslo region; a small paper is submitted and it is the intention to publish a larger monographic paper on the fauna. Together with various colleagues I am still working on drill cores through the Ordovician succession on the Island of Bornholm, eastern Denmark and in Scania, southern Sweden. Also, I am coordinator of a revision of Ordovician stages in Scandinavia, but progress is slow – it is my intention to speed this project up in 2017. My key interest is still sea-level changes, Ordovician as well as Cambrian.

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Please note new address and new email

Godfrey NOWLAN (Canada) is mainly retired from active research and is now working on the promotion of UNESCO Global Geoparks in Canada. A small project on the Cambro-

Ordovician stratigraphy of the Ottawa area is in preparation with David Lowe (University of Ottawa) and others.

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Olga T. OBUT (Russia) continues studies of the Ordovician sedimentary strata of the Altai-Sayan folded Area – microfossils and biostratigraphy.

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Alan OWEN (UK) has now retired from his academic post and so has much more time to pursue many lines of Ordovician research including investigations of the Ordovician biodiversification. Significant progress is being made on the description of Upper Ordovician trilobites from South Wales with Patrick McDermott (St Clears, South Wales) and Lucy McCobb (National Museum of Wales) and work on the trilobites of the Tramore Limestone in SE Ireland has been restarted after a very long hiatus. Description and analysis of other Irish and Scottish Ordovician faunas from terranes close to the Iapetus suture zone will soon follow as will an analysis of deep water faunas. Further papers on trilobite eyes with Martin Lee (Glasgow) and former research student Clare Torney (now Historic Environment Scotland) are also in preparation.

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Florentin PARIS (France) continues a few collaborations on Ordovician chitinozoan assemblages from Northern Gondwana and China. He is also involved in Armorican regional studies mainly related to chitinozoan biostratigraphy and heritage programs, e.g. description of the selectect ERB geosites (Espaces Remarquables de Bretagne) of the Crozon Peninsula.

The CHINOVOSP database includes now 1282 chitinozoan species with their stratigraphical ranges documented according to the latest definitions of the IUGS.

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Ian PERCIVAL (Australia) is currently easing into semi-retirement (though he seems to have been busier than ever this past year) with the intention of ending his employment with the Geological Survey of New South Wales at the end of 2017. His current research remains focussed on brachiopod research spanning the Cambrian to Silurian, as well as continuing collaboration with Yong Yi Zhen on Ordovician conodonts. Ian has also been involved in identifying Katian graptolites from new localities in southern NSW, collected during the current regional mapping project conducted by the Geological Survey. He has taken on the chief editorial role for *Australasian Palaeontological Memoirs*, replacing John Laurie, and continues as Secretary for the Subcommission on Ordovician Stratigraphy; editing *Ordovician News* remains his responsibility for the foreseeable future.

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Teresa PODHALAŃSKA (Poland) is working on the Ordovician and Silurian deposits in Poland to locate prospective areas and stratigraphic horizons of unconventional hydrocarbon accumulations. I am also studying Silurian biostratigraphy based on graptolites and the Ordovician/Silurian boundary beds in Poland.

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Leonid POPOV (United Kingdom) continues to work on general aspects of the Ordovician brachiopod faunas of Central Asia and the Middle East focusing on taxonomy, biostratigraphy and biogeography. A comprehensive review of the biogeography and biofacies of the Late Ordovician brachiopods of Kazakh terranes made in cooperation with Robin Cocks is now submitted for publication. Other topics include revision of the late Ordovician brachiopods of the Zerafshan-Hissar region carried out together with Irina Kim from the Uzbek Geological Survey and the monographic study of individual brachiopod faunas from various parts of Kazakhstan and Iran.

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Page QUINTON (USA) is finishing up her first year as an Assistant Professor at SUNY Potsdam. There she has continued her collaborative research with Stephen Leslie, Kenneth MacLeod, Achim Herrmann, and John Haynes using stable carbon and oxygen isotopes to address the paleoclimatic significance of environmental changes at the Sandbian-Katian boundary. At the GSA meeting in Denver she presented results from a collaborative project (with Kenneth MacLeod, James Miller, and Ray Ethington) using conodont oxygen isotopic trends to constrain Early Ordovician sea surface trends. Next year she will be directing two student research projects working to extend the available Late Ordovician stable oxygen and carbon isotopic records into New York state.

Page C. Quinton

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Elena G. RAEVSKAYA (Russia) studies Ordovician acritarchs, their morphology, taxonomy and implication for biostratigraphy and paleobiogeography. Being currently involved in the 3-years project started in 2016 (“Major biotic and abiotic events of regional and global scale in the Ordovician of Siberian and Russian platforms”) I am working on the elaboration of acritarch based zonation for the Ordovician of both the Siberian and the East European (Russian) platforms. Together with other members of the Organizing Committee, I am contributing to preliminary preparations for the 13th International Symposium on the Ordovician System, which will be held in July 2019 in Novosibirsk.

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John REPETSKI (USA): My Ordovician work continued to be chiefly on conodont biostratigraphy, CAI and systematics, USA and elsewhere, with numerous colleagues: compiling CAI maps and biostratigraphy of [oil- & gas-rich] black shales in 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 2016, with John Taylor and Justin Strauss, we continued refining biostratigraphic

data for the Cambro-Ordovician section in easternmost Alaska.

[Note: the available online version of the two chapters in the 12th ISOS field guidebook (Taylor *et al.*, listed in the bibliography at the end of this *Ordovician News*) contains some ‘corrupted’ figures. Anyone who wants to see the correct versions should contact one of the authors for a revised pdf.]

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Jiayu RONG (China) for the last nearly ten years has been working chiefly on the book *Phanerozoic Brachiopod Genera on the Type Species of China* (written in English), edited by Rong Jiayu, Shen Shuzhong and Zhan Renbin which will be published by Science Press in Beijing later this year. Altogether, there have been 757 brachiopod genera based on the type species and type localities from China, including 113 and 52 genera from Ordovician and Silurian respectively. A thorough survey of the occurrences of fossil brachiopods has made it possible to deliver an overall view on these genera and related faunas of all ages in many regions of China. Each of separate chapters (Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, and Cretaceous) includes a review of geographical distribution, stratigraphic correlation, faunal succession, palaeobiogeography, and systematic palaeontology of brachiopods. A substantial amount of new/revised information about their diagnosed characters, their temporal and spatial distributions have been provided, and all the holotype and/or paratypes (if any) of the type species restudied and/or re-illustrated (if possible). All the brachiopod genera are treated as valid taxa or various synonyms, homonyms, *nomina dubia*, *nomina nuda*, *nomina nulla*, *nomina veta* or others; additionally, 18 genera are excluded from Brachiopoda.

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Sergey ROZHNOV (Russia) continues working on Early Palaeozoic echinoderms from various parts of the former Soviet Union, Mongolia and Iran, and has begun to study the role of cyanobacterial communities in the Middle Ordovician hardground formation of Baltica.

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Artur Abreu SÁ (Portugal) is working on Ordovician stratigraphy and paleontology of Iberian Peninsula and N Africa, in collaboration with Juan Carlos Gutiérrez-Marco, Isabel Rábano, Diego García-Bellido, Carlos Meireles, Nuno Vaz, Sofia Pereira and Jorge Colmenar. His work is also focused in UNESCO Global Geoparks and Geoethics issues. He is directing Sofia Pereira Ph.D. thesis in Upper Ordovician trilobites of Portugal. Currently he is the Scientific Coordinator of the Arouca UNESCO Global Geopark, President of the Portuguese National Committee for the International Geoscience Programme (IGCP-UNESCO), Chair holder of the UNESCO Chair “Geoparks, Sustainable Regional Development and Healthy Lifestyles” and Member of the UNESCO Roster of Evaluators for UNESCO Global Geoparks.

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Matthew SALTZMAN (USA) remains active in stable (C, S) and radiogenic (Sr, Nd) isotope stratigraphy. Work was completed this year on a co-edited Special Volume of *P-cubed* together with Tom Algeo and Pedro Marenco. This Special Volume on Ordovician climate, biogeochemistry, and the biosphere titled "The Ordovician Revolution: Co-Evolution of Climate and the Biosphere" was published in Volume 458 (September 15, 2016). These publications include a review paper with Tom Algeo and Pedro Marenco, as well as papers by Seth Young, Ben Gill, Cole Edwards, myself and Steve Leslie on Middle Ordovician S-isotopes, and a paper by Cole Edwards and I on organic carbon isotopes. Also published this year in *PNAS* was a collaborative effort with Tim Lenton on the role that the earliest land plants had on modern levels of atmospheric oxygen. Manuscripts were also submitted this past year in collaboration with: 1) Cole Edwards, based on study of carbon isotope gradients in the Middle Ordovician based on data from Clear Spring, Maryland; 2) Cole, and Dana Royer, based on use of the global carbon cycle model GEOCARBSULF to examine the role of atmospheric oxygen in Ordovician biodiversity; and 3) Cole, Zunli Lu and Dave Fike, based on integration of sulfur and carbon isotopes with I/Ca ratios to examine possible development of anoxic conditions associated with the base Stairian 'biomere' extinction.

In addition to these published or submitted works, a successful full day oral session was organized at the GSA annual meeting in Denver (25-28 September 2016) by Erik Sperling, Steve Leslie, and myself. The session was titled, "The Early Paleozoic world: Radiations, extinctions, and paleoenvironmental change". Also at the end of this year, a new graduate student, Datu Adiatma, has arrived in Columbus from Indonesia and begun study of Ordovician chemostratigraphy in relation to the Knox unconformity interval in the central Appalachians. Datu is fully funded for his Master's degree by the government of Indonesia, having been awarded a scholarship of the Indonesia Endowment Fund for Education (LPDP) Scholarship.

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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. He continues his research mainly focused on the Great Ordovician Biodiversification Event (GOBE) within the frame of the new IGCP project dedicated to the onset of this event (www.igcp653.org), and the evolution of the marine microphytoplankton in general. Publications in 2016 concerned the results of the French ANR projects « terrestrialisation » (partly with M. Vecoli, Dahran) and « Cambrian-Ordovician radiation ». While the first project resulted in the publication of the first cryptospores from Siberia (with Lena Raevskaya, St. Petersburg), the « phytoplankton blackout in the Late Palaeozoic », and the early evolution of land plants, the second project resulted in the publication of a database analyses of the Cambrian phytoplankton and of the palynology of the Fezouata Lagerstätte of the Ordovician of Morocco (several papers by Hendrik Nowak, who finished his PhD in December 2015 at Lille). 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. In late 2016 a new PhD subject started on the analyses of the Palaeozoic phytoplankton diversity with David Kröck (Lille, France).

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Lawrence SHERWIN (Australia) remains affiliated with the Geological Survey of New South Wales as an Honorary Research Associate. He is currently grappling with the normalograptid species as part of his description of a Late Ordovician (Bolindian/Katian) graptolite fauna from the Cotton Formation near Forbes and a Late Ordovician (Eastonian/Katian) graptolite fauna from Gunningbland in central NSW.

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Paul SMITH (UK) is working with James Wheeley on oxygen isotopes in Floian conodonts from Cow Head, Newfoundland, as a test of models for conodont ecology, and has resumed work with Rob Raine and John Repetski on conodonts from the Durness Group, NW Scotland.

Professor Paul Smith

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Alycia STIGALL (United States): My students and I are continuing to work on Middle to Late Ordovician brachiopod diversity, ecology, and phylogenetic patterns 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 oversee the website for that project, so please email me with any project related posts or your related articles when they are published so I can include them. I was honored to receive the 2016 Charles Schuchert Award from the Paleontological Society.

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Raymond SUHM (USA) has completed an Ordovician subsurface project in Oklahoma and Arkansas pertaining to formations of the Simpson Group (Bromide, Tulip Creek, McLish, and Oil Creek, Burgen, and Tyner) and Everton Formation (Sneeds Limestone, and Calico Rock, Newton, and Jasper Sandstones). The study, “Stratigraphy and Petroleum Potential of Simpson Group (Ordovician), Oklahoma” can be found as part of the “Simpson Play, including parts of the Arbuckle and Viola Groups” --Oklahoma Geological Survey Open File Report 03-2016 (<http://ogs.ou.edu/docs/openfile/OF3-2016.pdf> , and <http://ogs.ou.edu/docs/openfile/OF3-2016P.zip>). This publication includes digital maps and cross sections. A state-wide Viola structure map was prepared from well control and seismic data and shows Viola struture beneath the thrust complex of the Ouachita Mountains. This map also shows Ordovician outcrops and subcrops of the Arbuckle, Simpson and Viola

Groups. Isopach maps were constructed for all formations of the Simpson Group. The sandstone at the base of the Viola Group (Seminole or Harding Sandstone) is also mapped in this report since it is an oil reservoir erroneously classified as Simpson. The formations and members of the Simpson Group in Oklahoma form specific lithologic associations in depositional provinces separated by regional faults. Broader implications of basin development, paleogeography, and paleotectonics are also discussed. Recent well logs show K-bentonites to be indicators of the Simpson/Arbuckle contact (Tippecanoe/Sauk Sequence boundary), similar to bentonites at its upper contact with the Viola Group.

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Zardasht A. TAHA (UK) is working on the ostracods of the Late Ordovician Ellis Bay Formation of Anticosti Island, eastern Canada. The aims of my study include the detailed systematic analysis of the ostracods and the identification of their biogeographical significance. My thesis team comprises Mark Williams, Jan Zalasiewicz and David Siveter in Leicester, Tõnu Meidla in Tartu, and Vincent Perrier in Lyon.

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John TAYLOR (USA) has spent most of the last year preoccupied with enigmatic Cambrian trilobites and agnostoid arthropods from carbonates interstratified with volcanic rocks in northern Alaska and northwestern Canada, but some progress was made on Tremadocian trilobite faunas in New Mexico and west Texas under study with James D. Loch. In the latter project, a number of species characteristic of specific zones within the Stairsian Stage in its type area in the Great Basin have been recovered from the El Paso Group, refining correlations across the southwestern USA. The faunas of the Jones Ridge Formation in Alaska are next on the queue after the Cambrian faunas associated with the volcanics, and they include basal Tremadocian (*Sympysurina* Zone) collections with quite a few new species of the eponymous genus to describe, along with the first occurrence of the earliest Ordovician genus *Tulepyge* in northwestern North America. Other projects mentioned in previous editions of Ordovician News involving Skullrockian and Stairsian faunas from the Appalachians (Stonehenge Formation) and western USA (Goodwin and Snowy Range formations) remain in active status. Likewise, collaboration continues with long-standing partners-in-crime Jim Miller and John Repetski (conodonts), Paul Myrow and Justin Strauss (sedimentology and geochemistry).

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Tatiana TOLMACHEVA (Russia) continuous to work on Ordovician conodonts from different parts of Russia in a frame of several research projects concerning litho- and sequence stratigraphy, tectonic and paleodynamic reconstructions of Central Asia and Siberia in the Ordovician (with Andrei Dronov, Kirill Degryarev).

Tatiana Tolmacheva

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Thijs VANDENBROUCKE (Belgium) remains interested in reconstructing the Ordovician palaeoclimate and palaeo-environment. In October 2015, I have changed jobs and moved back to Ghent University in Belgium for a lecturer position in stratigraphy and palaeontology.

Two co-supervised research students in Lille defended their PhD projects last year: Chloé Amberg's project concentrated on identifying and documenting Pre-Hirnantian glaciations. Lorena Tessitore's project was part of the ANR research grant "SeqStrat-Ice: Lessons from our Ancient Frozen Planet" (Project coordinator: J.F. Ghienne, University of Strasbourg/CNRS). This part of the grant focused on the glacial deposits of the Upper Ordovician in Morocco.

Julie De Weirdt started her PhD research project with me at UGent last year, focussing on Upper Ordovician (to lower Silurian) event stratigraphy in N. America (in collaboration with Poul Emsbo, USGS, and Patrick McLaughlin, Indiana Geol. Survey). Two MSc students joined the group and are working on related topics: Jana Bas and Tim De Backer, each focussing on the chitinozoans from a single core in the midcontinent. BSc-student Cecile-Marie Lissens studied the chitinozoans from Katian Penwhapple Formation in the Scottish Girvan District for her summer project (sponsored by the Pal Ass). I also co-supervise Matthias Sinnesael, who continues his PhD project with Philippe Claeys at the VUB (Belgium) on astronomical forcing during the Late Ordovician. With an international team coordinated by Mark Williams (University of Leicester, UK) and funded by the Leverhulme Trust, we are currently re-investigating the early Palaeozoic strata of Japan.

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Marco VECOLI (Saudi Arabia) works in the Biostratigraphy Group of Saudi Aramco, where my main activity is concentrated on Early Paleozoic palynostratigraphy (acritarchs, chitinozoans, cryptospores/miospores) in Saudi Arabia in support of hydrocarbon exploration. I am working together with my colleagues in Saudi Aramco on several projects all over the Arabian Plate in order to document the taxonomy, stratigraphic ranges and palaeoenvironmental distribution of palynomorphs to develop/refine a robust biozonation which can be used to validate key stratigraphic concepts in the various phases of hydrocarbon exploration (conventional and unconventional). These studies also include the optical characterization of kerogen (i.e., palynofacies analysis) and organic maturity assessment.

Together with my colleagues, we have developed a high-resolution palynostratigraphy in the Late Ordovician (Katian-Hirnantian) of northwestern Saudi Arabia, which is at the base of sequence-stratigraphic models use for predicting hydrocarbon potential of sandstones bodies in the study areas.

I am the coordinator of the “Saudi Aramco – CIMP Joint Project” which gives me the possibility to interact with colleagues from Academia and stay informed on the latest developments of Paleozoic palynology research.

I am still involved in the investigation of the “Terrestrialization Process”, in an attempt to understand the evolution of earliest terrestrial ecosystem and the origin of land plants, as Ordovician cryptospore assemblages of Saudi Arabia are among the oldest and best preserved assemblages in the world.

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

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Viive VIIRA (Estonia) is retired, but is still interested in Ordovician and Silurian conodonts.

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Gustavo G. VOLDMAN (Argentina) is working on taxonomy, biostratigraphy, and thermal alteration studies of lower Paleozoic conodonts. He is currently a visiting researcher at the Geology Department of the Oviedo University, where he is collaborating with Susana García-López and Juan Luis Alonso in deciphering the thermal evolution of the Precordillera Basin of Argentina and the Cantabrian Zone of Spain.

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WANG Guangxu (China) continues working on carbonates and corals across the Ordovician-Silurian transition in South China, where a complete coral sequence has been recognized in recent years. Some of these results have already been published (in print or online). I am also working on early corals in South China, which are probably of late Darriwilian age.

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Barry D. WEBBY (Australia) has no recently published research, but continues to maintain active interests in Ordovician palaeontology and stratigraphy. The bulk of my extensive collection of research materials, apart from some type specimens, were originally included in a small room for the "Type Collections" in the Edgeworth David Building of the Dept. of Geology & Geophysics, University of Sydney. However the Edgeworth David Building was demolished in 2006, and so prior to that date all these specimens had to be transferred to the Australian Museum in Sydney, and other fossil types were added directly to collections of the Australian Museum in subsequent years. However, due to overall limitations of storage space and curatorial assistance it has not been possible to incorporate the bulk of my current

research collections in the Museum. So now all my newly designated types and figured specimens as well as other more general New South Wales collections are being placed in the WB Clarke Geoscience Centre of the Geological Survey of New South Wales, Londonderry Road, Londonderry, New South Wales, 2753. This is an excellent alternative repository for long-term safe-keeping of fossil collections within New South Wales.

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Charles WELLMAN (UK) continues his work on early land plant spores and other remains, including those from the Ordovician. He is currently involved in collaborative work on Ordovician spore assemblages from Oman and Saudi Arabia.

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Henry WILLIAMS (Canada), after a long hiatus, has been identifying Ordovician graptolites from western Newfoundland collected by John Waldron (University of Alberta) and his graduates students during evening breaks away from oil exploration in Mesozoic and Cenozoic strata. The material is currently being used to help revise structural interpretations and stratigraphic correlations in the area, and should be ready for submission sometime later this year.

Henry Williams

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Mark WILLIAMS (U.K.) has been working with Vietnamese and Japanese colleagues in northeast Vietnam, looking at fossil assemblages from the Early Ordovician. Results have been compiled into a paper titled ‘Early Ordovician (Tremadocian and Floian) graptolites from the Than Sa Formation, northeast Vietnam’ that is now in press, to be published in *Geological Magazine* in 2017. This is a collaboration between the University of Leicester, UK, The Natural History Museum in London (Adrian Rushton is the lead author), Kumamoto University in Japan, and the Vietnam Institute of Geosciences and Mineral Resources (VIGMR) in Hanoi, Vietnam. We hope to find more new localities in the Ordovician in northeast Vietnam over the coming years.

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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 conodont taxonomy, biostratigraphy, and palaeoecology from the Zitai and Guniutan formations in South China. Another project has been focusing on the Cambrian-Silurian palaeoclimatic and palaeoenvironmental changes by use of conodont apatite oxygen isotope, carbon isotope and microfacies analysis.

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YAN Liang (China) continues working on Ordovician chitinozoans as an assistant researcher at NIGPAS, Nanjing. In 2016, two papers focused on the early and middle Ordovician chitinozoan biostratigraphy and biodiversity of the Upper Yangtze Region, South China, based on her PhD thesis have been published. Also, she described an abundant and diverse mid-late Ordovician chitinozoan assemblage from Yichang, South China together with Florentin Paris and Peng Tang. A manuscript with Thomas Servais, Peng Tang, Jianbo Liu and Wenhui Wang dealing with Tremadocian chitinozoan biostratigraphy from South China is in review. In 2017, she plans to attend the joint AASP-CIMP meeting in Nottingham. She has obtained a postdoc grant from the Estonian Research Council, and in the middle of this year, she will leave for Tallinn to further chitinozoan study with Prof. Olle Hints over the next two years.

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ZHAN Renbin (China) spent most of his academic time on Ordovician brachiopods from China and some related areas such as palaeoecology, palaeogeography, bio- and ecostratigraphy. The major research project he is in charge of from the National Natural Science Foundation of China (NSFC) is about the Great Ordovician Biodiversification Event (GOBE). In 2016, he published a paper in *Palaeo-3* dealing with the enigmatic shrinkage

feature of the lower Upper Ordovician Pagoda Limestone in South China. The new explanation of such strange structure points South China to the palaeoequator with implications for the unique pattern of GOBE that occurred in this palaeoplate. Together with his colleagues from the Nanjing Institute of Geology and Palaeontology (NIGP), Chinese Academy of Sciences (CAS), he also did some work on the end Ordovician mass extinction. Some field work was conducted in northern Sichuan and southern Shaanxi provinces, central China, particularly on the Hirnantian rocks and the faunas of this interval.

Dr. ZHAN Renbin

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Shunxin ZHANG (Canada) has focused her research on the Late Ordovician biostratigraphy on Akpatok Island in Ungava Bay, and the Late Ordovician–Early Silurian biostratigraphy, bio-events, and sea-level changes on Cornwallis, Devon and Ellesmere islands in the Arctic area. She has used her field collection in 2015 to try to improve the Upper Ordovician stratigraphy and biostratigraphy on Akpatok. She has also cooperated with Dr. Barnes on the Late Ordovician and Early Silurian conodonts from Cornwallis, Devon and Ellesmere islands in order to update the conodont biostratigraphy on these Arctic islands. She has continued working on the Late Ordovician–Early Silurian conodonts from carbonate xenoliths preserved in the kimberlites on the Hall Peninsula, southern Baffin Island to understand the kimberlite emplacement history. She has also taken part in the GEM-2 Hudson Bay Basin project to better understand the Late Ordovician petroleum source rocks.

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Yuandong ZHANG (China) is continuously working on:

(1) An integrated stratigraphy of graptolite, conodont, chitinozoan, acritarch, radiolarians, and carbon isotope chemostratigraphy, and cyclostratigraphy of the Ordovician in China. This work aims at a refined stratigraphic correlation of two critical transitions (late Darriwilian to early Sandbian, and late Katian to Hirnantian) in South China and Tarim blocks. The integrated graptolite and conodont biostratigraphy has been based on an international cooperation with Zhen Yongyi (Australia) and Stig Bergström (USA) and Dan Goldman (USA), while the chemostratigraphic work has been conducted with Axel Munnecke (Germany) and the cyclostratigraphy with specialists from University of Geosciences in Beijing. This work has been supported by a grant from the Natural Science

Foundation of China and a grant from the Ministry of Science and Technology of China (Atlas of Ordovician index fossils in China, 2014-2019).

(2) Geological characteristics of typical black shales in China. This has been the main tasks of a recently launching project on shale gas exploration in China, supported by the Chinese Academy of Sciences (2014-2018). As scheduled, many drills for the cores of the most potential gas shale in China, i.e. Early Cambrian, Darriwilian-Sandbian (Ordovician), Late Katian to Llandovery (Silurian), Lopingian (Late Permian), and Late Triassic (non-marine facies). In 2014, four wells have been drilled in the Yichang and Shennongjia areas, Hubei Province, and cores of Llandovery down through to Upper Tremadocian were obtained successfully. The cores are opened to global scientists for study and appropriate sampling, and from which some samples have been collected for geochemical and microfacies analysis. In 2017, two more wells will be drilled in the Upper Yangtze Region for the cores of Middle Ordovician through up to Llandovery. 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. This sponge-dominated lagerstätte, discovered in late 2012, is typified by the abundant and highly diverse articulate sponges (over 75 species) often with soft tissues, in association of graptolites, nautiloids, arthropods, echinoderms, etc. The Anji Fauna is preserved within a 9-meter-thick black shales, underlain and overlain by siltstone and sandstones, in the Wenchang Formation of clastic facies. Up to date, over 5000 specimens have been collected from seven sections in the Anji County. As constrained by the associated graptolites, the fauna is of latest Hirnantian age. A preliminary study indicates that this extraordinarily diverse, sponge-dominated community thrived immediately after the Hirnantian mass extinction in South China.

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Yong Yi ZHEN (Australia) is working on various projects researching Ordovician conodonts and their biostratigraphic applications. In July 2016 I attended the Palaeo Down Under 2 Conference in Adelaide, and presented a talk and two posters on Ordovician conodont biostratigraphy. I visited the Nanjing Institute of Geology and Palaeontology in October-November 2016, and there finalized a manuscript with colleagues at NIGPAS. My current research focus is on documentation of conodont zonations across the Cambrian-Ordovician boundary in western New South Wales (with Ian Percival and Barry Webby). This year I plan to attend the 4th International Conodont Symposium in Valencia in June (where I will co-chair with Ian Percival an IGCP 653-themed session on “The rise of conodonts prior to and during the Great Ordovician Biodiversification Event”), and will also participate in the IGCP 653 Annual Meeting in Yichang in October.

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ZHOU Zhiyi (China): In 2016, I was able to publish two papers together with my colleagues: one is a book by Zhou Zhiqian, Zhou Zhiyi and Xiang Liwen, entitled "Trilobite fauna from the Ordovician Pagoda Formation of Central and Western Yangtze Block, China" published by the Geological Publishing House (Beijing), including 422 pages and 62 plates, and the other paper "Ordovician trilobites from the uppermost Zhuozishan Formation (early Darriwilian) at Zhuozishan, Wuhai, Inner Mongolia" by Zhou Zhiyi, Zhou Zhiqian and Yin Gongzheng was published in Association of Australasian Palaeontologists, Memoir 49.

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ORDOVICIAN RESEARCH PUBLICATIONS 2015-2016-early 2017

[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]

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