# SILURIAN TIMES

## NEWSLETTER OF THE INTERNATIONAL SUBCOMMISSION ON SILURIAN STRATIGRAPHY (ISSS)

(http://silurian.stratigraphy.org)

INTERNATIONAL COMMISSION ON STRATIGRAPHY (ICS)

No. 29 (for 2021)

Edited by David Ray





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Cover photo: Stromatoporoids in the Hemse Group biostromes (middle Ludlow), at Kuppen 2 si	ite, Gotland, Sweden. The

low profile forms in the lower and upper parts of the photo are *Clathrodictyon mohicanum*, that makes up about 40% of the stromatoporoid fauna of this biostrome. The egg-shaped one in the middle is *Plectostroma scaniense* that is also common in these beds. The contrast between the growth forms in this photo inspired investigation of the relationship between taxonomy and growth forms in stromatoporoids and how that relationship may have influenced stromatoporoid success in the middle Palaeozoic. (Courtesy of Stephen Kershaw).

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## IUGS statement on the Russian Federation's invasion of Ukraine



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

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

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

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

Professor John Ludden CBE, FRSE, MEA, RAS President of IUGS

# SILURIAN TIMES Number 29 (for 2021) CHAIRMAN'S CORNER

Dear Silurian Colleagues,

The principal activities of the Silurian Subcommission focused in 2021 on the long-intended replacement of those previously ratified but currently inadequate basal stratotypes. Two of our three respective working groups were expected to submit their official proposals for new GSSPs of the Aeronian Stage and Telychian Stage at the 36th IGC in Delhi in March 2020. Neither these proposals nor the Geological Congress itself have materialized.

The Aeronian working group has focused on a candidate section for a new base Aeronian GSSP in Wales, UK. The restudy of the Rheidol Gorge section has not yet been submitted for publication due to delays in geochemical analyses. Submission of the paper by Melchin *et al.* (in prep) presenting the proposal of Rheidol Gorge as a candidate section for the base of the Aeronian Stage is currently planned for spring 2022. A comprehensive study on a Czech candidate section – the Hlásná Třebaň section in the Barrandian area (Štorch *et al.* 2018) – will be supplemented by a chitinozoan study carried out by A. Butcher. Submission of the chitinozoan paper is planned for summer 2022. Work on a Chinese candidate section in Yuxian, Sichuan Province, was revived in 2021. The Chinese working group led by J.X. Fan and Z.Y. Sun documented a new borehole situated near the proposed base Aeronian GSSP candidate section and collected samples for both biostratigraphy and chemostratigraphy purposes.

The working group for a base Telychian GSSP focused on a single candidate – El Pintado Reservoir section in the Seville province of Spain (Loydell 2019). The Aeronian/Telychian boundary and lower Telychian part of the El Pintado succession was described by Loydell *et al.* (2015), and a brief summary on the Aeronian part of the section was presented by Štorch *et al.* (2019) to the ISSS in the frame of the Silurian thematic session at STRATI 2019 in Milano, Italy. However, the paper describing the Aeronian part of the section, has not yet been submitted for publication. The formal proposal of the El Pintado Reservoir section as a new boundary stratotype of the Telychian Stage will be submitted to the Subcommission body as soon as the latter manuscript is accepted for publication.

Apart from this formal program, some efforts to find good tools for the subdivision of the Pridoli Series in two stages are made again in the type area of this unit. Results have been submitted for publication in the Newsletters in Stratigraphy by Manda et al. (in press).

A further search for sections suitable for a new GSSP of the Wenlock Series continued in a promising Llandovery/Wenlock boundary succession made available from drill-cores in Gotland, Sweden, as reported by B. Cramer. Last but not least, we should also consider the establishment of a Homerian working group in order to restudy the Homerian GSSP. Czech colleagues are working in advance on a richly fossiliferous, black-shale dominated Sheinwoodian/Homerian boundary section exposed in the Kosov Quarry, Bohemia.

Covid-related restrictions and a general absence of international meetings and conferences in 2020 and 2021 affected the only conference organized by the ISSS – the bi-annual conference/field meeting – originally planned for late August 2021 in Sofia, Bulgaria. However, due to the pandemic situation with travel restrictions and border closures alternately being eased and tightened, the meeting has to be rescheduled for summer 2023. The location of the meeting has not yet been decided. Our aim, already discussed in July 2019 at the STRATI

Congress in Milano, is to hold this conference in a new region with Silurian outcrops less well known to active titular and corresponding members of the Subcommission.

ISSS activity will move to the online space in 2022. I and David Ray will organize an online business meeting of titular members in summer 2022, using either Microsoft Teams, Zoom or a similar online meeting application. Please, send me your comments, suggestions and proposals regarding the intended online meeting and, in turn, stay tuned to receive further details in due time.

David Ray made a significant update to the list of corresponding members and Silurian experts. Please, check the address list at the end of the annual report and send changes and pending updates on David's email address (daveray01@yahoo.com). We would greatly appreciate this help, which will also indicate your willingness to participate on present and future activities of the subcommission.

We will finally be able to improve and update our homepage on the ICS web page. This longneeded refurbishment will be conducted by our webmaster Huang Bing in cooperation with ICS Webmaster Nick Car.

Last but not least, I wish to thank secretary David Ray and vice-chair Carlo Corradini for their collaboration. Also David's hard work on the Silurian Times is much appreciated.

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# International Commission on Stratigraphy Subcommission on Silurian Stratigraphy ANNUAL REPORT 2021

#### 1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

#### Subcommission on Silurian Stratigraphy (ISSS)

Submitted by:

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#### 2. OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY

#### **Mission statement**

The objectives of the Subcommission relate to three main aspects of IUGS policy:

- The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs at Series and Stage levels and related to a hierarchy of units (Substages, Standard Zones, Subzones etc.) to maximize relative time resolution within the Silurian Period;
- (2) Establishment of frameworks and mechanisms to encourage international collaboration in understanding the evolution of the Earth during the Silurian Period;
- (3) Working towards an international policy concerning conservation of geologically important sites (such as GSSPs, global and regional stratotype sections, etc.).

#### Goals

• Rationalization of Global chronostratigraphical classification

- Intercalibration of fossil biostratigraphies, integrated zonations, and recognition of global datums
- Establishment of magneto- and chemo-stratigraphic scales
- Redefinition of stage boundaries and restudy of global boundary stratotype sections
- Correlation of Silurian rock successions and events, including marine and non-marine
- Application of astronomically tuned cyclostratigraphy integrated with radiometric data and biostratigraphy

#### 3. ORGANISATION - interface with other international projects / groups

#### Organisation

The ISSS is a Subcommission of the International Commission on Stratigraphy. The Subcommission is organized by an Executive consisting of Chairman, Vice-Chairman and Secretary, who are all Voting Members of the Subcommission. In the Subcommission elected for 2020-2024 there are fourteen other Voting Members. Five members have been replaced by four new Voting members in March 2020. Broad network of Corresponding Members has first of all a responsibility for communication in both directions between the Subcommission and researchers on Silurian topics in their region. Secondly, they represent a broad spectrum of specialized stratigraphical disciplines from those countries or regions where Silurian rocks are extensively studied in relation to fundamental and/or applied geological research.

Current research activities and future plans are communicated through publication of the annual ISSS newsletter, Silurian Times, distributed as an email attachment and a web release. Website: http://silurian.stratigraphy.org/ contains newsletters, meeting announcements, discussion posting-boards, bibliography of Silurian articles, links to related sites, and other information.

#### Interface with other international projects / groups

IGCP project no. 652 "Reading geologic time in Paleozoic sedimentary rocks" and newly established "International Subcommission on Geochronology" under chairmanship of B. D. Cramer, titular member of the ISSS.

Collaboration will be developed with stratigraphically neighbouring subcommissions on Ordovician (ISOS) and Devonian (SDS) stratigraphy depending on subsequent revival of international meetings and conferences.

3a. Current Officers for 2020-2024 period:

Chair: Petr Štorch (second term)

Vice-Chair: Carlo Corradini (second term)

Secretary: David Ray (first term)

Webperson: **Huang Bing** (first term)

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

National/regional support has been provided to active members of Aeronian, Telychian and Wenlock GSSP working groups to facilitate their work.

5. CHIEF ACCOMPLISHMENTS IN 2021 (including any publications arising from ICS working groups)

- Silurian Times No 28 was edited by the secretary, David Ray, and distributed in April, 2021, posted on the website for the ISSS, and circulated as an email attachment to all titular, corresponding and interested members of the Subcommission. It contained the reports on previous meetings, announcements of planned meetings, the latest news and recent publications on Silurian research.
- The restudy of the Rheidol Gorge section has not yet been submitted for publication due to delays in geochemical analyses. Submission of the paper by Melchin *et al.* (in prep) presenting the proposal of Rheidol Gorge as a candidate section for the base of the Aeronian Stage was planned for 2021.
- Chinese working group documented a new borehole situated near the proposed base Aeronian GSSP candidate section at Yuxian and collected samples for both biostratigraphy and chemostratigraphy purposes.
- Melchin, M.J., Davies, J.R., Boom, A.R.A., Zalasiewicz, J.A., De Weirdt, J., Vandenbroucke, T.R.A., Russell, C.T., McIntyre, A.J., Morgan, G., Phillips, S. (in prep.). Integrated stratigraphic study of the Rhuddanian-Aeronian (Llandovery, Silurian) boundary succession at Rheidol Gorge, Wales: A proposed GSSP candidate for the Base of the Aeronian Stage.

6. SUMMARY OF EXPENDITURE IN 2021:	
Expenditures	US\$ 0
Total	US\$ 0
7. SUMMARY OF INCOME IN 2020:	
Carried forward from 2019	US\$ 3,500
ICS Allocation	US\$ 0
Total	US\$ 3,500
Balance (carried forward from 2020)	US\$ 3,500

#### 8. BUDGET REQUESTED FROM ICS IN 2021

Requested ICS Allocation US\$ 0

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

- Two ISSS groups working on restudy of the base of the Aeronian GSSP and base of the Telychian GSSP will be hopefully able to complete their work by submission of the formal proposals of the candidate sections (Štorch *et al.*, Hlasna Treban, Czech Republic and Melchin *et al.*, Rheidol Gorge, UK for Aeronian GSSP and David Loydell *et al.*, El Pintado Reservoir, Spain, for Telychian GSSP).
- ISSS online discussion and formal voting on the Aeronian and Telychian GSSP replacement candidate sections.
- Update of the website for Silurian Subcommission by webmaster Huang Bing. We gratefully acknowledge this work and the support provided by the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

#### Potential funding sources external to IUGS

Most of the costs of preparing Silurian Times and research activities of the working groups will be met by local support from host institutions and participation by individuals through national research grants and travel grants from their own authorities. Minor expenses may be covered from budget carried forward from 2021.

#### 10. OBJECTIVES AND WORK PLAN FOR THE PERIOD 2020-2024

- Principal work will be devoted to GSSP-related research activities restudy of some previously ratified but currently inadequate basal stratotypes. Delayed formal proposals of the Aeronian and Telychian GSSP replacement candidates will be completed in 2022. New stratotypes will be chosen by means of an online ballot. We aimed to vote on these candidate sections in 2019 in Milano but the deadline had to be postponed due to delayed work on some of the candidate sections.
- Homerian working group will be established and restudy of the Homerian GSSP will join the program, along with a further search for sections suitable for new GSSP of the Wenlock Series.
- Application of astronomically tuned cyclostratigraphy integrated with radiometric data and high-resolution biostratigraphy in conjunction with IGCP no 652 "Reading geologic time in Paleozoic sedimentary rocks".
- We will take part in further development of databases that would bring together and make available information from all sources associated with the Silurian researchers. One such database, operated by the Nanjing Institute of Geology and Palaeontology (Geobiodiversity Database, GBDB) is the official database of the ICS.
- ISSS bi-annual field-meeting and business meeting planned in Sofia, Bulgaria for August 2021 in collaboration with Geological Institute of Bulgarian Academy of Sciences had to be postponed once more, this time without definite term. Online business meeting of the ISSS will be organized instead in 2022.

#### APPENDIX (Names and Addresses of Current Officers and Voting Members)

#### **Nominated officers**

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#### **List of Voting Members**

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# Working group leaders

Base of Aeronian GSSP Restudy Working Group Leader **Petr Štorch** 

Base of Telychian GSSP Restudy Working Group Leader Michael J. Melchin

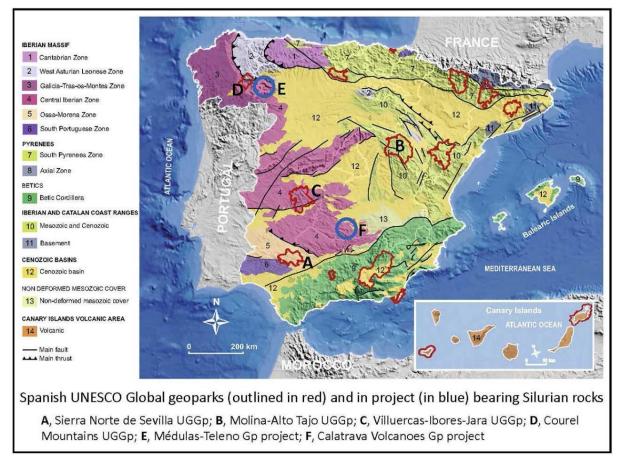
Base of Wenlock GSSP Restudy Working Group Leader **David K. Loydell** 

#### SILURIAN TREASURES IN SPANISH UNESCO GLOBAL GEOPARKS

#### By Juan Carlos Gutiérrez-Marco

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Among the European network of UNESCO global geoparks, there are four Spanish geoparks that have important outcrops of Silurian rocks, some of them of remarkable scientific interest due to the continuous nature of the successions and their outstanding fossil record. In general terms, the Iberian Silurian is also important because it fits in a peri-Gondwanan paleogeographic area, comparatively little studied for SW Europe, which evolves from high paleolatitudes during the Llandovery to lower paleolatitudes and temperate to warm waters during the Ludlow and Pridoli, accompanying the northern drifting of the Gondwana continent across the southern hemisphere. Additionally, the Iberian Peninsula shows an extensive development of shallow-shelf facies dominated by monotonous successions of sandstones and shales, besides other areas with essentially pelagic deposits where deeper and more continuous sequences of black shales and cephalopod-rich limestones prevail, showing resemblance with the "Thuringian triad" of central and Mediterranean Europe, as well as some North African localities.



Spanish UNESCO Global geoparks and geopark projects cited in the text

The most significant of these Spanish Silurian successions situated in geoparks were visited during the 1998 Field Meeting of the Silurian Subcommission. This was years before they were incorporated to the geological heritage of certain geoparks, and some of these successions are still being appraised as prospective future geosites. Scientific study of the most representative sections has since progressed unevenly, with generally much still to be studied and published. However, the progress of the work and the abundance of Silurian graptolites clearly refute, for instance, the generalized idea about Spain, published in the book "Graptolites" by the BIG G (The Boydell Press, 1991), which stated verbatim: "Other [graptolite] localities [= different from the Catalonian coastal ranges near Barcelona] in Spain, and in Portugal, are very difficult to collect and are not recommended for casual visits." The Silurian treasures in the Spanish geoparks show evidence contrary to this claim.

The Paleozoic succession of the Sierra Norte de Sevilla UNESCO Global Geopark (Ossa Morena Zone of the Iberian Massif, SW Spain), created in 2011, includes a nearly complete Silurian succession, ca. 150 m in thickness, deposited in outer shelf settings (Gutiérrez-Marco et al., 2021). Repeated Silurian sections occur along gulleys that flow into the western end of the El Pintado reservoir, in the core part of the Valle syncline, showing the tripartite character of the succession that comprises, in ascending order: a) the 'Lower Graptolitic Shales' (up to 125 m thick, earliest Rhuddanian to Ludfordian), a thick unit of sapropelitic black shales with some black siliceous chert levels; a few meters of silty black shales in the lowermost part and a dark-grey limestone horizon ('Cardiola Limestone': 0.50 to 0.80 m thick) in the uppermost part; b) the so-called 'Scyphocrinites Limestone' (late Ludfordian-Pridoli), which consists of 10 to 15 m of alternating black limestones and calcareous shales; and c) the 'Upper Graptolitic Shales' (20 m) of Pridoli–Lochkovian age which are rather similar to those of the lower unit but include large limestone nodules and lenses. The whole Silurian succession is richly fossiliferous, especially the graptolitic black shales that allowed identification of 25 distinct biozones of the international standard graptolite biozonation, as well as evidence of several global biotic crises and recoveries, and associated oceanographic events. Despite the fact that only a part of the Silurian sequence have been studied in detail, the preliminary paleontological record in the lower part of the succession so far comprises more than 200 species of Llandovery graptolites, and high-resolution biostratigraphical studies have led to the unanimous candidacy of the El Pintado-1 section as a replacement GSSP for the base of the Telychian Stage by the International Subcommission on Silurian Stratigraphy, which is being defined by the FAD of the distinctive and easily recognizable graptolite species Spirograptus guerichi. Other younger beds that have been already studied (and cited in the literature) are those of the Wenlock/Ludlow boundary which outcrops spectacularly in an adjacent section.



Sierra Norte de Sevilla UNESCO Global Geopark: a partial view of the Telychian strata (top to the right) on the northern shore of the El Pintado reservoir, west of Cazalla de la Sierra. Standing Petr Štorch gives the scale.

The second Spanish geopark with an internationally important Silurian geosite is the Molina-Alto Tajo UNESCO Global Geopark, approved in 2014, which is situated in the Western Iberian Cordillera, NE Spain. Paleozoic outcrops in the locality of Checa include an incomplete Silurian succession, but being one of the most continuous and most richly fossiliferous for this system in the Iberian Peninsula, it is recognized as one of the geosites of international interest in the Paleozoic of Spain (Gutiérrez-Marco & Štorch, 2021). The Checa section starts with quartzites (Los Puertos Formation: Rhuddanian to Aeronian) overlaid by a thick unit of graptolitic black shales (Bádenas Formation, ca. 350-400 m at the Nevera Paleozoic inlier). The basal 60 m of the latter unit are of Telychian age and exhibit rich graptolite faunas of nine successive graptolite biozones and subzones of the international standard chart and of the peri-Gondwanan regional graptolite biozonation, respectively, with more than 85 graptolite species identified so far. Besides the scientific value of the fossil locality for paleontology and international correlation of the early Silurian, aspects related with the promotion and preservation of the geological heritage have been enhanced by its integration in a geo-trail for visitors of the Geopark and the fencing of part of the fossil locality to avoid illegal digging and collecting.



#### Molina-Alto Tajo UNESCO Global Geopark: a general view of the La Tejera interpretative area east of the town of Checa with the parking to the right, and in the background the Silurian succession entirely developed in graptolitic black shales.

The third Spanish geopark with interesting Silurian rocks is the **Villuercas-Ibores-Jara UNESCO Global Geopark**, approved in 2011, which lies in the Central Iberian Zone of the Iberian Massif, W Spain. The Silurian succession, with a total thickness of about 250–290 m, outcrops in the main core of the impressive (> 150 km long) Guadarranque syncline, and comprises several units, which in ascending order are: a) the Guadarranque formation, consisting of 5–20 m of graptolitic black shales (Telychian); b) the Guadarranque Formation, represented by 150–200 m of sandstone and shale alternations, with the occasional presence of a dark shale member (Sheinwoodian); c) Cabezuelos sandstones (ca. 50 m), with rare intercalations of shales (Gorstian); d) Cerro Herrumbre quartzites, with poor outcrops of unknown thickness forming the core of the structure. Graptolites occur abundantly in the Telychian black shales together with some conodonts recorded from bedding plane surfaces in two stream sections of scientific value, but not yet considered among the geopark geosites. Remaining beds from Wenlock and Ludlow stages are sparsely fossiliferous and are concentrated in the two main road sections that traverse the syncline (Rodríguez Núñez *et al.*, 1989).

The most recent Spanish "Paleozoic" geopark to be approved (2019) is the **Courel Mountains UNESCO Global Geopark**, located on the boundary area between the Central Iberian and West Asturian-Leonese zones (NW Spain). The Silurian outcrops are located in the core of the spectacular Courel recumbent fold and are highly deformed and affected by metamorphism. For this reason its stratigraphy is difficult to determine and the fossils are rare and poorly preserved. The Silurian sequence comprises ca. 50 m of black shales at the base, followed by up to 400 m of chloritoid-rich shales of massive aspect, which includes very sporadic sandstone intercalations. The sparse graptolite data, as well as conodonts recorded from thin lenticular cephalopod-rich limestones, both occurring in the lower black shales, indicate imprecise Homerian to Gorstian horizons within formations that have not yet been studied in their entirety.

Finally, the proposal for two new Spanish geoparks with an important Silurian geoheritage is now being completed, to be first evaluated at a national level and hopefully at the international level in coming years. The first of these is the Calatrava Volcanoes Geopark project (Central Iberian Zone), which includes two significant Silurian geosites: on the one hand, the historic Almadén cinnabar mine, birth place of stratigraphic and paleontological Paleozoic research in the 19<sup>th</sup> and 20<sup>th</sup> centuries (Lorenzo *et al.*, 2009); and, on the other, the outstanding Jabalón river section in Corral de Calatrava. The latter was also visited by the Subcommission in 1998 and comprises ca. 40 m of richly fossiliferous graptolitic black shales and black clayey shales ranging from the early Telychian to the early Homerian. Despite the large number of biozones and graptolite species identified, a small unconformity detected at the top of the Telychian makes it impossible to verify the continuity of the Llandovery/Wenlock boundary in this important section (Loydell et al., 2009). However, another interesting aspect of the locality is the abundance of other fossil groups accompanying the graptolites both in Llandovery and Wenlock strata. Among them, well-preserved conodonts can be seen on the black shale surfaces, as well as abundant orthoconic nautiloids, some cardiolid and pterioid bivalves, remains of eurypterids and phyllocarids, rare trilobites and crinoid ossicles, epibenthic cornulitids, and brachiopod concentrations in some particular beds (mostly formed by paper-thin shelled rhynchonellids and orthids), besides some lingulellaceans and craniids. The second geopark that is under preparation is the Médulas-Teleno Geopark project, also on the boundary area between the Central Iberian and West Asturian-Leonese zones (NW Spain). The Silurian outcrops of its territory include the historical fossil locality of Salas de la Ribera (Homerian), yielding one of the most important records of graptolite synrhabdosomes worldwide (Gutiérrez-Marco & Lenz, 1998).

Due to the fragility of many Silurian black shale outcrops and their exclusively scientific nature, their listing as geosites within a UNESCO global geopark adds some administrative protection, favoring its public awareness and conservation beyond the regional or national legislative framework.

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## ANNOUNCEMENTS OF SILURIAN RELATED MEETINGS AND ACTIVITIES IN 2022



# 2022 Joint North-Central & Southeastern Section Meeting, Cincinnati, USA

#### **Pre- and Post-Meeting Field Trips**

**Dates**: April 6<sup>th</sup> and 9<sup>th</sup> 2022

Venue: Cincinnati, Ohio, USA

#### Website:

https://www.geosociety.org/GSA/Events/Section\_Meetings/GSA/Sections/nc/2022mtg/fieldtr ips.aspx

#### **Pre-Meeting** (April 6<sup>th</sup>)

# FT402. Upper Ordovician and Lower Silurian Facies, Cycles and Sequences in Southern Ohio: A Field and Core Workshop.

**Description**: This will be a single-day pre-meeting workshop combining field and subsurface study of newly reinterpreted uppermost Ordovician to lower Silurian successions. Facies include gray and red shales, fossiliferous limestones and dolostones, patch reefs, and minor ironstones. The focus is on methodology of correlation and sequence/environmental interpretation in mixed siliciclastic-carbonate successions using litho- and biofacies, gamma ray logs, and chemostratigraphy.

**Organisers**: Carlton E. Brett, University of Cincinnati, brettce@ucmail.uc.edu; Christopher Waid, Ohio Department of Natural Resources, Division of Geological Survey, christopher.waid@dnr.ohio.gov; Cole Farnam, University of Cincinnati, farnamce@mail.uc.edu; Patrick McLaughlin, Indiana Geological & Water Survey, pimclaug@iu.edu.

#### **Post-Meeting (April 9<sup>th</sup>)**

# FT406. A New Look at the Classic Cincinnatian: Sequences, Cycles, and Events in the Upper Ordovician of the Cincinnati Vicinity.

**Description**: This one-day, post-meeting field trip will highlight key reference sections of the world-renowned Upper Ordovician Cincinnatian Series (ca. 450-446 Ma) in its type region. Trip will provide an overview of highly fossiliferous shale/limestone successions, focused on the interpretation of depositional processes, cycles, taphonomy, and paleoecology in the context of a recently revised sequence stratigraphic framework.

**Organisers**: Carlton E. Brett, Department of Geology, University of Cincinnati, brettce@ucmail.uc.edu; Ben Dattilo, Purdue University, Fort Wayne, dattilob@pfw.edu; Kyle Hartshorn, Cincinnati Dry Dredgers, khartshorn1.0@gmail.com.



# 11<sup>th</sup> European Palaeobotany and Palynology Conference

19-22 June, 2022, Stockholm, Sweden

# 11th European Palaeobotany and Palynology Conference Symposia 10. Mass-extinctions and Misfits: Teratologies through time

**Dates**: June 19<sup>th</sup> to 22<sup>nd</sup> 2022

Venue: Stockholm, Sweden

**Website**: <u>https://jirango.com/cms/web/4b67cbd5?lang=eng</u> and https://jirango.com/cms/web/384b1e7c?&lang=eng

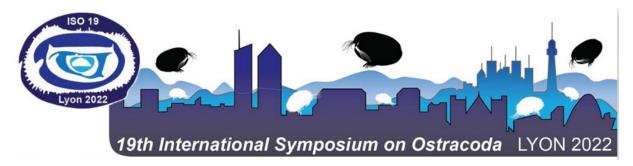
**Description**: Until recently, teratological (malformed) palynomorphs have been widely viewed as miscellaneous specimens with little scientific value. However, several recent high-profile publications are leading to a 'sea change' in how we view these biological aberrancies and misfits. Data suggest that they are a ubiquitous feature of mass-extinction intervals and may occur systematically during these upheavals in both the marine and terrestrial realm. Thus, teratologies offer the prospect of linking these realms and offer potential as monitors, and recorders of changing paleo-environmental conditions during the initiation and establishment of these events. This symposium is designed to bring together researchers working on any aspect of teratologies (including their morphology, geochemistry and modern analogues) to explore what information can be recovered from these X-files. <u>Silurian contributions to the theme are very welcome</u>.

Organisers: Barry Lomax, Thijs Vandenbroucke, Cindy Looy, Bas Van de Schootbrugge

#### **Important dates:**

Deadline for abstract submissions: April 1st 2022

Registration closes: April 1st 2022



## 19th International Symposium on Ostracoda

**Dates**: July 18<sup>th</sup> to 22<sup>nd</sup> 2022

Venue: Lyon, France

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

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

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

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

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

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

#### **Important dates:**

Deadline for abstract submission: March 31<sup>st</sup> 2022

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

# **BEYOND BIOSTRATIGRAPHY:** CONODONT MATTERS IN EVOLVING PLANETARY SCENARIOS



Dear Colleagues,

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

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

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

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



With best regards

#### Guillermo Albanesi<sup>1</sup> and Annalisa Ferretti<sup>2</sup>

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# 7th International Conference on Trilobites & Their Relatives Post-Conference Field Trip:

## Ordovician-Devonian trilobites of the Niagara region

Dates: July 19<sup>th</sup> to 23<sup>rd</sup> 2022

Venue: New York State, USA.

**Website:** <u>https://www.cincymuseum.org/7th-international-conference-on-trilobites-and-their-relatives/</u> and <u>https://www.cincymuseum.org/7th-international-conference-on-trilobites-and-their-relatives/post-conference-field-trip/</u>

**Description**: This four-day post-meeting trip will feature trilobite localities in the classic Ordovician-Devonian of the Mohawk and Niagara-Lake Erie regions of western New York State.

Organiser: Carlton E. Brett, University of Cincinnati, brettce@ucmail.uc.edu

#### **Important dates:**

Registration closes: March 15<sup>th</sup> 2022





#### PHD POSITION IN PALAEONTOLOGY AT UGENT

We are hiring a PhD student (4 years fully-funded) to work on a project at Ghent University in Belgium (UGent), investigating teratologies in Silurian microfossils. The position is funded by the Research Foundation, Flanders (FWO) under the collaborative research grant "Monsters of the Apocalypse: A link between Anoxia, Mutation, Extinction, and Stratabound REE Ores".

**Contract Type:** Fixed Term 1 + 3 years, full-Time **Position start date:** negotiable, but preferably Autumn 2022 **Duration:** 4 years **Stipend:** as per UGent scales

#### **JOB DESCRIPTION**

#### **Position Summary:**

Applications are invited for a four-year PhD researcher position investigating the palaeobiology and environmental implications of teratologic microfossils during Silurian extinction events. The position is funded by the Research Foundation, Flanders (FWO, www.fwo.be) and forms part of a new project by an international consortium, involving researchers at Ghent University, the United States Geological Survey (USGS) and the Illinois Geological Survey (IGS). The PhD student will be based at UGent and will join a team of fellow PhD students working on related topics (Palaeozoic and Mesozoic teratological microfossils). Supervisors are Thijs Vandenbroucke (UGent – palaeontology), Poul Emsbo (USGS – ore geology) and Pat McLaughlin (IGS – chemostratigraphy).

#### The project:

The successful candidate will undertake analyses of organic walled microfossils (palynomorphs) with aberrant morphologies and textures associated with extinction events in the fossil record.

The student will be trained in key analytical techniques including optical microscopy, scanning electron microscopy (SEM), laser ablation - inductively coupled plasma mass spectrometry (LA-ICPMS) and secondary ion microprobe mass spectrometry (SIMS). In addition to analytical research skills, the successful candidate will have opportunities to undertake training in transferable skills, to gain experience in mentorship, and to participate in fieldwork. The successful candidate will work closely with the PIs and other members of the wider team.

The successful candidate will join the team at a very exciting time, as part of a major expansion of our studies of new causative models for the Ordovician-Silurian biogeochemical events. Our new model has been developed by combining approaches, analytical tools, and data from two normally distant fields: ore geology and palaeontology. Stratigraphically, this PhD project will focus entirely on key sections in the Silurian System, which, combined, contain evidence of

extinctions, economic ore deposits and ocean anoxic events (OAEs) that are at the very core of our emerging model. Mechanistically, we focus on testing if fossil teratology could become an independent proxy for monitoring the original chemistry of the palaeo-ocean. Being able to use teratology as a key link between OAEs and biosphere extinction would represent an extraordinary opportunity to reshape the understanding of Earth System processes at a time that changed the trajectory of Earth's evolution.

The PIs are Thijs Vandenbroucke (UGent), Poul Emsbo (USGS) and Pat McLaughlin (IGS), respectively responsible for aspects of palaeontology, ore geology and chemostratigraphy in the project, which represents a wide range of expertise for the student to drawn on. The successful candidate will benefit from the PI's commitment to their career development and the joint PI's extensive global network of collaborators. For instance, the project will run in parallel with a recently funded HFSP Research project that includes researchers at the universities of Ghent, Nottingham, California, Berkeley, and Utrecht, and offers additional expertise in geology, palaeontology, biology and chemistry.

The host lab at UGent focuses on reconstructing environmental conditions and the evolution of life from ancient Palaeozoic times to the current Anthropocene. The group currently includes 9 PhD students and 1 postdoc working on various aspects of micropalaeontology, which will constitute a rich working environment for the successful candidate <a href="https://www.ugent.be/we/geologie/en/research/organization/palaeontology-and-palaeo-environments">https://www.ugent.be/we/geologie/en/research/organization/palaeontology-and-palaeo-environments</a> <a href="https://www.instagram.com/palaeo\_ugent/">https://www.instagram.com/palaeo\_ugent/</a>

#### Deadline for applications is April 18th.

More information, including how to apply, can be found here: https://www.ugent.be/en/work/scientific/phd-student-42

#### **Obituary: Charles Holland (1923-2019)**

Although Charles Holland died in December 2019, his death was unfortunately not reported in either the 2019 or 2020 *Silurian Times* and thus this obituary is largely similar to the one in *Geoscientist* and is also written by Robin Cocks.

Charles Hepworth Holland was a natural born organiser and committee chairman, who rose to eminence in several fields of geology, notably including Presidency of the Geological Society of London from 1984 to 1986 and Chairman of the IUGS Silurian Subcommission for eight years from its initial formation in 1974.

Charles was born on 30<sup>th</sup> June 1923 at Stockport, Lancashire, and his physics degree at Liverpool University was interrupted by World War II service in the Royal Air Force. After demobilisation, his cousin John Hepworth persuaded him to change to geology, which he read at Manchester, where William Pugh was head of department. A key figure then at Manchester was S.H. Straw, who kindled Holland's particular interest in the Upper Silurian and, after Pugh's departure, supervised Holland's doctoral thesis on the mapping of the largely Silurian rocks around Knighton, Radnorshire, Wales.

There were then a dozen or so like-minded younger workers in several places in Britain who together founded the Ludlow (originally Ludlovian) Research Group (LRG), who met for an annual meeting in the field every autumn, initially to provide discussion towards a coherent stratigraphical understanding for the whole of the Upper Silurian of Wales and the Welsh Borderland of England, and they circulated an annual *LRG Bulletin* from 1954 onwards, initially mimeographed. Of those, Holland, Jim Lawson, and Victor Walmsley combined to remap the type Ludlow area of Shropshire itself, and their new stratigraphy was published in a brief *Nature* paper in 1959 and also in a more substantial *British Museum (Natural History) Bulletin* in 1963. Four formations (then termed 'stages') were erected, but since they were based on biostratigraphy rather than lithology, they were not accepted for the subsequent lithostratigraphical maps published by the British Geological Survey of the Ludlow area. From 1962 the scope of the LRG was extended to cover those working on the whole Silurian, but the original name of the group was retained.

After a short time as a temporary assistant lecturer at Manchester, in 1952 Charles became a geology lecturer at Bedford College, London, then an all-female college in the idyllic setting of Regent's Park. When in London, he was one of the 67 people present at the foundation meeting of the Palaeontological Association, with which he became heavily involved, joining its second council in 1958 and rising to President from 1974-1976, with a *Special Paper* in his honour in 2002 and the award of the Lapworth Medal in 2008. However, what ended up as being a permanent move away from his native England came when he was appointed Professor and Head of the Geology and Mineralogy Department at Trinity College, Dublin in 1966, which he enlarged to become a vibrant research school. He went on to become a leader in Irish geology, including the editing of *A geology of Ireland* published in 1981 within which he wrote five of the papers himself. He became particularly interested in the Dingle Peninsula of County Kerry, one of the few places in Ireland where the Silurian rocks include some strata with shelly fossils rather than the interminable graptolitic shales to be found in most of the island.

His outlook was ever beyond just the British Isles: he had become a member of the international Siluro-Devonian Boundary Committee, headed by Anders Martinsson of Sweden, which after long debate stabilised that boundary in 1980 at the base of the Devonian Lochkovian Stage at Klonk, Czech Republic. But Holland himself took the lead in defining and formalising the various international divisions within the Silurian, and was appointed Chairman of the newly-formed IUGS International Subcommission on the Silurian System from 1976 to 1984. During those eight years, he succeeded in master-minding the establishment of the formal division of the Silurian into four series, each with two stages apart from the longer Llandovery Series which has three stages, and the shorter Pridoli, which only has one, and that system was internationally adopted by the IUGS Commission on Stratigraphy at the Moscow International Geological Congress in 1984.

Charles also saw the publication of the first four substantial volumes, all edited solely by himself, which originally set out to provide a complete survey of the Lower Palaeozoic rocks around the world, but the publisher, John Wiley, could not fund the subsequent planned volumes of that series. Initially through the Geological Society, Charles also developed particularly strong links with Chinese geologists, originally the team led by Mu En-zhi of Nanjing, which later culminated in a volume edited by Charles Holland and Mike Bassett in 2002 which contrasted the Upper Llandovery (Telychian) of South China and Britain and attempted detailed biostratigraphical correlation between the two regions.

Earlier, the Stratigraphy Committee of the Geological Society of London had recognised the need for modern correlation charts for each system throughout the British Isles (including Ireland), and had appointed Holland to produce the Silurian chart, together with Robin Cocks, Barrie Rickards, and Isles Strachan. That group was the first to complete its task and Charles read it to the Society in 1970, with the result that it was unique in being published both within the regular *Journal of the Geological Society* but also as the first volume in the free-standing *Special Report* series. Holland, Cocks, and Rickards were also the first team to produce a revised correlation chart in 1992. The Stratigraphy Committee commissioned the same three workers, as well as Mike Bassett and Peter Warren, to revise and standardise the type Wenlock area in Shropshire, which after comprehensive mapping and collecting was published in 1975, and whose two newly-defined stages were subsequently recognised as internationally standard within the 1984 scheme.



The type Wenlock team at Lower Hill Farm borehole, Wenlock Edge in 1973; left to right Mike Bassett, Robin Cocks, Charles Holland, Barrie Rickards, and Peter Warren.

Although interested in all the various macrofossils present in the Silurian, Charles was particularly active in the study of cephalopods, many of which had been commonly misidentified by the old name of *Orthoceras*. He wrote a number of papers on those molluscs, although he was somewhat hampered by their relatively poor cast and mould preservation in the British Silurian.

Charles was active on several Irish committees, not just in Trinity College, and was appointed a Member of the Royal Irish Academy. After his formal retirement in 1993, he retained an office at Trinity and was designated Emeritus Professor, and continued to write a formidable number of papers, particularly on cephalopods. Charles died on 26<sup>th</sup> December

2019: his wife Eileen had died three years earlier, but he is survived by his daughter Celia and two grandchildren.

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There is a more extensive appreciation of Charles Holland's life and bibliography in P.N. Wyse Jackson and M.A. Parkes 2002 *Special Papers in Palaeontology*, **67**, 5-13.

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# SILURIAN RESEARCH 2021 NEWS FROM THE MEMBERS

(in alphabetical order)

#### Fernando Alvarez

Departamento de Geología, Universidad de Oviedo, Oviedo, Spain.

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My research activities continue and I'm hoping that finally this year will crystallize in publications.

#### **B. Gudveig Baarli**

Department of Geosciences, Wachenheim Science Center,18 Hoxsey Street, Williamstown, MA, USA.

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I have continued working with atrypides and am doing a phylogenetic study of Ordovician and Silurian atrypides together with colleagues, chiefly Bing Huang in Nanjing.

Publications: Baarli 2021b, a, 2022

#### Alyssa M. Bancroft

Iowa Geological Survey, IIHR-Hydroscience and Engineering, University of Iowa, 123 North Capitol Street, 300 Trowbridge Hall, Iowa City 52252, Iowa, USA.

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In July 2021 I began working at the Iowa Geological Survey (University of Iowa) and have the pleasure of being involved in all manner of projects related to bedrock mapping in the state. However, I still get the opportunity to work on Silurian conodont biostratigraphy and integrate those studies with other chronostratigraphic proxies.

Publications: Biebesheimer et al. 2021; Hartke et al. 2021

#### **Chris Barnes**

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Chris Barnes is slowly continuing Silurian conodont paleontology / stratigraphy / isotope geochemistry research. The main current projects being: a) Ordovician and Silurian conodont biostratigraphy, bioevents, eustasy, and thermal maturation (with Shunxin Zhang); and b) Early Silurian microvertebrate assemblages from the Cape Phillips Formation, Sheills Peninsula, Devon Island, Nunavut, Canada (with Susan Turner (Queensland Museum) and David Sprague (Calgary)).

Publication: Zhang and Barnes In press

#### James E. Barrick

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"Retired" but still working on preparing finished Silurian projects for publication.

Publication: Barrick et al. 2021

#### **Carlton E. Brett**

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In the past year, I continued working with several colleagues on Silurian sequence, chemo- and event stratigraphy and paleoecology of southern Laurentia and comparisons with other regions. Research relevant to the Silurian is divided into three project areas.

A) Research on Silurian Sequence and Chemostratigraphy: Ohio-Kentucky-Indiana-Tennessee, Canada (with Indiana and Ohio Geological Surveys)

In 2020-2021, research included completing papers on Silurian stratigraphy in southeastern Ohio and into West Virginia with Dr. Stephan Oborny (former PhD advisee, now with Kansas Geological Survey) and Dr. Brad Cramer (University of Iowa). We have made newly correlated transects of mid Silurian strata from western Virginia-eastern West Virginia across Ohio into Indiana with some significant revisions based upon chemostratigraphy and improved conodont biostratigraphy.

Field and subsurface studies were largely focused on aspects of end Ordovician- early Silurian stratigraphy in Ontario in conjunction with UC graduate student Cole Farnam. Cole and I did fieldwork in Ohio, Indiana, and Kentucky to refine high-resolution sequence and event stratigraphy and 13Ccarb isotope stratigraphy. These outcrop studies were extended into the subsurface in detailed study of four continuous drill cores from northern and central Ohio. C isotopic studies have confirmed the presence of the Hirnantian isotopic excursion (HICE) in strata formerly considered to be lower Silurian and that the well-known Cherokee unconformity lies within the Upper Ordovician and marks the sea level lowstand associated with the major phase of very late, but not latest Ordovician. With this framework of sequence and chemostratigraphy we are presently documenting the high-resolution changes in associated benthic invertebrate assemblages through the late Cincinnatian (uppermost Katian, Hirnantian, and Ruddanian-early Aeronian stages).

In addition, I visited Silurian sections in the Nashville Dome area, east of Nashville, Tennessee with Patrick McLaughlin (Illinois Geological Survey); we collected samples for an isotope profile for a section of Silurian-Devonian unconformity. We also documented occurrences of phosphatic nodules and fossils.

Chris Waid of the Ohio Geological Survey and I have continued to extend Silurian correlations through the Ohio subsurface into New York, Ontario and other adjacent regions. We will present a combined core-outcrop workshop for the Geological Society of America North-Central-Southeastern section meeting in Cincinnati in April 2022.

B) Silurian Echinoderms and other Invertebrate Faunas

Dr. James Thomka (now at SUNY College at Plattsburg) and I continue study of the detailed sequence and cycle stratigraphy, taphonomy, paleoecology (especially of echinoderms) and paleoenvironments of the early Wenlock interval in Indiana, Kentucky, and Tennessee. In 2021, we published two new papers dealing with parasitic symbionts on Silurian echinoderms (Thomka *et al.* 2021b, a) and a review chapter on paleoparasitism in Paleozoic echinoderms with abundant Silurian examples (Thomka and Brett 2021). We are also working on better documenting traces formed by host-specific parasites that embedded themselves in certain species of crinoids and other pelmatozoans We are also working on a chapter on taphonomy for the projected new Treatise volume on crinoids, and a paper on crinoid columns as indicators of biodiversity and relative abundance of these organisms, again drawing extensively on our Silurian examples.

In July, 2022 I intend to co-lead a field trip to the Silurian and Devonian trilobite localities for the 7th International Conference on Trilobites and Their Relatives.

# C) Stratigraphic Nomenclature

As past Chair of the North American Commission on Stratigraphic Nomenclature (NACSN) in 2017-2018, I continued to work on developing the category of subseries as a formal chronostratigraphic subdivision. A larger project is the development of a guidelines for establishing formal units in the developing discipline of chemostratigraphy. In early 2020, we submitted a proposal for a standardized and classification of chemostratigraphic terminology to the journal Stratigraphy (Scott *et al.* 2020); we have received considerable feedback and are presently working on a revised version and formal terminology to potentially serve as an amendment to the North American Code.

Publications: Freeman *et al.* 2019; Brett *et al.* 2020; Oborny *et al.* 2020b, a; Scott *et al.* 2020; Thomka and Brett 2021; Thomka *et al.* 2021b, a

# **Carole J. Burrow**

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The investigation, in partnership with Sue Turner (QM) and Pat Conaghan (MUCEP), on the vertebrate microfossils in sediments from the late Silurian to Middle Devonian in the Mossgiel-DDH1 core from the Darling Basin, western NSW continues. Unfortunately, the project is still being delayed as we have been unable to locate the vertebrate microremains from the core. My revision of the Handbook of Paleoichthyology, Volume 5 – Acanthodii, Stem Chondrichthyes – has now been published. A short paper on the type material of some long-known Late Silurian acanthodian taxa from the Baltic region has also been published, coauthored with Tiiu Märss (Estonia). Notification of any new Silurian vertebrate discoveries in Australia will always be gratefully received! (Or information on lost collections, e.g., Link's vertebrate microremains from the Yass Basin...).

Publications: Burrow 2021; Burrow and Märss 2022

# L. Robin M. Cocks

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2021 was the second exceptional Covid-related year, with access denied to my Natural History Museum office and collections until July although I had been fully vaccinated before then. However, I have been busy, largely working from home as well as a visit to Berlin in September to work with Trond TORSVIK (normally Oslo), largely on global Devonian palaeogeography and climate. That work includes a global revision of the geography at about Siluro-Devonian boundary time (420 Ma). A Gondwana Research paper also with Trond on global Ordovician palaeogeography and climate was completed and published just before the end of the year. Another paper with Leonid POPOV (Cardiff) on the distribution of Ordovician higher-latitude Mediterranean brachiopods and their assemblages was completed, submitted, and published in the Geological Magazine. The paper by Torsvik, Domeier and Cocks (published in 2021) includes a review of global Silurian palaeogeography.

Publications: Cocks 2020; Cocks and Popov 2021; Cocks and Torsvik 2021; Torsvik et al. 2021

# Carlo Corradini

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My work on Silurian conodonts and biostratigraphy continues. Last year most of the researches were devoted to the Carnic Alps, where I am investigating the Pre-Variscan Sequence (Upper Ordovician-lower Carboniferous). Studies on Silurian and Lower Devonian mainly focus on "Orthoceras limestones" and calcareous levels within black shales sequences, both studying new sections and updating data from classical localities. A paper on the classical, but strongly tectonized, Valentintörl section, where a huge hiatus separating rocks of Hirnantian to Ludlow age is present (Corriga *et al.* 2021) was published; also the guidebook of a field trip connected with the annual meeting of the Italian Geological Society is available (Corradini and Pondrelli 2021).

In Sardinia research deal on a still poorly explored area of the SW part of the island.

A summary on conodonts across the Silurian/Devonian boundary in Peri-Gondwana regions is just published (Ferretti *et al.* 2022).

The study of conodonts from the San Juan Precordillera (Argentina) is in progress (with M.J. Gomez, A. Mestre and S. Heredia), and a new conodonts species, *Ozarkodina huenickeni* was described (Gómez *et al.* 2021).

Publications: Corradini and Pondrelli 2021; Corriga et al. 2021; Gómez et al. 2021; Ferretti et al. 2022

# Maria G. Corriga

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I am working on conodont taxonomy and biostratigraphy across the Silurian-Devonian boundary mainly in the Carnic Alps and other North Gondwana regions.

In the Carnic Alps, researches mainly focus on the Silurian and Lower Devonian in various sectors of the chain (mainly Lake Wolayer, Passo di Monte Croce Carnico and Monte Cocco areas), and paper on the Valentintörl section was published. A review paper on conodonts across the Silurian/Devonian boundary in Peri-Gondwana regions, and other areas is also published.

In Sardinia research deal on the Perda S'altari area, a still poorly explored area of the SW part of the island.

Publications: Corriga et al. 2021; Ferretti et al. 2022

#### Annalisa Ferretti

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My Silurian research continues to be focused on the biosedimentology and paleoecology mostly of the Austrian Carnic Alps.

My recent papers have strictly focused on the effect of diagenesis on bioapatite mineralogy and crystallization patterns over geological time (Ferretti *et al.* 2021a; Medici *et al.* 2021). The mineralogical and chemical signatures of enigmatic microspherules commonly referred to in literature as "conodont pearls" have been investigated so to provide a response on the affinity of these spherules (Ferretti *et al.* 2021b). Three-dimensionally preserved fragments of the enigmatic organism *Sandvikina*, previously reported from the Silurian of Ireland, Scotland and Scandinavia, were recovered from the original Irish material and studied in detail (Ferretti and Serafini 2021). A detailed biostratigraphic investigation has been carried out by means of conodonts in the uppermost Ordovician-lowermost Devonian sector of the Valentintörl cliff, located in the Austrian part of the Carnic Alps (Corriga *et al.* 2021). A global synthesis on the conodont occurrences along northern Gondwana at the Silurian/Devonian boundary was completed (Ferretti *et al.* 2022) to offer an efficient tool for locating the boundary level in carbonate facies.

We are proposing the Session "Beyond biostratigraphy: Conodont matters in evolving planetary scenarios" as part of the 5<sup>th</sup> International Conodont Symposium "ICOS 5" to be held in Wuhan, China (June 24<sup>th</sup>–27<sup>th</sup>, 2022). Considering the pandemic situation, the Symposium will combine offline (on site) and online (visual) presentations. Any related Silurian contribution, also extra-congress, is welcome!

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

Our hope is that you or members of your research group might even consider our invitation to be part of this innovative exploratory Session. Papers resulting from the ICOS 5 Session will be published as a Special Virtual Issue of Marine Micropaleontology. IF YOU ARE INTERESTED IN CONTRIBUTING, PLEASE CONTACT US (guillermo.albanesi@unc.edu.ar; ferretti@unimore.it)! We are collecting a list of possible contributors to return to the journal before ICOS 5. Please note that submission of manuscripts is due in April 2023.

Publications: Corriga et al. 2021; Ferretti and Serafini 2021; Ferretti et al. 2021b, a, 2022; Medici et al. 2021

#### Mansoureh Ghobadi Pour

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Mansoureh Ghobadi Pour is working on the Silurian (Aeronian) trilobite, brachiopod and bryozoan faunas of Central Iran and Kopet Dagh in cooperation with Caroline Buttler, Robert Owens and Leonid Popov.

Publication: Popov et al. 2021

## Jessica Carolina Gómez

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I am in the last year in a scholarship of the National Scientific and Technical Research Council of Argentina, with Dr. Matilde Barresi (Advisor) and Dr. Silvio H. Peralta (Co-Advisor). The subject of the work is focused on the Sedimentary, Paleobiological, Isotopic and Paleoenvironmental events in the Hirnantian-Rhuddanian transition of the San Juan Precordillera, Western Argentina. In addition, I am also working on the last stage of my PhD Thesis, in the National University of San Juan, with Dr. Silvio Peralta (Advisor) (CONICET-National University of San Juan), and Dr. Matilde BERESI (IANIGLA - CONICET) (coadvisor). I am working on the Ordovician-Silurian boundary of the San Juan Precordillera, Western Argentina. The research aims to analyze the elements of high-resolution stratigraphic correlation: a) Characterization of diagnostic deposits such as lag deposits, phosphate lag, upwelling, and Ironstone (Fe-phosphate oolites); b) Biostratigraphic elements, as is the case of diagnostic faunal associations: Hirnantia Fauna, and graptolites of the M. Persculptus, P. acuminatus and A. atavus Zones, and palynomorphs (with Dr. Mercedes DI PASCUO, CONICET-ENTRE RÍOS- UADER ); c) Isotopic anomalies of C, O, TOC, Hg (with Dr. Alcides SIAL, NEG-LABISE); d) Condensed section analysis; e) Regional correlation with homologous successions of Northwestern Argentina, such as the Zapla and Lipeón formations; as well as basins of Bolivia, Peru, Venezuela and Ordovician-Silurian of the Amazon Basin in Brazil, and Paraná Basin in Paraguay; f) Continental correlation, mainly with Africa and Gondwana areas of Europe and China. Furthermore, I have participated in the project "Highresolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128, Dr. Silvio Peralta)". I contributed to 8th Latin American Congress of Sedimentology. Parana, Argentina (with Silvio PERALTA; Matilde BERESI) (https://reunionsedimentologia2021.com.ar/); and 1st Colombian Congress of Paleontology, Bogota Colombia in 2020 (with Jaime Reyes Abril, SERVIGECOL LTDA, Bogotá, Colombia) (http://ciencias.bogota.unal.edu.co/eventos/congreso-colombiano-de-paleontologia/posters/).

# Juan Carlos Gutiérrez-Marco

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Publications: Gutiérrez-Marco and Štorch 2021; Gutiérrez-Marco *et al.* 2021b, a; Pereira *et al.* 2021

## Kathleen Histon

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I continue my studies on Silurian cephalopods, sea-level changes, oceanic cycles and biotic response in the Ordovician/Silurian of the Carnic Alps and other localities in relation to use of the migrational pathways of pelagic faunas as a tool for timing of open seaways and microterrane position along the North Gondwana margin. Investigation of Silurian nautiloid biozones for biostratigraphic correlation is ongoing.

Publication: Histon and Messner 2020

#### **Bing Huang**

State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing 210008, China.

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In 2021, I have been involved in studying a relatively new field for myself, the radiation of brachiopods after the Late Ordovician Mass Extinction, which occurred from Aeronian to Telychian, together with my PhD student Chen Di who is focusing on Telychian brachiopods from South China. I finished several field studies with my students, and collected brachiopod fossils from over twenty sections or outcrops of South China. Most of the specimens have been identified now, and quite high diversity implied they lived in the radiation interval after the LOME. The materials have been prepared for two case studies, and more importantly a PhD thesis. I finished a study with my colleagues, which reported a low diversified endemic

brachiopod faunule from the Aeronian of South China. During the last year, I also managed and reviewed 9 manuscripts for Acta Palaeontologica Sinica. With my help, Wang Qian (my MSc student) published his first paper in English, Chen Di finished a study about a linguliform microbrachiopod fauna from South China. Wang Qian has also almost finished his master's thesis on a study about a silicified Hirnantian brachiopod fauna, and will make thesis defense as scheduled.

Publications: Chen et al. 2021a; Huang and Jin 2021; Huang et al. 2021; Wang et al. 2022

# Dimitri Kaljo

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Dimitri Kaljo continued some studies on the Ordovician and Silurian bio- and chemostratigraphy of Baltica as an emeritus member at the geology department of the Taltech. The Covid pandemic slowed down different activities, but electronic cooperation with some colleagues from USA and Europe still works. Last year I have been mostly busy together with my earlier Taltech colleagues (T. MARTMA, T. MÄRSS, V. NESTOR, V. VIIRA) on a paper about the Silurian bio- and chemostratigraphy. Correcting the last year's report, I can tell that the paper is in press now, i.e., should appear in March.

# **Stephen Kershaw**

Department of Life Sciences, Brunel University, London, UK AND Earth Sciences Department, The Natural History Museum, London, UK (Note retired and working at home).

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Research on: a) Ordovician and Silurian stromatoporoids and facies; b) Cambrian microbialites; c) Carboniferous crinoids (contributing author); d) Permian-Triassic boundary microbialites.

For 2022, work will continue on: a) Ordovician, Silurian and Devonian stromatoporoids and their associated facies; b) Permian-Triassic boundary events and facies.

Publications: Balthasar et al. 2021; Jeon et al. 2021; Kershaw et al. 2021a, c, b, 2022; Sandström et al. 2021

# Tarmo Kiipli

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Publications: Kiipli 2021c, b, a, 2022

# **Philippe Legrand**

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I am trying to improve the Upper Ordovician and Lower Silurian stratigraphic scheme of the Western and of Southern borders of Murzuq Basin (Algeria and Libya).

# Qi-jian Li

State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Beijing East Road No.39, 210008 Nanjing, P.R. China.

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Qi-jian Li is mainly working on Ordovician-Silurian reefs and hypercalcified sponges (e.g., calathids, stromatoporoids and sphinctozoans). In 2021, I continued my sedimentological and paleoecological research on Ordovician reefs. Apart from the fossil materials, I also continue my collaborations on quantitative paleoecological analyses of reefs at the Ordovician-Silurian transition with several colleagues, mainly based on several databases. As a member in the advisory board of the Geobiodiversity Database (GBDB), I have worked with Dr. Na Lin on the download function of occurrence data. At the end of 2021, several small test runs have been done for this function. Please contact me if any of you are interested in the occurrence data of the GBDB.

Publications: Ernst et al. 2021; Kershaw et al. 2021a; Li et al. 2021c

# David K. Loydell

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Again, teaching duties, etc. left limited time for research in 2021. Most research time was spent on checking through my contribution to the Monograptidae chapter of the *Treatise* (now published in *Treatise Online* – see Maletz and Loydell 2021) and refereeing papers.

Publications: Farrell *et al.* 2021; Gutiérrez-Marco *et al.* 2021b; Loydell and Abouelresh 2021; Maletz and Loydell 2021; Mehra *et al.* 2021; Sperling *et al.* 2021; Sproson *et al.* 2022

# Peep Männik

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I continue to work on evolution, taxonomy and palaeoecology of conodonts, conodont-based high-resolution stratigraphy, bioevents and palaeogeography. I am also interested in sequence stratigraphy, palaeoclimatology and evolution of sedimentary basins. Joint studies together with colleagues from Estonia, Czech Republic, Germany, Poland, Iran, Russia, Sweden, UK and USA on evolution and high-resolution stratigraphy of the Early Palaeozoic faunas and sedimentary basins on different palaeocontinents are ongoing.

Publications: Chen et al. 2021b; Frýda et al. 2021

# Anna McGairy

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I am a PhD student at the University of Leicester and have published a paper in 2021 on late Silurian ostracods from Vietnam. For more information about my research activities see: <u>https://centa.ac.uk/our-students/anna-mcgairy/</u>

Publication: McGairy et al. 2021

# Tõnu Meidla

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Tõnu Meidla was teaching various geology subjects at the University of Tartu and worked on different aspects of stratigraphy, fauna and stable isotopes in the Silurian (and particularly addressing the lower boundary) in Estonia, Latvia and Lithuania (together with L. Ainsaar, B. Gul, A. Spiridonov, S. Radzevičius and S. Petrukonė), published several papers about the ostracod dynamics, biostratigraphy and isotopic stratigraphy of the Ordovician-Silurian boundary interval and in Wenlock. A review paper about the Silurian stratigraphy in Estonia is in progress, in cooperation with P. Männik and O. Hints. I co-supervised Karin Truuver who finalised her PhD in 2021 and served as a member of the doctoral committee at the Vilnius University (PhD defence of Anna Katarzyna Cichon-Pupienis).

I published, as a co-author, abstracts at the following meetings:

50 Congresso Brasileiro de Geologia, Brasilia, Brazil (Gonçalves et al. 2021. Ostracodes do Hirnantiano na América do sul (Bacia do Paraná, Ordoviciano tardio): implicações cronobioestratigráficas paleogeográficas).

Virtual Annual Meeting of IGCP 653 and IGCP 735, Lille, France (Hints et al. 2021. Latest Ordovician to early Silurian integrated bio- and chemostratigraphy in northern Lithuania, central East Baltic. <u>https://lille2021.files.wordpress.com/2021/09/abstractvolume-1.pdf</u>).

2nd Crossing the Palaeontological – Ecological Gap (CPEG), Museum für Naturkunde Berlin, Germany (Spiridonov et al. 2021. Recurrence plots reveal the 'sloshing bucket'-like ostracod paleocommunity dynamics in the mid-Silurian of Baltica. https://www.cpegberlin.com/uploads/1/3/7/5/137523179/cpeg\_schedule\_2021.pdf).

Publications: Gonçalves et al. 2021; Gul et al. 2021; Rinkevičiūtė et al. 2021; Truuver et al. 2021

# **Giles Miller**

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I am continuing to work on Ludfordian-Gorstian conodonts from the Sunnyhill Quarry section of the Mortimer Forest, Ludlow. Slides are all arranged by species now and illustration of key specimens is back in progress after lack of access to SEM due to the pandemic. Hopefully this will be submitted within the next year. Work with PhD student Anna McGairy and Mark Williams has resulted in a publication on Silurian ostracods from Vietnam with another accepted and coming early in the new year. Publication: McGairy et al. 2021

## Axel Munnecke

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Publications: Jarochowska *et al.* 2020; Claussen *et al.* 2021; Ernst *et al.* 2021; Kershaw *et al.* 2021c; Kroeck *et al.* 2021; Vachard *et al.* 2021; Yu *et al.* 2021; Sproson *et al.* 2022

## John S. Peel

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Publication: Peel 2021

#### Silvio Peralta

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I'm currently working in the Ordovician-Silurian Transition of the San Juan Precordillera, Argentina, as well as on the tecto-sedimentary evolution of the Hirnantian-Silurian basin of the Precordillera in Western Argentina. This research is carried out together with Jessica Gómez, by means of a Research Fellowship from the National Council of Scientific and Technical Research of Argentina (CONICET), with Dr. Matilde Beresi (Advisor) and Dr. Silvio H. Peralta (Co-Advisor). The main subject of the work is performed on Sedimentary, Paleobiologic, isotopic and Paleoenvironmental events in the Hirnantian-Rhuddanian transition in the San Juan Precordillera of Western Argentina.

In addition, I'm Advisor of the PhD Thesis, in the National University of San Juan, together with Dr. Matilde BERESI (IANIGLA - CONICET) as co-Advisor, working also on the Ordovician-Silurian boundary of the Precordillera de San Juan, Western Argentina.

The research focuses on High-resolution stratigraphic correlation elements: a) Characterization of diagnostic deposits such as lag deposits, phosphate lag, upwelling, and Ironstone (Fe-

phosphate oolites); b) Biostratigraphic elements, as is the case of diagnostic faunal associations such as Hirnantia Fauna and associated trilobites, graptolites of the *M. persculptus* Zone, and palynomorphs (with Dr. Mercedes DI PASCUO, CONICET- ENTRE RÍOS-UADER); c) Isotopic anomalies, essentially of C, O, TOC, Hg (with Dr. Alcides SIAL, NEG-LABISE); d) Condensed section analysis; e) Regional correlation with homologous successions of northwestern Argentina, as the Zapla and Lipeón formations; as well as in Bolivia, Peru, Venezuela, and Ordovician-Silurian basins of the Amazon in Brazil and Paraná in Paraguay; f) Continental correlation, mainly with Africa and Gondwanan areas of Europe and China.

I'm chair of the Research Project "High-resolution stratigraphic and biostratigraphic study of the Ordovician-Silurian boundary in the Central and Eastern Precordillera of San Juan, Argentina. Paleoenvironmental, Paleoclimatic, and Paleogeographic Implications (21/E1128, Dr. Silvio Peralta)". I published as co-author, some Abstracts in the 8th Latin American Congress of Sedimentology. Parana, Argentina (with Jessica Gómez; Matilde BERESI) (https://reunionsedimentologia2021.com.ar/); in the Virtual Annual Meeting of IGCP 653; Virtual Annual Meeting of IGCP 735. Lille, Francia (with Jessica Gómez and Mercedes DI PASCUO) (https://lille2021.files.wordpress.com/2021/09/abstractvolume-1.pdf).

## Ian Percival

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Ordovician research took a greater priority last year, although 2021 did see publication of a paper (Groome *et al.* 2021) on Silurian strata at the Cadia Valley gold-copper mining district (foreshadowed in Silurian Times 28) and collaboration with colleagues from China on Llandovery conodont biofacies (Yan *et al.* 2022). Studies on Silurian faunas from the Cotton Formation and Molong Limestone in central NSW are progressing slowly in the background.

Publications: Groome et al. 2021; Yan et al. 2022

# Vincent Perrier

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As a lecturer in Covid time, I did not have much time for my research... But I continue working of Silurian myodocope ostracods from Spain + Carboniferous myriapods from France.

Publications: Lorenzo *et al.* 2020; Mikhailova *et al.* 2020; Perrier *et al.* 2020; Siveter *et al.* 2020

# José Manuel Piçarra d´Almeida

LNEG - (Laboratório Nacional de Energia e Geologia / Portuguese Geological Survey). Unidade de Geologia, Hidrogeologia e Geologia Costeira, Ap. 14, 7601-909 Aljustrel, Portugal.

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I'm retired, but still being a collaborator of the LNEG (Portuguese Geological Survey).

# **Leonid Popov**

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Leonid Popov is currently working on the Silurian (Llandovery) brachiopods of the Chingiz Range, Kazakhstan and the Ludlow – Přídolí brachiopods of Central Iran in cooperation with Mansoureh Ghobadi Pour and Vachik Hairapetian.

Publication: Popov et al. 2021

# Sigitas Radzevičius

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I am working on the taxonomy, stratigraphic distribution, diversity, disparity, and phylogeny of Silurian graptolites. Most of my research is concentrated on the construction of high-resolution Silurian time scales by means of integrated stratigraphy. I'm integrating stratigraphic models, taxonomic data, geochemical, and geophysical proxies in order to understand the drivers of Silurian global extinction and turnover events.

Publications: Cichon-Pupienis et al. 2021; Rinkevičiūtė et al. 2021

# David Ray

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My research activities over the past year have focused upon the Silurian of the Midland Platform (England and Wales). In particular, collaboration with Emilia Jarochowska, Helen Hughes, Anna Claussen and others has focused on the area between Old Radnor and Presteigne (Powys and Herefordshire). We have now published our stratigraphic assessment of the succession (Aeronian to Sheinwoodian) and can confirm the identification of the early Sheinwoodian carbon isotope excursion, paleo-shoreline deposits and sea-level variations of regional and global significance. Further research upon associated bryozoan faunas is being led by Anna Claussen. In addition, a regional assessment of the transgression of the Midland Platform during Telychian and Sheinwoodian times is ongoing, and is focused upon the establishment of a sequence stratigraphic framework and relative sea-level curve.

Publications: Ray *et al.* 2021b, a; Ray and Dlubak 2022

## **David Siveter**

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Silurian research has concentrated on aspects of the Herefordshire Lagerstätte and ostracods from the UK and central and south-east Asia.

Publications: Carter *et al.* 2021; McGairy *et al.* 2021; Mikhailova and Siveter 2021; Siveter *et al.* 2021

#### **Derek Siveter**

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Research continues on the soft-bodied fauna of the Herefordshire Lagerstätte.

Publications: Carter et al. 2021; Siveter et al. 2021

# Ladislav Slavík

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In general - for several years, most activities are concentrated on Mid-Palaeozoic global correlation and late Silurian - early Devonian conodont biostratigraphy. Early in 2021 a manuscript integrating all obtained data and proposing the subdivision of the Přídolí Series was submitted, and two manuscripts on Silurian topics have been published. Several sections of Wenlock age were studied in cooperation with Petr Štorch and sampled for conodonts. Apart from Silurian tasks, most of the year was dedicated to sampling of candidate sections for Lower Devonian GSSP.

Publications: Hušková and Slavík 2021; Sproson et al. 2022

# Petr Štorch

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Multi-proxy studies related to the current search for Aeronian, Telychian and Homerian GSSP replacement candidate sections continued in the frame of a three-year project focussed on biostratigraphy and faunal dynamics of the Silurian pelagic biota in the Prague Synform. A comprehensive study on graptolite biostratigraphy of the Silurian System of the Prague Synform (Barrandian area, Czech Republic) has been completed. The paper will be submitted for publication in Bulletin of Geosciences in May 2022. Work on black-shale dominated Sheinwoodian-Homerian succession exposed in the Kosov Quarry, carried out with Š. Manda, L. Slavík and Z. Tasáryová continued and a joint paper is under preparation, another paper devoted to lower Gorstian graptolites and biostratigraphy is nearly complete. Collaboration with J.C. Gutiérrez-Marco, J. Roqué Bernal, Z.Y. Sun, M.J. Melchin and D.K. Loydell continued in the frame of several informal projects related to Silurian graptolites and stratigraphy. I am supervising Zuzana Strossová in her PhD project on lower Telychian graptolites and high-resolution stratigraphy.

Publications: Gutiérrez-Marco and Štorch 2021; Gutiérrez-Marco et al. 2021b, a; Pereira et al. 2021; Pšenička et al. 2021

## Susan Turner

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Dr Susan Turner is working (slowly, between rain bombs, leaks, and COVID) on Silurian thelodonts and other microvertebrates such as early 'sharks' from sites in Australia, Canada, Morocco, Pakistan, UK, USA (Pennsylvania, Wisconsin). In co-operation with colleagues Carole Burrow (Australia) and Mike Murphy (USA), a paper on Late Silurian vertebrates from Birch Creek II section, Roberts Mountains, Nevada has been completed and submitted to Paleobios. With David Sprague and Chris Barnes (Canada), I am working on Early Silurian microvertebrates from the Cape Phillips Formation, Sheills Peninsula, Devon Island, Nunavut.

A recent book (Berta and Turner 2020) looks at the work of some of our colleagues working on Silurian vertebrates.

For updates see: https://jhupbooks.press.jhu.edu/notice.html

Publication: Berta and Turner 2020

# Thijs R. A. Vandenbroucke

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Thijs Vandenbroucke remains interested in reconstructing the Silurian palaeoclimate and palaeo-environment. Julie De Weirdt and Tim De Backer continue their PhD research projects with me at UGent. Julie focusses on geochemistry and palynology of the Upper Ordovician - lower Silurian in N. America while Tim uses similar methods in the upper Silurian and Devonian. Carolina Klock started her PhD project focussing on the palynology of the Silurian Mulde event, currently using material from the USA midwest. These are projects in collaboration with Poul Emsbo (USGS), Patrick McLaughlin (Illinois Geol. Survey) and André Desrochers (UOttawa). The other members of the lab, including PhD student Cristiana Esteves and postdoc Dr. Thomas Wong Hearing pursue their interests in the Cambrian-Ordovician, but remain involved in various Silurian side projects. PhD student Joana Rosin focusses on the Triassic-Jurassic, co-supervised by Bas van de Schootbrugge (UUtrecht).

A new HFSP (The Human Frontier Science Program) funded project is a collaboration between my lab, Bas van de Schootbrugge (U.Utrecht, Nl.), Barry Lomax (U. Nottingham, UK) and Cindy Looy (UC Berkeley, USA), started in 2021, and focusses on teratology in microfossils as a proxy for understanding mass-extinctions through time. A new FWO (Research Foundation Flanders) that is a collaboration between myself, Poul Emsbo (USGS) and Patrick McLaughlin (Illinois Geol. Survey) started in 2022 and will focus on Silurian biogeochemical events. We will be recruiting a new PhD student on this grant in 2022. In the context of our new HFSP (The Human Frontier Science Program) project, Barry Lomax, Cindy Looy, Bas Van de Schootbrugge and myself will convene session 10 'Mass-extinctions and Misfits: Teratologies through time' at the 11th European Palaeobotany and Palynology Conference (EPPC, 19–22 June, 2022, Stockholm, Sweden). Silurian contributions to the theme are very welcome (<u>https://jirango.com/cms/web/4b67cbd5?lang=eng</u>).

For updates, follow the lab on instagram: @paleo\_ugent

Publication: Sinnesael et al. 2021

# **Jacques Verniers**

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In 2021 I was involved in the preparation of a manuscript: Mortier, J., Vanmeirhaeghe, J., Harper, D., Storch, P., Zalasiewicz, J., Van den haute, P., Deckers, J., Mestdagh, J., Pille, T., Verniers, J. (submitted January 2022). Stratigraphy and biostratigraphy with chitinozoans of the uppermost Ordovician and Silurian of the Condroz Inlier. Memoirs of the Geological Survey of Belgium. In addition, a poster presentation (Hirnantia Fauna from the Condroz Inlier, Belgium: another case of a relict Ordovician shelly fauna in the Silurian?) was made at the 7th International Geologica Belgica Meeting, Africa Museum Tervuren, Belgium, 15-17<sup>th</sup> September 2021 (p. 207,

https://geologicabelgica2021.africamuseum.be/sites/default/files/media/Geologica%20Belgic a%202021%20Abstract%20book.pdf).

In 2022 I plan to work on two manuscripts:

- 1. "A review of the Silurian in Belgium": an overview after 20 years of stratigraphical research at the Research Unit Paleontology (Ghent University).
- An update of all lithostratigraphical formation in Belgium: Verniers J., Herbosch A. et al. "Stratigraphy of the Lower Palaeozoic of the Anglo-Brabant Deformation Belt, Belgium (Part III): The Silurian formations of the Condroz Inlier and of the Orneau Group in the Brabant Massif."

Publication: Pereira et al. 2021

# **Olev Vinn**

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In the past year, I continued working with several colleagues on the evolution of symbiotic interactions and bioerosion in the Silurian. I also participated in a study on the taxonomy of problematic tentaculitoid tubeworm Anticalyptraea. Together with colleagues from Moldova, Belarus, and Ukraine we described multiple cases of symbiosis between stromatoporoids and the other invertebrates from the Silurian of eastern Europe.

Publications: Vinn et al. 2021b, c, a

# **Guangxu Wang**

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I continue to work on monographies of the Ordovician-Silurian boundary rugosans and Llandovery (early Silurian) cystiphyllid corals in South China.

# **Xiaofeng Wang**

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In the last year, together with Jorg Maletz from FUB and Wang Chuangshang (Graptolite) and We Kai (Geochemistry) from Wuhan Center, I have continually dealt with the re-study of the lower Silurian biostratigraphy in the Eastern Yangtze Gorges. In particular, the typical Longmaxi (Lungmachi) Formation, composed of black shale–bearing graptolites in the lower and green shale with rare graptolites and shelly fossils in the upper part, in the Yichang region on the Yangtze platform of China. Another area of research is concerning the global high-precision Ordovician division and correlative signs for the lower boundary of the Ordovician System, as well as taxonomy and biostratigraphy of the Tremadoc graptolites. My remaining time was devoted to the conservation of rare geological relics and the scientific popularization of stratigraphy and paleontology, together with my colleagues in Wuhan Center we have published three books named "Hubei Paleontology", "Hubei Fossils" (2021) and "Palaeontology in Hubei" (2019) and "Precise and rare fossil groups in Hubei Province" (2020)

under the support of Hubei Natural and Resources Bureau and National Publishing Foundation, respectively.

Publications: Wang et al. 2020, 2021c, b

# Yi Wang

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In 2021, together with my colleagues at NIGP and IVPP, CAS, I was working on the lithostratigraphic subdivision and correlation of the Silurian in China, and the characteristics of major hiatus in the middle Paleozoic rocks of South China and their significance of geotectonics. Also, I am very happy to get a project from NFSC of China, and will continue to work on the Late Silurian land plants of South China.

Publications: Wang et al. 2021d, e

# **Renbin Zhan**

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I was working mainly on the Ordovician stratigraphy and brachiopods, but, together with my domestic and international colleagues, I did conduct some Silurian related investigations in 2021. The published Silurian works include: 1) Compiling a monograph summarizing those major sections and rock units and all index fossils of various groups throughout the Silurian in China; 2) Introducing all Silurian GSSPs as well as their related stories to the general public, and pointing out the key problems of each GSSP and suggested possible solutions in the near future. The GSSPs monograph (Stratigraphical Golden Spikes - Critical Points in the Evolution of the Earth) is now being used as a textbook at many universities in China.

Publications: Wang et al. 2021a; Zhan et al. 2021

# Yuandong Zhang

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Yuandong Zhang is continuously working on:

(1) Systematic palaeontology and biostratigraphy of the late Katian to Rhuddanian sponges and graptolites (Anji Biota) in Anji, Northwestern Zhejiang Province, SE China. This work has been financially supported by President's International Fellowship Initiatives program (PIFI) and granted by NSF of China (2018-2021). In the Anji area, a complete graptolite succession has been revealed based on a big collection of specimens obtained in the past years, including *Dicellograptus complexus, Paraorthograptus pacificus, Metabolograptus extraordinarius, Metabolograptus persculptus, Akidograptus ascensus*, and *Parakidograptus acuminatus* biozones. This succession had been ratified by the National Committee on Stratigraphy of China as a reference standard for the Lower Yangtze Region. A highly diverse (over 100 species), deep-water sponge-dominated community of latest Hirnantian age has been recovered, shedding light on the survival dynamics in the aftermath of the End-Ordovician mass extinction. This work is jointly carried out with Drs. Joseph Botting and Lucy Muir from UK.

(2) Systematic palaeontology of Silurian (Telychian, Ludlow and Pridoli) graptolites from limited outcrops around Junggar Basin, Xinjiang, northwestern China, together with Chen Xu and other colleagues. This work is scheduled to be completed for publication in 2022. Palaeontology of the Silurian (Telychian) graptolites from Xainza area, Tibet, based on specimens collected in the summer, 2021, during a 4-week excursion to Tibet.

Publications: Deng et al. 2021; Li et al. 2021a; Zhang et al. 2021

# Wenjin Zhao

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In 2021, most of my research was still focused on the Siluro-Devonian vertebrate paleontology and relative stratigraphy together with my colleagues in IVPP, CAS. The main achievements can be represented by the redescription of Sanqiaspidae (Galeaspida) from South China, the further study on *Nostolepis* scale remains (stem Chondrichthyes) from Qujing Area (Yunnan, China), and the detailed chemostratigraphic and biostratigraphic works on the Silurian-Devonian boundary (SDB) in East Yunan (South China), which resulted in a better definition of the SDB in the study area and helped to calibrate the more accurate estimated minimum and soft maximum ages for the coelacanth-rhipidistian and lungfish-tetrapod splits.

In addition, I went to Qujing (Yunnan, China) to attend the 1st Academic Forum of Qujing Ancient Fish Kingdom Museum held March 28<sup>th</sup> to 30<sup>th</sup> (2021) and gave a talk of "New

knowledge on the fish-bearing Silurian-Lower Devonian in Qujing Area". Subsequently, I conducted a short-term field investigation around Qujing City, supported by the National Natural Science Foundation of China and the Strategic Priority Research Program of the Chinese Academy of Sciences. Some new important and interesting Siluro-Devonian fossil fishes have been found and collected.

Publications: Li et al. 2021b; Wang et al. 2021e; Zhao et al. 2021; Gai et al. 2022

## **RECENT PUBLICATIONS**

Please note that a few publications are from 2020 or even earlier, as they were not included previously in the Silurian Times. In addition, some papers are dealing with Ordovician and Devonian topics by members of ISSS. There are also a few papers in the list that are in press or online.

- Baarli, B.G. 2021a. Plectatrypinae and other ribbed atrypides succeeding the end Ordovician extinction event, Central Oslo Region, Norway. *Journal of Paleontology*, **95**, 75–105, https://doi.org/10.1017/jpa.2020.69.
- Baarli, B.G. 2021b. Survival and recovery atrypid fauna following the terminal Ordovician extinction, the Atrypinae: central Oslo Region, Norway. *Historical Biology*, **33**, 403– 440, https://doi.org/10.1080/08912963.2019.1620228.
- Baarli, B.G. 2022. The smooth, spire-bearing brachiopods after the terminal Ordovician extinction through lower Llandovery in the central Oslo region, Norway. *Journal of Paleontology*, 96, 81–111, https://doi.org/10.1017/jpa.2021.72.
- Balthasar, U., Kershaw, S., Da Silva, A.-C., Seuss, B., Cusack, M., Eichenseer, K. and Chung, P. 2021. Palaeozoic stromatoporoids and chaetetids analysed using electron backscatter diffraction (EBSD); implications for original mineralogy and microstructure. *Facies*, 67, 8, https://doi.org/10.1007/s10347-020-00618-5.
- Barrick, J.E., Sundgren, J.R. and McAdams, N.E.B. 2021. Endemic earliest Lochkovian species of Caudicriodus (conodont) from southern Laurentia and the Silurian–Devonian boundary. *Papers in Palaeontology*, 7, 1585–1600, https://doi.org/10.1002/spp2.1354.
- Berta, A. and Turner, S. 2020. Rebels, Scholars and Explorers: Women in Vertebrate Paleontology. *The Johns Hopkins University Press, Baltimore*, 1–328, https://doi.org/10.1353/book.77835.
- Biebesheimer, E.J., Cramer, B.D., Calner, M., Barnett, B.A., Oborny, S.C. and Bancroft, A.M. 2021. Asynchronous δ13Ccarb and δ13Corg records during the onset of the Mulde (Silurian) positive carbon isotope excursion from the Altajme core, Gotland, Sweden. *Chemical Geology*, **576**, 120256, https://doi.org/10.1016/j.chemgeo.2021.120256.
- Brett, C.E., Aucoin, C.D., Dattilo, B.F., Freeman, R.L., Hartshorn, K.R., McLaughlin, P.I. and Schwalbach, C.E. 2020. Revised sequence stratigraphy of the upper Katian Stage (Cincinnatian) strata in the Cincinnati Arch reference area: Geological and paleontological implications. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 540, 109483, https://doi.org/10.1016/j.palaeo.2019.109483.
- Burrow, C. 2021. Handbook of Paleoichthyology. Acanthodii, Stem Chondrichthyes. *Verlag Dr Friedrich Pfeil, Munich.*, **5**, 1–166.
- Burrow, C.J. and Märss, T. 2022. Neotypes for some upper Silurian acanthodian taxa from the Baltic Sea Region and the Welsh Borderland. *Estonian Journal of Earth Sciences*, **71**, 17–24, https://doi.org/10.3176/earth.2022.02.

- Carter, R.P., Sutton, M.D., Briggs, D.E.G., Rahman, I.A., Siveter, D.J. and Siveter, D.J. 2021. A Silurian ophiuroid with soft-tissue preservation. *Papers in Palaeontology*, 7, 2041– 2047, https://doi.org/10.1002/spp2.1390.
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# SILURIAN RESEARCH 2021 WORD CLOUD

A word cloud based upon the titles of members publications (larger words are more frequently used).

Sweden Silurian-Devonian Ordovician Dynamics UNESCO boundary stratigraphy Study carbon sedimentary stromatoporoids δ13Corg Paleozoic Geochemical Integrated global palaeoenvironmental 513Ccarb Symbiotic chemostratigraphic event Time <sup>Hubei</sup> Analysis <sup>hiatus</sup> carbonate Yangtze Estonia Carnic Alps Welsh Baltic Endemic climate Norway Ludfordian Devonian Platform Hirnantia sequence volcanic isotope organic America shelly Saaremaa Marine 🔒 cycles Perspectives Systematic Pridoli Review fossil Basin record biostratigraphy reefs conodonts Katian Series species facies ostracod diagenesis ostracodsLaurentia Asia anoxic tectono-magmatic myodocopeSpainOslo burial British Echinoderms volcanism Formation Bryozoans Fauna Δ13C Gotland Yunnan Llandovery Aeronian Province Hirnantian Excursion correlation extinction novel Evidence brachiopods Geopark Cincinnati Arch significance structures Preservation implications morphology

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